Table A-10 Non-Manual Labor Distribution for 2nd Quarter 2006.

OBS	EA	#Craft workers per Non-manual worker	%Non-Manual work hour/Craft work hour
T0-Management	19	99	0.86%
T1-Supervision	84	22	3.81%
T2-Field engineering	320	6	14.51%
T3-Quality Control	78	24	3.54%
T4-Subcontracts	30	63	1.36%
T5-admin	96	20	4.35%
T6-Project controls	45	42	2.04%
T7-Procurement	55	34	2.49%
T8-Safety	27	70	1.22%
T9-Field Services	12	157	0.54%
Total	766	2	34.73%
Total Craft	1887		

A2.19. REVIEW OF CONTINGENCY

The IR team reviewed the EPCC Contingency analysis completed by BNI, which included a thorough review of all underlying assumptions and bases used to determine the terms and variables input into the Bechtel Risk Analysis Contingency tool. In addition, there were discussions with many of the BNI personnel responsible for accomplishing the contingency analysis.

Although the contingency analysis was revised as both the IR team's and BNI's review of the underlying data uncovered a few errors or inconsistencies, the total proposed contingency allowance of $700 million was not changed. BNI used the schedule contingency allowance, meant to cover 6 months at the approximate hotel load level forecasted for the end of the project, as the element that would change, as small adjustments were made to the EPCC contingency.

The most recent breakdown of the proposed EPCC Contingency is summarized in table A-11.

Table A-11 EPCC Contingency Allowance ($M)

Project Element	ETC	Contingency	Contingency %
Pretreatment	1,137	188	17%
Low-Activity Waste	314	31	10%
High-Level Waste	679	119	18%
Balance of Facilities	165	20	12%
Laboratory	99	14	14%
Shared Services	1,753	132	8%
Commissioning	646	147	23%
Schedule Contingency		49	
Total Project	**4,793**	**700**	**15%**

A2.20. REVIEW OF TECHNICAL AND PROGRAMMATIC RISK ASSESSMENT (TPRA)

The IR team reviewed the most recent BNI submitted Risk Assessment Report (April 2005) and the supporting analysis used to calculate the proposed TPRA contingency allowance. During the review, an inconsistency was identified and was subsequently corrected by the BNI project team. This resulted in a lowering of the proposed TPRA contingency from approximately $79 to $78 million. The proposed TPRA is summarized in table A-12.

Table A-12 TPRA Summary

Risk Type	No. of Open Risks	Proposed TPRA Contingency
Technical Risks	11	$22M
Programmatic Risks	10	$34M
Commissioning Risks	6	$22M
Total Risks/TPRA	**27**	**$78M**

A2.21. INDEPENDENT ASSESSMENT OF DOE PROGRAMMATIC RISKS

As the IR team accomplished a detailed review of the 2005 EAC documentation provided by BNI and discussed issues and questions in numerous meetings with project personnel, the IR team compiled a list of critical assumptions and other issues that appeared to represent risk and uncertainty associated with the estimated project cost. After receiving the results of the EPCC Contingency and TPRA analyses done by BNI, and discussing these results with those responsible, the IR team assessed the degree to which its lists of risks and uncertainties had been appropriately captured in the BNI analyses. For those programmatic risks that remained, the IR team assessed the potential cost impacts in terms of best, most likely, and worst cases. This data was then used as input for a probabilistic risk analysis using Monte Carlo simulation software (specifically, Crystal Ball®). The IR team's risk/uncertainty list and the assessment of those risks and uncertainties can be found in appendix C. The results of the IR team's Risk Analysis can also be found in appendix C.

Table A-13 summarizes the programmatic risk elements the IR team assessed and included in the IR team's contingency analysis. The basis for these assessments can be found in appendix C.

Table A-13 Independent Programmatic Risk Contingency Analysis Elements

Risk Element	Potential Additional Contingency Required ($M)		
	Best Case	**Most Likely**	**Worst Case**
Escalation Impact	80 (3%/yr)	500 (4-5%/yr)	1100 (6%/yr)
New Engineering Event *	0	20 (1 new event)	60 (3 new events)
Engineering Scope Growth *	0	25 (5% more work)	50 (10% more work)
Engineering Performance	0	25 (5% more hours)	50 (10% more hours)
Fireproofing Additional Impact	10	25	50
Commissioning Schedule	25 (3 months)	100 (1 year)	200 (2 years)
ORR Impacts	25 (3 months)	50 (6 months)	100 (1 year)

* Values shown represent only engineering cost impact. Risk analysis model assumes there will also be a corresponding increase in construction costs based on historical average that shows engineering is approximately 30 percent of estimated construction costs. For example, the potential worst case impact if there is 10 percent more engineering work scope identified is the $50 million for engineering plus an addition of approximately $167 million of construction work.

A2.22. FUNDING LEVELS AND SCHEDULE SCENARIOS

The schedule extension has been executed in a two-step process. The first step was presented in unconstrained Scenario A in which engineering and installation activities were delayed, in part, by including a timeframe for revisions required for Seismic re-evaluation. Some construction work is proceeding with an "interim design criteria" that includes a safety factor in these tasks. After adjustments were made to the schedule to include the Seismic re-evaluation and to move out the spending profile, Scenario A extended the completion date two years. This Scenario still reflected spending over the funding limit.

Consequently, this resulted in the need to develop another spending profile, known as Scenario B. This version added two more years to the project completion. This plan further delayed design, procurement and installation activities to match the funding targets established by DOE. The schedule extension added approximately $300 million to the Scenario A budget, due to continuation of hotel costs.

<u>Scenario A 2005 EAC Development:</u>

This forecast represents a Class 2 estimate incorporating detailed factors that influence job costs. Detailed material and quantity take-offs were performed from design drawings and specifications. Installation hours were based on performance assessments of trades and equipment usage where applicable.

Four areas of scope were addressed:

- Capital expenditures consisting of permanent equipment, materials and installation
- Support services consisting of all supporting staff including Start-up and Commissioning.
- Escalation has been added to all areas as needed.
- This estimate includes Risk & Contingency.

Major changes from 2004 PMB:

- Non-Newtonian Mixing
- Hydrogen in Piping and Ancillary Vessels (HPAV)
- Design Evolution
- Fireproofing of Structural Steel
- Performance Related Changes
- Revised Ground Motion

The methods and logic behind this approach to developing the required EAC seem sound and based on reasonable assumptions and detailed information.

<u>Scenario B 2005 EAC Development:</u>

The funding compliant execution plan was developed using two models to reflect:

- Impact of flattening expenditures of project work
- Extending staffing costs due to extended period of performance

Several iterations were performed before the funding level was established.

Revisions to the current Scenario A spending profile to produce Scenario B are based on a schedule extension of unidentified P3 activities; therefore, there is no detail information available to review and reconcile the basis of the revisions. With this extension, the Total Float in Scenario B was increased and activities in engineering, procurement and construction were further deferred to take advantage of that added Float.

The constrained schedule would have contained more valuable information if fully developed first, as the new proposed baseline. It then would have been much easier to identify and define areas and activities that could be accelerated to produce the unconstrained schedule. The Scenario A schedule had already been given an additional 2 years of time for completion and therefore had significant float on many of the paths. Without detailed backup for a P3 schedule, it cannot be determined where 2 more years of float were required for Scenario B.

Appendix B
Seismic Background and Analysis

1.0 Background

The River Protection Project Waste Treatment Plant (WTP) selected DOE-STD-1020-94 as the seismic standard for the facility in 1997, using the contractually required standards-based integrated safety management selection process. The U.S. Department of Energy (DOE), Office of Safety Regulation (OSR) approved the selection in 1997.

In order to perform the facility design, the previous contractor, British Nuclear Fuels, Ltd. (BNFL), selected the most limiting site-specific peak ground acceleration (0.26 g horizontal, 0.18 g vertical) associated with the 2,000-year recurrence interval, along with the corresponding site-specific seismic response spectra. A 2,000-year recurrence interval was selected because the facility is Performance Category 3 using DOE-STD-1020, having a significant radiological hazard (Hazard Category 2) but less than a nuclear reactor.

The acceleration values, and associated spectra originated in the seismic hazard report for the Hanford Site (Geomatrix 1996). This report refined the seismic hazard model for the region that was begun in 1981 for the Washington Public Power Supply System's reactor sites, and that was subsequently updated to accommodate the latest seismic considerations in 1989 and 1993-1996. The acceleration and spectra were accepted for the DOE Hanford Site in 1997 by the DOE Richland Operations Office. The determination was extensively peer reviewed, revalidated by the previous privatized contractor (BNFL 1999), and independently reviewed by OSR contractors from the U.S. Army Corps of Engineers and Lawrence Livermore National Laboratories in 1999. It is also consistent with the latest recommendations of the United States Geologic Survey National Earthquake Hazard Reduction Project. Subsequently, the current contractor, BNI, adopted the same criteria in 2001, after a thorough review.

The Defense Nuclear Facilities Safety Board (DNFSB) staff questioned the assumptions used in the seismic design, in informal discussion on March 21-22, 2002. Initially, the focus of these discussions was the adequacy of the geotechnical survey of the site, performed by Shannon-Wilson, and related to the seismic design basis. All of these issues have subsequently been resolved by providing additional information. Follow up discussions were held on April 18, 2002. On May 22-23, 2002, the DNFSB further explored these and other issues with DOE-ORP and BNI.

The seismic concerns of the DNFSB were discussed in some detail at a June 5, 2002, meeting held in San Francisco, California. Since that meeting further discussions have occurred with the DNFSB staff and between BNI and DOE-ORP. Additional information was provided to DNFSB on June 28, 2002, and July 8, 2002.

Three issues concerning the seismic design were raised in the DNFSB letter dated July 30, 2002. These issues were the probability of tectonic activity of the anticlines and associated faults for the Yakima folds; the spectral amplification associated with the attenuation relationship; and the amplified floor and equipment response of the superstructure. The first two issues were reexamined and addressed in a position paper, ORP/OSR-2002-22. DOE-ORP's best estimate of the probability of tectonic activity at the WTP site, and of the spectral amplification remained as developed in the 1996 Geomatrix report.

In the DNFSB letter dated January 21, 2003, one unresolved issue was identified. The assumption that site response characteristics of the soils underlying the Hanford Site 200 Areas is similar to those represented in California. DNFSB indicated there is large uncertainty in the data using this approach, and the Hanford ground motion criteria did not appear to be appropriately conservative. Furthermore, the level of conservatism implemented by BNI must be maintained in future work at Hanford, unless site-specific attenuation relationships are developed.

To address this remaining concern, DOE-ORP provided a detailed plan in August 2004. The plan included acquiring site-specific soil data down to approximately 500 feet, re-analyzing the effects of deeper layers of sediments inter-bedded with basalt (down to about 2,000 feet) that may affect the attenuation of earthquake ground motion more than was previously assumed, and applying new models for how ground motions attenuate as a function of magnitude and distance at the Hanford site.

The Pacific Northwest National Laboratory (PNNL) report, "Site-Specific Seismic Site Response Model for the Waste Treatment Plant, Hanford, Washington," February 2005, documents the collection of new and existing site-specific geologic and geophysical data characterizing the WTP site and the modeling of the WTP site-specific ground motion response. The new horizontal ground response spectrum increased the peak ground acceleration from 0.26 g to 0.29 g, and the peak acceleration increased from 0.56 g to 0.80 g, a 38 percent increase. The increased ground motion is attributed to: (1) soil and gravel underneath the WTP is less than previously assumed (365 feet rather than 500 feet), and (2) less damping effect from the four deeper soil/basalt layers. Figure 1 shows the differences between the 1996 horizontal ground response spectrum and the 2005 horizontal ground response spectrum.

DOE-ORP provided BNI with advance notification of the expected outcome of the PNNL study on February 1, 2005, and with the revised spectra developed by PNNL on February 11, 2005.

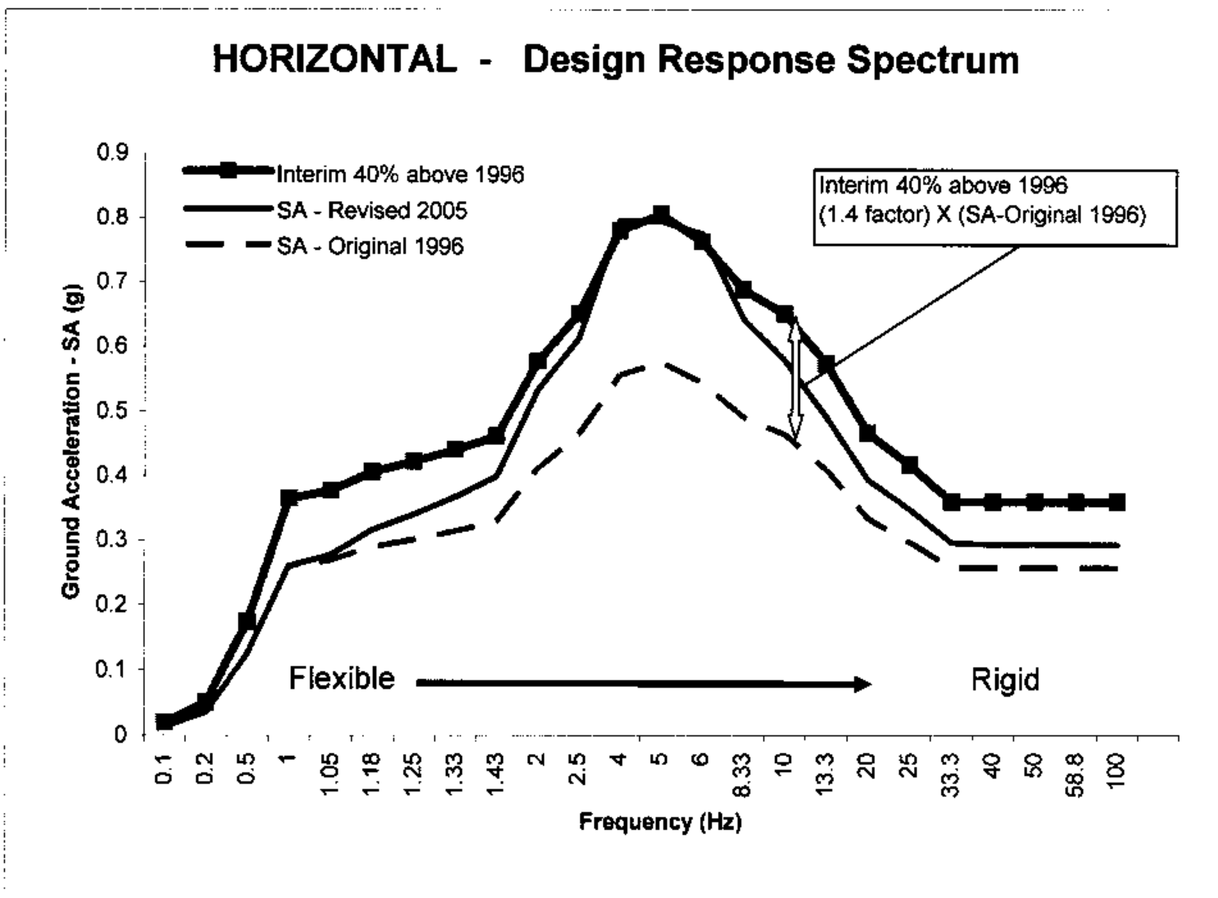


Figure 1 Horizontal Response Spectra Comparison including the April 1, 2005, Interim Seismic Criteria

After receiving a written request from the DOE-ORP, BNI developed recommended interim seismic criteria to be used prior to the completion of updating structural modeling, based on the revised ground motion, and submitted these criteria to DOE-ORP on March 8, 2005. DOE-ORP reviewed and modified the interim seismic criteria and provided the approved "Interim Seismic Criteria" to BNI on April 1, 2005, which states: "The acceleration is increased by 40 percent in the 4-7 Hz range, and to a smaller magnitude outside this range. Assessment of the seismic analysis is that the magnitude of increase in loading for the SSCs for most of the cases would be at least 5 to 10 percent less than the assumed 40% increase in the peak seismic accelerations.[12]" Figure 2 illustrates that there are a significant number of situations where the magnitude of loading increase is likely to be less than the 40% maximum increase.

[12] April 1, 2005 letter from ORP to BNI with the subject the Approval of the Interim Seismic Criteria for the Waste Treatment and Immobilization Plant with comments

Horizontal Increases: 25%20 % to 14% increase; 10% - 20% - 30% - 30% to 40% increase; ≤ 10% 20% 30%; No change

Vertical Increases: 25% to 20% increase; 30% to 25%; 10% - 20% - 30% - 30% to 40% increase; ≤ 10% 20% 30%; No change

Frequency (HZ)	SA - HOR 1996 (g)	SA - HOR 2005 (g)	% increase	difference between % increase and interim criteria requirement[1]	SV - VERT 1996 (g)	SV - VERT 2005 (g)	% increase	difference between % increase and interim criteria requirement[1]	Typical Examples from the project with calculated frequencies[3]
100	0.257	0.293	14.01%	-25.99%	0.175	0.2135	22.00%	-18.00%	
58.824	0.257	0.2937	14.28%	-25.72%	0.175	0.214	22.29%	-17.71%	circular 60" /72" ducts (67/80 Hz)
50	0.257	0.294	14.40%	-25.60%	0.175	0.2142	22.40%	-17.60%	rectangular 24" ducts (47 Hz)
40	0.257	0.2943	14.51%	-25.49%	0.198	0.242	22.22%	-17.78%	circular 34" ducts (36 Hz)
33.33	0.257	0.2967	15.45%	-24.55%	0.219	0.2692	22.92%	-17.08%	24" dia. Vessel (1st mode 29 Hz)
25	0.2975	0.348	16.97%	-23.03%	0.2567	0.3193	24.39%	-15.61%	rectangular ducts (24 to 27 Hz)
20	0.3333	0.3937	18.12%	-21.88%	0.2904	0.3644	25.48%	-14.52%	tanks (22 to 23 HZ)
13.333	0.4097	0.4916	19.99%	-20.01%	0.3634	0.468	28.78%	-11.22%	ducts (15 Hz)
10	0.4644	0.578	24.46%	-15.54%	0.3662	0.468	27.80%	-12.20%	
8.333	0.4913	0.6418	30.63%	-9.37%	0.3563	0.468	31.35%	-8.65%	
6	0.5439	0.7749	42.47%	2.47%	0.3392	0.468	37.97%	-2.03%	
5.75	0.5511	0.7941	44.09%	0.04	0.337	0.468	38.87%	-1.13%	
5	0.5754	0.7941	38.01%	-1.99%	0.33	0.4593	39.18%	-0.82%	
4	0.5565	0.7941	42.70%	2.70%	0.3097	0.4233	36.68%	-3.32%	
2.5	0.4642	0.6115	31.73%	-8.27%	0.2514	0.3311	31.70%	-8.30%	
2	0.412	0.5334	29.47%	-10.53%	0.2226	0.2882	29.47%	-10.53%	
1.429	0.3297	0.3993	21.11%	-18.89%	0.1738	0.2105	21.12%	-18.88%	
1.333	0.315	0.3676	16.70%	-23.30%	0.1652	0.1928	16.71%	-23.29%	
1.25	0.3018	0.3402	12.72%	-27.28%	0.1575	0.1775	12.70%	-27.30%	
1.176	0.2899	0.3163	9.11%	-30.89%	0.1506	0.1643	9.10%	-30.90%	
1.053	0.2693	0.2769	2.82%	-37.18%	0.1388	0.1427	2.81%	-37.19%	
1	0.2603	0.2603	0.00%	-40.00%	0.1336	0.1336	0.00%	-40.00%	
0.5	0.1239	0.1239	0.00%	-40.00%	0.0753	0.0753	0.00%	-40.00%	
0.2	0.0357	0.0357	0.00%	-40.00%	0.0268	0.0268	0.00%	-40.00%	
0.1	0.0139	0.0139	0.00%	-40.00%	0.0122	0.0122	0.00%	-40.00%	

Indicate the broadened peak recommended in PNNL-15089 and provided in the February 11, 2005 letter from DOE-ORP to BNI.

Figure 2 Comparison between 1996 Design Criteria, 2005 Design Criteria and the Interim Seismic Design Recommendation

1. Interim criteria developed by BNI specifies that the Structural design Criteria shall have the seismic (earthquake) component multiplied by 1.4 This column represents the difference between the increase in spectral acceleration recommended by the PNNL report and the 40% increase recommended in the interim criteria. A negative number indicates the amount the interim criteria overestimates the impact of the change in the spectral accelerations between the 1996 and 2002 criteria
2. The PNNL report page 3.30 states that the sharp peak of the recommended spectrum is at 5 Hz. The spectral broadening process was accomplished by extending the peak on the low-frequency side about 30% to about 3.85 Hz and about 15% on the high-frequency side to about 5.75 Hz. For higher frequencies, the spectrum was then extended linearly (in log-log space) to a frequency of 12 Hz.
3. The components and sample frequencies are examples taken from the calculations for the Waste Treatment Plant Facility. They are not necessarily representative of all of the similar components in the project but represent examples at specific locations in specific buildings.

