

# Hanford Site - Richland, Washington Waste Treatment and Immobilization Plant (WTP)

## INDEPENDENT REVIEW OF WTP ESTIMATE AT COMPLETION (EAC) 2005



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U.S. Army Corps  
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Cost Engineering Directory of Expertise for  
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# Independent Review of WTP Estimate at Completion 2005

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**EXECUTIVE SUMMARY**

The Department of Energy (DOE), Office of Engineering and Construction Management (OECM) authorized DOE Office of River Protection (ORP) to fund the U.S. Army Corps of Engineers (USACE), Walla Walla District, to conduct an independent review of the 2005 Estimate at Completion (EAC) report for the Hanford Waste Treatment and Immobilization Plant (WTP) prepared by Bechtel National Incorporated (BNI). The objectives are to determine the accuracy and viability of the 2005 EAC report and the effectiveness of the existing management controls.

In December 2000, DOE-ORP awarded BNI a contract to design, construct, and commission the WTP using a fast track design-build approach under a cost-plus-incentive fee (CPIF) contract. Since project inception, cost and schedule have continued to increase. On January 7, 2005, DOE requested BNI to prepare a high confidence level estimate at completion, using historical information and a defensible and credible construction schedule using two strategies: Scenario A – unconstrained funding and Scenario B – constrained funding of \$690 million per year.

Description	EAC 2006 Estimated Amount (Scenario A) \$M
<b>To-Date as of Dec 2004</b>	<b>5,040</b>
Increases in EAC from 2004 review	
Non-Newtonian Mixing	190
Hydrogen in Piping and Ancillary Vessels	90
Design Evolution	459
Revised Ground Motion	753
Fireproofing of Structural Steel	68
Performance Related Changes	150
Pricing Related Changes (95M in misc)	125
Misc. Other Adjustments	136
S/T Increases	1,971
Contingency	700
<b>2005 EAC Total</b>	<b>7,711</b>
Technical and Programmatic Risk Assessment (TPRA)	79
Fee	225
Transition	50
<b>Total Project Cost</b>	<b>8,065</b>



The independent review (IR) team reviewed the 2005 EAC between March 14, 2005, and April 30, 2005. An initial draft 2005 EAC was received on April 4, 2005, and the final 2005 EAC was received on April 22, 2005. The IR team approach was to evaluate procedures and methods used for developing the 2005 EAC cost and schedule. Due to the magnitude of data, along with the short suspense, the IR team focused on high-impact, high-cost areas. The IR team reviewed over 260 documents, interviewed representatives from DOE-ORP and BNI, and took part in numerous briefings on technical and/or programmatic subjects.

The 2005 EAC shows the estimated total cost of each scenario is significantly higher than the March 2003 total cost of \$5.78 billion, and the estimated completion date has extended beyond July 2011. The IR team's development of WTP cost, as shown in table 1.1, and BNI's scheduled contract completion dates for each scenario are as follows:

Scenario A – WTP total project cost equals \$8.065 billion, schedule complete date March 17, 2014.

Scenario B – WTP total project cost equals \$8.348 billion, schedule complete date July 2015.

*Note: Tri-Party Agreement (TPA) milestone for completion of hot commissioning is currently set at January 31, 2011.*

The majority of cost increase and schedule slippage was due to technical issues, such as: non-newtonian mixing; hydrogen in piping and ancillary vessels (HPAV); revised ground motion (change to seismic criteria); and fireproofing of structural steel. Other increases were due to design evolution, BNI contractor performance related changes, and commodity and plant equipment pricing increases. The following are three examples of significant increases in this EAC:

The overall increase was 3,548,000 in engineering labor hours from the December 2004 Trended Performance Measurement Baseline (PMB) to the 2005 EAC.

The construction cost, as defined by the EAC, which includes non-manual and manual labor and portion of other construction direct cost, has increased 60 percent (\$895 million) since the December 2004 Trended PMB, for a net change from \$1,483 to \$2,378 million.

The key commodity – concrete embeds, increased from 5 million pounds in the December 2004 Trended PMB to 10 million pounds in the 2005 EAC.

The scope of this review did not include validating the processes used in the "Site-Specific Seismic Site Response Model for the Waste Treatment Plant, Hanford, Washington" or the resulting recommended revisions to the response spectra that form the basis of the Revised Ground Motion (RGM).



## KEY FINDINGS/OBSERVATIONS

Several potential high cost impact and schedule issues (mainly seismic-related issues and Scenario B Schedule) are not at an adequate level of detail to validate this 2005 EAC cost and schedule. Given the conservatism built into the seismic-related estimates and schedule, the 2005 EAC cost appears to be a bounding estimate.

There is a concern, however, that the 2005 EAC has not fully estimated potential cost growth. This project requires aggressive management by DOE and BNI, sufficient annual funding, and contract incentives to control cost and schedule growth.

The IR team considered programmatic issues that may arise outside of DOE's immediate control [e.g., Revised Ground Motion (RGM)]. The IR team's independent assessment of DOE's Programmatic Risk identified \$1.3 billion (at the 80 percent confidence level) in addition to the forecasted total project cost. This \$1.3 billion should not necessarily be included in the proposed Total Project Cost (TPC) for the WTP Project, but DOE-ORP, DOE Headquarters, and Congress should be aware that potentially liability cost and schedule risks remain beyond those already captured by the BNI 2005 EAC.

### Management Controls, Contract Incentive, and Risk

Both DOE and BNI have exhibited a reactive, rather than a more effective, preemptive management approach on the determination of revised ground motion for the WTP.

For example: DOE and BNI limited their challenge of the Defense Nuclear Facilities Safety Board (DNFSB) RGM position. When DNFSB provided their position on the seismic issue, it appears both DOE and BNI accepted the increased seismic requirements without sufficient effort to keep the project on track and respond to the DNFSB through a parallel, non-critical path analysis of the issue and creation of an appropriate response strategy. The design was already conservative, and if seismic threats exist, it is imperative the project be accelerated to empty tanks as soon as possible (tanks and their contents represent the immediate risk in a seismic event), rather than further delay and increase cost of the project to do more analysis at this time.

Continued cost growth, extended schedule completion dates, and the on-going performance trends exhibited on this project indicate the acquisition and contract strategy is not working as originally envisioned.

The current contract does not provide sufficient incentive for BNI to control cost and schedule.

The complexity of this project is extremely high. Excellent communication and aggressive management are key drivers for the cost and schedule control of this project. Improvements need to be made to improve BNI performance measures.

Potentially significant cost and schedule risks remain beyond those already captured in the 2005 EAC. Potential cost and schedule growth may include: escalation, technical developments, commissioning, and programmatic and regulatory issues.



The IR team believes that it is appropriate to use project escalation rates that reflect current market trends rather than using DOE 2004 rates in calculating escalation at the WTP. The 2005 EAC has been developed using the escalation rate forecasts published by DOE in January 2004. These rates are not reflective of the excessive and abnormal impacts on construction costs experienced in 2004 as construction material prices increased at levels unseen in recent years. Price escalation and rising energy prices have caused a ripple effect on many construction commodities and plant equipment and is not captured by the DOE rates.

[REDACTED]

DOE-ORP has made several improvements in its management role for providing oversight on this cost plus contract. Concern has been expressed in the past and continues to be an issue regarding an adequate number of DOE-ORP staff to manage this contract. Especially, contract administration of the directed RGM change in accordance with Federal Acquisition Regulations (FAR) in a timely manner.

[REDACTED]

[REDACTED]

### Schedule Development

Scenarios A and B schedules are not sufficiently developed to provide an adequate analysis.

Scenario A schedule has a high number of constraints (over 1,400), which extended the project length. When asked about aggressive scheduling options for the EAC, BNI indicated that they had not been tasked with analyzing varying schedule methods.

[REDACTED]

- Scenario B schedule, which is the "most likely" funding scenario, was a graphical representation of a schedule. The IR team did not receive an acceptable schedule for Scenario B.

The 2005 EAC narrative on "Major Changes from December 2004 Trended PMB" referenced time-related cost impacts. The referenced calculation of cost impacts could not be verified.

### 2005 EAC Cost Development





The estimating methods used to develop the 2005 EAC cost appear consistent with standard estimating procedures. Tracking cost from a review standpoint is difficult due to the complexity of the cost and accounting system used by BNI.

The IR team found that the 2005 EAC submitted by BNI was not a Class 2 estimate. BNI stated this 2005 EAC is a Class 2 estimate, which incorporates detailed engineering design, site productivity, labor wage rate, escalation, fee, and other factors that influence the job cost.

[REDACTED]



## SECTION 1.0 - BACKGROUND

### 1.1. Introduction

The Department of Energy (DOE), Office of Engineering and Construction Management (OECM) authorized DOE-ORP to fund the U.S. Army Corps of Engineers (USACE), Walla Walla District, to conduct an independent review of the 2005 Estimate at Completion (EAC) report for the Hanford Waste Treatment and Immobilization Plant (WTP) prepared by Bechtel National Incorporated (BNI). The objectives are to determine the accuracy and viability of the 2005 EAC report and the effectiveness of the existing management controls.

The DOE-ORP contract with BNI is to design, construct, and commission the WTP using a design-build approach under a cost-plus-incentive fee (CPIF) contract, which was awarded to BNI in December 2000. Since project inception, cost and schedule have continued to increase. DOE requested that BNI develop a high confidence level estimate at completion, using historical information and a defensible and credible construction schedule. The 2005 EAC is a forecast of cost and schedule at project completion. The 2005 EAC does not change the established BNI performance measurements.

BNI was scheduled to submit a final 2005 EAC on March 31, 2005; however, the draft was not received until April 4, 2005, followed by a final 2005 EAC on April 22, 2005. The IR team review began on March 14, 2005, and was to be completed on or before May 6, 2005.

Members of the IR team consist of cost engineers, who possess extensive cost engineering knowledge in vertical construction, and consultants, who have subject matter expertise and a thorough understanding of the processes currently being used in the WTP.

Appendix A contains the project description, detailed methodology, and discussion; appendix B contains the seismic background and analysis; appendix C is the risk analysis with supplemental data; appendix D contains a brief biography of each IR team member; appendix E lists the acronyms; and appendix F contains the USACE IR team responses to DOE comments on the 2005 EAC Review.



### 1.2. Total Project Cost History

This section summarizes the project cost history from the Clarified Government Fair Cost Estimate (C-GFCE) completed in May 2000 to 2005 EAC\* submitted in March 2005. Table 1-1 summarizes this cost history in terms of significant updates to the project cost and/or scope.

**Table 1-1 WTP Cost Estimates from 2000 to 2005 (\$M)**

	C-GFCE <sup>1</sup>	WTP Target Cost Estimate <sup>2</sup>	Offeror's Proposed Cost <sup>3</sup>	WTP Estimate Submittals <sup>4</sup>						EAC 05	
				May 2000	Sept. 2000	Dec. 2000	Apr. 2001	July 2001	May 2002	Mar. 2003	Apr. 2004
Base Cost	\$3,714	\$3,359	\$3,465	\$4,025	\$4,025	\$4,492	\$4,856	\$5,269	\$5,039	\$7,011	\$7,294
Contingency	\$610	\$500	\$500	\$350	\$350	\$300	\$550	\$379	\$367	\$700	\$700
Contractor EAC* w/Contingency	\$4,324	\$3,859	\$3,965	\$4,375	\$4,375	\$4,792	\$5,406	\$5,648	\$5,406	\$7,711	\$7,994
Six Sigma Improvements <sup>8</sup>	\$0	\$0	\$0	\$0	(\$100)	(\$88)	\$0	\$0	\$0	\$0	\$0
Contractor Optimization <sup>5</sup>	\$0	\$0	\$0	\$0	(\$310)	(\$250)	\$0	(\$181)	\$0	\$0	\$0

1 Clarified GFCE: A Government Fair Cost Estimate was prepared for evaluation of the privatization proposal submitted from BNFL. The GFCE was clarified based on this submittal.  
 2 WTP Target Cost Estimate: The clarified GFCE modified, based on the proposed scope of work for the RFP  
 3 Offeror's Proposed Target Cost: As proposed by BNI, and awarded in December 2000.  
 4 WTP Estimate Submittals: BNI Contract Deliverable 1.5 Project Baseline (Annual Update)  
 5 Trended Baseline as of Dec 04.  
 6 Scenario A – Developed based on Unconstrained Schedule  
 7 Scenario B – Developed based on Constrained Schedule restricted to funding level of \$690M/yr  
 8 Six Sigma and Contractor Optimization first appeared in July 2001 revision.



