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Critical Analysis Team Report on the Draft Revised Feasibility Study for Remediation of Silos 1 and 2 Waste.

CAT Report 11

21 October 1999

The Critical Analysis Team (CAT) has completed its review of the Draft Revised Feasibility Study (FS) for remediation of Silos 1 and 2 wastes. The CAT has reviewed multiple revisions of the FS over a several month period to ensure that, (1) the presentation is based on facts, not opinions; (2) the document contains sound cost, schedule and technical information; and, (3) the document text is appropriately supported by the data.

This CAT report is organized as follows: (1) the CAT's general feedback on the document; (2) a table (Attachment 1) comparing issues in concerning each technology as viewed by the CAT; and (3) Attachment 2 is the CAT's specific comments on the document.

The Feasibility Study is now ready for release. While the CAT comments on this report raise a number of concerns, resolution of the concerns would not likely fundamentally alter the document or its analysis. It is important that the Silos 1 and 2 project move on as quickly as possible, and continuing to wordsmith the FS is counter to "getting on with the project."

FDF involved the CAT early in the document development process. This allowed the CAT a better understanding of the document and has made it easier for FDF to incorporate CAT comments into the document. FDF should be commended for its efforts in conducting an open document development process and working to resolve and incorporate comments.

The document development process must continue to be open. To this end, DOE should release the document to all interested parties and begin the public review as soon as possible. The ROD Amendment process is lengthy and, while the CAT recognizes the regulatory basis for this process, the CAT urges DOE to complete the ROD process as soon as possible. Engaging the public as a partner in decision-making early increases the prospect for early completion of the ROD Amendment, solidifying public support and getting on with the project.

While the CAT has several outstanding concerns, the document presentation is relatively fair and balanced. The document provides a suitable basis for making a decision on treatment of the Silos 1 and 2 wastes. However, the data presented in the document does not overwhelmingly support the selection of any of the alternatives. In the case of most of the decision-making criteria, there is no discriminating difference among the technologies.

As a result of the parity among technologies, the decision to favor one technology over another is largely a personal value judgment. The relatively subjective consideration of "implementability"—which technology is more likely to be successful—is very important to this particular decision. In addition, individual values play a role in judging the technologies. For example, if an individual feels that waste volume or processing temperature are the most important considerations, the individual's technology preference would reflect that belief.

The CAT emphasizes that the technology decision is *not* the most important factor in determining success of the Silos 1 and 2 remediation project. Many of DOE's failures of both chemical stabilization and vitrification have been the result of poor designs or management problems. Similar risks exist for this project. The following four factors, independent of the technology selected, will weigh heaviest on the project's relative success or failure:

- **Capability of the selected vendor.** While the POP test vendors were intended to be representative of each technology, each vendor's technology and/or approach had several unique characteristics. Some vendors, both vitrification and chemical stabilization, will be more capable than others. It is critical that the procurement process select a technically capable vendor that has a proven ability to perform.
- **DOE and FDF management of the project.** Many failed DOE projects (including the Vitrification Pilot Plant) have suffered from poor management. None of the technologies are sufficiently simple to build and operate themselves—success will only come from knowledgeable, experienced, involved and committed management.
- **Success or failure of Silo 3 and Accelerated Waste Retrieval (AWR) projects.** Silos 1 and 2 remediation relies heavily on the success of both Silo 3 and AWR. AWR in particular is necessary to provide feed for the Silos 1 and 2 treatment facility. Almost as important, the successful completion of all three silos projects is dependent upon the smooth flow and transition of capital, resources, and personnel throughout the project. If Silo 3 and/or AWR delay the current schedule or experience cost growth, Silos 1 and 2 remediation could be in jeopardy.
- **Labor force.** Fixed-price contracting in the context of Fernald's site labor agreement will be difficult. This creates a situation where personnel are working for a contractor to whom they are not directly responsible. Regardless of the performance of workers, contractors may have an incentive for claims purposes to shift blame for problems to the workforce.

Technical Challenges

In its involvement with the POP tests and the development of supporting engineering data, the CAT believes the following:

- All alternatives can be implemented.
- All technologies have relatively equal levels of technical risk making any difference among them minimal.
- No alternative is the clear "winner" or "loser" – each has strengths and weaknesses.
- No alternative requires extensive or sophisticated development.
- There are no unique materials of construction in the application of the technologies.
- All technologies require equipment modifications and unique facility designs to facilitate remote operations and protect personnel.
- All major process equipment is commercially available, although a few items do require custom design and fabrication.