2.0 Project and Facilities Overview

The WTP consists of a pretreatment (PT) facility, designed to separate tank waste into high activity and low activity fractions; a Low-Activity Waste (LAW) Facility, designed to process and vitrify the LAW fraction; High-Level Waste (HLW) Facility, designed to process and vitrify the HLW fraction; an Analytical Laboratory (LAB) for radiochemical analyses; and 21 supporting facilities known as the Balance of Facilities (BOF). The plant is designed to immobilize (vitrify) a minimum of 10% of the Hanford tank waste by mass and 25% of the Hanford tank waste by activity, by 2018.

Additionally, facilities and services are required by the River Protection Project (RPP) for WTP operation:

Tank Waste Retrieval – The waste must be removed from the tanks and piped to holding tanks for initial processing.

Waste Feed Delivery – The waste must be prepared to transport to WTP.

LAW Supplemental Treatment – WTP is designed to process all of the tank waste in the PT facility; however, only 40% of the LAW will be vitrified. Another facility must be designed and constructed to vitrify the remaining 60%.

Effluent Treatment Facility – Condensate generated by the tank farm operation, which is separate from WTP laboratory.

Integrated Disposal Facility – LAW canisters from TP will be interred in the Integrated Disposal Facility located on the Hanford Site.

Canister Storage Facility – This facility must be built to store the HLW canisters from WTP prior to shipment to the permanent storage facility at Yucca Mountain.
Infrastructure – Roads and utilities associated with the construction and operation of the WTP."

3.0 Correspondence Review and Timeline

The correspondence between the principal parties, DNFSB, DOE, DOE-ORP, and BNI related to seismic issues were reviewed to gain an understanding of the sequence of events, direction given to BNI, and BNI's stated intent. This section lists selected correspondence and summarizes the content of the correspondence. Selected correspondence significant to the revised ground motion is illustrated on the timeline in figure 3. This figure shows the date the Interim criteria were approved for use and the period during which BNI can use those criteria. This information was used in reviewing the seismic impacts to the schedule in the EAC.

3.1 July 30, 2002 - letter from the DNFSB to the Assistant Secretary for Environmental Management cited three issues related to seismic design: the probability of tectonic activity of the anticlines and associated faults for the Yakima Fold; the spectral amplification associated

with the attenuation relationship; and the amplified floor and equipment response of the superstructure.
The letter included several cautions: the "Board believes the current foundation design for the HLW Facility includes sufficient margin to safely accommodate increases in predicted seismic loading that could result from these issues, provided these margins are not otherwise consumed," and "That aggressive schedule allows construction to commence before the design has been completed, posing the risk that adjustments made in finalizing the design could have a negative impact on portions of the facility where construction is under way or complete. .... While this strategy has been employed successfully in the construction industry, it works best when well-defined and mature technologies are being used, and the facility to be constructed is not the first of a kind."

The following table represents DNFSB's opinion of the impact of potential changes in the understanding of the seismic demand:

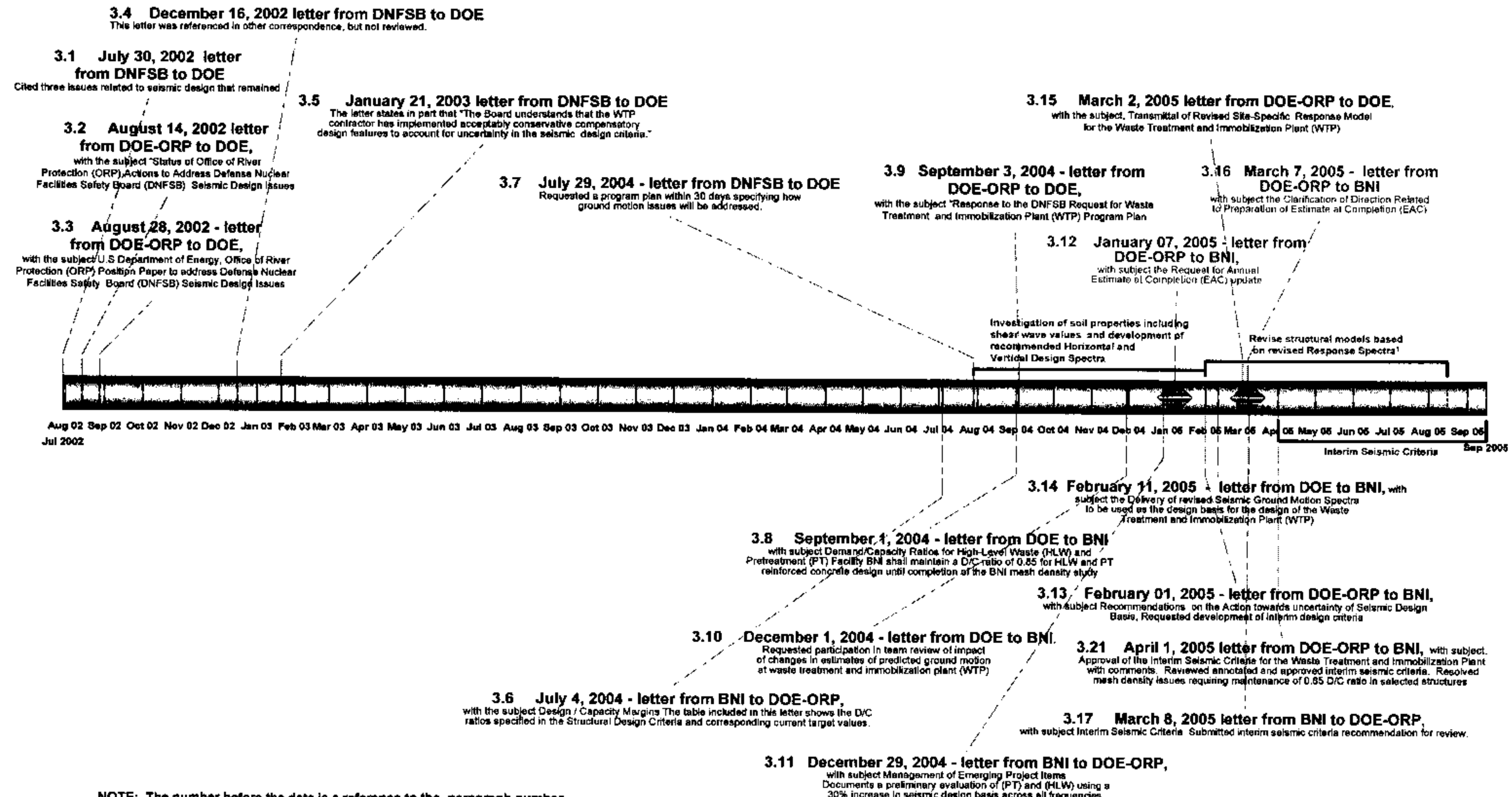
Uncertainty	Estimated Maximum Increase in Design Loads	Current Compensation
Earthquake source probability increase in seismic load.	35%	Demand/capacity ration of 0.85 limit permits an increase of approximately 53% in seismic load.
Adjustment to account for change in attenuation.	15%	The soil structure interaction dynamic analysis increased seismic loads by 15%.
Amplified floor and equipment response of superstructure.	40%	The use of 1.5 x peak acceleration increased seismic loads by about 70% in the below grade structure.

3.2 August 14, 2002 - letter from DOE-ORP to Assistant Secretary for Environmental Management with the subject "Status of Office of River Protection (ORP) Actions to Address Defense Nuclear Facilities Safety Board (DNFSB) Seismic Design Issues"

The letter indicated that DOE-ORP was developing a position paper on all three issues raised by the DNFSB and stated the intent to meet with DNFSB to discuss the technical positions. Part of the process that had been used to validate the Hanford Site seismic design criteria developed in the 1996 Geomatrix study prior to accepting it for use in the Waste Treatment Plant (WTP) was outlined in this letter.

3.3 August 28, 2002 - letter from DOE-ORP to Assistant Secretary for Environmental Management with the subject, "Position Paper to address Defense Nuclear Facilities Safety Board (DNFSB) Seismic Design Issues."

Figure 3 Selected Seismic Correspondence Timeline



NOTE: The number before the date is a reference to the paragraph number in Appendix B that describes the correspondence in greater detail.

1. April 1, 2005 letter (05-WTP-054) with subject, "Approval of the Interim Seismic Criteria for the Waste Treatment and Immobilization Plant (WTP) with comments" indicates in part that BNI had been directed to revise the dynamic analysis and the facility static analysis using the new seismic ground accelerations for the Seismic Category I and II structures. These analyses will develop facility structural response, building loadings and in-structure response spectra. These analyses are anticipated to begin to be completed in August 2005.

The letter transmitted the position paper outlining the process used for validation of the ground motion accepted for use at WTP.

Geomatrix developed the report in 1996:

DOE-ORP accepted for the Hanford Site in 1997
BNFL peer reviewed and revalidated the report
Independently reviewed in 1999
BNI adopted the criteria in 2001 after a due diligence review

3.4 December 16, 2002 referenced, but not found.

3.5 January 21, 2003 letter from DNFSB to the Assistant Secretary for Environmental Management.

This letter references a December letter requesting a report describing how structural design margins will be managed as a function of design uncertainties for the Waste Treatment Plant (WTP).
The letter states: "The Board understands that the WTP contractor has implemented acceptably conservative compensatory design features to account for uncertainty in the seismic design criteria. The Board believes this conservatism must be maintained for all future design work at Hanford (e.g. future waste treatment capabilities) unless site-specific attenuation relationships are developed."

The backup information and staff reports indicate that all issues related to the seismic ground motion questions have been addressed with the exception of the approach used to develop attenuation relationships for deep geologic formations to characterize the Hanford Site seismic hazard.

3.6 July 4, 2004 – letter from BNI, to DOE-ORP with the subject Design / Capacity Margins.

The letter notes that facilities have added conservatism to the guidelines where they believed additional design/capacity margin was warranted at this stage of the design process. In general, the Demand / Capacity ratio recommendations in the Structural Design Criteria developed by BNI range from 0.85 to 1.0 for different elements in the HLW and PT structures, while the target values currently agreed to by BNI design supervisors and engineering managers were uniformly 0.85.

3.7 July 29, 2004 - letter from DNFSB to the Acting Assistant Secretary for Environmental Management, which requested a program plan within 30 days specifying how ground motion issues will be addressed.

It further requested a report of findings of field studies and subsequent analysis of field data and resulting conclusions regarding the adequacy of the current Hanford ground motion criteria and the impact of the design of WTP structures and Components.

3.8 September 1, 2004 – letter from DOE-ORP to BNI with the subject Demand/Capacity Ratios for High-Level Waste (HLW) and Pretreatment (PT) Facility.

The letter identifies the mesh density as a remaining area of concern in the subject buildings and indicates that it may be prudent for BNI to maintain the D/C limit of 0.85 on both HLW and PT reinforced concrete design until resolution of the mesh density issue.

The letter states in part that: "In summary, BNI shall maintain a D/C ratio of 0.85 for HLW and PT reinforced concrete design until completion of the BNI mesh density study and the impact, if any, on both facilities is evaluated."

3.9 September 3, 2004 - letter from DOE-ORP to the Acting Secretary for Environmental Management with the subject "Response to the DNFSB Request for Waste Treatment and Immobilization Plant (WTP) Program Plan, which transmitted an issue specific program plan for analysis of Shear Wave Velocity Data to Address Uncertainties in Estimates of Hanford Ground Motion for the Waste Treatment Project at Hanford

3.10 December 1, 2004 - letter from DOE-ORP to BNI requesting participation in team review of impact of changes in estimates of predicted ground motion at waste treatment and immobilization plant (WTP)

3.11 December 29, 2004 – letter from BNI to DOE-ORP with the subject Management of Emerging Project Items, which documents a preliminary evaluation of (PT) and (HLW) using a 30% increase in seismic design basis across all frequencies. Letter states: "It is important to note that this review is preliminary and that in all cases, once the new seismic design basis is issued, all existing calculations must be re-evaluated to ensure that (1) the new seismic design basis can be accommodated by the current design and (2) that adequate margins are maintained for future uncertainties."

3.12 January 07, 2005 - letter from DOE-ORP to BNI with the subject the Request for Annual Estimate at Completion (EAC) update.

3.13 February 01, 2005 – letter from DOE-ORP to BNI with the subject Recommendations on the Action towards uncertainty of Seismic Design Basis.

Peak ground acceleration was raised from 0.26 to 0.29. The peak spectral acceleration is expected to increase from 0.58 to 0.8 g at 4-6 Hz, and BNI was directed to pursue the following:

(1) Updating the facility models for SASSI and other model runs
(2) Evaluation and rationale for "conservatisms" that may be reduced in these model runs
(3) Development of interim design criteria for the ongoing facility and component designs for construction release in advance of the completion of detailed model runs.

3.14 February 11, 2005 - letter from DOE-ORP to BNI with the subject the "Delivery of revised Seismic Ground Motion Spectra to be used as the design basis for the design of the Waste Treatment and Immobilization Plant (WTP)."

3.15 March 2, 2005 - letter from DOE-ORP to Principal Deputy Assistant Secretary for Environmental Management, with the subject Transmittal of Revised Site-Specific Response Model for the Waste Treatment and Immobilization Plant (WTP), and provided a copy of the Site-Specific Seismic Site Response Model for the Waste Treatment Plant, Hanford, Washington (number PNNL-15089).

3.16 March 7, 2005 - letter from DOE-ORP to BNI with the subject the Clarification of Direction Related to Preparation of Estimate at Completion (EAC).

The 2005 EAC will consist of two funding scenarios: (a) unrestrained funding and six months of schedule contingency; and (b) funding compliant profiles and scheduled contingency. (Verbal direction to focus on the latter in the review.)

3.17 March 8, 2005 letter from BNI to DOE-ORP, with the subject Interim Seismic Criteria, which provided BNI's recommendations for the interim seismic criteria to be used in the project applicable only to all Seismic Category I and II Structures, Systems, and Components (SSCs) being evaluated or designed.

3.18 March 10, 2005 letter from DOE-ORP to BNI with the subject, Clarification on the Identification of Impacts due to revised Seismic Ground Motion Spectra for the Waste Treatment Plant (WTP).

The letter requested a weekly list of the items that have been delayed or suspended, including installation or procurement award dates and the rationale for delay and actions taken to minimize the impact to the project and referenced the February 1, 2005 letter and directed BNI to perform the flowing activities immediately: (a) Update the STRUDL and other facility models, which are the prerequisites for the SASSI model runs; and (b) Evaluation and rationale for reduction of "conservatism" for some of the parameters to be used in SASSI and other analytical and design models.

3.19 March 24, 2005 letter from BNI to DOE-ORP with the subject Clarification of impacts due to revised Seismic Ground Motion Spectra.

3.20 March 29, 2005 letter from BNI to DOE-ORP with the subject Revised Ground Motion Spectra Weekly Status.

This correspondence transmitted an edited table of Potential Near Term Impacts, including activities being impacted, near term schedule implications, rationale for impact, actions to minimize impact, and status or comments.

3.21 April 1, 2005 letter from DOE-ORP to BNI with the subject Approval of the Interim Seismic Criteria for the Waste Treatment and Immobilization Plant with comments.

This criteria applies only to all Seismic Category I and II Systems, Structures, and Components (SSCs) being evaluated or designed.

BNI requested submission of the Authorization Basis Amendment Request (ABAR) changing the WTP seismic criteria to no later than August 16, 2005 to facilitate the timely review and approval by DOE-ORP of the Safety Requirements Document changes.

BNI requested submission of a proposed implementation schedule for all SSC comparisons to the final seismic design criteria for DOE-ORP approval within 60 days of the receipt of the letter.

BNI is directed to verify that any SSC to be constructed (including procurement) before this final implementation has occurred meets the interim design criteria before construction commences or continues, and to document this verification as a quality record.

BNI authorized to use the interim seismic criteria until September 16, 2005

Evaluations performed against these criteria are required to be originated and checked by engineers from the List of qualified Individuals. The evaluations do not have to comply with the Engineering Calculation procedure. Evaluations may cover multiple common SSCs and will be similar to the "Travelers" utilized prior to DOE-ORP approval. The results of these evaluations shall be submitted to Project Document Control with a Correspondence Control Number. Final evaluations and calculations using revised loadings will be performed at a later date, based upon the final SSI analysis. (Proposed in the interim criteria by BNI.)

General requirements:

All seismic accelerations used in support of future and pending designs and future evaluations of issues design shall be increased by 40%, as of the date of DOE-ORP's approval of these criteria. No deviations from this increase are permitted without prior DOE-ORP approval. Other deviations from these interim seismic criteria may be approved by the responsible BNI Discipline Engineering Manager provided documentation, and justification is provided to DOE-ORP within three (3) business days for its review and concurrence. Prior DOE-ORP concurrence of these deviations is not required.
The SSCs fabricated or in fabrication, but not yet installed before DOE-ORP's approval of these criteria, shall be completed and installed as planned unless directed by the responsible APM. The SSCs directed not to be installed will be captured in an impacts list and provided to the DOE-ORP.

Designs to Capacity Ratios listed in these criteria shall not be exceeded. If BNI deviates from these criteria, the deviations will be documented in the disposition with rationale. The deviation will not use conservatisms that have been jointly categorized (Reference CCN108127, E-mail

from J-Treadwell to Distribution, "DNFSB Meeting Results," dated January 18, 2005, attachment Option Table 2, Rev 1, "Preliminary Evaluation of Potential Conservatisms in Analysis and /or Design") as type B or C, without DOE-ORP approval.
For an SSC, which requires modification because of these evaluations, the modification will be required to be supported by a calculation performed in accordance with the Engineering Calculations procedure.

The following table provides the D/C Ratios to be used as referenced in item c above:

	Structure / Facility		
Material /Component	HLW	PTF	BOF
Reinforced Concrete Wall and Slabs	0.95	0.95	1.0
Embedments to support Cat I and Cat II SSCs	1.0	1.0	1.0
Structural Steel, Miscellaneous Steel, Platforms and Commodity Support Steel including Connections and Anchor Bolts	0.9	0.9	0.8
Steel Roofs and Stacks	0.5	0.5	0.8
Piping Design	1.0	1.0	1.0
Pipe Supports Cat I and Cat II other than Roof Supported	1.0	1.0	1.0
Cat I and Cat II Piping Supports – Roof or Stack Supported	0.75	0.75	0.75
HVAC Duct Design	1.0	1.0	1.0
HVAC Duct Support-other than Roof or Stack Supported	1.0	1.0	1.0
HVAC Duct Support- Roof or Stack Supported	0.75	0.75	0.75
Electrical Commodity and Supports Design- other than Roof or Stack Supported	1.0	1.0	1.0
Electrical Commodity and Supports Design- Roof or Stack Supported	0.75	0.75	0.75
Instrumentation and Control Equipment – other than Roof or Stack Supported	1.0	1.0	1.0
Instrumentation and Control Equipment –Roof or Stack Supported	0.75	0.75	0.75
Mechanical Equipment and Vessel Design	1.0	1.0	1.0

Enveloped Finite Element Model Mesh Density Factors for use a Guideline when using GT STRUDL Results (1x1 model).

Best Estimate Factors for Walls, to be used with GTS forces					
	Mtr	Vtr	Mn	Vn	Pnt
Walls (Note 1)	1.3	1.3	1.0	1.0	1.2
Wall Piers (Note 2)	1.4	1.9	1.0	1.0	1.2

Note 1: The factors listed for walls are to be used for full or partial wall section cuts spanning three or more elements.
Note 2: The factors listed for wall piers are to be used for full or partial wall and pier section cuts spanning one or two elements.

Best Estimate Factors for Slabs, to be used with GTS forces					
	Mtr	Vtr	Mn	Vn	Pnt
Middle Cut in slab with a minimum of 3 elements along slab edge	1.4	1.7	1.2	N/A	1.7
Slab modeled with 1 or 2 elements along one slab edge	2.4	2.0	2.2	2.0	2.2

The proposed Interim Design criteria require: a) seismic component of current loadings to be conservatively increased by 40%, independent of the actual frequency, to account for the increase in peak seismic acceleration of 40%; b) the use of bounding amplification factors to account for the mesh density concerns in the finite element model for the design of concrete structures; and c) specification of the maximum design margin (D/C) that various structures are required to maintain. Design margin D/C is defined as the ratio of maximum design stress and the allowable stress. Margins have been specified based on engineering judgment, considering the stage of design; and the uncertainty in loadings and analysis.