Contractor EAC	\$4,324	\$3,859	\$3,965	\$4,375	\$3,965	\$4,442	\$5,406	\$5,467	\$5,406	\$7,711	\$7,994
w/Reductions	\$0	\$275	\$335	\$335	\$335	\$335	\$225 <sup>9</sup>	\$225	\$225 <sup>10</sup>	\$225 <sup>10</sup>	\$225 <sup>10</sup>
Estimated Fee	\$4,324	\$4,134	\$4,300	\$4,710	\$4,300	\$4,777	\$5,631	\$5,692	\$5,631	\$7,936	\$8,219
Project Cost w/Fee	\$0	\$0	\$0	\$0	\$0	\$0	\$100	\$100	\$100	\$79	\$79
TPRA <sup>10</sup>	\$0	\$0	\$50	\$50	\$50	\$50	\$50	\$50	\$50	\$50	\$50
Contract Transition Cost	\$4,324	\$4,134	\$4,350	\$4,760	\$4,350	\$4,827	\$5,781	\$5,830	\$5,781	\$8,065	\$8,348
Total Cost											

\* EAC – Estimate at Completion

<sup>9</sup> Does not include \$200M in potential cost performance fee. Also assumes contractor will meet measurements to earn full available fee.

<sup>10</sup> Technical and Programmatic Risk Assessment



### **Project Baseline - March 2003**

BNI submitted the “Hanford Tank Waste Treatment and Immobilization Plant Project Forecast (Annual Update)” on March 7, 2003. The document reflected BNI’s EAC of \$5.406 billion for the WTP Project as of March 2003. At that time, BNI had completed approximately 40 percent of the WTP design. Total project cost is \$5.78 billion.

### **Estimate to Complete - March 2004**

BNI submitted the “Hanford Tank Waste Treatment and Immobilization Plant Project Forecast (Annual Update)” on April 30, 2004. The document reflected BNI’s EAC of \$5.648 billion for the WTP Project as of March 2004. At that time, BNI had completed approximately 55 percent of the WTP design and 22 percent of construction.

### **Project Baseline Trended - December 2004**

The Trended Performance Measurement Baseline (PMB) represents the March 2003 Project Baseline including approved project trends and scope changes to the contract.

### **Estimate at Completion - March 2005**

The 2005 EAC is a forecast for the WTP project based on the best available information that provides DOE-ORP and BNI with a current, reliable assessment of the cost to complete the project. In response to a specific DOE-ORP requirement, the 2005 EAC would consist of two scenarios:

Scenario A – Plan for unconstrained funding with 6 months of schedule contingency.

Scenario B - Plan for funding that will be constrained to \$690 million per fiscal year (FY) with 6 months of schedule contingency.

### **Major Changes from December 2004 Trended PMB**

The changes from the December 2004 Trended PMB to the 2005 EAC include, but are not limited to, the following subjects (detail regarding these major changes can be found in the 2005 EAC):

- Non-Newtonian Mixing.
- Hydrogen in Piping and Ancillary Vessels (HPAV).
- Design Evolution.
- Revised Ground Motion (RGM).
- Fireproofing of Structural Steel.
- Decreases in Productivity.



- Increases in Labor and Material Pricing.
- Project Funding Profile.

### 1.3. Funding Profile

The funding limit is a contract requirement that is managed as a cumulative value and has been established by DOE Headquarters at \$690 million per year for the contract duration. By letter, DOE-ORP directed BNI to provide a schedule reflecting “unrestrained” (the IR team will use the term “unconstrained”) funding and include 6 months of schedule contingency (Scenario A). The intent of Scenario A was to allow BNI to develop the most efficient execution plan to construct the project regardless of funding.

Further, the guidance letter required that an 2005 EAC be developed based on a constrained budget of \$690 million per year (Scenario B). Adjustments were made to the Scenario A plan at a summary basis to arrive at the Scenario B EAC.

BNI has developed the details of the 2005 EAC based on Scenario A. The FY 05 budget is relatively fixed with a funding profile of \$695 million. Unconstrained project cost in FY 05 is \$1,165 million.

Table 1-2 WTP Cost / Funding Profile Summary based on Scenario A from the 2005 EAC Table 8 illustrates the unconstrained funding profile. Estimated project costs exceed the annual funding in FY 05, FY 06, FY 07, FY 08, and FY 09. Schedule contingency is \$49 million and is included in the total project cost of \$7.8 billion. This project cost estimate includes fees expected to be paid through FY 05 and future fees to be determined.



**Table 1-2 WTP Cost / Funding Profile Summary, Scenario A**

\$ Millions	Prior	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	Total
<b>Project Costs</b>	<b>1,974</b>	<b>1,135</b>	<b>1,135</b>	<b>814</b>	<b>670</b>	<b>629</b>	<b>283</b>	<b>229</b>	<b>199</b>	<b>42</b>	<b>0</b>	<b>7,011</b>
Contingency		5	14	22	122	172	132	102	52	29	49	700
Fee	65	25	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
<b>Project Costs - Annual</b>	<b>2,039</b>	<b>1,165</b>	<b>1,149</b>	<b>836</b>	<b>792</b>	<b>701</b>	<b>415</b>	<b>331</b>	<b>251</b>	<b>71</b>	<b>49</b>	<b>7,800</b>
<b>Funding - Annual</b>	<b>2,377</b>	<b>695</b>	<b>690</b>	<b>690</b>	<b>690</b>	<b>690</b>	<b>690</b>	<b>690</b>	<b>486</b>	<b>71</b>	<b>31</b>	
<b>Project Costs - Cumulative</b>	<b>2,039</b>	<b>3,204</b>	<b>4,353</b>	<b>5,189</b>	<b>5,981</b>	<b>6,682</b>	<b>7,097</b>	<b>7,428</b>	<b>7,679</b>	<b>7,751</b>		<b>7,800</b>
<b>Funding - Cumulative</b>	<b>2,377</b>	<b>3,072</b>	<b>3,762</b>	<b>4,452</b>	<b>5,142</b>	<b>5,832</b>	<b>6,522</b>	<b>7,212</b>	<b>7,698</b>	<b>7,769</b>		<b>7,800</b>
<b>Surplus (Deficit)</b>	<b>338</b>	<b>(132)</b>	<b>(591)</b>	<b>(737)</b>	<b>(838)</b>	<b>(849)</b>	<b>(574)</b>	<b>(216)</b>	<b>19</b>	<b>19</b>		
Open Commitments	179	30	30	19	3	6	4	0				
<b>Funding Surplus (Deficit)</b>	<b>159</b>	<b>(162)</b>	<b>(621)</b>	<b>(755)</b>	<b>(841)</b>	<b>(855)</b>	<b>(579)</b>	<b>(216)</b>	<b>19</b>	<b>19</b>		
Carry-over	35	35	31	27	12	10	10	10	10	10		
Termination Liability	33	33	23	24	18	13	14	10	9	9		
<b>Net Funding Surplus (Deficit)</b>	<b>91</b>	<b>(230)</b>	<b>(676)</b>	<b>(806)</b>	<b>(871)</b>	<b>(878)</b>	<b>(602)</b>	<b>(235)</b>				
Incremental Funding Deficit		(230)	(446)	(130)	(64)	(8)						

**Fee \***

Estimate includes fees expected to be paid through FY2005. To-Go and total Fee is to be determined.

**Project Costs**

Includes project direct costs, contingency and schedule fee. FY01-04 represent actual costs reported. Does NOT include Technical and Programmatic Risk and pre-Contract Transition costs (\$50M)

**Funding Guidance**

Assumed \$690M/yr budget authority. Per Contract Section J, Funding requirements FY 2007 and beyond will be determined based on the WTP Project Baseline, and cannot exceed \$690M in any FY. There is a prior year shortfall (\$17M) which will not be made up in the current year.

**Open Commitments**

Bechtel's obligation to subcontractors and suppliers. Represents not more than 1 months advance budget authority for plant equipment & bulk construction material purchases and subcontracts. Includes lease obligations

**Carry-over**

Funds required for continued work pending additional funding authorization at the end of the fiscal year. Represents not more than 2 weeks scheduled work for the following month.

**Termination Liability**

Estimate of the minimum demobilization costs, includes approximately 1 month labor and associated relocation costs, 1 week craft labor, and lease obligations. Assumes "open commitments" will provide sufficient funds for subcontract, lease and supplier liabilities.



## SECTION 2.0 - SCOPE OF WORK

### 2.1. General

The IR team was to gain an understanding of the current cost and schedule baseline through interviews of appropriate DOE-ORP and BNI personnel, augmented by the knowledge of the project that USACE Independent Baseline review team gained from its 2004 review of WTP.

The IR team approach was to analyze procedures and methods used for development of the 2005 EAC cost and schedule information, the IR team reviewed details to ensure these procedures were used in developing cost and schedule reports. Due to the magnitude of data with a short suspense, the IR team focused efforts on high impact, high cost areas.

Specifically, the consolidated scope of work for this project consisted of the following tasks:

- Review contract terms and the site's decision on large contract changes based on Seismic, Hydrogen Gas, and Non-Newtonian Liquids; discuss impacts to contractor's incentive.
- Review cost and schedule baseline adjustments (such as seismic design changes, commodity cost increases, and various other adjustments) that have taken place since the FY 05 budget request of \$5.78 billion.
- Review critical path schedule used to develop EAC for reasonableness.
- Analyze commodity issues and related impacts to cost and schedule.
- Conduct an extensive review of the current schedule for the current baseline and assess its accuracy and viability.
- Perform a contingency analysis to analyze the risks associated with the current project.
- Review management controls, both DOE and contractor.
- Use of Earned Value Management System. Does contractor base To Go cost on historical information from site?
- Review change control process.
- Provide summary comparison of EAC to PMB.
- Review contractor indirect cost for reasonableness and appropriateness.

### 2.2. Review Approach

This independent review of the WTP 2005 EAC was performed under the direction of the U.S. Army Corps of Engineers, Cost Engineering Directory of Expertise for Civil Works and International/Interagency Support, Walla Walla District. The IR team, comprised of USACE employees, personnel from Project Time & Cost, Inc. (PT&C) and





subject matter experts, was assembled to address each task included in the scope of work.

The review followed the outline of the EAC. Document review was performed to identify the major cost drivers and focus the IR team's efforts in accomplishing the items in the scope of work.

The IR team reviewed over 260 documents, interviewed representatives from DOE-ORP and BNI, and took part in numerous meetings on technical and/or programmatic subjects.

**Timeline for the review:**

The review kickoff meeting on March 14, 2005.

Revised pages were provided with the Draft 2005 EAC presentation of the WTP 2005 EAC on April 4, 2005.

Engineering Labor Hours and Non-labor addendums were provided on April 5, 2005.

