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Addressee: Samuelson S.L.

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Title: **RESPONSE TO DOE-WTP ENGINEERING DIVISION DIRECTOR MEMORANDUM**

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MGR	Samuelson, Scott MGR	WTP	
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DEP	Charboneau, Stacy DEP		Bootsma, Amie
CPM	Champlain, George		Newcomb, Jan L.
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OCS	Meyer, Carrie		Bruggeman, Jeff
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WSC	Wrzesinski, Wendell		Brunson, Gary
			Young, Jason
			Brown, Dennis
			Sands, Jennifer
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**Comments: REF: 12-WTP-0274 NO ACTION ASSIGNED AT THIS TIME**

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**AUG 29 2012**

CCN: 250883

U.S. Department of Energy  
Waste Treatment & Immobilization Plant  
Mr. S. L. Samuelson  
Acting Federal Project Director  
P.O. Box 450, MSIN H6-60  
Richland, Washington 99352

Dear Mr. Samuelson:

**CONTRACT NO. DE-AC27-01RV14136 – RESPONSE TO DOE-WTP ENGINEERING  
DIVISION DIRECTOR MEMORANDUM**

This letter addresses the August 23, 2012 internal memorandum from the DOE-WTP Engineering Division Director recommending that BNI be removed as the design authority for the WTP. He asserts his position based on 34 issues that he identifies as occurring over the twelve year course of the project. BNI welcomes diverse opinions and opportunities for discussion, but feels the need to respond, since it is dangerously misleading about these specific issues and about the important work we are doing in general for this project and mission.

As you well know, the issues raised in the memorandum are not new, and have been addressed in concert with DOE – some as long as a decade ago. BNI and DOE have jointly addressed and resolved these issues during the course of the Project; the decisions have been validated by hundreds of independent experts and external review teams.

The Department's statement and prominent posting of this memorandum on its web site, and tacit support of the memorandum through its public response, could give an impression that the Department is endorsing this individual's divergent opinion on the status of these previously resolved issues and possibly even supporting his recommendation to remove BNI as design authority. Such a position would be surprising, and contrary to the long and well-established history of collaboration on issue resolution.

We acknowledge there are performance and technical issues that BNI must address, and are currently driving major improvement efforts to address them, such as continual safety conscious work environment training for all employees, and the recently formed Reliability Validation Process team and Technical Issue Resolution teams. However, setting up another entity as the design authority for WTP would address none of these issues, and would instead exacerbate the existing already cumbersome decision-making challenges, causing significant delay, without providing enhancements to safety or quality. Under the current structure, DOE can look to BNI as the single point of accountability for design authority and responsibility, fully responsible for both plant safety and operability – this would be lost if DOE accepted the recommendations in the memorandum, and be detrimental to the project and mission.

**RECEIVED**

**AUG 29 2012**

**BECHTEL NATIONAL, INC.**

2435 Stevens Center Place  
Richland, WA 99354

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**DOE-ORP/OPCC**

After reviewing the memorandum, we developed the attached initial set of point-by-point responses to the issues identified there. I request that you review these responses, and share them broadly, including posting our responses on the DOE web site. Full visibility of all viewpoints will help our efforts to promote a strong and open culture and allow the project employees to know that their solid work is being represented in the discussion.

I look forward to further discussions with you, to reach a common understanding of the status of these technical issues, and whether DOE intends to change its position on the decisions previously made. Clarity and durability of previous risk-informed decision-making is critical to completing the vitally important WTP mission.

If you have any comments or concerns please contact me at 509-371-2323.

Very truly yours,



*for* F. M. Russo  
Project Director

JHD/jmp

Attachment: WTP Project Initial Responses to the 34 Points in Brunson Memorandum

cc:

Bradford, R. W. w/o	WTP	MS14-3C
Brown, T. M. w/o	DOE-WTP	H6-60
Charboneau, S. L. w/o	ORP	H6-60
Crawford, S. S. w/a	WTP	MS14-2B
Dawson, R. L. w/o	DOE-WTP	H6-60
Dunkirk, J. H. w/o	WTP	MS14-3B
Hajner, R. S. w/o	WTP	MS14-1B
Heaston, S. M. w/o	WTP	MS14-3A
Kacich, R. M. w/o	WTP	MS14-3B
Noyes, D. L. w/o	DOE-WTP	H6-60
Oxenford, W. S. w/o	WTP	MS14-3B
Russo, F. M. w/o	WTP	MS14-3C
Sawyer, S. L. w/o	WTP	MS14-3C
Sproat, E. F., III w/o	WTP	MS14-3B
St. Julian, J. M. w/o	WTP	MS14-3A
DOE Correspondence Control w/a	ORP	H6-60
PADC w/a	WTP	MS19-A

Attachment to CCN 250883

WTP Project Initial Responses to the  
34 Points in Brunson Memorandum

10 Pages



## **WTP Project Initial Responses to the 34 Points in Brunson Memorandum**

BNI is the prime contractor for the Department of Energy for the Hanford Site Waste Treatment and Immobilization Plant (WTP) which upon completion will stabilize and contain 56 million gallons of radioactive waste from a half-century of nuclear weapons production at the Hanford Site in central Washington. On August 23, 2012, a memo issued by Gary Brunson, Department of Energy Director of Engineering for WTP, raised issues about the design of the Plant.

Initial review indicates that the issues raised in this memo have largely already been addressed with DOE. However, BNI welcomes the opportunity for continuing discussions, and is committed to full transparency about the critically important WTP project, which we are confident is being designed and built to safely and efficiently address the real risk currently in the tanks.

This paper reflects BNI's review of and initial response to the 34 technical issues raised in Brunson's memo.

### **Item 1 LAW Off-Gas Positive Pressure**

The conceptual design for the LAW process offgas was developed by BNFL Inc. and provided to Bechtel by DOE as Government Furnished Information (GFI) for usage. The conceptual design allowed positive pressure downstream of the radionuclide removal equipment including HEPA filters. Upstream the system was under vacuum in alignment with normal ALARA practice. The pressurized part of the system was located in maintenance rooms that were not to be continuously occupied and each room had instruments to detect and alarm if NOx was present. Working with DOE, BNI later changed the design to eliminate the positive pressure.

### **Item 2 Reboilers**

The Steam condensate system design was externally reviewed and the issue of risk of contamination was closed out with DOE approval in 2005. In 2008, BNI self-identified that the detection system would not detect a small pin hole leak. Therefore, BNI proposed to change the design to provide secondary containment, since the consequences of Balance of Facilities (BOF) contamination were too great. DOE approved the change in 2010.

### **Item 3 Preventing Precipitation in Ion Exchange Feed**

The extent of the post-filtration precipitation issue was identified following testing conducted by BNI in 2009. BNI identified two options to resolve this issue, the Heat and Dilute Option (H&D) and the Equipment Option (EO). Both options resolved the technical issue that had been raised. The H&D option had the lesser capital cost, but impacted the number of LAW canisters to be produced and had a small impact on mission duration. The EO was a significantly higher capital cost, though it had the potential to reduce the number of LAW canisters and reduce the mission duration. BNI developed and presented both options to DOE in late 2009. The overriding factor in presenting the two options was to provide solutions that would solve the problem and be in the best interests of the public. DOE selected

the equipment option in March 2010, reflecting DOE's judgment to incur additional capital costs to reap the expected benefits over the long-term operation of the facility.

#### **Item 4 Cathodic Protection**

BNI informed DOE that construction of the CPE system was complete, as defined in the applicable contract activity milestone. Since completion of construction of the CPE, reviews and evaluations continue, to ensure that the system fulfills its design requirements during changing conditions resulting from continued facility construction. CPE systems are not usually subject to construction conditions for over 10 years. This system will be subject to such conditions for upwards of 20 years and therefore requires special management.

The CPE system at WTP is recognized as complex due to the amount of buried material and the changing conditions at the facility as construction progresses. Monitoring of the system parameters is taking place at a higher frequency than provided by the standard, and temporary modifications to address deficiencies have been installed. Multiple outside reviews have been performed in addition to the oversight of the Independent Corrosion Expert (ICE). The ICE supports the BNI position that underground pipe is being protected.