As the text of the FS shows, all of the technologies would be technically challenging to implement. However, the technical risks are different for each technology. Following are the most significant risks the CAT has identified for each technology:

- **Joule heated vitrification (VIT-1):** The two greatest technical challenges for this technology are (1) the scale-up to a melter several times larger than any operating on similar wastes; and (2) the ability of the joule heated melter to avoid sulfate problems similar to those experienced in the Fernald Vitrification Pilot Plant.
- **Combustion vitrification (VIT-2):** The two greatest technical challenges for this technology are (1) treating the large volumes of melter off-gas; and (2) drying the waste feed prior to its introduction into the melter.
- **Chemical stabilization (CHEM-1):** The three greatest technical challenges for this technology are (1) the ability to remotely operate the mechanical stabilization system; (2) obtaining adequate product waste loading to minimize transportation and disposal costs; and (3) the ability to make acceptable product while minimizing recycle.
- **Chemical stabilization (CHEM-2):** The two greatest technical challenges for this technology are (1) the ability to operate the mechanical stabilization system remotely; and (2) obtaining adequate waste loading to minimize transportation and disposal costs.

Recommendations

- **Recommendation 11-1:** FDF and DOE should work with EPA to expedite the schedule for completion of the Record of Decision. The CAT sees no reason why completion of the ROD should take until the Spring of 2001. Public review of the document and public involvement activities should begin as soon as possible.

- **Recommendation 11-2:** Were the chosen technology to fail, the Record of Decision should include sufficient flexibility to allow for an "alternate path" consisting of another technology family to allow seamless transition and avoid years of regulatory documentation..

- **Recommendation 11-3:** Fluor should develop a in-house team of experts that can quickly and accurately respond to public questions about the Feasibility Study. DOE should utilize this team to support and participate in public meetings, discussions and workshop presentations.

ATTACHMENT 1: TABLE OF WASTE TREATMENT AND DISPOSAL ISSUES

In an attempt to clearly and succinctly describe the major treatment and disposal issues associated with each technology, and assist the reviewer in understanding these issues, the CAT has developed the following table with the pros and cons of the technologies. The CAT does not offer this table as comprehensive, but rather as an attempt to allow the reader to assess each technology based on qualitative facts.FDF is free to use this list if they believe it could prove useful.

VIT-1 Joule heated vitrification(Envitco)	**VIT-2 vitrification-other (VORTEC)**	**CHEM-1 chemical stabilization-cement based (IT)**	**CHEM-2 chemical stabilization-other (CNS)**
Scale-up presents significant challenges; first of a kind joule heated melter for this type of waste at this scale. This amounts to a demonstration facility.	The POP test for vitrification-other was demonstrated at a scale sufficient to meet project objectives. Higher capacities may be feasible.	Scale-up for chemical stabilization has been demonstrated on industrial materials. While it has not been demonstrated with this waste, scale-up should not present significant challenges.	Scale-up for chemical stabilization has been demonstrated on industrial materials. While it has not been demonstrated with this waste, scale-up should not present significant challenges.
Presence of sulfate in waste feed could cause problems similar to those experienced in the Vitrification Pilot Plant.	Presence of sulfate is a concern, however less so than with VIT-1.	Presence of sulfate should present no process problems for chemical stabilization.	Presence of sulfate should present no process problems for chemical stabilization.
Cost and schedule are not sensitive to minor waste loading changes.	Cost and schedule are not sensitive to minor waste loading changes.	Cost and schedule for are very sensitive to changes in waste loading.	Cost and schedule for are very sensitive to changes in waste loading.
Within the accuracy of the estimate, the costs are basically equal.	Within the accuracy of the estimate, the costs are basically equal.	Within the accuracy of the estimate, the costs are basically equal.	Within the accuracy of the estimate, the costs are basically equal.