Section 10. Scenario B – Funding Compliant 2005 EAC was provided on April 11, 2005.

Section 7. Engineering, Procurement, Construction, and Commissioning (EPCC) Contingency Evaluation was provided on April 11, 2005.

Technical and Programmatic Risk Assessment (TPRA) was provided on April 13, 2005.

Final WTP 2005 EAC was provided on April 22, 2005.



## SECTION 3.0 - FINDINGS, OBSERVATIONS, AND RECOMMENDATIONS

This section provides the IR team's findings and observations for each item in the scope of work.

A "Finding" is categorized as a clear statement of deficiency with respect to practices, regulations and codes, orders, requirements, and agreements. A "Finding" requires an action to be taken for the project to have a reasonable expectation of achieving its documented objectives; or require action to be taken before the IR team can make a final judgment regarding accuracy and viability of the 2005 EAC cost and schedule. The accompanying "Recommendation" is a suggestion to help improve the project, which may be implemented by the project, or the project may choose to initiate an alternative, which it judges to be more effective.

An "Observation" is categorized as other areas of suggested improvements or good practices.

### 3.1. Management Controls

The IR team reviewed the management controls, including the philosophy, used by DOE-ORP and BNI to ensure that the scope, cost, and schedule of the WTP project are adequate given the size and complexity of the project.

"Management Controls" are used to capture the policies, procedures, software systems, and methods employed to control the scope, cost, and schedule associated with a project. In the context of a WTP, management controls are imbedded in the different functional organizations that makeup the project teams for both BNI and the Government. Examples of these organizations include:

- Federal Project Directors
- Project Management
- Project Controls
- Procurement
- Engineering
- Construction Management

#### 3.1.1. DOE-ORP Management Controls

##### 3.1.1.1. Current Management of the Contract

This section provides the results of the IR team review of DOE-ORP management controls. The overall findings and observations are based on review of DOE's WTP



current project management processes, effectiveness, and future management control requirements that may be necessary.

**Findings:** DOE-ORP has made improvements since 2004 IR review; however, the IR team recommends DOE-ORP continue to make additional improvements in management controls for the WTP Project.

Many of the DOE-ORP management controls are essentially the same ones that have been in place for the last few years. Given the size and complexity of the project coupled with the relatively small Federal staff, the Government must rely on the BNI's ability to manage most aspects of the work. These management controls are acceptable as long as the project is progressing as planned; however, when major disruptions occur, the system's inadequacies are evident. Examples of deficiencies or areas in need of improvement are as follows:

The 2005 EAC report is difficult to review from a bottom-up effort. DOE guidance should have been more definitive for the EAC development. BNI did not provide complete details to support the Scenario B EAC, which is based on the current contract provision that limited expenditures to fit a flat funding profile of \$690 million per year. Standardized direction and guidance including specific report information from DOE-ORP would facilitate review and analysis of BNI data.

There appears to be a shortage of resources to conduct meaningful and in-depth independent review and analysis of BNI-submitted estimates and project controls reports. Given limited available resources, DOE should increase resources either through additional DOE-ORP personnel or outside resources. In addition, independent cost, schedule, BNI execution, or other technical reviews should be focused on specific areas representing high cost or high risk.

DOE should allow adequate time for BNI to develop estimates and schedules. The 2005 EAC had to be completed on an accelerated schedule because of the urgency to develop a revised estimate and schedule accounting for the new RGM criteria.

DOE should consider requiring an annual EAC submittal on a specific date, which would permit BNI to plan this effort and allow adequate time to accomplish the needed analysis and documentation.

Risk Management at the DOE level should be evaluated for enhancement or improvement. Rather than relying on BNI's submittal of risk analyses, DOE must take a more proactive approach to identify, manage, and plan for overall project risks and uncertainties. This includes planning for and funding adequate project level contingency allowances reflective of the identified risks.

DOE should encourage and be willing to pay for appropriate Value Engineering (VE) efforts on the part of BNI or independent parties hired for that purpose. The VE exercises should be focused on areas of high risk, uncertainty, and cost and should include execution strategies and technical issues.



**Recommendation:** Re-evaluate the management controls organization, systems, processes, and procedures being used by DOE-ORP to ensure they are appropriate for the nature of the WTP Project and contract at this time and for the remainder of the project life.

**Findings:** When the full extent of the RGM impacts are known, the cost and schedule impact for the revised seismic criteria needs to be independently reviewed in detail. During this review, the IR team was not able to fully evaluate the cost and schedule impacts of the changed RGM. DOE should ensure a thorough, in-depth independent review is completed to support the GFCE and negotiations with BNI regarding this scope change.

**Recommendation:** DOE should ensure that a thorough, in-depth independent review of the seismic impacts be completed to support the GFCE and negotiations with BNI regarding this scope change.

**Observations:** DOE-ORP has increased its management role for providing oversight on this cost plus contract. DOE-ORP has incorporated several improvements from the 2004 review, which include:

Required BNI to evaluate the remaining cost of this project focusing on high-risk areas based on experience to date.

Actively attempted to keep BNI moving on completion of the project by creating a single point of contact to communicate with BNI on trends and execution activities.

Increased guidance documents providing specific requirements to BNI.

Increased number of field oversight staff.

Established several subject matter experts to analyze BNI information.

The current acquisition and project execution strategy should be re-examined and potentially revised.

The continued growth in the estimated total project cost, schedule completion dates, and the on-going poor performance trends exhibited on this project indicate the acquisition and contract strategy that is currently in place is not working as envisioned when the BNI contract was awarded. Thus, it is prudent for DOE to re-visit the decisions that led to the current contract and to evaluate options for a revised contracting and project execution strategy that may achieve more economic and efficient project implementation. Such a strategy would require renegotiation of the BNI contract but may yield benefits for DOE and BNI, as well as result in an eventual lower cost and more efficiently completed project. Examples that could be considered are:

Options to continue construction efforts by accepting a level of risk on RGM modifications, taking into account current conservatism within the existing designs.



The feasibility of stopping or drastically slowing construction and focusing all efforts on completion of the design effort.

Use completed design packages to secure fixed price contracts for accomplishing most if not all of the construction effort.

Evaluate option to repackage the BNI contract and possibly remove construction from that contract, or require BNI to compete for fixed price contracts.

Ensure performance fees are tied to actual performance at a manageable level that lends itself to quantifiable evaluation.

Adopt a “design to cost” strategy. Limit reimbursable support function cost levels and include incentives for improvements in support function performance and lower cost levels.

The joint contingency management process put in place at the time Mod A029 was signed and the current Target Cost established do not appear to be working as planned.

The intent was for DOE and BNI to jointly manage the project contingency allowance, allocating contingency funds as needed, to accommodate approved changes, and trends that the project would experience. At the same time, a separate TPRA contingency allowance was recommended for risks that were being evaluated and managed, but which, if realized, would result in project cost and schedule impacts. However, this intended process has not worked as planned. There has been continued disagreement between DOE and BNI as to what changes and trends constituted appropriate utilization of available contingency funds and which should be treated as contract scope changes.

The project has established baselines and forecasts that have not adequately anticipated the project scope and complexity.

Over the years, starting with the initial Government estimate and contract proposal by BNI, project cost estimates and forecasts appear to have been constrained by the sensitivity of the bottom line Total Project Cost. Periodic reviews have consistently noted that costs were being understated. There has been a general reluctance on the part of the project team to fully recognize the potential for much higher project costs, even in the face of growing pressures, trends, and indicators that seemed to point in that direction. Prior independent reviews [both External Independent Review (EIR) and USACE reviews in particular], although offering opinions that costs would likely be higher than the proposed baselines or forecasts, have started from the point that the estimates being developed by BNI at least attempted to reflect the full scope of the project and the complexities that would be encountered during project execution.

The current BNI contract is structured as a CPIF contract. Because most of the incentives are not likely to be realized, it has become similar to a cost reimbursable contract. As a result, there are no contract incentives for BNI to control and minimize project costs. Given this situation, it would appear that a much higher level of DOE



oversight is warranted than is currently in place. DOE managers and experts need to be in position to effectively challenge BNI costs and strategies and provide suitable direction aimed at minimizing costs and cost growth for this project.

Both DOE and BNI have exhibited a reactive, rather than a more effective, preemptive management approach on determining the RGM for the WTP.

The IR team found little evidence that the DOE/BNI project team is aggressively attempting to anticipate possible project issues and challenges and to implement preemptive measures aimed at avoiding problems and minimizing impacts as these situations are encountered. For example, DOE and BNI limited their challenge of the Defense Nuclear Facilities Safety Board (DNFSB) RGM position. When DNFSB provided their position on the seismic issue, it appears both DOE and BNI accepted the increased seismic requirements without sufficient effort to keep the project on track and respond to the DNFSB through a parallel, non-critical path analysis of the issue and creation of an appropriate response strategy. The design was already conservative, and if seismic threats exist, it is imperative the project be accelerated to empty tanks as soon as possible (tanks and their contents represent the immediate risk in a seismic event), rather than further delay and increase cost of the project to do more analysis at this time.

DOE Headquarters (HQ) needs to ensure open communication of lessons-learned and effective practices across the DOE organization.

It appears the WTP project is sometimes required to identify and implement strategies and processes or to resolve key problems and issues without benefit of the experiences and knowledge of other DOE sites. Examples were provided to the IR team here other sites were consulted but rebuffed efforts by the WTP to gain some insight and guidance from them. DOE HQ needs to create a dynamic atmosphere and collegial environment throughout DOE to ensure appropriate lessons-learned and best practices are openly shared and communicated. (For detailed methodology and discussions, see appendix A, paragraph A2.1).

#### **3.1.1.2. WTP Change Control Processes**

The IR team reviewed the status of the change control process as it relates to DOE-ORP and the management of the WTP at Hanford. These same processes were reviewed and commented on in the *Independent Cost and Schedule Baseline Review Summary Report*, which was prepared and issued by the U. S. Army Corps of Engineers in May 2004. Since the revisions to the overall change control process have been minimal since then, this section will provide a recap of the DOE-ORP change control processes. A more detailed discussion of contract issues involving DOE-ORP and BNI is contained in the next section of the report.

**Findings:** None.



**Recommendations:** None.

**Observations:** Manual DOE-ORP M 413.3-1 is satisfactory for establishing the DOE-ORP roles and responsibilities to execute the WTP change control plan. However, the IR team has noted that throughout the baseline change control process there is an obvious need for more resources on the part of DOE-ORP to manage the WTP contract. Future contract scope changes at the WTP will undergo considerable scrutiny. The DOE-ORP should consider hiring more staff to document change order work, administer the contract, prepare GFCEs, and negotiate changes, especially in light of the recent directed contract change dealing with revised ground motion criteria. (For detailed methodology and discussions, see appendix A, paragraph A2.2.)

**3.1.1.3. Contract Cost Performance Incentives**

The IR team reviewed the current WTP Contract and pending contract issues. The major areas of concern involve technical and cost issues that were reviewed to determine if DOE-ORP and the IR team agree on their disposition. Based on review of the WTP contract, briefing data, and discussions with BNI and DOE-ORP, the IR team analyzed those cost performance incentives affecting BNI.

This portion of the review will assess the impacts to BNI's fee regarding the disposition of these pending contract scope issues and offer the IR team's opinion on the treatment of these technical issues by.

**Findings:** None.

**Recommendation:** None.

**Observations:**

[REDACTED]



[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]





### 3.1.2. BNI Management Controls

#### 3.1.2.1. Engineering, Procurement, and Construction Management Controls

This section provides the results of the IR review for BNI management controls. The overall observations are provided based on the IR team's review of BNI's WTP project management processes and effectiveness at this time, as well as what may be necessary to better manage and control this project in the future.