Uncertainty of the revised seismic spectra no longer exists, since the revised ground acceleration has been finalized. The acceleration is increased by 40% in the 4-7 Hz range and to a smaller magnitude outside this range. Assessment of the seismic analysis is that the magnitude of increase in loading for the SSCs for most of the cases would be at least 5% to 10% less than the assumed 40% increase in the peak seismic accelerations. This is due to: a) the 40% increase in seismic acceleration is limited to a narrow frequency band, and the increase is much less outside of the limited frequency band; and b) the current loading associated with accidental torsion was considered by increasing the net story shear for every floor. A more refined application of accidental torsion would maintain the load at external walls, with linearly decreasing loads as the distance to the shear center is reduced, instead of the current analysis using the same maximum load of the external wall at all internal walls.

4.0 Design Process and Conservatism

Typically, selection of government, industry, or other accepted criteria establishes reasonable design levels with appropriate conservatism for specific applications. This is true provided the selected criteria documents provide the performance required by the owner and the demand or load placed on the structure is consistent with the actual exposure period. If, for example, the structure is intended for only a limited useful life of less than 40 years and the criteria selected is based on a significantly longer period of exposure, using the criteria for the limited useful life facility would be considered conservative. Figure 4 illustrates some of the differences between the criteria and the application to different systems and components.

	PC-0	PC-1	PC-2	PC-3	PC-4
RPP-WTP Seismic Category	SC-V	SC-IV	SC-III	SC-II and SC-I[a] [a] [illegible]	None
DOE-STD-1021-93	An SSC that is not covered in Paragraphs 2.4(b) through 2.4(e) above may be placed in preliminary Performance Category 0 (PC-0) if it is not important because of safety, mission, or cost considerations, and if it is more cost-effective to replace or repair it than to design it to withstand NPH effects; however, an SSC whose failure may have any adverse effect on the performance of a PC-1, PC-2, PC-3, or PC-4 SSC shall not be placed in PC-0.	a. SSC is a building/structure with potential human occupancy, or b. SSC failure may cause fatality or serious injuries to in-facility workers, or c. SSC failure can be prevented cost-effectively by NPH design.	a. SSC performs emergency functions to preserve health and safety of workers as defined in Section 2.4(a), b. SSC is part of a building used for assembly of more than 300 persons in one room, c. It has been classified "safety-significant"	SSC failure has adverse release consequences greater than safety-class SSC Evaluation Guidelines, but not severe enough to place it in PC-4.	SSC is a "safety-class" item as defined in Section 2.3 (a), and its failure due to an NPH event would result in off-site release consequences greater than or equal to the unmitigated release associated with a large (>200 MWt) Category A reactor severe accident. Section 2.3 (e). For performance categorization of SSCs in accordance with this standard, "safety-class" and "safety-significant" SSCs shall be as defined in DOE-STD-3009-94 and DOE 5480.30. (b) An SSC, failure of which may impair or adversely affect an operator action that is required for safety during and following an NPH event, shall also be treated as a safety-class or safety-significant SSC for the purpose of selecting performance category in accordance with this standard. (c) Even if an SSC is not classified as safety-class or safety-significant according to the provisions of Paragraphs (a) and (b) above, it shall be treated as such if its failure by itself or its common-cause failure with one or more SSCs result in the nonperformance of a safety function identified in the safety analysis.
DOE-STD-1020-94	No special consideration for this category				
Target Seismic Performance Goal, P_F		1×10^{-3}	5×10^{-4}	1×10^{-4}	1×10^{-5}
Mean Seismic Hazard Exceedance Levels, P_H	No requirements	2×10^{-3}	1×10^{-3}	5×10^{-4} (1×10^{-3} for sites near tectonic plate boundaries)	1×10^{-4} (2×10^{-4} for sites near tectonic plate boundaries)
Risk Reduction Ratio, R_R		2	2	5 (10 for sites near tectonic plate boundaries)	10 (10 for sites near tectonic plate boundaries)
Return Period	No requirements	500 year	1000 year	2000 year (1000 year for sites near tectonic plate boundaries)	10,000 year (5000 year for sites near tectonic plate boundaries)
Response Spectra		Median amplification (no conservative bias)	Median amplification (no conservative bias)	Median amplification (no conservative bias)	Median amplification (no conservative bias)
Damping for Structural Evaluation		5%	5%	Ranges from 0.5% for sloshing to 10% for reinforced concrete structures or bearing bolted metal structures	Ranges from 0.5% for sloshing to 10% for reinforced concrete structures or bearing bolted metal structures
Design or Evaluation Acceptable Analysis Approaches for Structures		Building Code approach Static or dynamic force method normalized to code level base shear	Building Code approach Static or dynamic force method normalized to code level base shear	Dynamic Analysis Approach: 1. The input to the SSC model be defined by either a design response spectrum or a compatible time history input motion. 2. The approximate natural frequencies of the SSC be estimated, or the peak of the design response spectrum be used as input. Multi-mode effects must be considered. 3. The resulting seismic induced inertial forces be appropriately distributed and a load path evaluation (see Section C.4.2) for structural adequacy be performed.	Dynamic Analysis Approach: 1. The input to the SSC model be defined by either a design response spectrum, or a compatible time history input motion. 2. The approximate natural frequencies of the SSC be estimated, or the peak of the design response spectrum be used as input. Multi-mode effects must be considered. 3. The resulting seismic induced inertial forces be appropriately distributed and a load path evaluation (see Section C.4.2) for structural adequacy be performed.
Design or Evaluation Acceptable Analysis Approaches for systems and components		UBC Force equation for equipment and non-structural elements (or more rigorous approach)	UBC Force equation for equipment and non-structural elements (or more rigorous approach)	Dynamic analysis using in-structure response spectra (damping from Table 2-3)	Dynamic analysis using in-structure response spectra (damping from Table 2-3)
Importance Factor		I=1.0	I=1.25	Not used	Not used
Load Factors		Code specified load factors appropriate for structural material	Code specified load factors appropriate for structural material	Unity	Unity
Seismic Scale Factor			From PC-1 to PC-2, seismic hazard exceedance probability is lowered and importance factor is increased. All other factors are held the same.	From PC-2 to PC-3, load and importance factors are eliminated, damping is generally increased, and limits on inelastic behavior are significantly reduced. All other factors are essentially the same, although static force evaluation methods are allowed for PC 2 SSCs and dynamic analysis is [illegible] 1.00	From PC-3 to PC-4, seismic hazard exceedance probability is lowered and a seismic scale factor is used. All other factors are held the same. 1.25
Inelastic energy absorption		Accounted for by Rw from Table 2-2	Accounted for by Rw from Table 2-2	F_μ from Table 2-4 by which elastic response is reduced to account for permissible inelastic behavior	F_μ from Table 2-4 by which elastic response is reduced to account for permissible inelastic behavior
Material strength		Minimum specified or 95% non-exceedance in-situ levels	Minimum specified or 95% non-exceedance in-situ levels	Minimum specified or 95% non-exceedance in-situ levels	Minimum specified or 95% non-exceedance in-situ levels
Structural Capacity		Code ultimate strength or allowable behavior level	Code ultimate strength or allowable behavior level	Code ultimate strength or limit-state level	Code ultimate strength or limit-state level
Peak ground acceleration PGA				minimum 0.06g	minimum 0.10g
Quality Assurance		Quality Assurance Program consistent with model building code requirements	Quality Assurance Program consistent with model building code requirements		
Peer Review			Required	Required	Required
Equipment and Distribution Systems		Building Code approach	Building Code approach By DOE-STD-1020 equipment located at or below grade, the value Cp for non-rigid or flexibly supported items (except for piping, ducting or conduit systems made of ductile materials and connections) is specified to be twice the value for rigid and rigidly supported equipment.	Seismic design or evaluation shall be based on dynamic analysis, testing, or past earthquake and testing experience data. In any case, equipment items and non-structural elements must be adequately anchored to their supports unless it can be shown by dynamic analysis or by other conservative analysis and/or test that the equipment will be able to perform all of its safety functions without interfering with the safety functions of adjacent equipment. Anchorage must be verified for adequate strength and sufficient stiffness. Subsystems and component support excitation shall be represented by means of floor response spectra. Floor response spectra should be developed accounting for the expected response level of the supporting structure even though inelastic behavior is permitted in the design of the structure. It is important to account for uncertainty in the properties of the equipment, supporting structure, and supporting media when using in-structure spectra which typically have narrow peaks. For this purpose, the peak broadening or peak shifting techniques outlined in ASCE 4 shall be employed. Equipment or distribution systems that are supported at multiple locations throughout a structure could have different floor spectra for each support point. In such a case, it is acceptable to use a single envelope spectrum of all locations as the input to all supports to obtain the inertial loads. Alternatively, there are analytical techniques available for using different spectra at each support location or for using different input time histories at each different support.	Seismic design or evaluation shall be based on dynamic analysis, testing, or past earthquake and testing experience data. In any case, equipment items and non-structural elements must be adequately anchored to their supports unless it can be shown by dynamic analysis or by other conservative analysis and/or test that the equipment will be able to perform all of its safety functions without interfering with the safety functions of adjacent equipment. Anchorage must be verified for adequate strength and sufficient stiffness. N/A on WTP
Evaluation by Testing		RRS ≥ (1.1) (In-Structure Spectra)	RRS ≥ (1.1) (In-Structure Spectra)	RRS ≥ (1.4) (SF) (In-Structure Spectra) The Test Response Spectrum (TRS) of test table motions must envelop the RRS. If equipment has been tested and shown to meet NRC requirements, then it need not be subjected to further testing.	RRS ≥ (1.4) (SF) (In-Structure Spectra) The Test Response Spectrum (TRS) of test table motions must envelop the RRS. If equipment has been tested and shown to meet NRC requirements, then it need not be subjected to further testing.
Occupational Safety		No structural collapse, failure of contents not serious enough to cause severe injury or death or prevent evacuation	No structural collapse, failure of contents not serious enough to cause severe injury or death, or prevent evacuation	No structural collapse, failure of contents not serious enough to cause severe injury or death or prevent evacuation	No structural collapse, failure of contents not serious enough to cause severe injury or death or prevent evacuation
Concrete Barrier		Containment not required	Concrete walls will remain standing but may be extensively cracked, they may not maintain pressure differential with normal HVAC. Cracks will still provide a tortuous path for material release. Don't expect largest cracks greater than 1/2 inch	Concrete walls cracked; but small enough to maintain pressure differential with normal HVAC. Don't expect largest cracks greater than 1/8 inch	Concrete walls cracked; but small enough to maintain pressure differential with normal HVAC. Don't expect largest cracks greater than 1/8 inch
Metal Liner		Containment not required	May not remain leak tight because of excessive distortion of structure	Metal liner will remain leak tight	Metal liner will remain leak tight
Component Functionality		Component will remain anchored, but no assurance it will remain functional or easily repairable	Component will remain anchored and majority will remain functional after earthquake. Any damaged equipment will be easily repaired	Component anchored and functional	Component anchored and functional
Visible Damage		Building distortion will be limited but visible to the naked eye	Building distortion will be limited but visible to the naked eye	Possibly visible local damage but permanent distortion will not be immediately apparent to the naked eye.	Possibly visible local damage but permanent distortion will not be immediately apparent to the naked eye.

FIGURE 4, SELECTED SEISMIC CRITERIA FOR SSCs

PRELIMINARY EVALUATION OF POTENTIAL CONSERVATISM IN ANALYSIS AND/OR DESIGN

Analysis and Design Conservatism[1]

Table 1. – Soil Structure Interaction Analysis

Number	Item	Remarks	Value[2]
1.1	Perform new SSI analysis for new ground motion and latest building configuration.	Because the new response spectra are increased and the PT and HLW buildings are near design completion, new seismic loads and equipment response spectra will be needed. This will be done by incorporating the latest designs into the SASSI model.	A
1.2	Determine SSI parameters consistent with new ground motion. This may increase the soil dampening with resulting load reduction.	Since the seismic ground motion has increased, it will result in new strained soil properties to be used in the SASSI model. The analysis should include any recent changes in soil properties. The higher seismic ground motion should result in increased soil damping and potentially lower design loads.	A
1.3	Use DOE 1020 damping for Response Level 2 in the SSI analysis.	DOE 1020 allows the use of material damping higher than that used in the current design calculations when developing building loads. It is suggested that the project investigate using the higher damping values for the SSI analysis.	A
1.4	Remove conservatism associated with the development of enveloping static seismic loads from the bubble sheets.	In previous project calculations summarizing the results of the SSI analysis conservative factors have been applied to the floor area loading developed from the SSI "Bubble Sheets." It is suggested that this conservatism is no longer necessary since the building design is now well delineated, with few changes anticipated.	A
1.5	Include ground motion incoherence in the existing SSI analysis.	Ground motion incoherence as it affects large mat foundations, such as at the PT building if accounted for in the SSI analysis will result in lower SSI loads and should be included. If SASSI is used for this evaluation it will have to be verified.	B
1.6	Allow reduction of peak of the in-structure response spectra when broadening as permitted by ASCE 4.	When smoothing and broadening the envelope in-structure floor response spectra ASCE 4 allows a reduction of the peak of the spectra by 15%. Since equipment qualification will be a critical issue, this allowable reduction should be implemented.	A

Table 2. – Building Analysis and Design

Number	Item	Remarks	Value[2]
2.1	Perform a static analysis of the building using the new seismic loads from the SSI analysis.	The new SSI will provide new seismic loads for the building structures. These new SSI loads will be stripped of unnecessary conservatism as discussed above. Using the latest building configuration develop new element seismic loads that will be used in load combinations with other design loads.	A
2.2	Member design using controlling load case.	The results of the static analysis will be included in the design basis load combinations and design loads developed. It is suggested that the controlling design load combination be used for design rather than the envelop load components as was done in the current design	A

PRELIMINARY EVALUATION OF POTENTIAL CONSERVATISM IN ANALYSIS AND/OR DESIGN
Analysis and Design Conservatism[1]

		calculation in order to minimize design loads.	
2.3	Reduce OOP moments and shears to face of walls or d/2 from wall respectively as allowed by code.	It is acceptable to reduce design moments to the face of the supporting walls and for in-plane shears to a distance of d/2 from the face of the supporting wall. Including this feature in developing the design loads will result in reduced member end loads. Note, when evaluating already designed structural elements, it is only necessary to compare the previous design loads and D/C ratios to determine if the new load would be within code acceptable criteria if this would result in a more efficient way to show qualification.	A
2.4	Realistic treatment of thermal gradient loads by reduction associated with cracking.	When thermal gradients result in bending moments that crack the concrete, it is acceptable to redistribute the moment considering reduced member stiffness.	B
2.5	Minimize conservatism associated with accidental torsional loading applied to shear walls.	In the existing design calculations, the effect of torsions load on building walls was uniformly applied to all walls. It is suggested that the load be applied as a function of the distance from the cg of the wall system. Rather difficult to apply.	B
2.6	Allow for Fμ greater than 1.0 for in-plane shear, bending and out-of-plane bending in accordance with DOE 1020.	In accordance with DOE 1020, it is suggested that the project allow the use of Fμ factors. It is necessary to show that the building retains confinement during and after a seismic event if Fμ factors are used. Therefore, it is necessary to demonstrate that the safety class HVAC system used to maintain negative pressure be qualified to the new seismic ground motion and have sufficient capacity for the calculated concrete cracking.	C
2.7	Use f'c based on verified concrete test properties from site test cylinders.	In the event that a specific area is not able to be quantified using the specified design concrete strength, then a revised design strength based on ACI methodology can be calculated and used. This process shall only be applied to constructed structures.	C
2.8	Consider response spectra analysis for seismic design.	As an alternative to the static seismic analysis of the building, the project may consider a response spectra methodology. This can be considered if the new seismic loads do not result in a design that meets code acceptance criteria, but are within approximately 10% of the acceptance criteria. Difficult to apply in complex structures.	B
2.9	Reduce conservatism in below grade wall design by using SASSI wall pressures.	Use the SASSI wall pressures for design of below grade walls for lateral seismic soil pressure.	A
2.10	Review and revise existing assumed design commodity floor loads	With design nearing completion review and revise the assumed building loads, for example the overpack has been removed from the building resulting in a significant change in dead load.	A
Table 3. – **In-Structure Response Spectra**			

PRELIMINARY EVALUATION OF POTENTIAL CONSERVATISM IN ANALYSIS AND/OR DESIGN

Analysis and Design Conservatism[1]

Number	Item	Remarks	Value[2]
3.1	Perform new SSI analysis for new ground motion and latest building configuration and generate new In-structure response spectra.	This is the same as item 1.1 in Building qualification and includes the removal on conservatism as specified in Items 1.2 through 1.5.	A
3.2	Remove conservatism from existing spectra, both PT and HLW have vertical amplification factors, and one has a horizontal amplification factor.	This is an action that can be used for the interim review of equipment qualification.	A
3.3	Reduce peaks of existing response spectra in accordance with ASCE 4.	This is an action that can be used for the interim review of equipment qualification.	A

Table 4. – Equipment Qualification

Number	Item	Remarks	Value[2]
4.1	Reduce seismic demand on equipment by Fμ as permitted in DOE-STD-1020 and ASCE-43.	DOE-STD-1020 permits a seismic demand reduction for ductile behavior Fμ but does not specify the value of the ductility reduction factor Fμ. ASCE-43 specifies Fμ values or use in equipment seismic qualification. Passive, ductile, not pressure boundary = limit state A → Fμ = 1.50 to 2.00 Passive, ductile = limit state B → Fμ = 1.25 to 1.50 Active post-DBE with operator set = Limit state B → Fμ = 1.00 to 1.25 Active = Limit state D → Fμ = 1.00	B
4.2	Scope of SCI and SCII	Review basis for seismic classification SC I and SC II for possible downgrades to SC III within safety basis.	A
4.3	Experience data DOE-EH-0545	Evaluate installed or procured equipment based on earthquake experience data for the higher floor spectra. The technique is permitted for new equipment in ASCE-43. This recommendation does not apply to piping systems, electrical or electronic equipment. It is also limited to building locations where the spectrum is below the DOE0EH00545 applicability spectrum (1.2g peak). This option would prevent re-qualification of some mechanical equipment (valves, pumps, fans, and conduit and cable trays.	C
4.4	Pipe damping of 5%	Use 5% damped spectra in piping analysis, which has a lower damping at high frequency.	A

PRELIMINARY EVALUATION OF POTENTIAL CONSERVATISM IN ANALYSIS AND/OR DESIGN Analysis and Design Conservatism[1]			
		When the Code Case was incorporated into the current ASME III it was replaced by a constant 5% damping. The 5% damping value for piping is also in ASCE-43. Because much of the piping response is governed by flexible modes, a drop in high frequency camping will have a limited benefit.	

Figure 5 Preliminary Evaluation of Potential Conservatisms

1 Developed January 18, 2005

2 Value A: Non-controversial, Value B: Additional justification necessary for acceptability, Value C: Very controversial changes

In developing the series of design criteria documents to be used in the design of WTP systems, structures and components variations from the selected criteria documents were included in the project specific design documents. These variations may affect the calculation of the loads, resulting in a higher demand on the structure, system, or component than required by the basic criteria. Modifications may be to factors affecting capacity calculations. In some cases, the modifications result in higher minimum thresholds that the design needs to meet to be considered compliant. In other cases, the modification results in lower allowable levels that the design cannot exceed, or it will not be considered compliant. Figure 5, Preliminary Evaluation of Potential Conservatisms dated January 18, 2005 identifies some of the conservatisms and a joint assessment of the potential controversy associated with those conservatisms. The table should not be considered all inclusive. It does not appear to include some of the conservatisms incorporated at the calculation level.

During the design process, additional deviations from the industry criteria and the design criteria established for the Project are included. Capacity margin is the extra capacity supplied beyond what is needed to resist demand requirements. Typically, target demand/capacity ratios, less than the ratios established in the criteria documents, are used. Examples of deviations from established criteria resulting in a more conservative design are unexplained 10% increases to vertical accelerations; using damping values that result in higher demand values; using in-structure responses from elevations that are significantly higher than those where the component or system installation is required (this results in higher demand); and rounding values or arbitrarily setting minimum demand values. Typically, the only annotation included in the calculations with the additional deviations to provide an explanation is the statement "this is conservative."

"BNI utilizes a design margin program to manage uncertainties in the structural design process on WTP. The program includes applying margins or contingencies to both the demand (i.e., design loads) and capacity of the structure. During the early stages, more contingency is applied to account for the uncertainties associated with the project. As progress is made, some of the contingencies are removed, consistent with a better definition of project design. A related consequence of this process is that more allowance is provided for load variation in the lower elevations of the structure, which are designed based on preliminary and conservative loads.[13]"

It is unclear from the documentation provided that the extent of the conservatism incorporated into the design of the facilities is completely understood. The written correspondence, the verbiage in the 2005 EAC document, and the verbal presentations were not consistent on the approach that will be taken to identify and remove excess margins or conservatisms.
Figure 6 shows some of the layering of conservatism in the design of the HLW facility. The conservatisms included in the PT Facility and HLW Facility are similar, but there are differences in the development of the in-structure response and in the application at the design level. The

[13] Document number 24590-WTP-RPT-ST-03-001, Rev A, Summary Structural Report for HLW Vitrification Building February 20, 2004

layering of the conservatisms makes it difficult to manage the design margins and to know the final capacity of the structure.