Vitrification Joule heated	Vitrification-other	Chemical stabilization-cement	Chemical stabilization-other
Requires operators to make process control adjustments while the process continues operation.	Requires operators to make process control adjustments while the process continues operation.	The batch process allows some time for process adjustments. However, adjustments may not be possible until a significant amount of unacceptable waste product is created.	The batch process allows some time for process adjustments. However, adjustments may not be possible until a significant amount of unacceptable waste product is created.
Chemically and physically binds the waste.	Chemically and physically binds the waste.	Physically binds the waste.	Chemically and physically binds the waste.
The melter is a single piece of specialized equipment. Problems with the melter could lead to long delays in restarting the facility.	The melter is a single piece of specialized equipment. Problems with the melter could lead to long delays in restarting the facility.	While mixers may fail, they are more readily available and easier to replace than melters.	While mixers may fail, they are more readily available and easier replace than melters.
Operates at high temperatures (approximately 1150 C).	Operates at high temperatures (approximately 1500 C).	Operates at low (ambient) temperatures.	Operates at low (ambient) temperatures.
Produces 2,398 containers. Number of containers is not sensitive to waste loading.	Produces 2,162 containers. Number of containers is not sensitive to waste loading.	Produces 6,078 containers. Number of containers is sensitive to waste loading.	Produces 6,106 containers. Number of containers is sensitive to waste loading (e.g. if waste loading is 18% instead of 24%, number of containers increases to 7,877.
Cannot quickly stop process operations in an emergency situation. When not processing, melter must maintain contents as molten glass.	Can stop process operations more quickly than joule heated vitrification because the waste does not remain in the melter for a long period of time.	Is forgiving in the ability to quickly stop process operations. However, emergency stops could lead to large volumes of secondary waste that must be recycled.	Is forgiving in the ability to quickly stop process operations. However, emergency stops could lead to large volumes of secondary waste that must be recycled.

Vitrification joule heated	Vitrification-other	Chemical stabilization-cement	Chemical stabilization-other
Glass is generally viewed as a more stable waste form. In the melting process, radon is released to the off-gas, and radon generation in the waste form is extremely low.	Glass is generally viewed as a more stable waste form. In the melting process, radon is released to the off-gas, and radon generation in the waste form is extremely low.	Radon is an issue throughout treatment, curing, and storage of the stabilized waste.	Radon is an issue throughout treatment, curing, and storage of the stabilized waste.
Some potential for generating secondary waste streams.	Significant potential for generating solid and liquid secondary waste streams.	Significant potential for generating secondary liquid waste, particularly during shutdown (flush equipment).	Significant potential for generating secondary liquid waste, particularly during shutdown (flush equipment).
Relatively simple to automate (although remote electrode adjustment and replacement could prove difficult). Adjusting the process "on the fly" will require continuous attention. Complex off-gas system with standard equipment, but many simultaneous unit operations.	Relatively simple to automate. Adjusting process "on the fly" will require continuous attention. Complex off-gas system with standard equipment but requires several integrated unit operations.	Many mechanical parts that could prove difficult to automate for reliable, trouble-free operation. More complex storage scenario due to continuous radon generation and number of containers.	Many mechanical parts that could prove difficult to automate for reliable, trouble-free operations (particularly the waste container fill-head). More complex storage scenario due to continuous radon generation and number of containers.
Insufficient information to determine sampling capability or difficulties. This area should not be ignored.	A cullet waste form that should result in a simpler product sampling system. Insufficient information to determine sampling capability or difficulties. This area should not be ignored.	Insufficient information to determine sampling capability or difficulties. This area should not be ignored.	Insufficient information to determine sampling capability or difficulties. This area should not be ignored.

Vitrification joule heated	Vitrification-other	Chemical stabilization-cement	Chemical stabilization-other
Because of scale-up issues, little potential for acceleration	Potential for acceleration which would impact interim storage capacity and the RCS system. Shipping rate (which is subject to public acceptance) will affect schedule acceleration.	Potential for acceleration which would impact interim storage capacity. Shipping rate (which is subject to public acceptance) will affect schedule acceleration.	Potential for acceleration which would impact interim storage capacity. Shipping rate (which is subject to public acceptance) will affect schedule acceleration.