**Findings:** [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

**Recommendation:** [REDACTED]

#### Observations:

[REDACTED]



### **Quality Assurance Electronic Systems**

The Quality Assurance Information System (QAIS) is used to improve communications between the BNI and Federal personnel, plus create visibility on suspense items. The BNI continues to make improvements to the system.

**Observations:** The system appears to have senior management support and should be a valuable management tool. The QAIS will present a single user interface, implement required user restrictions, and provide search and reporting capabilities for project management and personnel. (For detailed methodology and discussions, see appendix A, paragraph A2.4.)

#### **3.1.2.2. Use of Earned Value Management System**

The IR team determined the BNI has used project actual cost to date to assist in the determination of the forecasted To Go cost.

**Findings:** None.

**Recommendations:** None.

**Observations:** The IR team has verified that the method used to develop the estimated 2005 EAC cost is consistent with standard estimating procedures, but the IR team has not verified the reasonableness of the costs. The 2005 EAC cost was based on the reasonable utilization of actual construction cost and forecast estimating for future work.

ORP is in the process of planning for a review of the BNI Earned Value Management System starting this FY with the intention of identifying and addressing weaknesses within the system.

### **3.2. Seismic Impact Review**

Appendix B provides detailed information on the background, development, and impact of the RGM seismic change. Selected summary observations from appendix B are provided below:

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

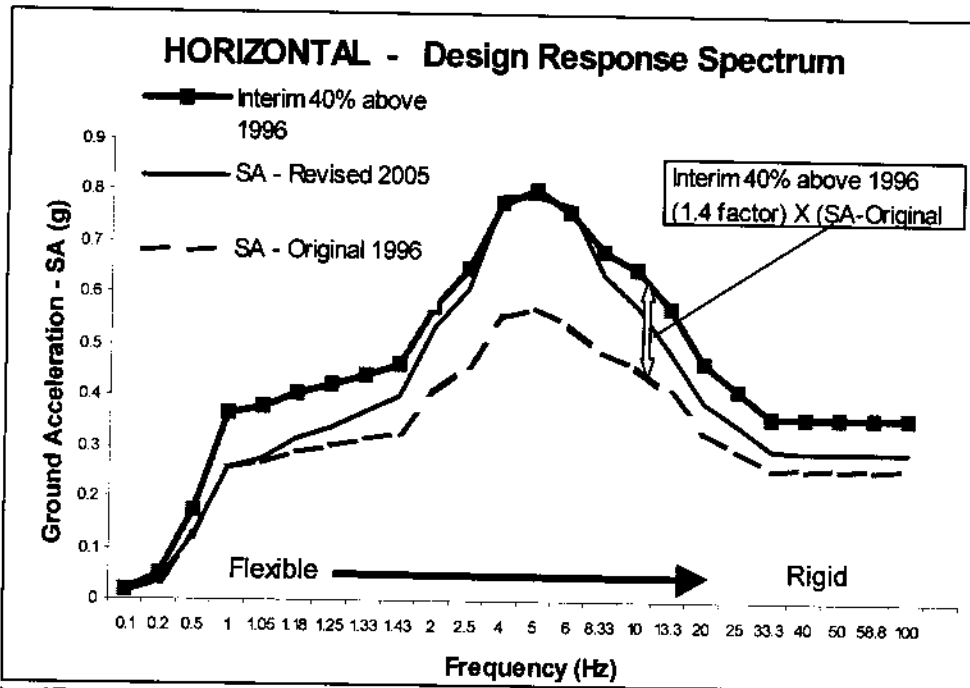
The development and approval of Interim Seismic Criteria to allow design and construction to continue during the period that the RGM is being incorporated into the models is a significant important step to try to minimize both the cost and schedule impact of the RGM.

Appendix B, figure 5, Preliminary Evaluation of Potential Conservatism, 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.

### 3.2.1. Seismic Analysis

Design of the WTP began using the seismic ground motion spectra published in 1996. This spectra and corresponding supporting report were given a due diligence review by BNI prior to acceptance for use on the project. In 2002, the DNFSB raised concerns about the conservatism of the design being sufficient to cover uncertainties in ground motion. In August 2004, another study was initiated at the site to address continuing DNFSB concerns about conservatism in the ground motion. Active discussions between DOE-ORP and BNI regarding the potential impact of changes in estimates of predicted ground motion at the WTP began in late 2004. DOE-ORP provided BNI with advance notification of the expected outcome of the study on February 1, 2005, with the RGM on February 11, 2005, and directed BNI to develop bounding interim design criteria to be used to continue with the release of structures and components for installation prior to the development of in-structure responses and structural loads using analytical models. BNI responded to DOE-ORP and interim seismic criteria was developed and approved. This interim criteria applies only to Seismic Category I and II Structures, Systems, and Components (SSCs) requiring in part that all seismic accelerations, used in support of future and pending designs and future evaluations of issued design, shall be increased by 40 percent. Additional background information including details on the development of the ground motion and documentation of the related correspondence are included in appendix B.

Figure 3-1 shows that the difference between the revised ground spectra (2005) can be significantly less than the 40 percent interim criteria. Verbal presentations indicated that many of the tanks, vessels, ductwork, and other features were designed to be relatively rigid, having higher frequency values. For rigid structures, systems, or components, the amplification would likely be much less than the 40-percent interim criteria.



The IR team did not attempt to validate the processes used in "Site-Specific Seismic Site Response Model for the Waste Treatment Plant, Hanford, Washington" or the recommended revisions to the spectra that form the basis for the RGM change.

The IR team assessment of the RGM change on the project focused on important safety structures, systems, and components, typically designated as Seismic Category I or II.

The Uniform Building Code Requirements permitted for design of other Seismic Category structures, components, and systems typically do not require changes described in the Site-Specific Seismic Site Response Model for the WTP.

**Figure 3-1 Horizontal Design Response Spectrum**

The IR team review related to seismic issues included selected portions of the correspondence chain by the DNFSB, DOE-ORP, and BNI related to seismic issues, recommendations, and decisions. The IR team also reviewed: (1) the requirements of selected applicable DOE standards; (2) sections of the Safety Requirements Documents (SRD), developed by BNI and accepted by DOE; (3) sections of the design criteria established for the project by BNI, such as the Structural Design Criteria and the Seismic Analysis and Design Criteria; and (4) sample selected calculations and source data provided in various BNI handouts and briefings.

**Findings:** The written correspondence, the 2005 EAC document, and the verbal presentations are not consistent on the approach that will be taken to remove excess margins or conservatism or the requirement to remove them.



**Recommendation:** The IR team recommends that BNI and DOE-ORP establish and document a consensus on the approach to be taken to remove excessive margins or conservatisms. This consensus should include any specific requirements to remove excessive or unidentified conservatisms.

**Findings:** A cursory review of individual calculations identified additional margins used in design that were not identified in the Table of Potential Conservatisms dated January 18, 2005, and reproduced in appendix B, figure 5.

It is unclear from the documentation provided if the extent of the conservatism incorporated into the design of the facilities is completely understood. The correspondence and meetings used to develop the appendix B, figure 5, represent a reasonable first step in attempting to identify the conservatisms, but it is not complete. Additional discussion of this item is contained in appendix B.

**Recommendation:** Recommend that BNI and DOE-ORP address additional conservatisms that were not included in Table of Potential Conservatisms.

**Findings:** [REDACTED]

[REDACTED]

**Recommendation:** [REDACTED]

**Findings:** The 2005 EAC documentation does not support or reflect that BNI has pursued efforts to reduce the impact of the RGM change.

A series of correspondence between DOE-ORP and BNI documents some of the efforts to identify, track, and minimize the impacts to the project due to the RGM change and subsequent adoption of interim Seismic Design Criteria.

**Recommendation:** DOE-ORP should require BNI to document their procedure to minimize the cost and schedule impacts of the RGM.



**Observations:**

The information and documentation provided with the 2005 EAC does not include sufficient detail to separate or clearly assign costs that would be required, without the RGM change. The following are two examples of potential cost duplication or overlap:

One example involves the calculation validation process. This is part of the BNI process to change calculations from committed to confirmed status. Prior to turnover of the project to assure DOE-ORP of a functional product, validation is required under the original contract as part of the design process. It is not clear that the costs identified in the 2005 EAC for RGM represent only the difference between the original contract requirement and the additional effort for validation due to the RGM.

Another example is duplication in the estimate for the revision and re-issuance of the same drawing when required by more than one technical change.

A series of correspondence between DOE-ORP and BNI documents some of the efforts to identify, track, and minimize the impacts to the project due to the Revised Ground Motion Spectra and subsequent adoption of interim Seismic Design Criteria. The cost and schedule data within the 2005 EAC documentation does not support or reflect that BNI has planned efforts to reduce the impact of the Revised Ground Motion Spectra.

The Design Basis Earthquake for the PC-3 SSCs has a 2,000-year return period. The WTP is tentatively scheduled to be operational in 2011 and finished with operations in 2028. The steel superstructures of the PC-3 structures (HLW and PT) are to be decontaminated and removed. The substructure, heavy concrete walls, slabs, and mat foundation are to be entombed with backfill material. This means there is a relatively brief useful life and exposure period for the facility. While DOE criteria require that this earthquake be used in the design of the facility, it should be recognized that this provides a significant level of conservatism to the design at the outset of the project.

(For detailed methodology and discussions, see appendix A, paragraph A2.5.)

**3.2.2. RGM Cost Impact Review**

The reported estimated cost impacts resulting from the RGM design changes are summarized in table 3-1.

**Table 3-1 RGM Design Change Cost Impacts in the 2005 EAC Scenario A**

\$253M	Allowance for bulk commodities and equipment, rework of completed and in-progress work, design hours, support to design, documenting, procuring, planning, implementing, and managing
--------	---



<u>\$500M</u>	Extended overhead, impacts, and delay
<u>\$753M</u>	Total RGM Design Changes – BNI Estimate without contingency
<u>\$59M</u>	Contingency [part of the \$700M of Engineering, Procurement, Construction, and Commissioning (EPCC) value]
<u>\$812M</u>	Total 2005 EAC cost impact from RGM Design Changes

**Findings:** The review of the backup for the RGM cost impacts identified disconnects within the supporting documentation and from the supporting documentation to the 2005 EAC.

**Recommendation:** The DOE-ORP should insist the estimate documentation be complete and supporting documentation be traceable from and to the basis of estimate and report summaries.

**Findings:** The 2005 EAC indicates "a good faith estimate accounts for the known direct cost in the EAC." The labor hour increases and other increases are not typically well supported. The approach of providing a typical heading described as "lot" without supporting documentation is typical. Supporting documentation provided verbally or in briefing packages was changing during the review process. There is a lack of consistency in the costs developed and the costs currently do not track from the limited breakdowns to the roll-ups.

**Recommendation:** BNI should provide additional documentation to support the cost estimate for the RGM.

**Findings:** Identification of the specific items assigned to the "addition of revised ground motion criteria" is complicated by the use of various different labels in different summaries. The use of a variety of titles such as "Assessment of ground motion design criteria," "Seismic," "Impact of Increased Seismic Motion," "RGM," "RGM TREND," "RGM impacts," etc., adds unnecessary confusion in identifying significant costs related to the EAC.

**Recommendation:** Provide consistency in the identification of the relevant related items. This should be coordinated with all disciplines.

**Findings:** The 2005 EAC documentation and the presentations do not support or reflect that BNI has planned efforts to reduce the impact of the RGM change related to costs.