5.0 Document review

Based on the information provided in the 2005 EAC, BNI briefings, and handouts, the IR team requested additional documents from BNI. These documents received a cursory review. This review was not a criteria check and should not be construed to validate the requirements, the process, the adequacy of the specific criteria, or the sensitivity of the criteria to the revised ground motion.

The following documents were given a cursory review by the IR team:

Document number 24590-WTP-DC-ST-01-001, Rev 6, Structural Design Criteria.

Document number 24590-WTP-DC-ST-04-001, Rev 1, Seismic Analysis and Design Criteria.

Document number 24590-WTP-DC-PS-01-001, Rev 4, Pipe Stress Design Criteria including "Pipe Stress Criteria" and "Span Method Criteria."

Document number 24590-WTP-DC-PS-01-002, Rev 3, Pipe Support Design Criteria.

Document number 24590-WTP-3PS-SS90-T0001, Rev 1, River Protection Project – Waste Treatment Plant Engineering Specification for Seismic Qualification of Seismic Category I/II Equipment and Tanks.

Document number 24590-WTP-3DP-G04B-00037, Rev 6, BNI River Protection Project –Waste Treatment Plant Engineering Department Project Instructions, Engineering Calculations.

Document number 24590-WTP-RPT-ST-03-001, Rev A, Summary Structural Report for HLW Vitrification Building February 20, 2004.

Document number 24590-WTP-3DP-G06B-00001, Material Requisitions.

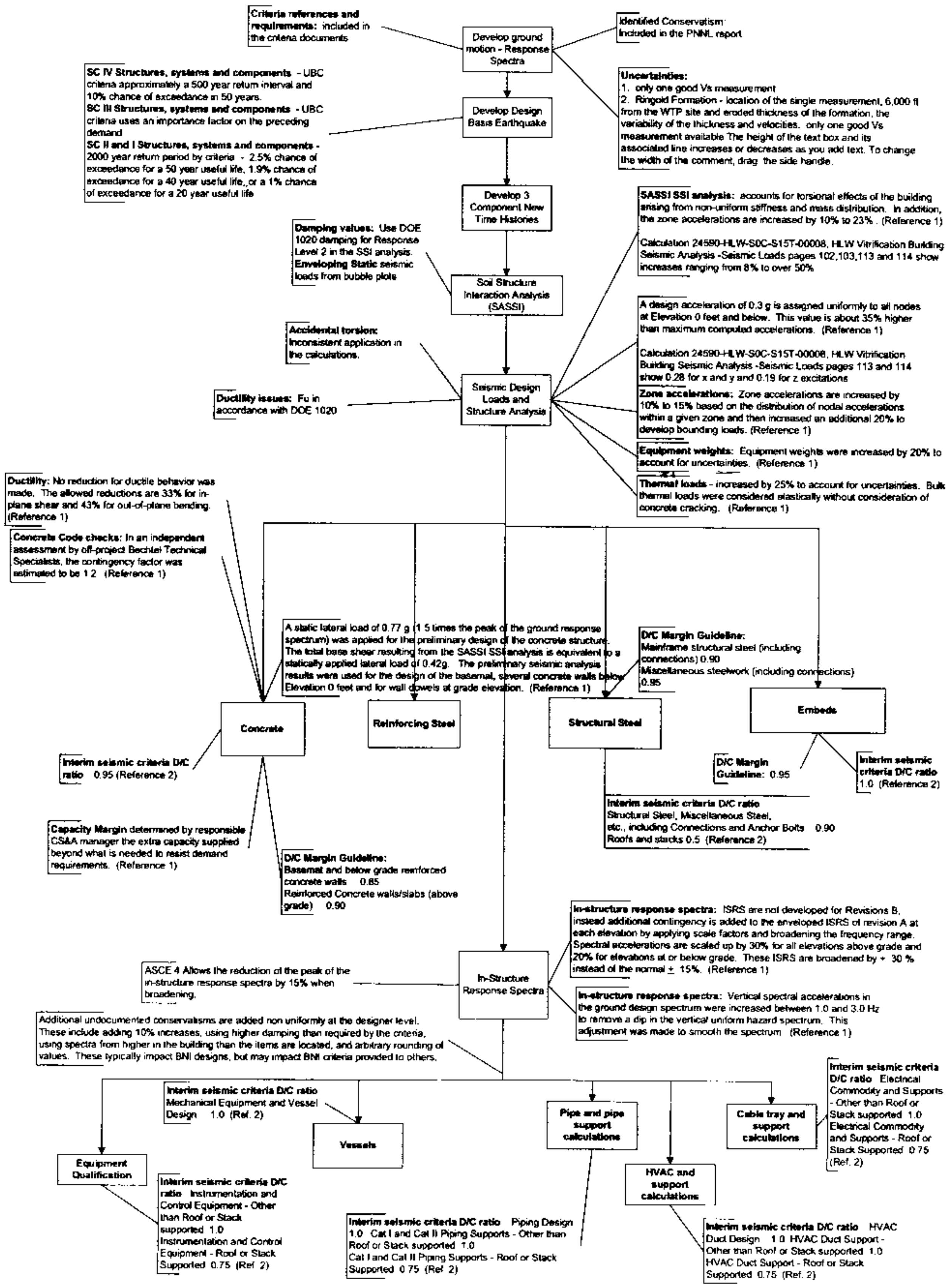
Document number 24590-WTP-3DP-G04B-00058, Supplier Engineering and Quality Verification.

Document number 24590-WTP-3DP-G04B-00037, Engineering Calculations.

Document number 24590-WTP-3DP-G04B-00049, Engineering Specifications.

Document number 24590-WTP-3DP-G04B-00046, Engineering Drawings.

HIGH LEVEL WASTE FACILITY



Reference 1 - 24590-WTP-RPT-ST-03-001, Rev A Summary Structural Report for HLW Vitrification Building February 20, 2004

Reference 2 - Letter dated April 1, 2005 from U S. Department of Energy Office of River Protection with subject Approval of the Interim Seismic Criteria for the Waste Treatment and Immobilization Plant (WTP) with comments

FIGURE 6, Layering of Design Margins or Conservatisms in HLW Facility

5.3 Observations from the Summary Structural Report for HLW Vitrification Building

5.3.1 BNI utilizes a design margin program to manage uncertainties in the structural design process on WTP. The program includes applying margins or contingencies to both the demand (i.e., design loads) and capacity of the structure.

5.3.2 BNI has specified a demand-capacity ratio upper limit of 0.85 for the below grade portions of the structure. According to the subject document, this factor may be gradually increased up to 1.0 at higher elevations. Table 5-3 is a summary of the demand/capacity (D/C) ratios that serve as a guideline for CS&A manager-supervisors and engineers to establish margins. Actual D/C ratios utilized reflect the degree of confidence in design definition at the time of release."

Table 5-3 Demand/Capacity Margin Guidelines	
Maximum Demand/Capacity Ratio	HLW
Basemat and below grade reinforced concrete walls	0.85
Reinforced concrete walls/slabs (above grade)	0.90
Structural embeds	0.95
Mainframe structural steel (including connections)	0.90
Miscellaneous steelwork (including connections)	0.95
Roof	1.0

5.3.3 Demand Margin

a. A static lateral load of 0.77 g (1.5 times the peak of the ground response spectrum was applied for the preliminary design concrete structure. The total base shear resulting from the SASSI SSI analysis is equivalent to a statically applied lateral load of 0.42 g. The preliminary seismic analysis results were used for the design of the basemat, several concrete walls below Elevation 0 feet and for wall dowels at grade elevation.

b. For seismic analyses, equipment weights were increased by 20% to account for uncertainties.

c. SASSI SSI analysis produces peak accelerations at each node in the structure. The structure is divided horizontally into three zones to distribute the building floor accelerations. A uniform acceleration in each zone is determined considering the responses at each node in a zone. Zone accelerations are applied as static lateral loads in structural analysis to determine the member seismic forces. There are several contingencies applied in this process to account for potential design modifications:

The zone accelerations are increased by 10% to 15%, based on the distribution of nodal accelerations within a given zone.

Zone accelerations were increased by an additional 20% to develop bounding loads. Final building accelerations from SASSI Rev 0C analyses are expected to be of lesser magnitude than the bounding accelerations.

A design acceleration of 0.30 g is assigned uniformly to all nodes at Elevation 0 feet and below. This value is about 35% higher than maximum acceleration computed directly form the SASSI SSI analysis.

d. Seismic design forces for structural elements are determined from an elastic analysis using the Design Basis Earthquake as the seismic load. DOE STD 1020 allows the seismic forces to be reduced for ductile behavior associated with reinforced concrete structures. The allowed reductions are 33% for in-plane shear and 43% for in-plane and out-of-plane bending. In the design of this building, no reduction for ductile behavior is used.

e. The vertical spectral accelerations in the ground design spectrum were increased between 1.0 to 3.0 Hz to remove a dip in the vertical uniform hazard spectrum. This adjustment was made in order to smooth the spectrum. As a result, in-structure response spectra (ISRS) ordinates are increased over those frequencies.

f. The SASSI SSI analysis accounts for torsional effects of the building arising from non-uniform stiffness and mass distribution. In addition, accidental torsion effects are included in the analysis as required by ASCE 4. Depending on the building orientation, the zone accelerations are increased by 10% to 23%, which results in a corresponding increase in the total lateral load to the building. In reality, torsional effects generate a torsional moment and do not increase the lateral force. Typically, the majority of the torsional moment is resisted by in-plane shear in the exterior walls. Therefore, applying additional lateral load for accidental torsion results in substantially higher shear forces in the interior walls of the building.

g. All design forces are conservatively enveloped when performing concrete code checks. In an independent assessment by off-project Bechtel Technical Specialists, the contingency factor was estimated to be 1.2. Regardless of the exact number, this contingency is available for all concrete work designed using the standard templates and can be utilized in analysis refinements.

5.3.4 Capacity Margin

Capacity margin is determined by the responsible CS&A manager-supervisor and design engineer during the course of detailed design. Capacity margin is the extra capacity supplied beyond what is needed to resist demand requirements. An example of capacity margin is the selection of #11 rebar at a 6-inch spacing when the calculation indicates that #11 rebar at 9 inches is adequate for the demand.

5.3.5 In-Structure Response Spectra

In-structure response spectra (ISRS) are calculated at various locations in the HLW building for the seismic qualification of SC-I and SC-II equipment, systems, and components. The development of these ISRS is documented in Rev 0Q of Calculation 24590-HLW-S0C-S15T-00009 where the following steps are performed in this process:

At each selected location and for each soil case, calculate the acceleration response spectra (ARS) in each response direction. Co-direction responses are combined by SRSS method.

Envelop the ARS from three soil cases.

Broaden each peak in the acceleration response spectra by ± 15% of the frequency at which the peak occurs.

Revision 0B states that since the structural design modification is ongoing, a portion of the structural model and all of the SDOF systems are not updated. In addition, only the upper bound soil case is analyzed in Rev 0B. In consideration of these factors, ISRS are not generated for Rev 0B as described above. Instead, additional contingency is added to the enveloped ISRS (of Rev 0A) at each elevation by applying scale factors to the spectral accelerations and by wider broadening of the frequency range. ISRS are not developed for Rev 0B at individual locations, vertically flexible slabs (SDOF), or for those with variable damping. Spectral accelerations are scaled up by 30% for all elevations above grade and 20% for elevations at or below grade. These ISRS are broadened by ± 30% instead of the normal ± 15% to cover the uncertainties related to the on-going and the anticipated changes in the structural design of the HLW building.

6.0 List of Calculations

Based on the information provided in the EAC, BNI briefings and handouts, sample calculations were requested from BNI. The lack of a complete calculation list until late in the process hindered the team's ability to identify and obtain those calculations that would have the greatest impact on the cost increase. These calculation packages received a cursory review. This review was not a calculation check and should not be construed as validation of the individual calculations, the process used to develop the calculations, or as the adequacy of the applicable system or component for the revised ground motion. The following calculations were given a cursory review by the IR team:

- 24590-PTF-S0C-S15T-00002, Pretreatment Facility (PTF) – Structural Model for SSI Analysis, 1/15/03
- 24590-PTF-S0C-S15T-00004, Pretreatment Building Seismic Analysis – Seismic Loads, 1/15/03
- 24590-PTF-S0C-S15T-00014, Pretreatment Facility – Calculation of Floor Slab and Roof Beam Vertical Frequencies, 1/15/03
- 24590-PTF-SSC-S15T-00005, Pretreatment Building Seismic Analysis – In Structure Response Spectra (ISRS), 1/21/03
- 24590-PTF-SSC-S15T-00045, Pretreatment Facility (PTF) Seismic Analysis – Enveloped In-Structure Response Spectra, 2/25/04
- 24590-PTF-SSC-S15T-00012, Columns and Bracing Design for PT Building, 11/25/03
- 24590-PTF-SSC-S15T-00051, Standard Seismic Category I & II HVAC Ducts and Duct Supports for PT Building, 8/10/04

- 24590-PTF-SSC-S15T-00052, Intermediate Support Members for Seismic Category I & II HVAC Duct Supports for PT Building, 9/14/04
- 24590-PTF-SSC-S15T-00053, Standard Seismic Category I & II HVAC Duct Side-Mounted Supports for PT Building, 9/17/04
- 24590-PTF-DGC-S13T-00022, Design of Slab at 56' Elevation, 6/9/04
- 24590-PTF-DGC-S13T-00016, Design of Walls at Col Lines B, E, H, & L bounded by Col lines 24 and 30, from EL 56' to 77', 8/12/04
- 24590-HLW-S0C-S15T-00009, HLW Vitrification Building Seismic Analysis – In Structure Response Spectra (ISRS), 12/22/03
- 24590-HLW-S0C-S15T-00039, HLW Vitrification Building Seismic Analysis – Enveloped In Structure Response Spectra, 3/16/04
- 24590-HLW-S0C-S15T-00019, Steel Structure Analysis, 3/25/04
- 24590-HLW-DGC-S13T-00075, Concrete Walls elev. 0 ft to +14 ft – rebar Calc. Col. Lines 6.8, 9.2, 9.8, 12.0, 13.0 14.2, 14.8, N.7, P.1, R.2, T.0 & T.5, 8/12/04
- 24590-WTP-S0C-S15T-00002. Generation of DBE Time Histories, 1/06/04
- 24590-WTP-PHC-E50T-00001, Typical Supports for Cable Trays & Conduits, 8/11/03
- 24590-WTP-SE-ENS-03-704, Safety Evaluation for Design, Seismic Design of Piping and Pipe Supports, 10/02/03.
- 24590-WTP-PHC-E50T-00002, Typical Supports for Cable Tray & H.V.A.C., 10/26/02.
- 24590-PTF-SSC-S15T-00055, Non-Standard Seismic Category I & II Supports for Vertical HVAC Ducts or PT Building, 11/2/04.
- 24590-HLW-SSC-S15T-00066, Standard Seismic Category I & II HVAC Ducts and Duct Supports of HLW Building, 7/28/04.
- 24590-PTF-SSC-S15T-00017, Design of Pipe Rack Framing Below El. 98'-0", 04/22/04.
- 24590-PTF-P6C-P40-00001, PTF In-Structure Response Spectra (ISRS) Conversion, 3/10/03
- 24590-HLW-P6C-P40T-00003, HLW In-Structure Response Spectra (ISRS) Conversion, 4/13/04.
- 24590-PTF-DDC-S13T-00008, Design of Embedded Plates for Framing at El. 77'-0" (Walls 30 Inches Thick and Greater) and PipeRack Framing Between El. 56'-0" and El. 77'-0" for the PT Building.
- DCN 24590-QL-POA-MVA0-00006-08-00002, Seismic Data Report
- 24590-QL-MRA-MVA0-00009, Material Requisition and supplements S0001 through S0007
- 24590-QL-POB-MVA0-00009-04-00001, Nozzle Loading Calculations

7.0 Observations from Selected Calculations

The observations identified and listed in this section do not reflect concurrence with- or validation of the information listed. In addition, the observations indicated do not necessarily represent all the data in the calculation that may be relevant to the revised ground motion. The calculation is identified by title and number, followed by the observations relevant to that calculation.

Pretreatment Facility (PTF) Design of Embedded Plates for Framing at El. 77'-0" (Walls 30 Inches Thick and Greater) and PipeRack Framing between El. 56'-0" and El. 77'-0" for the PT Building, Calculation 24590-PTF-DDC-S13T-00008, Revision A:

SADC allows the use of 7% damping for the calculation of seismic loading; however, BNI used 4% damping for this calculation, and then rounded the value up. Using 4% damping instead of 7% in this instance translates to over a 38% increase in the vertical factor and over 20% increase in the horizontal factor.

The elements being designed are at Elevation 77' or lower; however, the factors used are based on the In-Structure Response Spectra values at Elevation 98'-0". The use of the higher elevation spectra translates to a 3% increase (for the 7% damping) and to a 5% increase (for the 4% damping) in the vertical factor. In this case the use of the higher elevation spectra translates to more than a 50% increase in the horizontal factor, depending on the damping values required.

In addition, the vertical factor in increased by 10%.

The preceding information results in changing the vertical factor from the 1.1 factor used in design to a 0.7 factor allowed by the criteria, which is a 57% increase in the factor used for design. The resulting change in the horizontal factor is from 2.1 used in the design to a factor of 1.1 allowed by the criteria, which is a 90% increase in factor used for design. This information should not be interpreted to mean that the final design is over-designed by the specified percentages. In addition, the design subsequently includes additional conservatisms.

7.2 PT Facility Structural Model for SSI Analysis, Calculation 24590-PTF-S0C-S15T-00002 Revision 1A issued 1/10/2003, status committed:

The PT building is a reinforced concrete structure with a steel superstructure enclosure. The building footprint is 540' long (east-west direction) by 216' wide (north-south direction). The building height is 120' above ground elevation 0'. An embedded pit at a maximum depth of -45' occurs between column lines 12 and 17, and a smaller pit to elevation -19' occurs between column lines E to J and 28 to 30. An 80-foot high steel framed stack also occurs between column lines L to N and 25 to 27. The building has a uniform column line grid spacing of 18 feet in both directions with the exception of the ancillary facilities. This column line grid is used as the grid for joint locations. The intersection of co
lumn line A-1 at ground level is selected as the origin of the coordinate system.
Once the building model is fully described and the weights applied, a static analysis is performed to determine the combined weight of the various items. The reactions, maximum deflections and deflected shapes are examined to confirm the adequacy of the model. A dynamic analysis is then performed to determine the modes of vibration of the building. Once these two analyses are completed, the model is translated into a SASSI finite element model and the SSI analysis is performed using the SASSI program. The SSI analysis takes into account the interaction of the building and soil and the embedment of the structure.

Floor loads (mass) uses standard established in Structural Design Criteria

The equipment weights have been increased by 25% to account for uncertainty in final equipment weights. Major fundamental frequencies of the reduced model:

Mode	Frequency	Direction	Description
1	3.82	NS (Z)	Steel superstructure and stack support
3	4.49	EW (X)	Stack support
4	5.60	NS (Z)	Concrete wall @ line 9
5	5.97	NS (Z)	Concrete walls btw lines 17 and 31
6	6.39	EW (X)	Steel superstructure
10	8.41	NS (Z)	Concrete walls btw lines 1 and 12
14	9.12	EW (X)	Concrete walls
17	10.0	NS (Z)	Concrete walls @ line 1
18	10.21	EW (X)	Concrete walls
19	10.47	EW (X)	Concrete walls

Only modes with a mass participation factor of 5% or more are listed. The steel superstructure is a vertical braced frame system with horizontal bracing at the roof level to transmit the horizontal forces of the individual column lines to the vertical braced column lines. The steel superstructure also has ancillary facilities around the perimeter for stair towers, elevators, and vertical chase systems. These facilities are modeled. However, they are deactivated prior to generating the SASSI structural model to reduce the model size.

	Detailed Model		Simplified Model	
Direction	Mode	Frequency (cps)	Mode	Frequency (cps)
Z-direction	2	3.332	1	4.427
	4	4.212		
X-direction	34	8.683	2	8.612
	38	8.984		
	42	9.640		
	45	9.909		
Y-direction	42	18.116	4	17.53
	43	18.213		

7.3 PT Seismic Analysis: SSI Analysis, Calculation 24590-PTF-S0C-S15T-00003 Revision 1A issued 12/26/2002, status committed.

Soil pressure values were combined together following the (1.0+0.4+0.4) rule, i.e.

Sxx = 1.0*Sxx(x-shaking) + 0.4*Sxx(y-shaking) + 0.4Sxx(z-shaking), and

Syy = 0.4*Syy(x-shaking) + 1.0*Syy(y-shaking) + 0.4Syy(z-shaking),

7.4 PT Seismic Analysis – Seismic Loads, Calculation 24590-PTF-S0C-S15T-00004, 1/15/03:

Sheet No. 4: "As stated in SADA (Reference 4), 7% material damping values may be used for both reinforced concrete and steel members in calculating seismic design loads. However, the SSI analysis for the generation of In-Structure Response Spectra, which uses 4% material damping for both reinforced concrete and steel member, are used here."