#### **Item 5 Newtonian versus Non-Newtonian Fluids**

A report documenting the assumption that Newtonian bounds non-Newtonian was issued in 2010 after a peer review by several experts on the subject, and PNNL and SRNL agreed with the report's conclusions. If it could be shown that Newtonian fluid characteristics bound non-Newtonian fluid characteristics, then significant cost savings could be realized for analysis and testing. Since no method was available to scale non-Newtonian vessels, Computational Fluid Dynamics (CFD) was expected to provide the most cost effective approach. Previous testing had been successfully completed for non-Newtonian vessels with non-Newtonian simulants. However, these tests did not include the 700 micron particle, which is beyond the limits of the feed and design basis. A small scale non-Newtonian test was of concern since the test itself would be extremely difficult to set up. When the test was completed, in 2011, there were still questions on whether the test itself or the analysis provided the more accurate results. As a result, it was determined that further analysis and testing to demonstrate that Newtonian bounded non-Newtonian was not the best path forward. The time frame to develop the analysis, complete expert reviews, design the test, conduct the test, and finalize the results did require approximately 18 months. However, this did not result in a delay to the project of 18 months, because this work was undertaken in parallel with many other required project activities. Overall, the testing is one more example of the need for judgment in determining whether further testing will provide additional confidence given the uncertainties inherent in either method.

#### **Item 6 Flow Sheet Design Basis Mass Balance**

Recent mass balances for maximum radionuclides in WTP have correctly omitted accounting for a Sr/TRU strike being performed in WTP, because since 2007, the tank farms feed delivery plans have shown that the Sr/TRU strike is performed at the tank farms prior to delivery to WTP. However, BNI has incorporated all contract required unit operations, including the capability to conduct Sr/TRU unit



operation, in the WTP design. This capability will not be exercised unless conditions change and it is needed. The mass balance used for the LAW Facility Hazard Category correctly accounts for the fact that the Sr/TRU was removed from the supernate prior to delivery at WTP. The DOE WED comments on the calculations use for the LAW Facility Hazard Categorization were reviewed and it was determined that the concerns raised were not due to errors in the calculation.

#### **Item 7 Garnet/Olivine Additions**

In 2012, Tank Farms and BNI jointly issued a report evaluating the potential impact to WTP of the addition of olivine to tank waste from a cutting operation to allow waste retrieval from a very old single-shelled tank. The quantitative analysis showed that olivine has a hardness equal or lower than the WTP design basis, which is sand, and the added olivine accounts for less than a 0.5% increase in the abrasive particles (those with a hardness greater than stainless steel) in the receiving tank. This change is clearly very minimal and well within the accuracy of any erosion estimate; nevertheless, a quantitative estimate of the impact is under development. This is an excellent example of a risk-informed judgment being used to address the risk posed by the material in an aging tank, and to comply with a consent decree milestone.

#### **Item 8. Ion Exchange Sample Capability**

The issue of sample capability from the bottom of ion exchange columns was raised in a draft document prepared by WRPS (CLIN 3.2 Report). As a result of the question raised in this document, BNI developed 24590-WTP-PIER-MGT-12-0354 to capture the issue. The issue was thoroughly evaluated in CCN: 244080, which identified each autosampling point and the need and purpose for samples at those points. This document explains why the BNI design provides for the capability to detect and respond to off-normal conditions, such that the function to be fulfilled by the sampling capability was no longer required. The One System technical team is instituting a process to interact with the WRPS authors on this and other issues identified in the subject CLIN 3.2 Report.

#### **Item 9 Computational Fluid Dynamics (CFD)**

CFD is proven technology successfully used in multiple industry applications. Testing is very expensive, and due to the limitations of the science, the question of simulants and operational differences will always remain. CFD provides an analytical tool to analyze multiple configurations in a more cost effective way. DOE agreed with the overall PJM vessel design and control strategy, which included CFD, by letter in December 2011.

Scaling is another way to help mitigate the need for full scale prototypic testing, but current questions for CFD applications are also applicable to scaling and full scale testing. We have chosen to use both of these methods (CFD, scaling) in combination to provide added confidence. BNI's continuing work with NETL on CFD, and PNNL on scaling, will help ensure that the critical bases are adequately covered.