ATTACHMENT 2: CAT COMMENTS ON THE DRAFT FS FOR REMEDIATION OF SILOS 1 AND 2

The CAT has the following specific comments on the latest version of the FS. These comments are provided for FDF's information and consideration. As the comments show, the CAT has many concerns with the FS. However, the CAT stresses that, were these concerns all resolved and incorporated into the document, they would likely not alter the document or its analysis. In short, a document of this size and scope could be wordsmithed for a very long time and still contain deficiencies. The CAT's desire is that the project move forward and these comments not impede that process.

For comparative purposes, the document inappropriately combines the two chemical stabilization technologies and the two vitrification technologies. Page 4-4, lines 13-14 state, "No differences were identified in the detailed analysis of alternatives that provide a compelling reason to select one process option over the other in either treatment technology alternative." While the CAT agrees that it would not be wise to select a very specific technology in the ROD, for the purposes of analysis there are significant differences between the individual processes within a technology family. Lumping the two processes into a technology family tends to blur important information, and characteristics of any process could be inappropriately applied to another process.

Data and text supporting the assumptions in the document must be available and clearly identifiable to the reader. FDF must document telecons and meetings, etc. which impact decisions. Also, processes must be developed that clearly support assumptions/decisions in the document. An undocumented meeting that results in important decisions is insufficient. An example of this is found on page ES-5 where the FS states that information was obtained from "current data bases and vendor interviews." The CAT was unable to find a single reference to a recorded data base search or vendor interview.

Another example is the assumptions for startup of the facilities (Tables 3.2-1, 3.3-1, 3.4-1 and 3.5-1). The POP test assumptions required vendors to design facilities that could complete waste treatment in three years. The Draft FS includes a 6 month startup period for both vitrification and chemical stabilization. In addition, a six month cold testing period has been added to vitrification. This extends the operational period for vitrification from 3 years to 3.5 years (20 more days operability testing and 80 days proof of principle testing for vitrification). Startup of the technologies is likely to be similar. The CAT was unable to identify why and through what process FDF decided to include an additional 6 months for vitrification.

The FS seems to largely ignore the issue of remote operations and maintenance for all four technologies. This oversight is most glaring in the chemical stabilization portions of the report. No mention is made of the challenges to design, build and test materials handling equipment for remote operation. The text gives the impression that these systems are commercially available—they aren't. A similar problem potentially exists with VIT-1 in the installation and adjustment of electrodes.

The FS cost estimate appears well developed, organized, and sufficiently detailed. FDF should take credit for this good work. The cost estimate appears equivalent to an advanced conceptual estimate. It is supported by considerable detail, including equipment data sheets and a detailed schedule with milestones. In addition, the basis for each cost element is traceable to the source of the cost. The CAT commends FDF for this work. In addition, the CAT notes that the cost estimate appears to have been the responsibility of one individual – as opposed to multiple authors for the text – resulting in a more coherent presentation.

One cost estimate deficiency is that the estimate doesn't appear to adequately take into account a significant chemical stabilization assumption. The current chemical stabilization scenario assumes starting up and shutting down the system 780 times during the project life (5x52x3=780 events). This number of startups and shutdowns amounts to abuse of the system. Hanford data clearly indicates system availability is directly dependent upon its operating history. That is, frequent starts and stops lead to failure and shorten system life. Further, the logistical challenges in starting and stopping operation every day are daunting – procedures, checklists, planning meetings, safety meetings.

The CHEM-1 operating scenario of starting and stopping the process each day will probably require a system flush following each shutdown. That portion of the process system prior to additive addition and mixing can be flushed to the feed tank. However that portion of the process following additive addition and mixing must be flushed to a separate holding tank and treated through some other method. None of this has been discussed or costed in the FS.

The cost estimate does not include any penalty or risk budget associated with this activity. A risk budget should be allocated based on this assumption. This number of startups and shutdowns is more indicative of a laboratory environment rather than a production process.

FDF needs to develop a group of experts that can quickly and accurately respond to questions in a public forum. Because the FS was written by multiple authors and is a large, complex document, FDF needs to ensure it has the capability to accurately respond to public inquiry. A public perception that FDF doesn't understand its own document would prove unacceptable.

Because of the linkage of the FS and PP, these documents should be reviewed simultaneously. The CAT is eager to review the Proposed Plan in the near future. It is important that the proposed plan contain a decision that is supported by the FS and, at this point, the CAT is unable to make this determination.