Sheet No. 4: "To account for future uncertainties (such as relocation and/or addition of equipment weights) and to account for possible local unconservative responses (due to the application of uniform accelerations) all of the nodal maximum accelerations above grade are scaled up by 20%."

Sheet No. 106 & 107: All accelerations are factored by 20% to account for accidental torsion, except at and below grade.

Sheet No. 108: "The averaged seismic responses at each elevation of the stack nodes are increased by 20%."

7.5 PT Seismic Analysis: Calculation of Floor Slab and Roof Beam Vertical Frequencies, Calculation 24590-PTF-S0C-S15T-00014, 1/15/03.

50 psf miscellaneous dead load used, and idealized support conditions.

7.6 PT Seismic Analysis – In Structure Response Spectra (ISRS), Calculation 24590-PTF-SSC-S15T-00005, 1/21/03.
Sheet No. 5: "Widen ARS by +/- 15%. Per SADA (Reference 1) in order to cover all of the uncertainties, all spectral accelerations of the final-combined ARS's are broadened by +/- 15 % (see Reference 1 for more detail). Additionally, all spectral values in the vertical ARS's (Z direction) for the flexible slab and roof beam locations (vertical oscillators) are increased by 10% to cover uncertainties and future modifications on equipment data. All of the other ARS's (in all 3 response directions, X, Y, and Z), for locations other than flexible slabs and roof beams, will be plotted without any increase." ASCE –4, section 3.4.2.3 allows for a 15% reduction of peak value.

Sheet No. 4: "The material damping of the reinforced concrete and structural steel members were set as 4% for the purpose of calculating ISRS, as stated in SADA (reference1)."

Sheet No. 6: "Assumptions listed in Section 6 of Calculation 24590-PTF-S0C-S15T-00002, Rev. 1A, 00003, rev. 1A, 00004, Rev. 1A and 00014, Rev. 0A are indirectly applicable to this Calculation, since these calculations are used as an input to this Calculation."

Pretreatment Facility (PTF) Seismic Analysis – Enveloped In-Structure Response Spectra Calculation 24590-PTF-S0C-S15T-00005 Revision 0A issued 1/10/2003, status committed.

Vertical slab frequencies, which are used to calculate vertical response accelerations, are calculated and documented in Reference 5 calculation.

For systems and components that are seismically qualified by testing, additional scale factor as given in DOE-STD-1020-94, Reference 11, is required. The material damping of the reinforced concrete and structural steel members were set as 4% for the purpose of calculating ISRS, as stated in SADA (Reference 1).

Widen ARS by ± 15% Per SADA (Reference 1) in order to cover all of the uncertainties, all spectral accelerations of the final-combined ARS's are broadened by ± 15% (see Reference 1 for more detail). All spectral values in the vertical ARS's (Z direction) for the flexible slab and roof beam locations (vertical oscillators) are increased by 10% to cover uncertainties and future modifications on equipment data. All other ARS's (in all 3 response directions, X, Y, and Z) for locations other than flexible slabs and roof beams will be plotted without any increase.

All final ISRS plots are manually smoothed by conservatively removing any sharp dips on the plots that may be created by soil variation or by concrete cracking at slabs.

Assumptions listed in Section 6 of Calculation 24590-PTF-S0C-S15T-00002, Rev. 1A, 00003, Rev 1A, 00004, Rev 1A, and 00014, Rev. 0A are indirectly applicable to this Calculation. Elevation ranges from -45'-0" to 98'-0." *(Note: all nodes are located at the intersection of a slab and a supporting wall; thus the nomenclature slab/wall joints.)*

For elevation 0, 17, and 18 all slab frequencies are in the rigid range > 33 Hz, except for location EL17_H-J-24-27 where the frequency is 24.23 cps.

7.7 PT Seismic Analysis – Enveloped In-Structure Response Spectra Calculation 24590-PTF-S0C-S15T-00045 Revision A, issued 2/12/2004, status committed.

Uses raw data from the above Calc - 00005
ENV2SF performs the enveloping of individual raw (unbroadened) Acceleration Response Spectra (ARS) and applies a scaling factor to increase the amplitude of the spectral acceleration to provide additional conservatism in the ARS amplitudes.

For wall-slab joint ARS no increase is applied. For Slab vertical response ARS a 10% increase is applied.

BRD2 uses the output file from ENV2SF which broadens the envelope raw data by ± 15% to achieve the In-structure response spectra (ISRS)

Applies to gloveboxes up to floor elevation 77'0" and Posting Port up to Elevation 80'-9". The East-West and North-South ISRS are the same for both conditions; however, the vertical ISRS are significantly different.

7.8 PT Seismic Analysis - Columns and Bracing Design for PT Building, Calculation 24590-PTF-SSC-S15T-00012, 11/25/03.

Sheet No 2: "Maximum bounding loads are used along with a limiting D/C ratio of 0.85 to ensure design conservatism, although the Structural Design Criteria (Ref.9.1) permits D/C ratio of 0.9."

Sheet No. 7, columns: "contribution of vertical wind and seismic loads ... do not have a significant impact on the design." The highest D/C ratio is 0.66 for crane columns.

Sheet No. 7: "Bracings are designed to meet the slenderness requirements per UBC (Ref. 9.8), and D/C ratios are summarized in Section 8.2. The D/C ratio for the braces below 98' in general are low, and only in a few cases equal to 0.49." "For bracings above elevation 98', the maximum D/C is 0.85. The design and configuration of bracing members above 98' will be improved, and the design will be modified and released in the later revision to this calculation."

Sheet No. 7, Beams: "The D/C ratio for the bracing beams below 98' in general are low, and only in a few cases equal to 0.61. For beams above elevation 98', the maximum D/C ratio is 0.66."

7.9 Standard Seismic Category I & II HVAC Ducts and Duct Supports for PT Building, Calculation 24590-PTF-SSC-S15T-00051, 8/10/04.

Sheet No. 2: Design tables for rectangular and circular ducts and duct supports – design tables valid at and below El. 98'.

Seismic acceleration from CALC NO.: 24590-PTF-SSC-S15T-00005, Pretreatment Building Seismic Analysis – In Structure Response Spectra (ISRS), - figure 3E (horizontal spectra) and figure 5E (vertical spectra) – for ISRS at El 98' – the ISRS used is in Attachment F.

Sheet No. 4, Seismic Analysis:
Equivalent static method is used and the total seismic response is computed using the Component Factor Method 1.0/0.4/0.4 (Ref. 9.5).

System frequency analysis of the duct and duct supports is calculated to obtain the vertical and horizontal acceleration values at 3% damping (Ref. 9.5). Acceleration values are then multiplied by 1.5 to account for the multimode factor. The 1.5 factor is from ASCE 4, section 3.2.5.3.

Response spectra curves corresponding to the enveloped acceleration values at El. 98' are used for design (Attachment F)

Sheet No. 21 provides tables of duct system frequencies and acceleration (multiplied by 1.5).

Sheet No. 105 gives summary of results and conclusions - "the duct and duct supports design is conservative as the design is based on ....Max acceleration values at El. 98' are used for all levels .. 3% damping in lieu of 5% damping as permitted in Ref. 9.5

7.10 Intermediate Support Members for Seismic Category I & II HVAC Duct Supports for PT Building, Calculation 24590-PTF-SSC-S15T-00052, 9/14/04. Loadings are from Calc 00051. All support beams are rigid (frequency > 33 hz) and D/C ratios less than 0.85.

7.11 Standard Seismic Category I & II HVAC Duct Side-Mounted Supports for PT Building, Calculation 24590-PTF-SSC-S15T-00053, 9/17/04 Loadings from Calc 00051 and D/C ratios less than 0.85.

7.12 Design of Slab at 56' Elevation, Calculation 24590-PTF-DGC-S13T-0002214, 6/9/04

The strength reduction factor used for shear is 0.60 (verse 0.90), sheet no A-4, (minor issue for overall design of slab)

7.13 Design of Walls at Col Lines B, E, H, & L bounded by Col lines 24 and 30, from EL 56' to 77', Calculation 24590-PTF-DGC-S13T-000161, 8/12/04

The strength reduction factor used for shear is 0.60 (verse 0.90), sheet no A-13, (minor issue for overall design of slab)

7.14 Design of Pipe Rack Framing Below El. 98'-0", Calculation 24590-PTF-SSC-S15T-00017, 4/22/04:

The ISRS for the slab-wall joint response curves at El. 98'-0" are used for pipe rack systems at El. 85'-6" and 86'-8". The design criteria, SADA allows using 7% damping values from the ISRS; however, the design states that it uses 4% damping values from the ISRS. The value for vertical acceleration is then increased by 10%.
In this case, the difference between using the different damping values results in a 38% increase in demand in the vertical factor and a 21% increase in the horizontal factor. The additional 10% factor added to the vertical acceleration results in a 53% overall increase in the vertical factor used in design over the vertical factor shown in the in-structure response spectra.

Per SDC, allowable stresses for seismic loading are allowed an increase of 1.6 times gravity load allowable stresses. Conservatively, 0.90 times F_y is used as the limiting bending seismic allowable stress. The weak axis bending has a 33% margin for Demand/Capacity Ratio and weak axis bending, F_{by}, is the predominant contributor to the Demand Capacity Ratio. Demand capacity ratios are less than 0.85.

Allowable bending is limited to $0.60F_y$, while the code allows $0.66\ F_y$ for L_b less than or equal to L_c.

Seismic loading interactions are calculated using the 100/40/40 component Factor Method.

7.15 CALC NO.: 24590-HLW-S0C-S15T-00009, HLW Vitrification Building Seismic Analysis – In Structure Response Spectra (ISRS), 12/22/03:

Sheet No. 5: "Widen ARS by +/- 15%. Per SADA (Reference 1) in order to cover all of the uncertainties, all spectral accelerations of the final-combined ARS's are broadened by +/- 15 %. Additionally, all spectral values in the vertical ARS's (Z direction) for the flexible slab and roof beam locations (vertical oscillators) and roof/column joint locations are increased by 10% to

[14] Input forces from 24590-PTF-S0C-S15T-00012, Structural Analysis for the PT Building, GT Strudl model

cover uncertainties and future modifications on equipment data. Similarly, all of the other ARS's (in all 3 response directions, X, Y, and Z), for slab/wall joint locations are increased by 5%." ASCE –4, section 3.4.2.3, allows for a 15% reduction of peak value.

Sheet No. 4: "The material damping of the reinforced concrete and structural steel members were set as 4% for the purpose of calculating ISRS, as stated in SADA (reference1).

Sheet No. 6: "Results of Calculation 24590-HLW-S0C-S15T-00006, Rev. 0C, 24590-HLW-S0C-S15T-00007, rev. 0C, and 24590-HLW-S0C-S15T-00008, Rev. 0C are used as input to this Calculation." Assumptions listed in Section 6 of the above calculations are also indirectly applicable in this calculation.

7.16 HLW Vitrification Building Seismic Analysis – Enveloped In-Structure Response Spectra Calculation 24590-HLW-S0C-S15T-00039 Revision C issued 3/8/2004, status committed:

ENV2SF performs the enveloping of individual raw (unbroadened) Acceleration Response Spectra (ARS) and applies a scaling factor to increase the amplitude of the spectral acceleration to provide additional conservatism in the ARS amplitudes.

For wall-slab joint ARS a 5% increase is applied. For slab vertical response ARS a 10% increase is applied.

BRD2 uses the output file from ENV2SF which broadens the envelope raw data by ± 15% to achieve the In-structure response spectra (ISRS)

Applies to gloveboxes up to floor elevation 77'0" and Posting Port up to Elevation 80'-9". The East-West and North-South ISRS are the same for both conditions; however, the vertical ISRS are significantly different.

7.17 HLW Vitrification Building Steel Structure Analysis, Calculation 24590-HLW-S0C-S15T-00019, 3/25/04

Sheet No. 14 – used the El. 58' conservative enveloped ISRS, fig. 298, 306, & 322 of ref. 9.7

Sheet No. 15: Shows significant frequencies and mass participation factors – structure will be significantly impacted with the 38% seismic increase due to the structure frequencies

Sheet No. 16: 7% damping used (in agreement with Seismic Analysis and Design Criteria

Sheet No. 45: The results for this calculation are only applicable for the steel below El 58', although the total steel structure is modeled – layout/design above El 58' is work in progress.

7.18 HLW Vitrification Building Concrete Walls elev. 0 ft to +14 ft – rebar Calc. Col. Lines 6.8, 9.2, 9.8, 12.0, 13.0 14.2, 14.8, N.7, P.1, R.2, T.0 & T.5, Calculation 24590-HLW-DGC-S13T-00075[15], 8/12/04

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[15] Input from 24590-HLW-S0C-S15T-00023 and 24590-HLW-S0C-S15T-00025 (00025 the basis for the seismic loads is SASSI, Rev 0C)

Sheet No. 5: "Commodity loads – these loads account for equipment, piping, etc., that are attached to embedded plates on walls (or items attached to walls with post-installed anchors). The loads (transverse moments and shears) are defined in appendix B of Reference 9.1. Note: Reference 9.1 recommends that commodity loads be based on embeds at 8-ft spacing; for conservatism, HLW uses 6-ft embed spacing. The methodology used to incorporate commodity loads in rebar design loads is shown in Appendix A." Reference 9.1 - 24590-WTP-DC-ST-01-001, Structural Design Criteria, Rev. 2.

Sheet No. 7: "The rebar design inputs for this calculation are in Appendix G and are based on Calculation HLW-S0C-S15T-00023 (Ref 9.6) and 24590-HLW-S0C-S15T-00025 (Ref 9.10), both of which have a committed design status. The unverified assumption is that when Ref 9.6 and 9.10 are changed to confirmed status, there will be negligible impact on rebar design because of conservatism in Ref 9.6 and 9.10."

8.0 Summary

The following represents an overview of some of the observations based on the seismic portion of the team review:

Based on a review of some of the correspondence, the development of the "Site-Specific Seismic Site Response Model for the Waste Treatment Plant, Hanford, Washington" (dated February 2005) represents a collaborative effort between DOE-ORP, BNI and consultants to address the concerns raised by the DNFSB. The IR team did not attempt to validate the processes used in the study or the recommended revisions to the spectra. The revised spectra were used as the starting basis for the review.

The correspondence chain (figure 3) shows that DOE-ORP was proactive in notifying BNI of potential changes and requesting assessment of impacts in December 2004 prior to the finalization of the changes to the design response spectra (February 2005).

The development and approval of Interim Seismic Criteria to allow design and construction to continue during the period that the RGM is being incorporated into the models is a significant important step to try to minimize both the cost and schedule impact of the RGM.

Figure 5 - Preliminary Evaluation of Potential Conservatisms, reproduces information received from DOE-ORP. This is a good initial step to identify conservatism that can reasonably be eliminated from the design to reduce the impact of the proposed ground motion increase.

Cursory review of selected calculations identified additional layers of conservatism not covered in the "Preliminary Evaluation of Potential Conservatisms." These are primarily in the application of criteria. Since in the BNI process the calculations are interrelated it is often difficult to quantify the impact of the specific changes and assumptions.

Verbal comments during some of BNI's presentations indicated that some of the conservatisms would be eliminated in future design refinements. But the written documentation does not make clear the intent for removal of the conservatisms. The approved interim seismic criteria states in part that, "If BNI deviates from these criteria, the deviations will be documented in the disposition with rationale. The deviations will not use conservatisms that have been jointly categorized as type B or C without DOE approval."

The 2005 EAC document is not clear on how the conservatisms will be addressed or how they will be addressed.

The actual cost impact of the seismic change cannot reasonably be estimated with certainty until the modeling of the soil structure interaction and in-structure response spectra have been completed and compared with the current in-structure spectra is complete. The following factors contribute to the difficulty in trying to assess whether the process to assess the costs or the costs are the reasonable:

There is no documented approach to address and manage the existing design margins used through the design process. The design margins include more conservatism that is shown by the Demand / Capacity ratios. Conservatism is introduced at many levels during the design (see figure 6).

There are inconsistencies in the approach described to develop the engineering man hours and the bounding conditions for the Revised Ground Motion provided in the EAC.

Currently there is overlap between the estimates for the major increases and the requirements under the original contract. This means that the engineering hours estimates for the Revised Ground Motion duplicate hour that would be used for other technical changes. (For example, the same drawing may require revisions for more than one technical change.)

Currently there is overlap between the estimate for Revised Ground Motion and the calculation validation process required by the original contract. There is insufficient detail to assess the incremental change due to seismic.

[redacted]

The actual schedule impact of the seismic change cannot reasonably be estimated with certainty based on the level of detail in the information provided. The development and acceptance of interim seismic criteria dated April 1, 2005 could reasonably be expected to be included in the schedule submitted with the EAC. Critical path items related to the RGM could be expected to link with the criteria date. However, this is not reflected in the schedule.

The 2005 EAC states that a preliminary schedule impact analysis was performed based on the data derived from the preliminary review of the new criteria. This preliminary review established a 29 month impact to the HLW facility critical path and a 25 month impact to the

Pretreatment Facility critical path. With an estimated cost for the delays related to RGM schedule impact of $500 million. The documentation for the EAC does not support the durations identified. Typically, only two placeholders are included in the P3 schedule with no explanation or clarification of the duration or the necessity of sequencing without overlap.

Review of the P3 schedule long path layout did provide a breakdown for a vessel delay. Since a relatively high percentage of the total cost of the revised seismic ground motion, is attributed in the 2005 EAC to vessels the delay due to vessels has a significant impact on the overall project. The comparison baseline shows an activity description GEN-SGM Delay – Q-MC-MVA0-B2 Med Pres Vsls with an early start of 17 February 2005 and an early finish of 16 February 2006. The breakdown shown on the schedule is as follows:

Vendor on Hold	- 3 months
Revise Material Requisition	- 3 months
Contract Negotiations	- 2 months
Seismic Analysis approved and performed	- 1 month
Vendor Redesign	- 1 month
Modify Equipment	- 2 months

With the information available at this time there is no basis for assessing the appropriate time frame for the overall, 12 month delay The overall time frame established for the identified vessel may be reasonable, but there is no back up or documentation to support the individual distribution, the increases in the scheduled time for the vessel procurement, or the fact that the activities are established as sequential without overlap. Typically, in the schedule there is no explanation or justification for the establishing the activities as sequential and not overlapping activities. See figures 7, 8, and 9 for clarification of this issue.

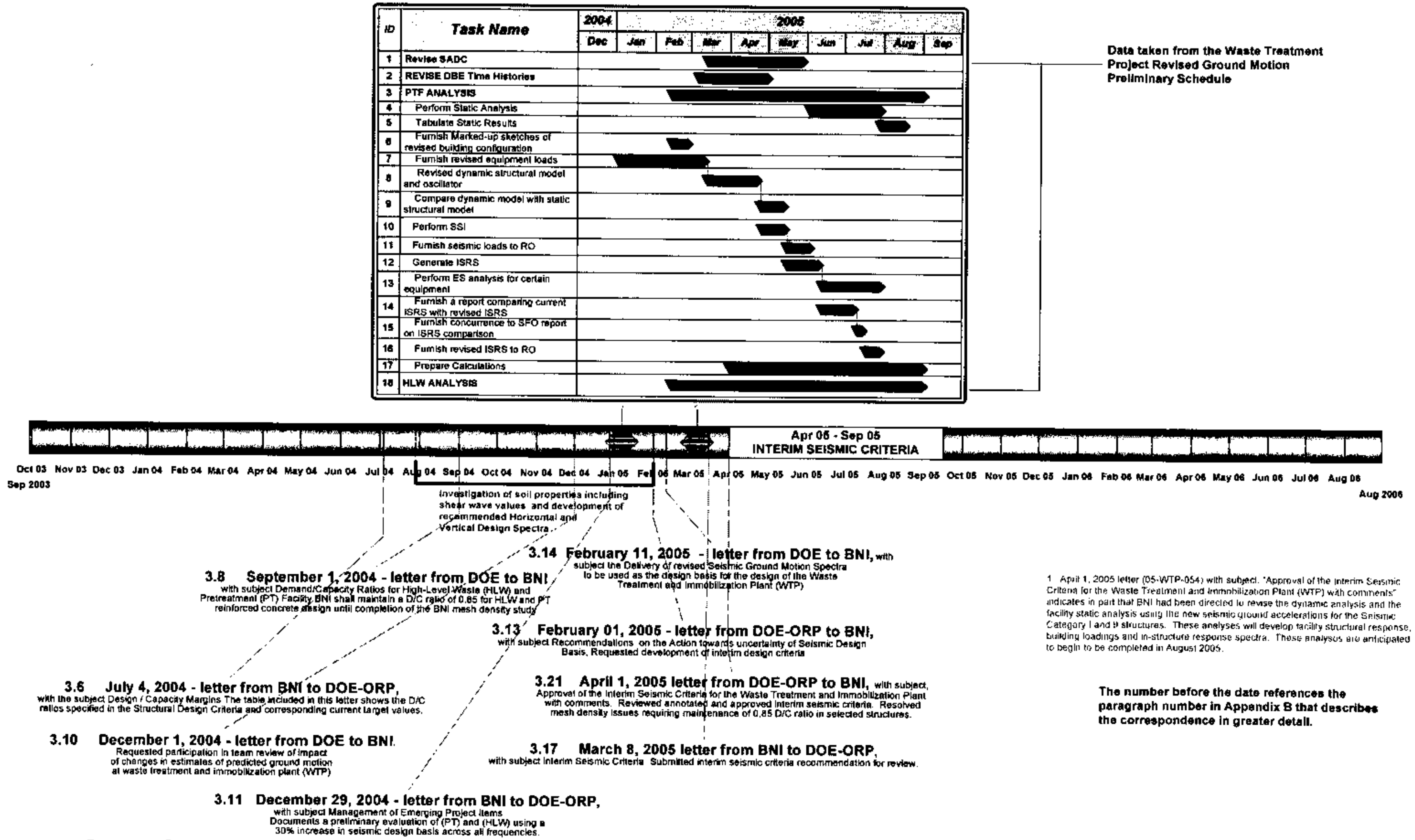
[redacted]

The development and approval of Interim Seismic Criteria to allow design and construction to continue during the period that the revised ground motion is being incorporated into the models is an important step to try to minimize both the cost and schedule impact of the Revised Ground Motion. The 2005 EAC does not reflect this development of the interim criteria or the plan to implement the RGM including the interim seismic criteria.