#### **Item 10 LAW Vitrification Hazard Category**

The original hazard category was established in accordance with the applicable DOE Standard in existence almost a decade ago. DOE subsequently wrote supplemental informal guidance that was

recently used to revisit the original categorization. Although the hazard category changed, no physical changes to the LAW facility or any safety system in that facility are required because the current BNI designs already align with the higher hazard category requirements. This is because BNI decided early in the design process to design to the higher classification to account for the uncertainty in the hazard classification. The changes to the Project documentation to align with the new hazard category will be completed as part of the finalization of the DSA.

**Item 11 Gas Turbine Generators**

Turbine generators were selected as the preferred technology because they can operate in the WTP environment without water cooling. Water cooling would add complexity to the design due to the need to address ash fall for not only supply air but for radiator performance as well.

The cost of the turbine generator on a commercial basis, even with commercial dedication costs, is significantly less than a diesel generator from a NQA-1 supplier, saving the government and the tax payer money without negatively impacting safety or efficiency. Further, the cost and technical comparison demonstrated the turbine generator was also the superior technical choice. BNI and DOE have had continuous interfaces on the selection of the turbine generator technology and agreement on the decision was reached with DOE in 2011.

The time to start for the turbine generators is longer than the diesel generator. However, a UPS power source to bridge the time to start for either type of generator is required. For awareness, one commercial nuclear facility ran for 25 years with the on-site emergency power sources being one diesel generator and one turbine generator. Also, to the extent that ash fall design requirements will be more conservative, as is contemplated, the water cooling issue noted above would have been even more challenging.

**Item 12 Defects in Buried Piping**

Buried pipe is reviewed prior to backfill operations. Holidays (coating defects) occur over time because although the coating system is high quality, it is not rated or expected to last for the life of the plant. The identification of 9 of 11 sites having holidays was an expected result for such a sampling campaign, and the BNI action plan responsibly deals with the unique challenges associated with the extended duration of the WTP construction effort, as described further in the answer to item 4, above. The action plan includes selective use of controlled density fill, revised procedures that call for increased inspections, and timely energizing the cathodic protection system as conditions permit.

Cathodic protection systems are partially energized when complete to protect the pipe to mitigate the implications of the holidays. BNI construction has a procedural requirement to perform the holiday test on any new or existing pipe prior to backfill. This process provides ongoing reviews of extent as the procedure applies to new or excavated pipe. As part of the cathodic protection system independent consultant review, additional methods for evaluation of buried pipe without excavation are being investigated.



**Item 13 Mixing Design Basis**

The WED particle size distributions and density increases have been extensively tested by BNI since 2010. However, DOE has not incorporated these new proposed waste parameters into the WTP contract.

The EFRT identified a potential concern with fast settling solids in Newtonian slurries, but did not point out the potential for an increase in the portion of dense particles during aluminum leaching. The waste-size particles utilized by BNI for initial M-3 testing were consistent with the waste acceptance criteria in ICD-19, a prime contract submittal. See, response to Item 34 with regard to BNI's evaluation of post-leaching particle properties.

**Item 14 HEPA Filter Loading**

The original circular filters were part of the conceptual design provided by DOE to BNI. The filters are not first-of-a-kind, are used extensively at the Sellafield site, and are particularly useful for remote change out of filters. DOE evaluated and approved the safety of this type of filters in September 2005.

The statement that BNI recommended that no testing was needed is incorrect. Qualification testing is still required in BNI's plans. The information from recent testing will inform the qualification testing.

**Item 15 Materials Selection**

The simulant recommended by BNI for testing was more than acceptable for proper and prudent testing. It contained all constituents that would be present in the waste, at high enough concentrations to have an effect on the corrosion rate of the stainless steel. The selection of the simulant was well known to DOE and not challenged prior to performing the tests. The materials chosen have been repeatedly endorsed as correct by several external review groups, most recently during the week of August 20, 2012.

The established temperature limits and analysis of the literature conditions and their applicability to WTP conditions was not documented in Table 5-1 in 24590-WTP-M-04-0008 as noted in the comment. However, Section 6 of that report, Summary and Conclusions, does compare the literature and test results against WTP conditions.