Assumptions about the Advanced Waste Water Treatment plant (AWWT) may be inaccurate or incomplete. The CAT identified several instances in both the POP designs and the FS where assumptions about the availability, capacity and capability of the AWWT may be incorrect. For example, in certain instances the subcontractor may be planning on sending more wastewater to the AWWT than would be allowed. Also, incidents such as heavy rainfall will render the AWWT unavailable for the Silo 1 and 2 Project (because of treatment capacity and priority). All processes have the potential for sending significant volumes of liquid waste to AWWT. Because the AWWT only treats solids and uranium, blending will be used with the Silos 1 and 2 wastewater to meet discharge requirements. The project could easily overburden the AWWT both in terms of contaminants and volume.

Page ES-17, Lines 11-15: This section states that chemical stabilization is 10% less costly than vitrification. It should also be stated that the cost estimate is a +50/-30% estimate, making the costs essentially equal.

Page ES-13, Lines 15-17: This page discusses vitrification in two separate bullets (one for joule heated vitrification and one for vitrification-other). However, Chemical stabilization is represented by only one bullet. There is a significant difference between the two chemical stabilization technologies and discussing them as two separate bullets should reflect this.

P. 3-31, line 19: This line states that remote operations concerns are "consistent across the four technologies..." The CAT feels the remote application will be more difficult for chemical stabilization than for vitrification. This belief is due to the multiple mechanical operations associated with chemical stabilization.

P. 3-47, 05: Is there any reason to believe the silo solid secondary waste will not meet the NTS WAC? If so, actions should be taken to evaluate the risk and identify alternative disposal locations.

P. 3-58, Line 13: If the shredded steel is returned as feed to the melter, does this present any process problems? That is, small steel particles in the feed stream or in the glass.

P. 3-70, Line 14: States that the Silo material has been "thoroughly characterized." The CAT sees this as an overstatement. Suggest dropping the word "thoroughly."

P. 3-70, Line 16: How is a recycling requirement going to be enforced upon a subcontractor? Typically, recycling is more costly than using new materials, and voluntary compliance with this requirement probably won't happen. In addition, how will compliance be measured? Will goals be set and penalties imposed for exceeding goals?

P. 3-70, Line 22: If FDF pays for the disposal of secondary waste there is little incentive for the vendor to minimize secondary waste volume.

P. 3-71, Line 12: Is there anything in the decant sump tank that would negatively influence any of the treatment processes? If so, then plans are needed to accommodate those materials.

P. 3-79, Line 8: Would there be any value in providing an estimate of the total volume of waste that will be generated by each treatment method: construction, secondary waste, product, D&D?

P. 3-87, 3-88, 3-127, 3-143: These pages refer to the scale-up factors for Vitrification joule heated (VIT 1) and Chemical Stabilization cement based (CHEM 1). Different methods of determining scale-up factors are applied to the two technologies and therefore they are not considered in an equitable fashion. VIT-1 was demonstrated in the POP testing at 0.34 tons per day on a melter designed for 1 ton per day. Scaling up to 15 tons per day is then communicated as a 45:1 scale-up. This is based on the difference between the *demonstrated* scale and the full scale. The CHEM-1 technology was demonstrated at 2.15 tons per day on a facility designed for 8 tons per day. The scale-up factor is given as 10:1. The CHEM-1 scale calculation is done by considering the POP testing facility's *design* capacity—not what was demonstrated. If either method were applied to the two technologies consistently, the scale-up factors would be either 37:1 (CHEM 1) and 45:1 (VIT 1) or 10:1 (CHEM 1) and 15:1 (VIT 1). Instead, the FS inappropriately presents the scale-up factors as 45:1 (VIT 1) and 10:1 (CHEM 1).

P. 3-89, Line 19: Design, construction, startup and operation of additional RCS capacity during or following startup of the treatment system could easily be a "show stopper". This is a problem that should be avoided in design—not during operation. Further, it is inappropriate for the FS to assume design flaws. That is, does the project "tread water" until the increased capacity is provided, or does the facility operate at a reduced throughput? Neither is a good solution.

P. 3-108, Activity 8900: The estimated D&D period of 120 days appears insufficient if D&D includes decontamination, demolition, packaging, transportation and disposal.

P. 3-112, first paragraph: Although the vendor proposed a design producing a frit product, a monolith similar to VIT 1 could be made.