DOE-ORP staff provided an outstanding level of cooperation and assistance in the review process.

The accelerated review schedule and late receipt of the EAC documents limited the scope and complicated the review.

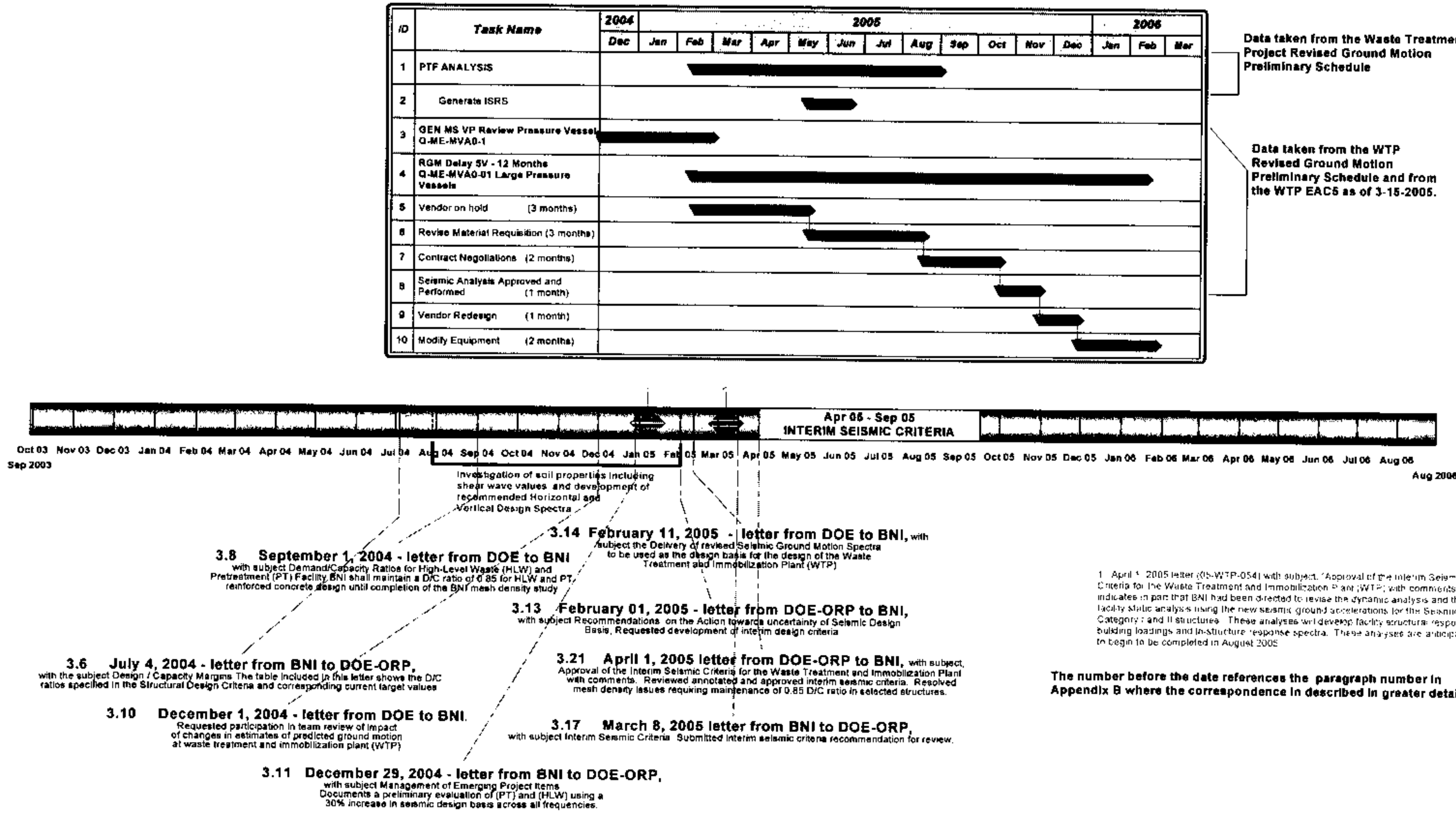
Figure 7 Schedule Impact Due to Revised Ground Motion Calculations



1 April 1, 2005 letter (05-WTP-054) with subject. "Approval of the Interim Seismic Criteria for the Waste Treatment and Immobilization Plant (WTP) with comments" indicates in part that BNI had been directed to revise the dynamic analysis and the facility static analysis using the new seismic ground accelerations for the Seismic Category I and II structures. These analyses will develop facility structural response, building loadings and in-structure response spectra. These analyses are anticipated to begin to be completed in August 2005.

The number before the date references the paragraph number in Appendix B that describes the correspondence in greater detail.

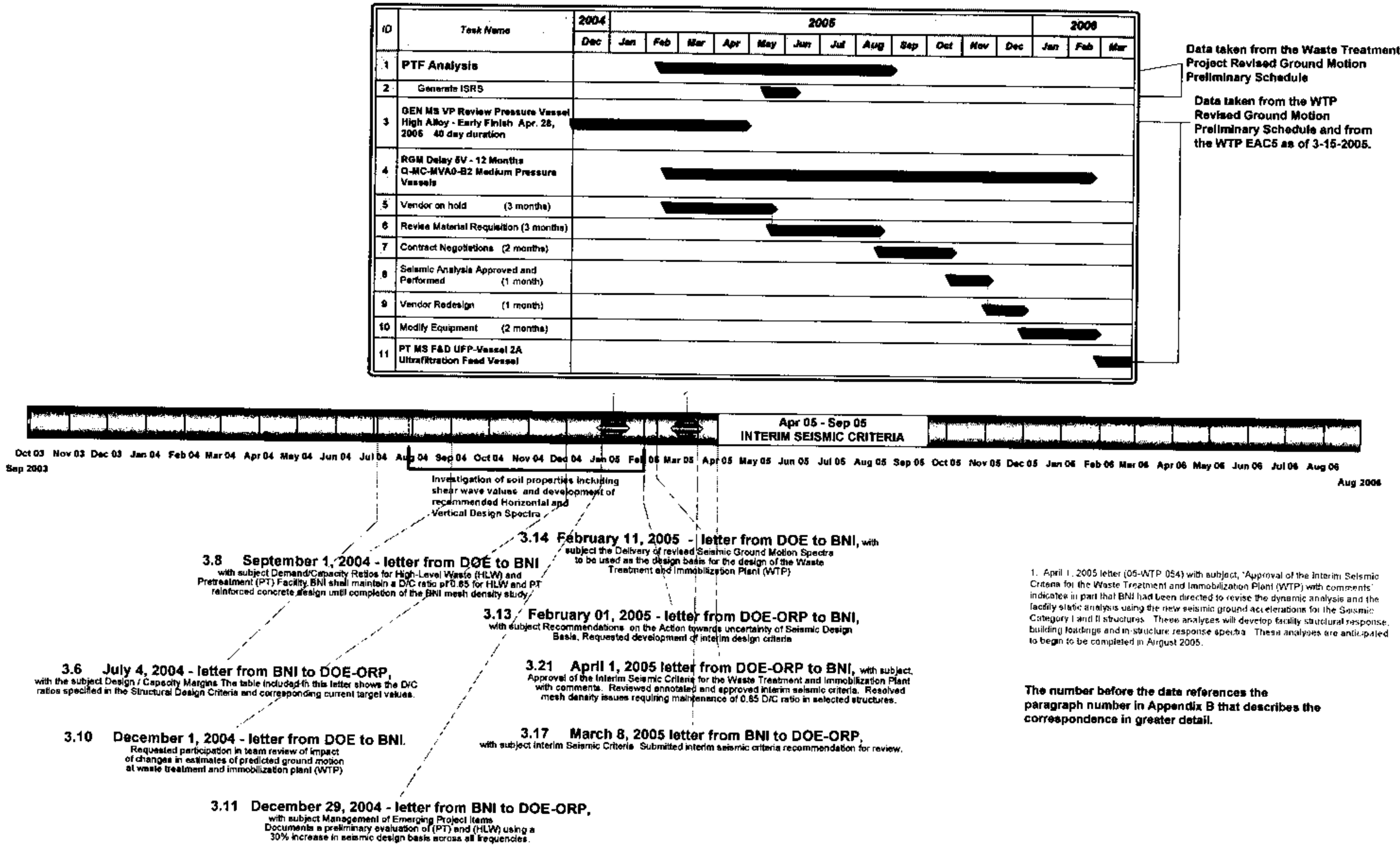
Figure 8 Schedule Impact Attributed to Revised Ground Motion for Large Pressure Vessels



1 April 1, 2005 letter (05-WTP-054) with subject, "Approval of the Interim Seismic Criteria for the Waste Treatment and Immobilization Plant (WTP) with comments" indicates in part that BNI had been directed to revise the dynamic analysis and the facility static analysis using the new seismic ground accelerations for the Seismic Category I and II structures. These analyses will develop facility structural response, building loadings and in-structure response spectra. These analyses are anticipated to begin to be completed in August 2005

The number before the date references the paragraph number in Appendix B where the correspondence in described in greater detail.

Figure 9 Schedule Impact Attributed to Revised Ground Motion for Medium Pressure Vessels.



References

Geomatrix Consultants (1996b). "Probabilistic Seismic Hazard Analysis," DOE Hanford Site, Washington, WHC-SD-W236-TI-002, Revision 1a, prepared for Westinghouse Hanford Company, Richland, Washington, October 1996.

BNFL (1999), "Validation of the Geomatrix Hanford Seismic Hazard Report for Use on the TWRS-P Project." Prepared for Tank Waste Remediation System Privatization Project, Revision 0 (draft), dated February 18, 1999.

DNFSB (July 30, 2002), letter from J.T. Conway to J.H. Roberson, DOE dated July 30, 2002.

DNFSB (January 21, 2003), letter from J.T. Conway to J.H. Roberson, DOE dated January 21, 2003.

ORP/OSR-2002-22, Office of River Protection Position Concerning Assumed Probability of Tectonic Activity, and Adequacy of Ground Motion Attenuation Model Used in the Design of the Waste Treatment Plant, August 26,2002.

Rohay A.C. and S.P. Reidel, Site-Specific Seismic Site Response Model for the Waste Treatment Plant, Hanford, Washington," Pacific Northwest National Laboratory, PNNL-15089, February 2005.

Appendix C
Risk Analysis - Supplemental Data

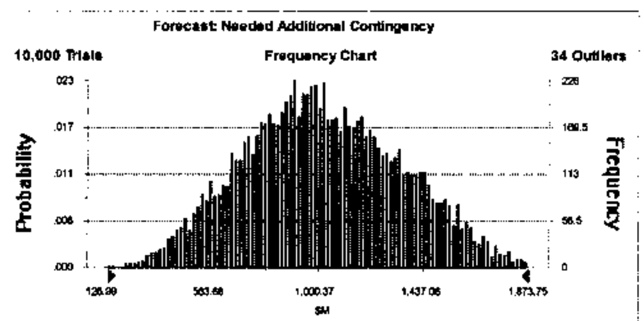
Risk REPORT1

Crystal Ball Report
Simulation started on 4/20/05 at 16:34:17
Simulation stopped on 4/20/05 at 16:34:41

Forecast: Needed Additional Contingency **Cell: K81**

Summary:
Display Range is from 126.99 to 1,873.75 $M
Entire Range is from 37.86 to 2,024.17 $M
After 10,000 Trials, the Std. Error of the Mean is 3.29

Statistics:	Value
Trials	10000
Mean	1,022.75
Median	1,005.10
Mode	---
Standard Deviation	328.59
Variance	107,968.87
Skewness	0.14
Kurtosis	2.56
Coeff. of Variability	0.32
Range Minimum	37.86
Range Maximum	2,024.17
Range Width	1,986.31
Mean Std. Error	3.29



Page 1

Risk REPORT1

Forecast: Needed Additional Contingency (cont'd) **Cell: K81**

Percentiles:

Percentile	$M
0%	37.86
10%	598.15
20%	732.87
30%	834.46
40%	922.33
50%	1,005.10
60%	1,097.92
70%	1,198.35
80%	1,318.32
90%	1,467.23
100%	2,024.17

End of Forecast

Risk REPORT1

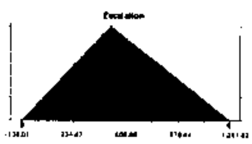
Assumptions

Assumption: Escalation **Cell: K7**

Triangular distribution with parameters:

5% - tile	80.00	(=G7)
Likeliest	500.00	(=H7)
95% - tile	1,100.00	(=I7)

Selected range is from -138.01 to 1,351.92



Assumption: Engineering Issue Identified **Cell: K10**

Triangular distribution with parameters:

5% - tile	0.00	(=G10)
Likeliest	20.00	(=H10)
95% - tile	60.00	(=I10)

Selected range is from -11.78 to 75.58

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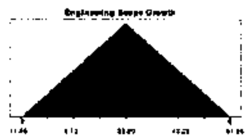
Risk REPORT1

Assumption: Engineering Scope Growth **Cell: K11**

Triangular distribution with parameters:

5% - tile	0.00	(=G11)
Likeliest	25.00	(=H11)
95% - tile	50.00	(=I11)

Selected range is from -11.56 to 61.56

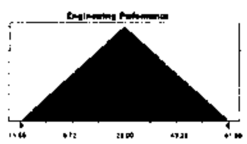


Assumption: Engineering Performance **Cell: K14**

Triangular distribution with parameters:

5% - tile	0.00	(=G14)
Likeliest	25.00	(=H14)
95% - tile	50.00	(=I14)

Selected range is from -11.56 to 61.56



Assumption: Commissioning Schedule **Cell: K23**

Triangular distribution with parameters:

5% - tile	25.00	(=G23)
Likeliest	100.00	(=H23)
95% - tile	200.00	(=I23)

Selected range is from -13.01 to 242.72

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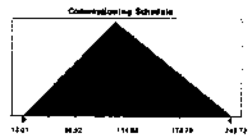
Risk REPORT1

Assumption: Commissioning Schedule (cont'd) **Cell: K23**

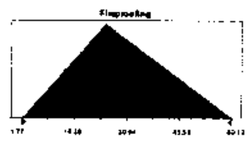


Assumption: Fireproofing **Cell: K43**

Triangular distribution with parameters:

5% - tile	10.00	(=G43)
Likeliest	25.00	(=H43)
95% - tile	50.00	(=I43)

Selected range is from 1.77 to 60.12

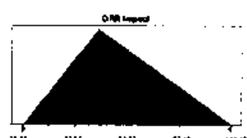


Assumption: ORR Impact **Cell: K72**

Triangular distribution with parameters:

5% - tile	25.00	(=G72)
Likeliest	50.00	(=H72)
95% - tile	100.00	(=I72)

Selected range is from 10.27 to 119.48



WTP Project

USACE Indpendent Risk Assessment

		Risk Assessed			Potential Additional Cost Impact (beyond EPCC, TPRA and Schedule Contingencies)			
		Contingency	TPRA	IR-05EAC Team Position	Best	Most Likely	Worst	Basis
	General Estimate Risks/Uncertainties							
1	Areas not reviewed druing EAC development, e.g., construction unit rates for electrical, controls, etc.	Partial		Adequately addressed by contingency analysis				
2	Minimal quantity growth allowances included in the EAC.	Y		Adequately addressed by contingency analysis				
3	Escalation – used DOE rates which are not reflective of current construction industry experience and expectations	Not Addressed		Needs to be added to contingency	80	500	1100	See escalation sheet - assume best 3%, ML 4-5%EV, worst 6% on Scenario B
4	Craft availability – there are no incentives included in the estimate			Not a risk based on discussions with project team				
	Engineering Assumptions/Risks:							
5	Experience to date and unit rates do not include future major workflow interruptions such as that experienced for Pulse Jet Mixers (PJM), Concentrate Receipt Vessel (CRV) Deletion, or RGM.			Assume some additional interuption of engineering may happen	0	20	60	Assume another incident on order of HPAV ($20M) - best none, ML 1, worst 3
6	There are no major design changes required for systems arising from the completion of design verification, response to external audits, or acquisition of systems and equipment.			Assume some degree of design change will be needed	0	25	50	Assume possible increase in ETC engineering for scope growth - best none, ML 5%, worst 10%
7	There are no significant design changes required during finalization of the Integrated Safety Management System (ISMS).			Assume some degree of design change will be needed				Assume covered by #6
8	There is the ability to retain key staff and obtain replacements as the design effort matures.			Assume longer schedule will have uncertainty relative to retention of key staff -- include some impact				Assume negligible impact covered by above
9	The estimate to complete is based on locating and or retaining qualified staff when needed, and assuming no more than 10% overtime, including the additional work associated with RGM and HPAV.			Assume future engineering performance will be somewhat less than estimated (based on experience to date)	0	25	50	Assume possible increase in ETC engineering for peformance issues - best none, ML 5%, worst 10%
10	A single ORR is assumed and the engineering effort will be limited to internal readiness assessments and coordination with the review team and significant new work products, such as requirements compliance matrices, will not be required.			Include ORR impact/uncertainty in risk assessment -- see #62				Covered by #62

WTP Project

USACE Indpendent Risk Assessment

		Risk Assessed			Potential Additional Cost Impact (beyond EPCC, TPRA and Schedule Contingencies)			
		Contingency	TPRA	IR-05EAC Team Position	Best	Most Likely	Worst	Basis
11	Major modifications exceeding 200 design hours generated during Startup and Commissioning are not included and will be trended as they occur.			Assume some degree of design change will be needed				Assume covered by #6
12	It is assumed that the structural steel deflections for pipe support design are predicted appropriately, with no major redesign driven by pipe modules, HVAC duct and fire protection piping supports, or the Pretreatment racks.			Assume some degree of design change will be needed				Assume covered by #6
13	Fire protection requirements for structural steel remain unchanged.			Assume some degree of design change will be needed				Assume covered by #6
14	The EAC excludes costs for Phase 3 implementation of the Simulator Model.			Not sure what this means				No risk identified
15	The EAC excludes additional analyses and evaluations of emissions profiles beyond 2006 that may result from unforeseen design evolution.			Assume some degree of design change will be needed				Assume covered by #6
16	The EAC excludes additional work for any flow sheet modification required to align Operations Research, Tank Utilization, and Steady State models with final design.			Assume some degree of design change will be needed				Assume covered by #6
	Startup and Commissioning Assumptions/Risks:							
17	Acceptance Criteria do not require performing unanticipated tests, or significantly increase test durations during system testing, IWR, Cold Commissioning and Hot Commissioning.			Assume more work needed than planned and Commissioning schedule gets longer	25	100	200	Assume longer Commissioning schedule - best 3 mos, ML 1 yr, worst 2 yrs @ $100M/yr
18	DOE and the Tank Farm Contractor will meet their responsibilities as set forth in the Interface Control Documents and will have no disruptive impact on project activities.			Assume some impact on Commissioning schedule is possible				Assume covered by #17
19	Toxic Substances Control Act (TSCA) permit will not be required to treat Hanford tank waste.			Not sure if risk				
20	Regulatory actions will support the dates specified in the schedule. Department of Ecology review of environmental performance test data and Dangerous Waste Permit modifications will not delay Hot Commissioning.			Assume no risk since schedule now stretched				
21	The Startup effort does not include hours for Engineering re-design or efforts to resolve design issues discovered during component or system testing.			Assume some degree of design change will be needed - see #6				Assume covered by #6
22	The Cold and Hot Commissioning schedule assume no process system re-design due to chemistry or rheology issues.			Assume some degree of design change will be needed - see #6				Assume covered by #6
23	MACT training requirements associated with incinerators will not be imposed on the Project.		Y	Covered by TPRA				