**Item 16 HLW Spent Melter Disposal**

As identified on page 16 of 24590-WTP-PL-RT-03-003, BNI did state that "for spent and failed melter disposal, a permitting and regulatory pathway is being evaluated to ensure that melter design, treatment, and classification provide a high level of confidence that necessary permits can be obtained and that the melters are classified such that Hanford Site disposal is possible." In 2003, Research and Technology (not Engineering, the Design Authority) recommended evaluating disposing of HLW melters on-site as remote handled TRU, and acknowledged the prohibition on disposal at Hanford by citing the need to evaluate the regulatory and permitting path to do so. We made this recommendation in the spirit of proposing cost-effective solutions for DOE consideration, fully recognizing that in this instance a new permitting path would be required.

ICD-3 which addresses melter interface information, was issued with DOE concurrence in August 2003. The introductory paragraph of ICD-3, Section 4 states "This section provides interface information related to the melters that are generated at the WTP and transferred to the DOE for management and disposition. Providing the transportation and disposal system capability, including supporting activities (that is, permitting, safety analysis, performance assessments and so on) is included in the TFC planning baseline." Disposal of spent and failed melters is currently actively being evaluated by WRPS, including the possibilities for disposal at Hanford. Although WTP's baseline includes construction of a spent/failed melter storage facility, BNI has suggested DOE consider instead using an existing Hanford Site TRU processing facility as a lower cost alternative. Currently the One System organization is addressing an update to ICD-3.

#### **Item 17 Melter Purge Vacuum System**

Equipment can be introduced into the melter caves and pour caves. The melter caves are not black cells; they are accessible, and contain cranes and manipulators that will allow equipment to be installed and operated effectively.

The current concept for reducing radionuclide content at the end of melter life is to purge by running clean glass through the system. The removal of spent or failed melters has always included placing the melter in a shipping cask for disposal. The cask will be able to handle a failed melter. Reducing the radionuclide content by purging with clean glass or an alternative like that tested at West Valley is a desired condition; however, it is not necessary for replacing a spent or failed melter.

#### **Item 18 Sparger Plugging**

The discussions on the optimum solution to mitigate sparger plugging are ongoing; meetings and proposals to provide solutions, including automated flushing, reflect the ongoing, normal dialog. The current design provides for manual flushing, a proven design solution that has been implemented at other sites. The use of water is the preferred remedy, but provisions for chemical addition are available in the current design if needed during facility operations. At this point additional testing was not prescribed, as the phenomenon cannot be fully prevented, only reduced in frequency.

#### **Item 19 Hazard Analysis and System Descriptions**

The governing procedure for conducting hazard analyses properly requires the evaluation of available engineering documents. The term "whatever" was a poor word choice by BNI. The intent was to indicate that the hazard analysis team should be using the best available information that fully captures the design. The intent of the procedure changes was to remove the mandatory input requirement because due to the design iteration process, it may not be available at the time of every hazard analysis and could further delay the process without the capability of resolution.

As of the week of August 20, 2012, BNI met with DOE WED and came to common agreement as to what the procedure would say. All parties were satisfied with the path forward and draft language of the revised procedure would be shared with DOE WED prior to issuance.



**Item 20 Decontamination Methods**

The CO<sub>2</sub> decontamination system was part of the advanced conceptual design provided by DOE to BNI at the outset of the contract. CO<sub>2</sub> decontamination is a common method used in D&D of nuclear sites. BNI retains both stainless steel containers and decontamination due to contractual requirements that have been unchanged since the original contract was signed in 2000.

Contract specification C.2.2.2.1 requires a stainless steel container and contract specification C.2.2.2.10 places limits on external contamination. To meet these decontamination criteria on stainless steel requires use of the CO<sub>2</sub> method. If the requirement to decontaminate was removed, changes in the LAW HVAC zoning design would be required to deal with the delivery of contaminated containers for disposal.

**Item 21 Technetium-99 Ion Exchange Capability**

BNI recommended to DOE in January 2003 that the Tc-99 ion exchange system be deleted from the Pretreatment facility flowsheet based on the knowledge that the isotope would be incorporated in the glass and that the ion exchange system would not remove enough of Tc-99 to be effective (only 80 percent removal). Additionally, DOE, in an effort to curb increasing capital and operating costs, strongly encouraged BNI to eliminate or reduce unneeded features in the design, and defended the removal of the system in a Dangerous Waste permit modification submitted by DOE to the Department of Ecology in 2004. Should Tc-99 removal be judged to be needed based on recently gained information, it is considered to be far less costly to perform that function after pretreatment.