P. 3-115, line 25: This line refers to a "proportional cost increase" as a result of scaling up the melter. A cost increase is incurred, but it is not proportional to scale-up. Increasing capacity of effected equipment would likely increase equipment costs ten percent and project cost much less if incorporated during the design stage.

P. 3-118, line 8: This line states that "redox balancing conditions will remain oxidized." This statement is untrue. The melter can run reducing conditions. Still, the statement is not relevant because oxidizing conditions are desirable. Recommend deleting this whole sentence.

P. 3-118, lines 5 and 6: This text states that lead and sulfates were volatilized out of the melter and this "implies" that the lead must be partitioned from the off-gas and recycled. This is not just an implication—the lead *must* be partitioned and recycled.

P. 3-118, line 15 and 16: Viscosity is also controlled by chemical additions such as Lithium Carbonate.

P. 3-118, lines 19-21: Operability and control of continuous processes such as this is normally less difficult than batch processes because once the system is operational all unit operations are steady state. Batch processes, on the other hand, are constantly varying from start to finish and may or may not be reproducible batch-to-batch.

P. 3-119, lines 16: add "...and to extend ceramic liner life" to the end of the sentence.

P. 3-121, line 2: Again, additional costs are incurred but they are not proportional to capacity increases.

P. 3-121, line 21: add, "and the system design presented has installed excess capacity that can accommodate this (i.e. two full-scale centrifuges and two full-scale dryers)" In addition, remove text referring to a clarifier. This design does not include a clarifier.

P. 3-122, line 4-6: These lines refer to specialized construction techniques, additional unit operations, and integration of multiple components in the off gas system for VIT-2. These items are not challenges to constructability.

P. 3-123, lines 12-15: The wording infers that proof of process surrogate testing, ORR, and SOT is more difficult for this option than the others. The CAT does not understand why.

P. 3-136, line 15: The long-term environmental impacts in this reference don't recognize the much higher radon emanated from the chemically stabilized waste (because it meets the NTS criteria—largely because the site is very remote).

P. 3-142, line 9: Costs would be greater, but not proportional.

P. 3-145, Line 13: It is unclear how a batch mode of operation influences (positively or negatively) operating complexity?

P. 3-146, Line 5: Do manual methods of removing caked material imply maintenance personnel would be performing physically demanding activities while protected by bubble suits?

P. 3-148, line 6: This line claims there is no off-gas system in the design of the CHEM-1 facility. However, there is off-gas control and treatment for particulates and radon. Since there is no gas generation other than radon there is no need for removal of sulfate.

P. 3-148, line 20: The cost increase will be greater but will not be proportional to capacity increase.

P. 3-149, lines 4-8: This technology (CHEM-1) is much less robust per the definition than the other three technologies. Appendix G has an excellent explanation of why it is less robust.

P 3-171, line 12: This text states that there is not an off-gas system included in the estimate. However, there is an off-gas confinement and treatment system for particulates and radon.

P. 4-15, line 11: This line refers to "unique" off-gas systems for vitrification. These off-gas systems, while containing multiple unit operations, are standard commercial industry applications.

P. 4-16, lines 20-22: The VIT-2 option, as presented, has considerable excess capacity for centrifuge and drying operations. As a result, increasing the diameter of the melter would not add significant cost but could increase throughput. The most significant impact from the increase in throughput would be to the RCS system.

P. 4-21, line 17: This line should read, "resulting in a larger number..."

Appendix G Comments

Appendix G overall organization and writing is quite good. However, the section could use more attention to increase its reader-friendliness. The following points would make the section more readable:

- The mass balances should identify streams on the PFD and their SK number. Without this guidance the reader cannot understand what these numbers mean or what they relate to.
- The PFD should immediately follow the mass balance.
- The system numbers are not consistently used in appendix G. The system narrative descriptions and the reference to the system number designations are not identified. For example, G.7.4 Product Handling and G.6.5 Gaseous Emission Control.
- Figures G.4-1, G.5-1, G.6-1 do not show the required product rework functions.
- G.5.1 shows K-65 material as solids in a slurry. G.4.1.1 shows the silos waste solids as K-65 material. G.6.1-1 calls the K 65 material as waste solid. The document should use consistent terminology.