Efforts should be made to coordinate and group activities to maximize efficiency in checking and revising calculations by BNI. BNI should develop a coordinated plan to address these issues, maximize resource efficiencies, and limit the cost of the RGM.



**Recommendation:** DOE-ORP should require BNI to document their procedure to minimize the cost impacts of the RGM.

**Observations:**

BNI states that 2005 EAC is a Class 2 estimate. The IR team would disagree with this conclusion, based upon statements throughout the 2005 EAC and review of the supporting documentation. A more accurate description of the 2005 EAC would be that it includes a variety of estimating approaches and levels of detail. The RGM estimate is a Class 4 estimate (rough order of magnitude).

The actual impact of the RGM change to the cost of design and construction cannot reasonably be estimated with certainty at this time. This is due in part to the lack of a documented plan to address and manage the existing design margins used through the design process.

Discrepancies were discovered in the review associated with the development of engineering labor hours that were provided to BNI during a briefing to clarify and explain the development of the engineering hours. Some of these discrepancies were corrected, but the bottom line total did not change and other discrepancies were introduced with the provision of the revised data.

The final draft 2005 EAC states: “No new or additional design, verification, or resolution of items or issues not directly related to the increased RGM will be required.” The briefing on the development of the engineering hours for the increased RGM indicated that the estimates were based on the requirement to “touch every calculation.” The stated assumptions in the 2005 EAC should agree with the assumptions used in the development of the data for the estimate and agree with the plan to accomplish the work.

(For detailed methodology and discussions, see appendix A, paragraph A2.6.)

**3.2.3. RGM Schedule Impact Review**

The IR team reviewed the 2005 EAC, the 2005 EAC schedule review, the revised Ground Motion Preliminary Schedule, and selected portions of the Primavera Project Planner ® (P3) files pertinent to seismic. These documents were supplemented with briefings, presentations, and information requested from various disciplines. Additional findings and information regarding the impacts due to the RGM change are included in section 3.3.

**Findings:** 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. 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 PT Facility critical path. With an estimated cost for the





delays related to RGM schedule impact of \$500 million, the schedule clearly requires more documentation and support for the durations identified.

**Recommendation:** Key milestones need to be incorporated into the schedule and the multiple impacts on the significant systems and components need to be assessed. Specifically, key milestones related to the development and adoption of interim seismic criteria; the completion of the revised SSI design; and the development, review, and release of the revised criteria need to be incorporated.

**Findings:** The actual schedule impact of the seismic change cannot reasonably be estimated with certainty based on the detail of the information provided.

No backup information is provided to support these delays, and the delay outline does not support the verbally stated intent to minimize the impact of the RGM. The P3 schedule shows only one seismic-related individual schedule impact breakdown. The breakdown is for a 12-month vessel delay. Other locations in the 2005 EAC and briefing packages cite vessel delays of 14 or 15 months depending on vessel type and location.

**Recommendation:** Provide schedule detail to support breakdown, sequencing, and timing of the delay.

**Observations:**

The schedule shows delays classified as SGM to specific activities classified under General Facilities, the PT, HLW, LAB, Diesel Generator, and ITS Switchgear Building the delays range from 42 days to 294 days. These delays are not supported with details, and the impact of the delays on the overall schedule is not clear or well supported.

The actual schedule impact of the seismic change cannot reasonably be estimated with certainty based on the detail of the information provided.

The schedule shows a significant float; it does not appear that the schedule reflects any effort to minimize the impact of the Revised Ground Motion. With an estimated cost for the delays related to the RGM schedule impact of \$500 million, better documentation is needed.

The schedule specifically identifies HLW – F&D C5V Rmt Filter Housing SGM Delay with work on hold due to seismic criteria change (day for day slip) from February 15, 2005, to January 26, 2006. The HLW – Complete F& D C5V Rmt Filter Housings EL+0 shows an additional day for day slippage, due to seismic criteria change. Again, there is no clear indication of the anticipated duration of the delay period or of any steps to be taken to minimize the impact.

The schedule compiled from elements of the 2005 EAC submittal for large vessels shows some of the dates from the BNI's redesign schedule. The information is shown in figure 3-2. 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.

ID	Task Name	2004												2005			2006		
		Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar		
1	PTF ANALYSIS																		
2	Generate ISRS																		
3	OEN MS VP Review Pressure Vessel Q-ME-MVA0-1																		
4	RGM Delay 5V - 12 Months Q-ME-MVA0-01 Large Pressure Vessels																		
5	Vendor on hold (3 months)																		
6	Revise Material Requisition (3 months)																		
7	Contract Negotiations (2 months)																		
8	Seismic Analyses Approved and Performed (1 month)																		
9	Vendor Redesign (1 month)																		
10	Modify Equipment (2 months)																		

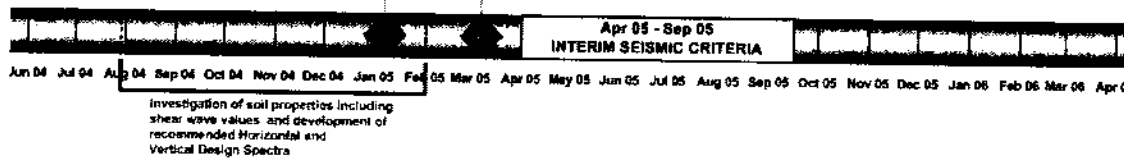


Figure 3-2 Large Pressure Vessel Schedule Impacts

(For detailed methodology and discussions, see appendix A, paragraph A2.7.)

### 3.3. Schedule, Release, and Installation Curves Review

The IR team reviewed the critical path schedule for reasonableness and to assess its accuracy and viability as it applies to development of the 2005 EAC. BNI provided the IR team with schedules for both Scenarios A and B. However, since there is no detailed level schedule file for Scenario B available at this time, the IR team has based their detail analysis on the Scenario A Primavera® (P3) schedule.

Per the contract, the BNI is to provide a schedule that shall “Be logic driven and show the duration of tasks, completion milestones, and critical path.” BNI provided the Scenario A schedule representing the activities and durations that are required to complete the remaining work if unlimited funding were available. Scenario A is a P3 unconstrained schedule, which is a Critical Path Method (CPM), logic driven network that encompasses the project work scope. It provides information on the project status and forecasts the completion date of project work elements. The critical and near critical paths have a defined logic path and are integrated through all elements of the project, but these critical paths may not necessarily be accurate, due to potential problems with the logic structure.



The Scenario B schedule is intended to represent the activities and durations that are required to complete the remaining work within fixed annual funding limits (fixed resource model). The Scenario B schedule provided to the IR team is a graphical representation of the schedule activities. It is not a logic driven P3 schedule and not yet available in P3. The work scope remains identical to Scenario A. It takes the budgeted cost profile of the Scenario A schedule, summarized by building/area/function, and stretches out or delays activity durations to limit budgeted costs to the assumed fixed profile. Scenario B also incorporates provisions for project suspension and delays in annual funding authorizations. The Scenario B model also addresses escalation impacts on delayed work, using DOE forwarding rates.

**Findings:** Scenario A and B schedules are not sufficiently developed to provide an adequate basis for analysis.

The seismic impact activities in the PT Facility appear to be plug values intended to provide a rough impact of the seismic criteria change on the building. Similar plug values were found in the HLW building, which caused the major slippage in its completion date. These plug values provide at best a rough preliminary estimate of the time impact. Numerous other new short duration activities were added in other areas, primarily to incorporate changes in material requisitions. The balance may be viewed as “place holders” to assure that the potential impacts are checked.

The activities added for the seismic delay and their current float values are as follows in table 3-2:

**Table 3-2 Float Values for Seismic Delay Activities**

Bldg/Area	Total	<100 Days TF	101-300 days TF	301+days
General	69	12	18	39
PT	74	1	6	67
HLW	34	1	10	23
LAB	1	0	0	1
ITS Swtchgr Bldg	7	0	3	4
Diesel Generator	2	1	1	0
Total	187	15	38	134

The decision to adopt the RGM (a start milestone); the release of Interim Seismic Criteria; development/review/release of Final Revised Seismic Criteria; and the multiple impacts on the structural work, pipe supports, seismic restraints, vessels, and other equipment all need to be added and incorporated into the P3 network. This will allow valid critical path analyses to be performed, and management may focus its attention on the key schedule drivers.

Once the details have been developed by BNI, reflected in the network logic and durations, the IR team anticipates that a series of new critical paths will be present through the PT and HLW (most of which will be in the PT) facilities. One group of key



paths will likely pass through the remaining civil-structural work (walls, slabs, structural steel, embed plates, etc.); a second group through the pipe supports/restraints; and a third group through equipment/vessel modifications. Modifications to existing or already installed structural elements may also be required.

**Recommendation:** DOE needs to provide BNI with additional time to refine the schedule with special emphasis on implementing the RGM.

**Findings:** The few activities related to the Operational Readiness Review (ORR) requirements are not included in the critical path for the project.

The Cold Commissioning logic flows directly into Hot Commissioning without any delay for the ORR report, recommendation for approval and subsequent DOE approval to proceed with Hot Commissioning.

The level 4 forecast schedule contains high-level (summary) activities for Commissioning and Training (C&T). BNI has a separate study schedule containing over 13,000 activities for C&T. The component testing portion (more than 6,000 activities) has been included in the baseline schedule P409 and COE6. The Commissioning part remains at a high level, which is acceptable at this stage of the project and is consistent with the "rolling wave" philosophy of schedule development used by BNI. BNI reports that its detailed Start-up/Commissioning plan is holding to the 26 months provided in the initial baseline. More Commissioning detail will be added to the schedule at a later date.

The ORR has been summarized in a few activities. Unlike other nuclear facilities, the WTP ORR is not currently included in the critical path for the project.

The current level of detail reflected in the working schedules is inadequate and needs to be defined. BNI has advised that it is in the process of developing a "white paper" describing the proposal to have the ORR run in parallel with Cold Commissioning so that no time is lost between completion of Cold Commissioning and start of Hot Commissioning.

**Recommendation:** The current level of detail reflected in the working schedules for ORR is inadequate and needs to be defined. The ORR on most DOE nuclear facilities involves several months of review, followed by a report with some specific findings and recommendations for refinement of operating procedures and training, all of which must be addressed to the satisfaction of the Approval Authority before Hot Commissioning can be approved. The IR team believes the ORR should be on the critical path.

**Findings:** It appears likely that the seismic impact allowance activities are a contributing factor to changes in float values and impacting the earlier path analyses.



The critical path for the project that is represented in the COE6 Scenario A currently starts with a 12-month seismic impact in the PT Facility. The basic sequence is essentially the same as the earlier versions of the schedule. The primary difference is the shift of the front-end path through seismic impact, instead of the pipe module design and pre-assembly.

The long paths in the Scenario A P3 file were traced by key building and for the project as a whole, and then compared to those traced by BNI using their CPM field. With the sole exception of the longest PT path, all of the BNI paths differed significantly with the IR team's path analyses. Additionally, the BNI paths did not continue into Start-up/Commissioning.

**Recommendation:** Reinstate the practice of tracing the key long paths and performing rigorous analysis to verify the validity of the traced paths after each update. Also, trace the key paths through Start-up and Commissioning so that logic changes impacting this work can be more readily identified. The QA of the path tracing can be added to the "Schedule Checklist" documents provided in the Schedule Management meeting held with the IR team.

**Findings:** The 2005 EAC schedule constraints have become drivers to the activities versus predecessor activities.

Of particular concern is the Early Finish Constraints in the PT Facility. Milestone activities have been added to the schedule to identify when engineering will release individual wall and slab drawings. The IR team analyzed several of these milestones and determined that:

The milestones are constrained by Early Finish constraints. *(Note: none of the milestones examined by the IR team had any predecessor activities).*

The constrained milestones are driving network logic paths leading to and including construction activities.