**Item 22 Vessel Cooling Jackets and Margin**

The original margin requirement was based on the use of a pressure relief valve which relies on a mechanical device to limit the pressure. That valve has since been replaced by a static head system. The design pressure of the cooling jacket is based on the distance from the max level of the fluid level in the cooling tank to the minimum level of the head jacket and uses the max density of water. There is no possible higher pressure; therefore, a set margin on the design pressure is not needed, and the now-unnecessary requirement has been removed from the guide.

The original design of the vessels did not include cooling jackets on the bottom head when the vessel heads were formed. The vendor is working with BNI to develop the final design so that the vessel meets the applicable code requirement at the least cost to the government. Those options include application of code cases as well as an evaluation if the lower cooling jacket is still necessary for plant operation.

**Item 23 Nationally Recognized Testing Laboratory Label (NRTL) Exemption**

BNI, acting as the electrical Authority Having Jurisdiction (AHJ), issued a ruling that items with only less than 50 V did not require NRTL listing. The ruling was supported with information from other DOE sites and also with bases related to the relative lack of electrical danger at that voltage level. BNI agreed that the code only allowed alternatives or exceptions for specific cases. They noted that this interpretation was specific to components rated less than 50 V.

In 2012, DOE disagreed with the interpretation, causing BNI to revise the specification to remove the exemption. The DOE decision to remove the exception resulted in additional reviews and documentation regarding some of these low voltage items, which added significant cost without a clear improvement in protection to the plant or co-located workers.

**Item 24 Uninterruptible Power Supplies**

Early in the project, if UL was not available other internationally recognized testing bodies such as Canadian and European were considered to meet the requirement of a Nationally Recognized Testing Laboratory. BNI believed this interpretation to be reasonable and technically sound. Subsequent to that, with DOE input, BNI concurred that additional documentation would be necessary to support such determinations on a case-by-case basis. BNI has been in the process of identifying non-compliant equipment using the NCR/CDR process. BNI has had an ongoing contract with UL since June 2006 to review these non-conforming items using the field evaluation process to re-certify as needed.

**Item 25 Ammonia Dilution Skids**

Ammonia dilution skids are commonly placed in various locations, including inside buildings. The hazard to the worker from this placement has been recognized and the system is classified to meet safety requirements and protect workers.

The thermal catalytic oxidizers, located in the LAW and HLW facilities, require the use of ammonia, which means that ammonia will be present inside the facilities regardless of the location of the dilution skids. The ammonia storage vessels are located outdoors at a downwind location, but the ammonia must be piped to the dilution skids in the facilities to support the thermal catalytic oxidizers.

For HLW, the PDSA will confirm that necessary controls are included. For LAW, the DSA development will confirm the controls. Since ammonia will be used in the facilities, some administrative controls may be required in addition to the engineered controls identified in the PDSA; this is expected to be confirmed by the PDSA/DSA updates.

**Item 26 Isolok Sampling System**

Sample system testing was performed by BNI, and the EFRT P9 issue closed by DOE and concurred on by the EFRT member who originated the issue. The closure report, issued in November 2009, recommended follow-on actions, including one to address some random biases observed in the HLW testing. An action to adjust the glass algorithms for the uncertainties observed in the testing is in the BNI action tracking system and is planned to be completed in the spring of 2013.

**Item 27 Conservatism in Feeds for Process Corrosion Data Sheets**

The BNI correspondence (CCN) was not a design input analysis and the assumption that 1 mole of aluminum complexes 3 moles of fluoride has not been used in the mass balance calculation. The contract does not contain speciated waste component values. Assessing final waste forms is necessary, and therefore some enabling assumptions have to be made.



**Item 28 Process Control of Pulse Jet Mixed Vessels**

There have been no formal calculations issued with respect to bubbler length. Informal CFD analyses were performed for the UFP vessels to gauge the effects of the PJM cycling, recirculation flows, and pump suction flows on bubbler level readings. Based on the results of this analysis and using engineering judgment, BNI recommended raising the bubblers in 17 PTF vessels. The logic behind the recommendation is that raising the bubblers minimizes the potential of plugging due to potential sludge layer accumulation at the bottom of the vessel, and it locates the bubblers in a quieter zone within the vessel. This change was made in anticipation of a significant improvement in the measurement quality affording more dependable PJM stroke control.