G.2-21, Line 3: Are the secondary waste boxes "standard issue", or must they be specially manufactured, i.e. leaktight? If specialty manufactured, must they be fabricated of any special material?

G.2-17, Line 14: Are the waste containers proven and certified as air-tight, or is this statement an assumption? This becomes important because leakage could mandate negative pressure for the interim storage facility.

P. G.2-17, Line 17: The interim storage facility for the chemical stabilization options is not currently designed to treat radon although the radon will still be released from the treated chemical stabilization waste containers. The treated waste containers are currently supposed to be airtight (G.2-17, Line 17) but they probably won't be—CNS containers definitely will not be. Also, standards require a sloped and decontaminable, floor, curbing and storage such that waste containers cannot set in accumulated liquids.

G.2-25, Line 4: How will need for ventilation of the interim storage area be known until the facility is filled with containers? If at that time radon exceeds limits what would be the resolution?

P. G2-32: This page states that HEPA filters are 99.997 on 3-micron particles. The CAT assumes this is a typo and that the text should refer to 99.97 efficiency on 0.3-micron particles.

Section G.3, general: If this section is intended as a discussion of problems, then the installation, adjustment and extension of the VIT-1 electrodes should be included. The impact of oxidation of these items upon the melt pool should also be included.

P. G.3-3, note 20: This note is incorrect. As can be seen in the VITPP inspection video the refractory was badly cracked contained holes and had missing bricks. Had the bottom drains not failed, the refractory probably would have. If the VITPP is being used as an example, in a three-year operating period the refractory would probably have to be replaced at least twice. It is inappropriate for the document to base assumptions concerning alumina in the waste on this footnote.

P. G.4-41, Line 15: Is the cooling tower blowdown sent directly to AWWT?

P. G.6.1-2: Table identifies the Stream 9 as a 54,000 lb/day and Stream 11 as 1471 lb/day with 64,210 lb/day of additives. The air flow for stream 11 seems very low—should the units be pounds per hour instead of pounds per day?

Comments which should be considered during design phase of the project.

P. 3-89, Line 12: Parallel development and design efforts are typically very difficult to successfully accomplish, and require careful planning, coordination and communication. Frequently, design "blockouts" are used as "placeholders" until development data are available to the design team. Generally, pursuing these efforts simultaneously adds costs because of decreased efficiency, and adds risk because of the possibility of overlooking important information.

P. 3-102, Line 23: Are there time limits for operating the treatment process using the emergency off-gas System and continuing to operate the treatment facility? That is, how quickly must the Off-gas System be returned to normal service before release limits are exceeded?

P. 3-149, Line 20: If an assembly is prefabricated off-site and NDE testing is required (e.g. weld radiography), would those NDE tests need to be repeated following lifting, transporting and installation of the module at the construction site?

P. 3-128, Line 12: Because of the number and type of sources that must be maintained at a negative pressure, there are also many sources of leaks, and a high probability that supplemental RCS capacity would be required. However, this will not be known until the facility is built and operating.

P. A-1-20, 264.35: The fire access requirements could impact the size of both the curing room and the interim storage facility.

P. A-1-23, 264.171-178: The product drums in both the curing room and the interim storage facility must be inspected weekly. Depending upon the definition of inspection, this requirement could significantly impact the design of these facilities

G.2-31, Line 1: At 1.0"wg, a 36"x80" door will require 110 pounds of force to open. May want to consider a door-mounted lever device to "break" the seal and assist in opening Zone 3 doors. This is important to assure the ability of personnel to exit those areas.

P. G.2-32, Line 6: Hanford has recent studies that indicate isokinetic sampling may not be necessary to obtain representative samples. This should be investigated.

P. G.2-32, Line 13: Typically, prefilters are 95% efficient.

P. G.2-38, Line 21: Remote operations, especially those performed via TV, demand excellent visibility and thus better than normal lighting.

P. G.2-62, Line 18: "Gross decontamination" must be defined in measurable terms (e.g. mr/hr at contact, no smearable contamination) to avoid claims.

P. G.4-30, Line 15: Hammermills are notorious for dusting; this presents containment and remote challenges.

P. G.4-31, Lines 1 and 6: Once rework begins, both the glass/concrete breaker and the crane will become contaminated. Decontamination methods and locations should be considered.