The intent, as stated by the lead Project Control engineer for PT, was for these particular milestones to indicate when an engineering drawing was required on site (ROS) to support construction. Clearly, the intent has not been maintained as these constrained milestone activities are driving construction aspects of the schedule.

BNI has limited the use of constraints to Early Start and Early Finish, which is commendable. In addition, BNI has used Zero Float constraints to schedule deliverable "Just in Time," avoiding unnecessary early budget outlays and reducing the risk of damaged or lost procurement items in the lay down yard.

The intent of the Early Start and Early Finish constraints, as stated by the lead project controls engineers interviewed, is to non-critical work efforts leveling the resource usage. The PT schedule contains numerous Early Finish constraints intended to identify ROS dates for engineering release of civil documents. However, during the



schedule development, these constraints have become the drivers to construction activities, which reduce the schedule effectiveness as a planning tool.

**Recommendation:** Review and validate relationships (predecessors) and constraints included in the schedule to accurately reflect the sequence of workflow.

**Observations:**

There are multi-month gaps between engineering release and construction installation in the PT and HLW buildings.

BNI uses a series of installation curves as a management tool to analyze the schedule and workflow. The installation curves identify the major commodities of materials for installation. There are several data points that can be inferred through analysis of the installation curves including:

- Schedule gap between the engineering release and the construction installation of commodities.
- The Installation sequence of all commodities

Although in general, the installation curves accurately reflect the design and installation sequence, the 24-month gap between engineering release and construction installation in the PT building does not suggest an unconstrained condition (BNI stated the target gap is 6 months.) It seems reasonable that construction could accelerate the schedule and reduce the gap in civil and steel work, thus shortening the overall schedule duration.

Similarly, the HLW building contains a 19-month gap between engineering and construction activities for erecting the building structure, and this does not support an unconstrained condition. Moreover, the combination release and installation curves for HLW do not support a smooth, integrated approach to installation.

The installation curves for the LAW building do represent the expected gap between engineering and construction, as well as an expected sequence for installation commodities as displayed on the combined plot.

A combination commodity curve was not provided for the PT building.

The installation curve analysis supports the IR team's observation that the schedule submitted to the DOE for review is not complete. Specifically, the Pretreatment building schedule is not sufficiently developed to allow accurate analysis.

Facility scheduling groups use different approaches to organize their schedules. For example, HLW and LAW have maintained the Elevation/Planning area concept, while PT organizes its schedule using more scheduler defined code fields.

The 2005 EAC scheduling notebook provided to the IR team includes a section on activity coding. Of the 20 available code fields, 5 are mandatory (*i.e.*, must be



populated). The remaining 15 fields are optional and can be used by the individual projects as deemed necessary. While the mandatory code fields provide certain characteristics useful to the project, they do not facilitate organizing the schedule for detailed analysis. The area code field does segment the project into: PT, HLW, LAW, LAB, and BOF; which is the lowest level of detailed organization available through the mandatory (controlled) codes. The previous schedule review (May 2004) identified non-mandatory fields for Elevation Level and Planning Area codes, which allowed the schedule to be organized to a geographical area. Activities could then be sorted by work type, Organizational Breakdown Structure (OBS), waterfall (by early start), or by float to analyze the project from different perspectives.

Of greatest concern is the organization of the PT building, which is the critical path to operations of the WTP. The IR team cannot identify a clearly organized approach in analyzing the PT schedule. While the scheduling team has developed detailed planning activities, it is difficult to organize the schedule in a manner that provides an integrated analysis of the facility. For example, the civil portion of the schedule has been developed to track specific walls and slabs for both engineering and construction work scope; however, the method of selecting a specific wall for schedule analysis is to extract the wall number from the Activity ID. Unfortunately, engineering activities and construction activities do not use the identical numbering conventions in the Activity ID. Engineering generally places the wall numbers in placements 7-10, while construction uses placements 6-9. In addition, the wall number embedded in the construction Activity ID quite often does not match the wall number contained in the activity description, nor does it match the wall number defined in the related engineering Activity ID.

(For detailed methodology and discussions, see appendix A, paragraph A2.8.)

### **3.4. Cost Review**

#### **3.4.1. Quantity Review**

This section presents a review of the Key Quantity Summaries in Attachment 2 of the 2005 EAC. The review includes the supporting data in BETK (Bechtel Estimating Tool Kit) Rev-4 (without equipment) and numerous Quantity Development Package (QDP) submittals provided by BNI.

The review was conducted assuming each QDP is the basis for quantities in BETK Rev-4, which is the basis for the 2005 EAC estimate. Quantities should be traceable from and to each document. Quantities associated with the "seismic impact" were identified and reviewed along with the most costly BETK line items that comprise 20 percent of the BETK total cost. The quality of the estimates supporting the 2005 EAC were evaluated against the Bechtel Corporate Estimate Classification Matrix, Revision-4, dated January 10, 2003, Class 2 estimate project definition and estimating methodology.

**Findings:** None.



**Recommendation:** None.

**Observations:** Quantities with a unit of measure titled lot, lump sum, or allowance costs within the line items that comprise 20 percent of the total cost appears to be inconsistent with BNI's corporate estimate classification matrix description of a Class 2 estimate.

One lump sum and two cost allowances are found within the top 20 percent cost items in BETK Rev-4. Lump sum and allowances of this magnitude appear contrary to BNI's Class 2 estimate definition. Included in the top 20 percent cost items:

“General Facility - Construction Distributables,” 1 “Lot” \$13,000,000.

“Additional Scaffolding Allowance,” 1 Lot, amounting to 120,000 hours.

“Safety related type conduit support allowance,” 1,396 each.

Lump sum amounts and allowances of this cost magnitude appear contrary to the statement on page 2 of the 2005 EAC, which states: “This forecast represents a Class 2 estimate incorporating detailed design, detailed take-offs, performance, etc.”

The IR team acknowledges the fact that the above apparent lump sum items represent a small percent of the total BETK cost and each of the allowance. The accuracy of the amounts is not questioned, but the methodology appears inconsistent with BNI's own guidance for preparation of a Class 2 estimate.

Data anomalies and discrepancies discovered during the review were provided to BNI for clarification.

During the review, BNI provided additional information to clarify or explain these. It appears that the BNI's process of data gathering for the 2005 EAC is well intended; however, the sheer volume of quantity data information appears to have overwhelmed the task of preparing an error/omission free presentation of the EAC.

(For detailed methodology and discussions, see appendix A, paragraph A2.9.)

### **3.4.2. Engineering**

The IR team reviewed the methodology and procedures used by BNI in developing the Engineering section of the 2005 EAC. For the first time since the contract was initiated, the 2005 EAC represents a bottom-up estimate of the future engineering costs. Previous EACs have based engineering estimates on the direct development of a staffing plan, which incorporates and reconciles trends, rather than a bottom-up estimate. Based on the IR team's review, the approach used by BNI to forecast future engineering costs at the WTP appears to be satisfactory.

The purpose of this portion of the review was to assess the completeness and reasonableness of the 2005 EAC prepared by BNI and to provide comments regarding





engineering labor and associated other direct costs (ODCs). The approach used by BNI to develop the 2005 EAC for engineering was to examine actual costs through December 2004 and develop their estimate to complete (ETC). The sum of the actual costs and the ETC provides the 2005 EAC for engineering. In order to examine the proposed engineering changes from the last baseline prepared by BNI, the 2005 EAC was compared to the December 2004 Trended PMB.

**Findings:** Throughout the review of the backup for BNI engineering hours, there appeared to be disconnects relating to traceable support documentation and linkage to the EAC.

This issue could relate to the lack of time to prepare the 2005 EAC document, or it may be a function of the enormity of the project. In any event, BNI should present a defensible EAC to DOE-ORP for the cost development of engineering or for any other functional area.

**Recommendation:** Provide estimate documentation that is complete and traceable such that the BNI backup data accurately rolls-up to the summaries.

**Observations:**

The IR team has observed that the methods used to develop the estimated 2005 EAC for engineering cost are consistent with standard estimating procedures.

Review of engineering hours at all levels was difficult to trace and produced some inconsistencies.

For example, without the additional backup for labor development on seismic design changes provided by the BNI Engineering staff, meaningful review of estimated To Go hours (provided in the final EAC) would have been difficult.

Engineering costs have increased nearly 41 percent.

The Engineering cost has increased from the December 2004 Trended PMB of \$796 million to the 2005 EAC cost of \$1,121 million. This is an overall cost increase of 40.8 percent, with labor hours alone increasing 34 percent. At this time, the IR team cannot determine if this overall engineering cost increase is reasonable; however, it does appear that the amount of hours added to the 2005 EAC to cover the overall increase in engineering work activities is conservative. (*Note: dollar amounts and percentages are based on Scenario A.*)

Only 25 percent of the engineering hour increase is tied to the proposed RGM scope change.

The total amount of engineering hours for the seismic RGM design change is estimated at 900,000 hours in the EAC. This represents only 25 percent of the overall increase in engineering hours between the 2004 PMB and the 2005 EAC. The remaining increase



in hours is significant, since these hours do not appear to be related to any valid contract scope changes. The ability to forecast To Go hours to complete the Engineering work on the WTP has been and continues to be an on-going problem that casts doubt on this EAC.

(For detailed methodology and discussions, see appendix A, paragraph A2.10.)

### 3.4.3. Plant Equipment

The cost for Plant Equipment does not include the construction cost for installation. Plant Equipment cost does include buying the equipment, including vender design and estimated costs for incorporating seismic impact costs; plus piping hose connectors and back flow preventers are included rather than pricing them as piping commodities.

**Findings:** None.

**Recommendations:** None.

#### Observations:

The IR team has verified that the method used to develop the estimated 2005 EAC plant equipment cost is consistent with standard estimating procedures, but the IR team has not verified the reasonableness of the costs. The 2005 EAC Plant Equipment cost was based on the reasonable utilization of actual construction cost and forecast estimating for future work.

The Plant Equipment cost has increased from the December 2004 Trended PMB cost of \$750 million to the 2005 EAC cost of \$985 million. This is an increase of 31 percent. Purchase orders have been issued for 67 percent of the project Plant Equipment, which helps improve the accuracy of the estimate; however, because the remaining 33 percent of equipment cost is estimated, there is potential for additional increase in Plant Equipment cost.

(For detailed methodology and discussions, see appendix A, paragraph A2.11.)

### 3.4.4. Bulk Materials

The cost for bulk materials does not include the construction cost for installation. Most quantities are computer generated from design models and most material prices are based on purchase orders adjusted to today's price level.

The review was conducted to identify anomalies, discrepancies, and the traceability from detail documents to BETK and ultimately to the 2005 EAC. A unit cost was computed using the quantity and cost data provided in the 2005 EAC supporting data. Cost guides and cost engineering judgment was used to evaluate the reasonableness of the computed unit price.



**Finding:** To date only 28 percent of the bulk materials has been installed. Future pricing has been determined using DOE escalation rates. Because a large portion of the bulk materials are dependent on steel pricing, there is a high probability that escalation will be much higher than reflected by the DOE rates.

**Recommendation:** The IR team believes that it is appropriate to use project escalation rates that reflect current market trends rather than using DOE 2004 rates in calculating escalation at the WTP.

**Observations:**

The IR team has verified that the method used to develop the estimated 2005 EAC bulk material cost is consistent with standard estimating procedures but the IR team has not verified the reasonableness of the costs. The EAC bulk material cost was based on the reasonable utilization of actual construction cost and forecast estimating for future work.