WTP Project

USACE Indpendent Risk Assessment

		Risk Assessed			Potential Additional Cost Impact (beyond EPCC, TPRA and Schedule Contingencies)			
		Contingency	TPRA	IR-05EAC Team Position	Best	Most Likely	Worst	Basis
24	The environmental permits will impose no ramp-up/production rate limitations.			Assume some impact on Commissioning schedule is possible				Assume covered by #17
25	Removal and disposal of stimulant waste heels will not be required prior to Hot Commissioning.			Not sure if risk				
26	Feed from the Hanford Tank Farms will be of sufficient quality and quantity to support the schedule for commissioning.			See #18 - same issue				
27	No special testing of canisterized waste forms will be required.			Not sure if risk				
28	Melters will meet or exceed their design life and will not fail during the contract period. Failed melter/spare melter handling and/or disposal costs, as well as associated schedule impacts, are not included.			Not sure if risk				
29	DOE will provide radioactive waste packaging containers estimated in the WTP Solid Waste Forecast and any treatment required for transportation/disposal at no cost to the contractor.			Probably not a risk to project				
30	The Commissioning effort does not include hours for Engineering re-design or efforts to resolve design issues discovered during commissioning.			Assume some degree of design change will be needed - see #8				Assume covered by #6
	Research and Technology assumptions/risks:							
31	R&T Plan changes are approved by ORP, which will not require characterization of AY101/C-104 and not require some portions of the phase III alternative resin scope.			Same as #65				
32	Additional antifoam activities in the existing 24590-WTP-RTD-RT-04-0003 are not required (dimethyl mercury, rheology effects, etc.).		Y	Covered by TPRA				
	Other Major Technical Risks							
33	Non-Newtonian (PJM) assessment indicates there are no additional risks or uncertainties that have not already been captured in the EAC. There are reportedly some impacts included in the contingency analysis.			Probably adequately covered by EAC				
34	HPAV assessment and discussion indicated there are still some additional risks and uncertainties associated with this issue. There should be a corresponding assessment of risks included in the TPRA, if not in the contingency analysis.		Y	Covered by EAC and TPRA				
35	Fireproofing assessment and discussion seemed to indicate the full costs of required fireproofing may not be fully captured but should be captured/reflected in the contingency analysis. There are no TPRA type risks associated with this issue.			Not clear if adequately addressed in EAC	10	25	50	Assume minimal level of additional cost impact not yet recognized -- say best $10M, ML $25M, W $50M
	From TPRA Document							
36	PT-004 Waste Characterization		Y	Covered by TPRA				
37	PT-006 Pump Capacity		Y	Covered by TPRA				

WTP Project

USACE Indpendent Risk Assessment

		Risk Assessed			Potential Additional Cost Impact (beyond EPCC, TPRA and Schedule Contingencies)			
		Contingency	TPRA	IR-05EAC Team Position	Best	Most Likely	Worst	Basis
38	PT-010 Particle Size Design Basis		Y	Covered by TPRA				
39	PT-020 Evaporator Foaming		Y	Covered by TPRA				
40	PT-025 Cs Resin Performance		Y	Covered by TPRA				
41	PT-056 Sampling Line Pluggage		Y	Covered by TPRA				
42	BOF-004 Emerging Project Needs Generate Additional Requirements for BOF		Y	Covered by TPRA				
43	BOF-012 Discontinuation of the Operator Training Software (OTISS) support for WTP Simulator		Y	Covered by TPRA				
44	HLW-053 Failure to meet MACT Standard		Y	Covered by TPRA				
45	IMT-020 Effluent characteristics not within LERF/ETF treatment envelope ICD 6-27, 6-33		Y	Covered by TPRA				
46	LAB-003 Failure to meet analytical TAT requirements		Y	Covered by TPRA				
47	LAW-066 Failure to meet MACT Standard		Y	Covered by TPRA				
48	PRJ-007 Black Cell Vessel Erosion Protection		Y	Covered by TPRA				
49	PT-085 Spent Resin Disposal		Y	Covered by TPRA				
50	BOF-007 Inadequate handling and incorrect batching of glass formers		Y	Covered by TPRA				
51	HLW-003 Waste compliance process control strategy		Y	Covered by TPRA				
52	HLW-012 Loss of melter vacuum when integrated with offgas		Y	Covered by TPRA				
53	HLW-043 Canister distortion during cooling cycle		Y	Covered by TPRA				
54	LAW-041 Changeout frquency of HEPAs		Y	Covered by TPRA				
55	LAW-070 CO and H2 and Volatile Species (Organics) in Melter Offgas		Y	Covered by TPRA				
56	PRJ-014 Steam boiler operating limit risk		Y	Covered by TPRA				
57	PT-048 Ultrafiltration Risks		Y	Covered by TPRA				
58	PT-074 Formation of Aluminium Silicate in the treated LAW evaporator		Y	Covered by TPRA				
59	PT-087 Formation of hazardous mercury compounds in evaporator overheads		Y	Covered by TPRA				
60	PT-092 Mercury Partitioning		Y	Covered by TPRA				
	Other Programmatic Risks - Critical Decisions in EAC							
61	Approval of revisions to the small business subcontracting plan and the 60/40 self performed work restriction (Clause H.13) to achieve consistency with current scope of work.			BNI forecasts indicate there is a high probability they will not be able to comply with this contract provision and BNI believes S/C work costs more than does self-performed.				Team believes there is not likely cost impact from this risk.
62	Support of the one ORR concept during Cold Commissioning			Need to include potential impacts (C/S) in contingency analysis	25	50	100	Assume ORR impact on schedule - best 3mos, ML 6 mos, worst 1 yr @$100M/yr

WTP Project

USACE Indpendent Risk Assessment

		Risk Assessed			Potential Additional Cost Impact (beyond EPCC, TPRA and Schedule Contingencies)			
		Contingency	TPRA	IR-05EAC Team Position	Best	Most Likely	Worst	Basis
63	Support of the Sequential Commissioning team concept			Appears this concept has been accepted by ORP but still uncertainty regarding staffing, etc. for SCTs				Could have cost impact but not clear how to quantify.
64	Design features to accommodate Dangerous Waste Permit performance test standards limited to WTP design for abatement of mercury in HLW and LAW Melter offgas streams. No modifications to design required.			Not sure how significant but since included by BNI as Critical Decision may represent significant risk				Assume covered by #6
65	Elimination of characterization and vitrification of AY-101/C-104			Not sure how significant but since included by BNI as Critical Decision may represent significant risk				Not sure how to evaluate impact
	Model Adders							
66	Construction Impact for added scope as result of engineering risks being realized (i.e., scope growth) -- See #5 and #6							Assume engineering is 30% of construction - base on #5 + #6

WTP Escalation Impact Analysis

	Prior	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	Total
Escalated EAC													
Cost Profile - Scenario A	2039	1167	1173	845	812	721	435	351	262	75	57		7937
Cost Profile - Scenario B	2039	885	661	662	706	688	639	584	459	358	289	123	8083
DOE Escalation Rates Used		103%	106%	109%	111%	114%	117%	120%	123%	127%	130%	133%	
Annual Rate		2.90%	2.80%	2.60%	2.60%	2.60%	2.60%	2.60%	2.60%	2.60%	2.60%	2.60%	
Unescalated - Scenario A	2039	1134	1109	779	729	631	371	292	212	59	44	0	7399
Unescalated - Scenario B	2039	860	625	610	634	602	545	486	372	291	207	92	7363
Escalation Estimate - Scenario A		33	64	66	83	90	64	59	50	16	13	0	538
Escalation Estimate - Scenario B		25	36	52	72	86	94	98	67	77	62	31	720
Escalation Delta @ 2.5%		1.025	1.0506	1.0769	1.1038	1.1314	1.1597	1.1887	1.2184	1.2489	1.2801	1.3121	
Scenario A		-4.54	-7.97	-6.56	-7.09	-6.99	-4.84	-4.08	-3.30	-1.02	-0.83	0.00	-47.00
Scenario B		-3.44	-4.49	-5.14	-6.16	-6.67	-6.81	-6.79	-5.78	-4.98	-3.90	-1.90	-56.08
Escalation Delta @3%		1.03	1.0609	1.0927	1.1255	1.1593	1.1941	1.2299	1.2668	1.3048	1.3439	1.3842	
Scenario A		1.13	3.42	5.77	8.73	10.60	6.11	7.94	6.97	2.30	1.97	0.00	56.95
Scenario B		0.86	1.93	4.52	7.59	10.11	11.92	13.21	12.21	11.27	9.32	4.76	87.69
Escalation Delta @4%		1.04	1.0816	1.1249	1.1699	1.2167	1.2653	1.3159	1.3686	1.4233	1.4802	1.5395	
Scenario A		12.48	26.38	30.79	41.07	46.81	34.56	33.06	28.59	9.32	7.96	0.00	271.00
Scenario B		9.46	14.86	24.12	35.71	44.66	50.77	55.00	50.08	45.72	37.55	19.08	387.02
Escalation Delta @5%		1.05	1.1025	1.1576	1.2155	1.2763	1.3401	1.4071	1.4775	1.5513	1.6289	1.7103	
Scenario A		23.82	49.55	56.30	74.36	84.44	62.31	59.66	51.71	16.90	14.48	0.00	493.53
Scenario B		18.06	27.92	44.11	64.65	80.57	91.53	99.27	90.58	82.93	68.33	34.85	702.82
Escalation Delta @6%		1.06	1.1236	1.1910	1.2625	1.3382	1.4185	1.5036	1.5938	1.6895	1.7908	1.8983	
Scenario A		35.16	72.95	82.30	108.61	123.53	91.41	87.84	76.42	25.09	21.59	0.00	724.89
Scenario B		26.66	41.11	64.47	94.43	117.87	134.28	146.14	133.86	123.09	101.87	52.20	1036.02

Impact of Alternative Escalation Rates			Expected Most Likely Impact as Determined by Team		
Potential Add to WTP EAC ($M)					
Rate	Scenario A	Scenario B	Prob.	EV-B	EV-A
2.5%/yr	-47	-56	5%	-2.8	-2.4
3%/yr	57	88	5%	4.4	2.8
4%/yr	271	387	45%	174.2	122.0
5%/yr	494	703	40%	281.1	197.4
6%/yr	725	1036	5%	51.8	36.2
			100%	*508.7*	*356.1*

Appendix D
Independent Review Team Members

Project Manager: Kim C. Callan, P.E., C.C.E. – Mr. Kim Callan has 23 years of experience in cost estimating and cost engineering for a wide variety of public construction and environmental projects. As Chief of the U.S. Army Corps of Engineers Cost Engineering Directory of Expertise for Civil Works and Interagency/International, he is responsible for the Corps' support mission to Department of Energy (DOE) and Environmental Protection Agency (EPA). He leads the development of Project Management Plans for these efforts, including scope, schedule, and budget. Mr. Callan served as Project Manager for DOE River Corridor Cleanup Contract, a 6-month assignment, where the led a multi-discipline team in the development of technical flow, cost and schedule for a $2 billion contract. He also served as Project Manager for Project EPA, which provided cost estimating support for the Environmental Protection Agency. Project EPA included three teams that traveled to all ten EPA regions and performed a detailed analysis of cost estimating procedures to identify areas for potential improvement in EPA's cost estimating capabilities. Mr. Callan is a member of the National Cost Engineering Steering Committee, a tri-service committee that reviews and develops cost engineering policy and procedures used by USACE and other DOD agencies. Previously, he served as the cost engineering specialist responsible for planning, coordinating, developing, and reviewing all specialized work for HQUSACE relating to cost engineering. He was responsible for the preparation of Corps Construction Equipment cost publication. Mr. Callan holds a B.S. in Civil Engineering from Washington State University. He is a licensed Professional Engineer in Washington and is a Certified Cost Engineer.

Wallace W. Brassfield, P.E., C.P.E. - Mr. Brassfield has over 40 years of construction cost estimating experience including 13 years estimating for small business heavy construction and specialty contractors. From 1989 to his retirement at the end of 2004, Mr. Brassfield served as the Division cost engineer for the US Army Corps of Engineers, Northwestern Division (NWD). At NWD he was responsible for coordinating and oversight of the five NWD District cost estimating organizations located at Seattle, WA, Portland, OR, Walla Walla, WA, Omaha, NE and Kansas City, MO. NWD administered an annual billion dollars plus budget for engineering and construction of military, heavy civil works, dredging, O&M and HTRW projects through out the region. Mr. Brassfield has a civil engineering degree (B.S.C.E.), is a registered professional engineer in the state of Washington and is an American Society of Professional Estimators "Certified Professional Estimator".

Mark A. Childs, C.C.E., PMP – Mr. Mark Childs has 29 years of experience in project and contract management, cost estimating, construction, and scheduling. He has specific expertise in construction management, cost estimating, value analysis and value engineering, life cycle costing, claims analysis, engineering consulting, training, scheduling, bid preparation, budgeting, purchasing, construction supervision, and management and technical oversight. Mr. Childs has extensive experience working with the Department of Energy at Savannah River, Rocky Flats, and Hanford. He has provided auditing services for environmental liabilities reviews for DOE and the Federal Aviation Administration. Recently, Mr. Childs developed an Operations and

Efficiency Plan for a low-level radioactive waste disposal facility in Barnwell, South Carolina. For Rocky Flats, he managed a project controls contract to provide cost engineering and project controls services to Kaiser-Hill. He managed the baseline development for the PUREX/UO3 Facility at the Hanford Site. Mr. Childs also managed the development of the Baseline Environmental Management Reports for the Savannah River Sites and served as Project Manager for several DOE projects that employed the Activity-Based Costing methodology to assist in the development of operational baselines, including Project EM, the Fast Flux Test Facility, the Hanford Landlord Program and the Plutonium Finishing Plant. Previously, Mr. Childs served as Operations Manager for a national environmental services company, managing projects to decontaminate and remove PCB-contaminated electrical equipment. Mr. Childs holds a B.S. in Agricultural Engineering from the University of Georgia. He is a Certified Cost Engineer, a Project Management Professional, and a licensed electrical contractor in Arizona, Georgia, and Louisiana.

Gareth M. Clausen – Mr. Gareth Clausen has over 34 years of experience in planning and estimating civil works projects, of which 5 years as a supervisory engineer, and over 10 years experience in construction. Currently with the U.S. Army Corps of Engineers (USACE), he serves as a cost engineer and prepares budget, baseline, schedules, and bid and control estimates for procurement actions. He performs technical reviews, provides cost support to value engineering studies, and serves as a member of negotiating teams for negotiated procurements. Mr. Clausen's DOE experience includes participating in the assessment of Fluor Daniel Northwest cost estimating procedures and evaluation of cost estimates. Participated on the Cost Analysis Team comprised of independent personnel from the Department of Energy (DOE), U.S. Army Corps of Engineers and a Private Sector Cost Engineering Specialist that conducted a Cost Realism Analysis of proposals received in response to the DOE solicitation for the Columbia River Corridor Remediation Contract. The independent Government estimate for this contract was $1.3 billion. Participated in preparing the comprehensive review of INEEL's program planning and estimated cost for the Settlement Agreement compliance. Was the team lead for the Idaho Settlement Agreement Review of the INEEL Spent Nuclear Fuels Operations. This review included reviewing the scope schedule, and cost basis of the SNF operations to identify potential cost benefits. In addition to this review, the team prepared an independent cost estimate for Spent Nuclear Fuel Dry Storage Facility and conducted a value engineering study of the conceptual design for that facility. He was a participant in the development of a $50 million Completed Construction Cost Estimate for the Pit 9 Project at INEEL. He has participated in the cost review for the Department of Energy Technology Deployment Initiative proposal selection process. Also, the Department of Energy, Project EM, Phase 1, at the Richland Operations and Idaho Operations offices where the quality of baseline cost and schedule estimates, methodology, key assumptions, and supporting documentation were evaluated. Mr. Clausen led and participated in teams of USACE personnel that assessed the Environmental Protection Agency cost estimating processes. Mr. Clausen holds a B.S. in Civil Engineering from North Dakota State University.

Michael Deiters, P.E., C.C.E. – Mr. Mike Deiters has more than 28 years of experience in engineering, design, and construction, and field engineering with large construction projects. He has extensive consulting experience in project management, cost engineering, cost engineering tool development, schedule, baseline development review and validation, and claims management. Mr. Deiters has extensive experience in cost modeling and parametric estimating of environmental cleanup activities at Savannah River, Hanford, and Rocky Flats. He is an expert at cost estimating and cost engineering in areas including conceptual through definitive estimate development, cost modeling, parametric estimating, research, writing, baseline development, and training. He is experienced in providing cost engineering/estimating for multiple disciplines, including civil, structural, and architectural; civil, military and HTRW projects; and value engineering studies. He has developed and taught courses in Activity Based Cost Estimating, ABC Code of Accounts and HTRW Cost Engineering. Mr. Deiters has a B.S. in Civil Engineering from the Georgia Institute of Technology. He is a registered Professional Engineer in Georgia, Virginia, and Colorado, and a Certified Cost Engineer.

Gregory P. Dowd, Jr., C.C.C. – Mr. Greg Dowd has more than 21 years of experience as an Environmental Cost Engineer and Systems Analyst. He has specific expertise in database design and analysis, and systems design and analysis for environmental and nuclear facilities. He has provided auditing services for environmental liabilities reviews for DOE and the Federal Aviation Administration. He has produced cost estimating models for the removal, remediation, or stabilization of radiological, hazardous, and toxic waste for the EM-60 Baseline Environmental Management Report (BEMR) and the Hanford ER cost estimates. His responsibilities have included project planning, coordination of resources, fiscal management, baseline development and control, schedule analysis, cost-loading efforts, and risk analysis activities. Mr. Dowd led the contractor team supporting USACE in assessing the DOE 10-Year Plans for the Chicago, Oak Ridge and Weldon Springs Sites, conducting independent analyses of cost and schedule projections, addressing scope criteria used as the basis for program development, and preparing reports that detailed the overall adequacy of the site's baseline support. Previously, Mr. Dowd led a team of trainers, technical support and information systems professionals supporting a national property/casualty contractor referral network, and was responsible for analysis, design, development and implementation of database applications in support of the DOE's Office of Civilian Radioactive Waste Management. Applications included records management, schedule milestone tracking, commitment tracking, budget data management, and program management information systems. Mr. Dowd holds a B.S. in Business Administration from Shepherd College.

Chris Gruber, C.C.C, PMP – Mr. Chris Gruber has over 31 years of experience in all facets of cost engineering, cost management, risk management, and project management and control related to construction, operation and decommissioning of complex capital projects. Extensive experience with the assessment and evaluation of projects of all types at all points of the project life cycle, as well as project management and control capabilities, practices, processes, tools and systems. Experience gained during eighteen years of employment by a large architect engineer, two years with a project management consulting firm, five years as the managing partner of a cost management consulting practice, and over six years working as an independent consultant. Consulting experience primarily includes work for owner organizations in both the government and private sectors, either directly or through arrangements with various consulting and contractor organizations. Mr. Gruber holds a B.A. in Business Economics from Albright College and a M.B.A. in Finance from St. Joseph's University.

Helen J. Petersen – Ms Petersen has more than 20 years of experience in construction management, structural design, seismic criteria development, and project management for the U. S. Army Corps of Engineers. Ms Petersen is the current program and project manager for the U.S. Army Corps of Engineers Earthquake Hazard Reduction Program, a national program. This program identifies, develops, and simplifies the implementation of seismic criteria. She is a working member of the lifelines subcommittee for the Interagency Committee on Seismic Safety in Construction. This subcommittee deals with the identification and recommendation for federal wide adoption of applicable seismic design and construction criteria for non-building structures. Ms Petersen has provided technical services in the seismic area to a variety of Federal Agencies on seismic hazard reduction programs and design and evaluation of individual projects. Ms. Petersen has also participated in the development of seismic standards for IEEE for the testing and seismic qualification of equipment and DOD building and lifeline standards. Previously, Ms Petersen served as lead structural engineer on a wide variety of unique specialized projects for both military and civil works construction. Ms Petersen holds a M.S. in Civil Engineering from the University of Nebraska and has done additional post graduate work.