The recommended bubbler location allows for normal level controls for the vessels. Level indication for heel management was not identified at the time this recommendation was made. The level and density bubbler tubes are immersed in the process with their ends a known distance from each other (20 inches). Density is derived using this distance and the measured back pressure. The derived density value is applied for the whole vessel. Therefore, no matter where the 20 inch delta is located, this density will be extrapolated for the entire vessel. Further insights from LSIT will inform the decision on the optimum bubbler location in the vessel. When complete, BNI's final design will be informed by all available information, and documented in a transparent manner.

**Item 29 Closure Method for LAW Glass Canisters**

DOE agreed with the transition from welding to the mechanical closure device, and to deleting the requirements for leak testing, and incorporated those changes into Section C 2.2.2.12 of the Contract in April 2003. Welding of LAW glass container lids was removed based on an evaluation of the low radionuclide content in the glass form, which determined that mechanical closure was an acceptable method for LAW container closure, thus allowing for significant cost savings associated with long term operational costs of welding lids. With respect to unresolved leak test issues, CCN 226707 closed several technical issue actions, and recognized there are additional actions required to be closed to fully address the lid testing.

**Item 30 PJM-Mixed Vessels**

Custom vessel sizing was part of the advanced conceptual design provided to BNI by DOE at the outset of the contract. Some vessel sizes are driven by contract requirements, and attempting to standardize vessels would either result in oversizing or undersizing many vessels, driving up cost in the former case and decreasing throughput rate in the latter case. A careful review of vessel sizes was conducted by the joint BNI, DOE, and Tank Farm Technical Integration Baseline Development Team in 2002-2003 resulting in elimination of four vessels and resizing of two other vessels (HLP 28 was changed from 9,000 gallons to 81,000 gallons and HLP 22 was changed from 86,000 gallons to 160,000 gallons) from the original conceptual design.

**Item 31 Design Concept**

As part of the initial contract due diligence, BNI recommended major changes to the original black cell concept that significantly reduced the size of the black cells and the components they contained. For example, the evaporators, the cesium ion exchange systems and the ultrafiltration system, which were originally in the black cell, were placed into hot cells, where they can readily be accessed for maintenance or replacement. These major changes were reviewed by DOE in 2001 and implemented. DOE and BNI have continued to pursue measures to increase the reliability of black cell equipment.

**Item 32 HLW Concentration Use of Ultrafilters**

The use of ultrafiltration for solids separation was part of the advanced conceptual design provided to BNI by DOE at the outset of the contract; this process is required by the contract. BNI did extensive lab and engineering-scale testing in response to EFRT recommendation M12. Testing with ultrafilters of prototypic diameter and length in 2009 on the Pretreatment Engineering Platform showed that the leaching and concentration processes worked as designed. Evaporation is a concentration process, not a solids separation process, both solids separation and concentration is needed for WTP.

**Item 33 Material Balance**

In 2008, BNI determined that the existing analytical basis for the mass and energy balance, an Excel spreadsheet called WEBPPS, should be replaced by Aspen software that would be sustainable into plant operations. The development of the new mass and energy balance was considerably delayed by the need to perform V&V of this software to conform with newly issued DOE Order 413.1C on software life-cycle documentation. After V&V was completed, a mass and energy balance calculation was completed and the Process Inputs Basis of Design document was issued in mid-2010. Updates supporting shielding analyses and corrosion analyses were planned to be performed subsequently, and have been completed.

**Item 34 Implementation of Black Cell Oversight**

BNI provided the evaluation (recommended in February 2004) of the potential for waste processing to increase the erosion potential of the waste due to precipitation of large hard particles. The evaluation was provided in a letter (and later in a report), that was accepted by DOE in May 2004 when DOE closed the recommendation. In 20102, BNI did an exhaustive evaluation of waste particle properties after washing and leaching as part of the M3 mixing issue and found little change to the erosive parameters of the particles.