It was discovered that a number of bulk material quantity amounts did not match from document to document. This was brought to BNI's attention and they subsequently found errors in the roll-up formulas and re-submitted the information.

The supporting Excel detail sheet shows a greater dollar amount than what was carried forward to the 2005 EAC. The increase dollar amount from the supporting detail sheet to summary sheets is not presented or explained suggesting an under estimated Bulk Material Cost.

The bulk material cost has increased from the December 2004 Trended PMB cost of \$242 million to the 2005 EAC cost of \$328 million. This is an increase of 35 percent.

(For detailed methodology and discussions, see appendix A, paragraph A2.12.)

**3.4.5. Acquisition/Procurement Services**

The IR team reviewed the methodology and procedures used by BNI in developing the Acquisition Services section of the 2005 EAC. Based on the IR team's review, the approach used by BNI to forecast future acquisition services costs at the WTP was satisfactory, but it does lead the reviewer to question the results. The purpose of this section is to assess the completeness and reasonableness of the 2005 EAC prepared by BNI, and to provide comments regarding acquisition services labor and associated ODCs. BNI developed their acquisition services portion of the forecasted 2005 EAC using costs to date through December 2004 and a projection of costs to go in support of the revised WTP schedule. To Go PMB staffing and ODC plans were updated to reflect the unconstrained funding project schedule, and from the job hours, direct dollars were calculated.

**Findings:** None.

**Recommendations:** None.



**Observations:** The IR team was unable to determine how BNI applied the time-related delays in the development of the acquisition services portion of the EAC.

The draft 2005 EAC used 34 months for labor and ODC schedule delay. The Final 2005 EAC stated the ODC time extension was based on 15 months, while labor impacts were apparently based on 34 months of delay. In both the draft and Final 2005 EAC estimates, the cost increase (\$99.4 million) remained the same. Furthermore, based on the final Scenario A schedule, the actual time extension is 32 months.

The IR team has verified that the methods used to develop the estimated 2005 EAC for acquisition services cost is consistent with standard estimating procedures.

The acquisition services cost increased 64 percent, with labor hours alone increasing 69 percent.

The total acquisition services cost has increased from the December 2004 Trended PMB amount of \$155.2 million to the 2005 EAC total of \$254.6 million. At this time, the IR team cannot determine if this overall acquisition services cost increase is reasonable. Based on our analysis, a more detailed examination of the acquisition services portion of the estimate appears to be warranted.

On-time delivery of Plant Equipment and Bulk Materials has been an ongoing problem. Currently only about half of these items are shown to be delivered on time. The recent direction to provide 6 months of schedule contingency would perhaps help alleviate some of this delay.

Prices for many materials have and continue to escalate. Commodity price escalation is a major issue and one that BNI needs to follow closely.

(For detailed methodology and discussions, see appendix A, paragraph A13.)

#### **3.4.6. Construction**

The Scenario A 2005 EAC construction cost was developed from a bottom-up review of all major quantities, unit installation rates, bulk material costs, plant equipment costs, and subcontract costs. In addition to these, the construction distributable costs for non-manual labor and ODC were reviewed and estimated from the bottom-up. The costs for the installed-to-date (ITD) items were developed from records of actual material and installation costs through December 19, 2004, while the costs for the 2005 EAC were developed by using ITD costs, experience factors for piping and an escalation allowance. The engineering staff calculated the 2005 EAC quantities.

**Findings:** None.

#### **Observations:**

The IR team has verified that the method used to develop the estimated 2005 EAC construction cost is consistent with standard estimating procedures, but the IR team has not verified the reasonableness of the costs. The EAC construction cost was



based on the reasonable utilization of actual construction cost and forecast estimating for future work.

The construction cost has increased 60 percent (\$889 million) since the December 2004 Trended PMB, for a net change of \$1.483 to \$2.372 billion. The BNI Construction Manager has stated that the increase is caused by the PJM and RGM, and an increase in commodity quantities. However, the increases in crew installation unit rates, based on ITD and re-evaluation of projected rates, have also significantly increased the construction cost.

(For detailed methodology and discussions, see appendix A, paragraph A2.14.)

### 3.4.7. Safety, Technology, and Operations Cost Review

The IR team reviewed the methodologies and processes used to develop the 2005 EAC for the Safety, Technology, and Operations organizations and found the overall EAC for this area to be appropriately developed and documented. Some of the EAC elements appear to reflect reasonable cost estimates and bases; however, the IR team did find numerous instances of inconsistent estimation and other issues warranting further investigation and consideration. The cost estimate for Start-up and Commissioning is much improved from that which is included in the current baseline for the WTP project. Most of the costs are now activity-based and will lend themselves to effective performance measurement techniques. The overall effort for Start-up and Commissioning has increased only slightly (by approximately 6 percent more job hours), despite the more rigorous and better documented estimating process used. The backend of the project schedule does not appear to properly and completely capture the logic and durations needed to complete a complex nuclear project within DOE, especially regarding the ORR needed prior to the authorization to start Hot Commissioning.

**Findings:** The average labor rate for Research and Technology (R&T) appears to be conservatively estimated in the EAC.

The R&T average labor rate to date is shown as approximately \$80/hour in the 2005 EAC document. However, the ETC average hourly rate is over \$88, and the resulting EAC hourly rate is over \$83, compared to the PMB rate of just over \$79/hour. The R&T hours increased 9 percent, but labor cost increased 14 percent, despite a statement in the 2005 EAC documentation that wage rates were "derived from average historical rate charging." It appears that these labor costs may be somewhat overstated and should be more carefully reviewed and potentially revised if they cannot be fully substantiated.

**Recommendation:** Evaluate the ETC average labor rate for Research & Technology and ensure that any changes from historical experience can be fully explained and justified.

**Findings:** The largest element of Commissioning, the ODCs and spare parts, have not been re-estimated.



Commissioning only re-evaluated the “top 20 in dollar value” ODCs, which accounts for approximately 50 percent of the total ODCs and excluded the largest ODC, spare parts, which at \$80 million represents 37 percent of the ODCs. The 2005 EAC effort should have included a re-evaluation of needed spare parts to support the Commissioning phase of the project and a complete definition of project scope relative to spare parts to be provided by the EPCC Contractor.

**Recommendation:** Complete an evaluation of spare parts to be provided by the EPCC contractor, both in support of the Commissioning phase of the WTP as well as for eventual turnover to an Operating Contractor. Ensure appropriate cost estimates are included in the project EAC, Performance Baseline and budget projections.

**Findings:** The potential cost and schedule impacts of an ORR have not yet been fully recognized and reflected in the EAC.

Neither the BNI nor the DOE (ORP and HQ) ORRs currently appear on the project critical path. The project schedule states that the needed ORRs can be accomplished in parallel with Commissioning activities. This does not appear reasonable, since the successful completion of the ORR is a prerequisite to the start of the Hot Commissioning effort. It appears the schedule logic may be flawed since the only prerequisite to the BNI ORR appears to be the completion of the ORR program/procedure several years prior to the ORR start. In reality, completion of all start-up testing and Cold Commissioning efforts will be necessary before the ORR can be accomplished. Similarly, the durations for the ORRs, especially the DOE-HQ ORR, appear optimistic. DOE-HQ ORR is estimated to take only 9 weeks, while experience would indicate durations of at least 6 months might be more appropriate for a complex nuclear facility such as the WTP. Because the overall project schedule may be understated due to the lack of full recognition of ORR requirements and durations, it is likely the 2005 EAC for both Commissioning and the overall WTP Project may be understated. This is because the extended project time has a cost associated with it, plus any additional ORR support and response costs the project will encounter.

**Recommendation:** Re-evaluate the schedule durations and logic associated with the execution and successful completion of all ORRs and other readiness reviews and assessments the project will encounter. The costs to fully support reviews, response and closeout of any issues or problems found should be incorporated into the project EAC and Performance Baseline.

#### **Observations:**

Environmental and nuclear services (E&NS) cost increase of 15 percent recognizes more than the impact of an extended schedule.

The 2005 EAC for E&NS appears to be reasonably estimated; however, the labor rates do not track to actual experience to date. The estimated labor hours for E&NS increased approximately 10 percent, but the costs have increased 15 percent. This is a



result of an increase in ODC costs of 26 percent, while the EAC average labor rate has only increased slightly from the PMB average labor rate. Approximately 76 percent of the total increase (EAC versus PMB) has been attributed to the extended project schedule. The remainder is due to increased labor and ODC estimates to accomplish the remaining work scope.

Research and Technology costs continue to increase despite the maturity of this effort.

The estimated cost for R&T increased 5 percent, despite the fact that most of this work has been completed, and there is minimal impact to R&T from the extended project schedule. Specifically, overall R&T is approximately 80 percent complete, while R&T Waste Qualification and Vitrification testing is approximately 60 percent complete for HLW and 40 percent complete for LAW. The R&T increase is mostly attributed to scope growth in subcontracts for PJM. Additional R&T increases are related to the amount of residues, disposal unit rates, priority conflicts in clean-up and longer active period, and study durations for waste characterization subcontracts represent 50 percent of the total increase. The other portion of the increase is due to the extension of staff performing qualification report activities during Cold and Hot Commissioning due to the new project schedule, as well as increased wage rates and extended positions to manage additional subcontractor scope.

The Commissioning estimate does not reflect the latest 2005 EAC schedule.

The Commissioning estimate was developed using an earlier schedule with a Hot Commissioning end date of January 31, 2011, then factored to a Hot Commissioning end date of January 31, 2013. However, this estimate was never subsequently changed to the current planned date of March 13, 2013. It is not expected that this inconsistency will significantly impact the accuracy and validity of the EAC.

Commissioning estimate assumptions do not appear tied to risk and contingency analyses.

Risks were identified in the Commissioning assumptions that should subsequently be addressed by either the EPCC Contingency or TPRA analyses; however, no evidence was found that these assumptions were fully considered during the contingency and TPRA analyses. The specific risks or assumptions identified are:

- Acceptance Criteria do not require performing unanticipated tests, or significantly increasing test durations during system testing, Integrated Water Runs, Cold Commissioning and Hot Commissioning.
- 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.
- A Toxic Substances Control Act (TSCA) permit will not be required to treat Hanford tank waste.



- 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.
- The Start-up effort does not include hours for Engineering re-design or efforts to resolve design issues discovered during component or system testing.
- The Cold and Hot Commissioning schedules assume no process system re-design due to chemistry or rheology issues.
- MACT training requirements associated with incinerators will not be imposed on the project.
- The environmental permits will impose no ramp-up/production rate limitations.
- Removal and disposal of stimulant waste heels will not be required prior to Hot Commissioning.
- Feed from the Hanford Tank Farms will be of sufficient quality and quantity to support the schedule for Commissioning.
- No special testing of canisterized waste forms will be required.
- 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.
- 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.
- The Commissioning effort does not include hours for Engineering re-design or efforts to resolve design issues discovered during Commissioning.

The overall Commissioning duration does not appear to have been re-evaluated.

The total duration of Commissioning is unchanged from the current target schedule of 26 months from start of Integrated Water Runs to completion of Hot Commissioning. There is, however, an additional 6 months added for schedule contingency.

A revised Commissioning estimating approach resulted in negligible change to EAC.





Commissioning labor costs increased almost 13 percent, hours only increased 7 percent, and ODCs remained virtually unchanged. Consequently, total Commissioning cost increased only 7 percent, despite the use/application of a totally revised estimating approach. The Commissioning estimate has now been developed using unit rates and is much improved over previous estimates. Approximately 80 percent of the To Go cost is now activity based with the remainder based on staffing plan estimates. Unit rate development and assumptions have now been appropriately documented and should provide a sound framework for performance monitoring and control as the Commissioning effort proceeds.