R. Scott Moore – Mr. Scott Moore has more than 19 years of experience supporting nuclear programs for the U.S. Nuclear Regulatory Commission, the U.S. Department of Energy, and their contractors. Mr. Moore is experienced in applying his broad base of nuclear and environmental experience to technical and economic analyses. He currently leads and supports independent technical reviews of DOE construction projects for the Office of Engineering and Construction Management. He has supported EIRs for construction projects for NNSA, the Office of Science and the Office of Environmental Management, including the Mixed Oxide (MOX) Fuel Fabrication Facility, the ·Immobilized High-Level Waste (IHLW) Interim Storage Facility Project at Hanford, the Plutonium Packaging and Stabilization Project at Savannah River, the Sandia Underground Reactor Facility, and the Pit 9 Demonstration Project at INEEL. He recently participated in a Team of Independent Professionals that quantified the economic benefits and penalties associated with ongoing production of weapons-grade plutonium at three Russian reactors. For the DOE Office of Contract Reform and Privatization, Mr. Moore led a study of best practices and lessons learned related to contract transition at DOE sites, focusing on management and operating and management and integrating contracts. He also reviewed draft Requests for Proposals for major DOE procurements (Yucca Mountain Project and the Hanford Waste Treatment Plant Project). Mr. Moore holds B.S. in Math and Physics and an M.S. in nuclear physics from the University of South Carolina.

James D. Payne – Mr. Jim Payne has 23 years of experience in Project Management, Project Controls, and Project Engineering with key accomplishments in system design/development, scheduling, and program development for major federal construction, environmental remediation and waste management programs. He has developed Management Control Systems for DOE and commercial contracts. As manager of a scheduling department for Fluor Hanford, Mr. Payne designed, developed, and implemented a project controls system to track project performance for the Plutonium Finishing Plant. Previously, as Site Scheduling Manager at the Rocky Flats Environmental Technology Site, Mr. Payne led a rebaselining of the site closure project plan, resulting in a compression of the baseline by 30 % and a project costs reduction of over $1 billion. Previously, Mr. Payne was responsible for designing, developing, and implementing a Project Management and Control System for DOE's Grand Junction office and was an integral member of the Hanford Site Standard Scheduling team. Mr. Payne also established project control systems and engineering, construction, and procurement schedules for several commercial power plants, including WNP-2, Palo Verde Units 1, 2, and 3, and the Clinton Power Station. Mr. Payne holds a B.S. in Economics from the University of Washington.

Ronald L. Porter, P.E. – Mr. Ron Porter has more than 30 years experience in cost engineering, value engineering, quality control, and contract administration for the U.S. Army Corps of Engineers. Mr. Porter was responsible for planning and executing the value engineering program for the Walla Walla District. He served as Team Lead for cost reviews conducted by the USACE for DOE's Hanford Site, the assessment of DOE Ten-Year Plans, the Pit 9 remediation project at INEEL. He served as a team member for the review of the TRU Waste Treatment project at ORNL and the review of updates of DOE Environmental Restoration Project Baselines. As a cost engineering specialist, he planned, coordinated, developed, and reviewed various taskings assigned by HQ USACE. Previously, Mr. Porter served as lead estimator for a wide variety of architectural, structural, civil, and hydraulic projects, lead negotiator for contract negotiations with 8(a) contractors, and was a contract administrator for construction of the Lower Granite Dam. Mr. Porter holds a B.S. in Civil Engineering from Washington State University and is a Professional Engineer in Washington.

Donn W. Ruotolo – Mr. Donn Ruotolo has more than 30 years of experience in the design, engineering, procurement, management and construction of capital projects. Mr. Ruotolo's experience includes: design/procurement/construction of new buildings/modifications to existing buildings for the U.S. Government, a number of infrastructure projects, and significant management oversight/audit assignments. Previously, Mr. Ruotolo served as Manager, Construction Technical Services and Construction Manager for a major engineering and construction firm. He supported ongoing projects by reviewing overall project schedules, development of detailed erection plans for complex equipment, reviewing design drawings for constructability, and providing input to construction subcontract development.

Mr. Ruotolo served in a series of executive positions for an operating company within a major engineering and construction firm. As Vice President of Engineering and Construction Services, he managed departments responsible for engineering, coordination and project controls for oversees projects with an aggregate value in excess of $250 million. As Vice President of Projects and Procurement, he managed departments providing contract administration, project coordination, project controls, purchasing, expediting and logistic support of projects located in Belarus, Egypt, Israel, Oman, Russia and Ukraine.

Mr. Ruotolo served as Director, Project Management Operational Review (PMOR), where he was responsible for the internal audit function set-up to review the status of large projects. During the 3 year assignment, he conducted and/or supervised project reviews/audits of more than 20 projects, with an aggregate value in excess of $3 billion. Mr. Ruotolo holds a B.S. in Management from Syracuse University and a M.B.A. in Business Administration from the University of Massachusetts.

Mark Summers. P.E. – Mr. Mark Summers is a structural engineer having more than 26 years of design experience as a structural engineer on hydroelectric projects, fish bypass facilities, fish hatcheries and military projects. Currently servings as a senior structural engineer evaluating existing powerhouses and high risk buildings for seismic performance. Recent design work includes, seismic upgrade of the Lucky Peak intake tower and service bridge the spillway deflectors for Ice Harbor Dam, cutoff wall for the Wyckoff/Eagle Harbor Superfund site, dock facility at the Port of Benton for the Navy for unloading nuclear reactors, and multistory buildings at Fort Lewis. Mr. Summers has a Master of Science in Civil Engineering, a B.S. in Civil Engineering from Walla Walla College and is a Professional Engineer in State of Washington.

Appendix E
Abbreviations and Acronyms

BCCPP	Baseline Change Control Program Plan
BETK	Bechtel Estimating Tool Kit
BNFL	British Nuclear Fuels Limited Incorporated
BNI	Bechtel National Incorporated
BOF	Balance of Facilities
B&O	Business and Occupation Tax
C-GFCE	Clarified Government Fair Cost Estimate
CAR	Corrective Action Report
CPIF	cost-plus-incentive fee
CPM	critical path method
CS	carbon steel
CUR	craft unit rates
C&T	Commissioning and Testing in the report as Commissioning and Training
CY	cubic yard
D/C	Demand to Capacity
DOE	Department of Energy
DNFSB	Defense Nuclear Facilities Safety Board
EAC	Estimate at Completion
EIR	external independent review
EPCC	Engineering, Procurement, Construction and Commissioning
ETC	estimate to complete
E&NS	environmental and nuclear services
FAR	Federal Acquisition Regulations
FPM	Federal Project Managers
FT	Feet
FTE	Full Time Equivalent
FY	fiscal year
G&A	General and Administrative
GFCE	Government Fair Cost Estimate
HLW	high-level waste
HQ	Headquarters
HPAV	Hydrogen in piping and ancillary vessels
HVAC	heating, ventilation, and air conditioning
IR	Independent review
IR team	independent review team
IGE	Independent Government Estimate
IPT	Integrated Project Team
ISRS	In-Structure Response Spectra
ITD	installed-to-date
ITS	important to safety
K	Thousand

LAB	Analytical Laboratory
LAW	low-activity waste
LB	Pounds
M	Million
MACT	maximum achievable control technology
NCR	nonconformance reporting module
OBS	organizational breakdown structure
ODCs	other direct costs
OECM	Office of Engineering and Construction Management
ORP	Office of River Protection
ORR	Operational Readiness Review
OTS	Observation Tracking System Module
PAAA	Price Anderson Amendment Act
PJM	pulse jet mixers
PMB	Performance Measurement Baseline
PNNL	Pacific Northwest National Laboratory
PT	Pretreatment Facility
PT&C	Project Time & Cost, Incorporated
P3	Primavera Project Planner®
QA	Quality Assurance
QAIS	Quality Assurance Information System
QDP	Quantity Development Package
RCAM	Root Cause Analysis Module
RFP	Request for proposal
RGM	Revised Ground Motion
RPP	River Protection Project
RITS	Recommendation and Issues Tracking System Module
ROS	required on site
R&T	Research & Technology
SF	square feet
SRD	Safety Requirements Documents
SS	stainless steel
SSC	structures, systems, and components
TN	Ton
TPA	Hanford Federal Facilities Agreement and Consent Order or Tri-Party Agreement
TPC	total project cost
TPRA	Technical and Programmatic Risk Assessment
TSCA	Toxic Substances Control Act
USACE	United States Army Corps of Engineers
VE	value engineering
WBS	work breakdown structure
WGI	Washington Group International, Incorporated
WTP	Waste Treatment and Immobilization Plant

Appendix F
USACE IR Team Responses to DOE Comments on the 2005 EAC Review

1. Several sections of the report discuss the adequacy of the estimated cost at completion and the schedule basis for that cost. In order to complete the Corps "independent review" of the EAC, summarizing statements need to be brought forward into the executive summary providing the Corps' position on acceptability of the EAC from an overall cost and schedule perspective.

   USACE IR Team Response:

   Summary statements were consolidated and brought forward into the executive summary section of the report.

2. The report does not recognize the ORP management philosophy and flexibility in applying resources to present and future WTP technical and contract management issues. Since 2002 ORP has been proactive in applying resources (both Federal and contractor) in steadily increasing staff as the project moves through various phases and intensity levels. The current Federal involvement is conservatively estimated at 50 FTE with an annual Support Contractor budget of approximately $4 million. As discussed with the review team, the design, construction and commissioning of a robust WTP, safely and at the lowest reasonable cost is the highest priority of the ORP organization and resources will continue to be made available as required.

   USACE IR Team Response:

   The report was clarified to recognize the management philosophy and resource flexibility of ORP. The IR team recognizes that ORP has increased its resources and the IR team still maintains its position that additional Federal resources will be required to successfully administer this multi-billion dollar acquisition. . In addition, when the report indicates an increased federal oversight, this also includes training for individuals in contracting officer duties. This would help individuals understand what requirements the federal role is. This is not to say the federal workforce is untrained, but this contract is a complex and will need help from all federal workforce onsite.

3. The Corps states that both "DOE and BNI have exhibited reactive rather than a more effective preemptive management approach on the determination of revised ground motion for the WTP." The report continues by stating that the project team should have challenged the DNFSB position on RGM. The Corps may not be fully aware of all related correspondence or the number of meetings between DOE-EM, ORP and the DNFSB regarding the need for additional studies, the scope of the studies, interpretation

of the results, and negotiations over the final revised spectra. The suggested response to the DNFSB that the design had progressed too far to change design criteria is not consistent with departmental (or nuclear industry) requirements governing the recognition and management of newly identified or changes to the hazards from natural phenomena. Furthermore, the notion to disregard the new seismic hazard is contrary to the nuclear safety convention and culture that DOE aspires to achieve. DOE concurs with the adoption of the revised ground motion.

USACE IR Team Response:

Two items are contained in Comment #3:

The IR team stands by the statement regarding DOE and BNI management approaches. The first mention of the RGM issue in the 2004 monthly reports from BNI to DOE is in the December 2004 report.

The statement with the suggested response to the DNFSB was deleted from the report.

4. Assertions that the project cost estimates have been constrained by political sensitivity to the bottom line Total Project Cost are subjective. The management philosophy and project control systems utilized by ORP and BNI after the contract restructuring (modification A029) were specifically designed to provide an early warning of cost and schedule problems. The contract requirement for an annual formal Estimate-at-Completion (EAC) combined with joint management of the BNI trend program; near-real time contingency allocation and cost/schedule performance index data effectively identified potential end-point cost and schedule issues in 2004. These issues have been compounded, expanded and complicated by the recent change in seismic criteria but the management approach and systems did achieve their intended purpose of early identification. The report appears to focus on events and data since December 2004 when ORP was required by to change to a more traditional project controls approach that would delay the acknowledgement of future contingency utilization and carry large variances over long periods. ORP acknowledges that following the decision to suspend further allocation of project contingency, the joint contingency management approach has not worked as envisioned. ORP does not agree with continuation of this approach and recommends a return to the original philosophy outlined in the contract and the approved Project Execution Plan.

   USACE IR Team Response:

   The statements that reference political sensitivity were deleted from the report.

5. While it is accurate that ORP does not identify and analyze project risks using statistical methods, ORP <u>does</u> aggressively identify and management project risks using a combination of design, construction, cost and schedule reviews. ORP has contractually

charged the contractor to function as the design agency, design authority and the owner's agent; each function requiring a high level of professional standard and a system of continual surveillance. The ORP processes that provide for this surveillance form the basis of a system of checks-and-balances. For example, through ORP's technical and design reviews we identified that two of seven non-Newtonian vessels presented significant risks to facility throughput, functional operability, and project cost. ORP directed the contractor to remove the vessels from the design creating a conservatively estimated project cost savings of approximately $22 million and a life cycle cost savings of several million dollars. In another example, ORP recognized that through a simplified waste blending strategy (sending WTP a "vanilla" waste feed) that significant cost savings could be realized, functional operability could be enhanced, and higher facility productivity could be achieved. ORP subsequently directed the contractor to use less hazardous waste characteristics during the design which ultimately reduced the engineering, capital, and startup costs; notwithstanding the life cycle savings. In summary, while ORP relies on the contractor to identify and mitigate engineering-procurement-construction- commissioning and technical/programmatic project risks, ORP has active processes to identify and mitigate risks incurred both during construction/startup and the plant's operating life.

USACE IR Team Response:

The IR team stands by its recommendation that ORP develop a formal risk process similar to the BNI TPRA process for programmatic risks. BNI has distanced themselves from the "critical decisions" they documented in their 2005 EAC submittal. The responsibility accepted by BNI on this project is clear, however, ORP still has a responsibility to manage the project, including "critical decisions" and risks, through project completion.

[redacted]

[redacted]

7. Observations that partnering relationship has deteriorated and that BNI is using various reports and management systems to assert their position on contract scope changes/disputes is valid but the impact to the project is over-emphasized. The WTP is a large, complex undertaking and a certain amount of contractual posturing and position-taking is an inherent part of project management and execution. ORP does not agree that the partnering relationship has significantly deteriorated and that posturing is an issue that, either is not, or cannot be successfully managed. Experience to date with contract scope changes and disputed items is significantly less than that experienced prior to 2002

when the current management philosophy was implemented. This management philosophy has actively avoided contract scope changes and aggressively developed and communicated the government position on disputed items. Future resolution of the seismic scope change issue and any disputed items will be supported by the necessary resources and in accordance with the requirements of the FAR.

USACE IR Team Response:
The statements regarding "deterioration" and "posturing" were removed.

[redacted]

[redacted]

9. Value Engineering (VE) studies or similar alternative approaches for the future execution of project construction, commissioning and longer term operations are supported by ORP. This is consistent with current efforts to optimize the overall high-level waste system and better utilize tank farm capabilities to improve the consistency of the waste feeds to the WTP. The benefit of using VE at this stage of the design process will be carefully considered as part of any adjustment to the incentive nature of the current contract.

USACE IR Team Response:
The IR team received a listing of Six Sigma Benefit/Savings for the project after the draft report was issued. However, the team believes there are opportunities for additional savings.

10. TPRA contingency funds are included in budget requests and project funding levels. While the specifics of how the TPRA contingency allowance included in the Total Project Cost are not discussed in the BNI contract, the TPRA allowance is effectively an

extension of the EPCC contingency pool. Realization of a TPRA risk should not automatically result in a PMB or target cost change.

USACE IR Team Response:
The comment has clarified the TPRA contingency discussion and the IR team has deleted statements referred to in comment #10.

[redacted]

12. Now that the RGM has been adopted by the project, the Corps could be helpful in supporting some of the mitigating factors being proposed by DOE. The two most important are evaluations of incoherence resulting from the extremely large footprint of the two major process facilities and utilization of F_u or inelastic energy absorption. Incoherence is being recognized as a real phenomenon in determining building accelerations yet it has not been adapted in the NRC. The project is reluctant to support this design approach without precedence to justify it. The Corps opinion on this would be helpful. Inelastic energy absorption is also recognized in the codes and DOE 1020 yet there are concerns over loss of ventilation control through cracking of the concrete. DOE believes that concern is overly restrictive and requests any data the Corps might have on expected levels of concrete cracking resulting from inelastic energy absorption.

USACE IR Team Response:
The Corps and ORP will meet to discuss the needs of the project.

13. The Corps comments regarding EVMS management systems should recognize that ORP is in the process of planning for a review of the BNI EVMS system starting this fiscal year with the intention of identifying and addressing weaknesses within the system. The use of the BNI trend program is an excellent way to track changes on the project in a real time basis and EVMS should supplement the trend program in the ability to forecast final costs.

USACE IR Team Response:

The IR team does recognize that an EVMS review is planned. The subject of real-time basis EVMS reporting versus another time interval is a good subject for a cost/benefit review.

[redacted]

15. With respect to findings regarding excess conservatism in the analysis and design process, some clarification is needed. Figure 5 in appendix B was developed by an independent review group familiar with the BNI analytical and design methodology. It was given to BNI with the understanding that BNI would adopt the appropriate ideas as they moved forward in the design process. The outside review did not analyze individual design calculations as correctly stated in the Corps' report. The current path forward is to have BNI complete the dynamic and static reanalysis of the PC III facilities, expected in late August, and then determine which conservatisms may exist in the calculations. Interim Design Criteria have been agreed to for use until the new calculations are available. In general, identified conservatisms will be evaluated and adopted/rejected by BNI/ORP during the interim design period.

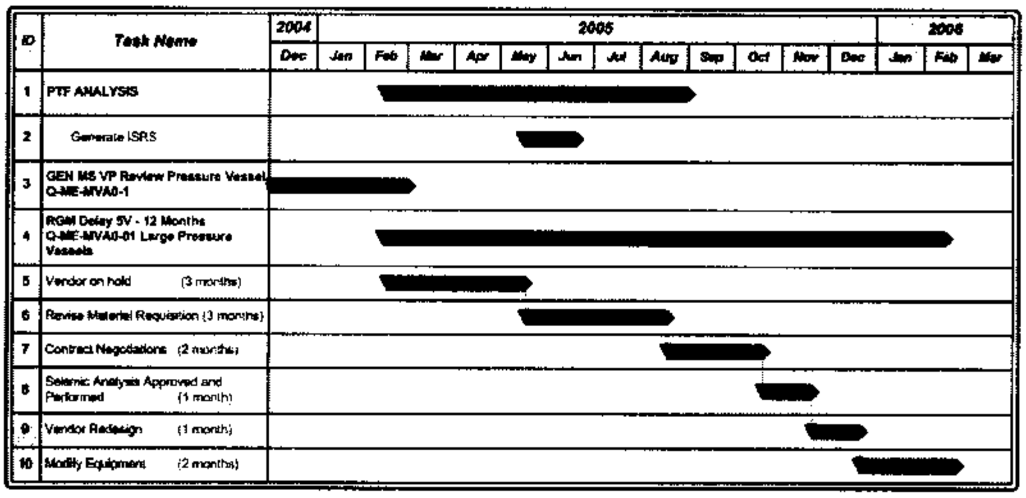
    USACE IR Team Response:

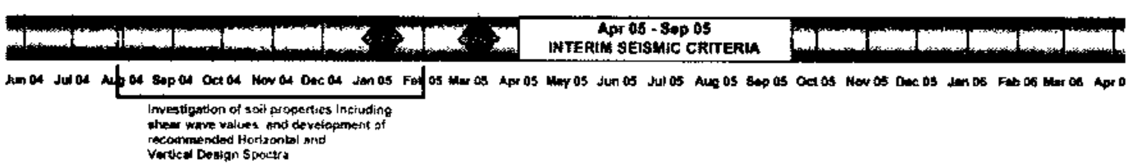
    The clarification of DOE-ORP's position is appreciated. The report indicated that the IR team felt that "The Preliminary Evaluation of Potential Conservatisms in Analysis and/or Design" was an excellent start in identifying some of the conservatisms and design margins included in BNI's design.

    a. *The issues were originally raised because of subtle differences in comments made by BNI during briefings, possible interpretations of some of the written documentation, and the wording of some correspondence. There is similarity between all of the above, but not necessarily clear agreement and they are open to interpretation about the actual implementation plan. A clear consensus between all parties on the intent and implementation plan was not obvious during the IR team review.*

b. *The list is not complete, there are additional conservatisms added at the individual calculation level. It was not clear from the limited review that there was an established pattern on the part of BNI or the designers for adding these additional conservatisms.*

c. *The schedule below, compiled from elements of the EAC submittal for large vessels, shows some of the dates from the BNI's redesign schedule. The information submitted does not appear to take advantage of the interim seismic criteria to accelerate the schedule or to take advantage of the development of the revised in-structure response spectra to accelerate the critical path schedule.*





16. The use of 4% damping in lieu of 7% as allowed in the criteria is driven by continued concerns, similar to taking credit for inelastic energy absorption, over potential excessive cracking and loss of confinement.

USACE IR Team Response:

Noted. One of the suggestions included in the report is to view the individual conservatisms within the context of the layers of conservatism included for the project as well as on their own individual merit. There are specific situations where the use of the higher in-structure response spectra (based on the lower damping values) may be warranted; however, prior to making that determination a clearer understanding of the concerns would be necessary.

In general, an option to the concern may be to perform a check to determine whether the performance of the element remains within or close to the elastic range rather than continue to add layers of conservatism to try to address a concern for potential loss of confinement.

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