Commissioning phase costs have increased for many functional areas.

Many other functional areas also increased estimated hours needed to support the Commissioning effort. This is seen as an indicator that the entire WTP project team has attempted to better understand and plan for the Commissioning phase of the project. Engineering added approximately \$38 million for additional support to both Construction and Start-up and Commissioning, but the split for Start-up and Commissioning support was not provided. Approximately \$21 million was identified in table 3-3 as follows:

**Table 3-3 Select Functional Area Cost Increases During the Commissioning Phase**

<b>Project Controls</b>	<b>\$ 1.9M</b>
Human Resources	\$ 2.0M
Support Services	\$ 0.4M
Information Systems	\$11.7M
QA	\$ 5.2M

The estimated level of effort for Preventive and Corrective Maintenance appears reasonable.

The estimated hours for Preventive and Corrective Maintenance compare favorably to expected benchmark ratios. Specifically, approximately 4 hours of Preventive Maintenance has been assumed for every hour of Corrective Maintenance.

The level of Management and Integration for Start-up and Commissioning appears reasonable.

The costs for all Management and Integration activities within the Start-up and Commissioning functional element represent approximately 13 percent of all other Start-up and Commissioning hours. This ratio appears to be reasonable for such work.

(For detailed methodology and discussions, see appendix A, paragraph A15.)

**3.4.8. Management and Support Services Cost Review**

The IR team reviewed the methodologies and processes used to develop the 2005 EAC for the Management and Support Services organizations and found the overall EAC for



this area to be appropriately documented but conservatively estimated. Almost all of the organizations are showing a significant increase in the EAC over the December 2004 PMB. While these functions are generally level-of-effort based and largely schedule dependent, not all of the increases appear to be reasonably attributed to the extended project schedule.

**Findings:** Management and Support Services labor rates appear inconsistent and questionable.

The labor rates used for many of the Management and Support Services organizations appear to have been inconsistently increased or changed to reflect the extended project schedule and may be conservative. Some increase over the PMB average rate is to be expected due to the longer schedule. However, the rate of increase appears excessive for many organizations and the average To Go rates appear high when compared to the actual experience to date, even considering the effect of escalation. Table 3-4, which shows the average labor rates derived by dividing the total estimated labor costs by the total estimated man hours in the EAC.

**Table 3-4 Management and Support Services Labor Rate Comparison (\$/hour)**

Organization	PMB	EAC	%Change	To-Date	ETC	%Change
Controller	██████	██████	██████	██████	██████	██████
Project Controls	██████	██████	██████	██████	██████	██████
Communications	██████	██████	██████	██████	██████	██████
Management	██████	██████	██████	██████	██████	██████
HR	██████	██████	██████	██████	██████	██████
Administration	██████	██████	██████	██████	██████	██████
Support Svcs.	██████	██████	██████	██████	██████	██████
IS&T	██████	██████	██████	██████	██████	██████
QA	██████	██████	██████	██████	██████	██████
Contracts	██████	██████	██████	██████	██████	██████

**Recommendation:** Re-evaluate the estimated labor rates for the Management and Support Services 2005 EAC to ensure the labor rates used or assumed are reflective of the staffing mix that will be needed for each specific area and is in line with recent project experience.

The estimated level of required Project Controls staffing may be overstated.



Project Controls increased approximately 64 percent, and approximately 60 percent of that was attributed to schedule extension impact. However, the remainder of the increase is due to added hours for commissioning support (5 percent), PJM and Seismic support (15 percent), EVMS Phase II implementation and certification (7 percent), and labor rate (12 percent). Since Project Controls is largely a level-of-effort function, it does not seem appropriate to incrementally increase the Project Controls estimated hours and staffing for incremental increases in project costs and scope, as was done for the 2005 EAC (and appears to be routinely done for Trends on the WTP Project). This process would appear to overstate the level-of-effort that will actually be required to implement and accomplish the project controls for the WTP.

**Recommendation:** Complete a bottom-up re-evaluation or re-estimation of Project Controls staffing needed for the remainder of the WTP Project and adjust the EAC estimate and Performance Measurement Baseline as necessary to reflect the results of this analysis.

### Observations:

The level of Management and Support Services are growing but may be reasonable.

The Management and Support Services costs presented in the above tables represents approximately 12.6 percent of the other PMB costs and 13.1 percent of the other 2005 EAC costs. These percentages do not appear unreasonable for a large, complex DOE project; however, the fact that this ratio is increasing is a troublesome sign, even given the ostensible explanation of the cause being the extended project schedule. In effect, the project's hotel load is increasing at a faster rate than the scope-driven project activities. This is largely a function of the extending the project schedule. However, the cost of Management and Support Services represents only 11.7 percent of the ETC for the project. Thus, the management level is higher during the initial phases of a project and is expected to decline as the project proceeds. This trend is consistent with DOE project experience.

Management and Support staffing needs were not re-evaluated.

BNI did not do a bottom-up re-evaluation of staffing needs but rather an extension of budgeted positions in support of the revised schedule dates. Any new positions that were added were generally supported by a specific trend and were not characterized as a time related cost impact.

There appear to be opportunities for cost reduction through re-evaluation of staffing needs.

The 2005 EAC for Management and Support Services is well documented for the most part. However, the EAC represents both a significant increase over the December 2004 Trended PMB and much more than the impact of the extended project schedule. There appears to have been no attempt to re-evaluate and economize in these areas to minimize or reduce staffing and project costs. Rather, although it is expected that ETC labor rates will be higher than the to date rates due to escalation impacts, the rates



used are consistently much higher than can be explained by escalation impacts. A thorough scrubbing of the 2005 EAC for Management and Support Services, accompanied by a re-evaluation of needed management and support staffing requirements, may provide a mechanism to effect project cost reductions. Even a reduction of the Management and Support Services to the same 12.6 percent of other activities as represented in the PMB estimate would result in a reduction of over \$30 million for the WTP project.

(For detailed methodology and discussions, appendix A, paragraph A2.16.)

### 3.4.9. Overall Indirect Review

#### 3.4.9.1. Project and Corporate Indirect Markups Cost Review

The DOE contract requires the BNI to design and construct the project, and provide project Start-up and Commissioning. The project has been separated into several types of direct cost, and each of these has different layers of project and corporate office indirect costs.

**Findings:** There is a high potential for the actual inflation to exceed the DOE recommended escalation rates.

Escalation has been included in the EAC, based on the DOE rate of about 2.5 percent. The Engineering News Record magazine historical building construction cost inflation rates has been averaging about 5 percent per year, and the average increase in labor rates has been about 4 percent per year. The Corps of engineers Civil Works Construction Cost Indices System (CWCCIS) for powerhouse construction actual inflation rates are 1969-1974 average 7.3 percent; 1975-1984 average 7.7 percent, 1985-1994 average 2.5 percent. All of these indicate a high potential for higher escalation rates over the life of the project.

**Recommendation:** The 2005 EAC cost should be stated in three time related costs - Cost in today's dollars, cost using DOE escalation and cost based on BNI analysis of future escalation rates. Also, the cost performance fee, lower and upper limits, and the performance fee amount should be established in today's dollars. The limits and fee should then be adjusted annually using the Corps of Engineers Civil Works Construction Cost Indices for powerhouse construction.

**Observations:** The BNI has defined all labor as non-manual labor, except for the craft labor performing construction. Similar to the craft labor, there are those in engineering who produce a product and those who supervise. Those producing the product should be classified as direct labor and the supervision as non-manual with indirect costs applied appropriately. An Opportunity for reduction of home office overhead could be realized.





(For detailed methodology and discussions, see appendix A, paragraph A2.17.)

#### 3.4.9.2. Field Office Non-Manual Labor Indirect Cost Review

The field office non-manual labor is used to manage the project construction activities and is therefore classified as an indirect cost. It is also known as job office overhead. The cost for field office non-manual labor has been developed by determining a detailed staffing plan for each quarter of construction.

**Findings:** Based on a comparison between the number of craft labor to the number of non-manual labor in 2006 there will be 1 field engineer for each 6 craft workers.

This appears to be an excessive amount of field engineers.

**Recommendation:** It is recommended that BNI review the field engineering staff to ensure they are not over staffed and that there is no duplication between field engineering and project engineering. Consideration should be given to moving some of the field engineering staff back to the engineering design group where the designer can help with development of the installation work packages. This should help increase the efficiency, as the CADD drawings should help in the package development.

**Findings:** Based on a comparison of craft to non-manual, in 2006 there will be 84 superintendents for the 1,887 craft workers.

This seems to be an excessive amount of superintendents.

**Recommendation:** Standard supervisory control guidance recommends a supervisor can effectively and efficiently supervise 10 people. Current USACE goal is one supervisor to 15 workers. Craft installation teams generally have a working or non-working foreman with 5 to 10 craft workers. The supervisor controls the work through the craft foreman; therefore, a superintendent should control 7 to 10 craft crews or 49 to 70 craftsmen. Use an average of 50 craft labors per superintendent then the project would require 40-50 superintendents versus the 84 shown in appendix A, table A-10.

**Findings:** Based on the 2005 EAC detailed non-manual staffing plan and the acquisition services full time equivalent (FTE) comparison, in the 2<sup>nd</sup> Quarter 2006 there will be about 200 acquisition services FTEs and 55 material specialists at the project work site.

This seems to be a duplication of acquisition services.



**Recommendation:** It appears that the work site material specialists are doing much of the same type work performed by the acquisition staff. The staffing plans for acquisition and work site material specialists should be reviewed and duplication of effort eliminated.

**Observations:**

The IR team has verified that the method used to develop the estimated 2005 EAC non-manual labor work hours and cost is consistent with standard estimating procedures, but the IR team has not verified the reasonableness of the costs. The EAC non-manual cost was based on the reasonable utilization of actual construction cost and forecast estimating for future work.

The non-manual labor cost has increased from the December 2004 Trended PMB cost of \$338 million to the 2005 EAC cost of \$547 million. This is an increase of 62 percent. The total non-manual labor hours have increased from the 2004 Trended PMB of 5,262 million hours to 7,887 million hours. This is an increase of 50 percent.

The percent of 2005 EAC field non-manual hours to direct craft hours is 46.4 percent versus the current PMB of 46.2 percent. This is in line with previous BNI experience for nuclear construction of 45-50 percent.

(For detailed methodology and discussions, see appendix A, paragraph A2.18.)

**3.5. Risk and Contingency**

**3.5.1. Review of Contingency**

The IR team reviewed the methodologies and processes used by BNI to develop the EPCC Contingency for the 2005 EAC. In general, the IR team found the processes to be sound and appropriately applied. The resultant contingency, at approximately 15 percent of the estimated cost to complete (ETC), and the DOE-ORP directed 6 months schedule contingency appears reasonable for the project at this time.

**Findings:** There was no analysis of schedule risk and uncertainty, and schedule contingency may be inadequate.

BNI has included 6 months of schedule contingency, represented as a duration immediately preceding project completion and as a cost of approximately \$50 million based on end-of-project hotel load levels. This schedule contingency was directed by DOE-ORP in the letter directing the development of the 2005 EAC. Although there are many schedule risks and uncertainties to be confronted over the remaining 10 years of the project, no schedule risk analysis was completed by BNI. Thus, there has been no attempt to evaluate and quantify schedule risks and to develop appropriately necessary schedule contingency allowances, both for duration and associated costs. The IR team believes the schedule contingency will likely be fully consumed long before the Commissioning phase of the project begins, and it is the Commissioning phase that



represents the highest level of risk and uncertainty for the project. Furthermore, by using the end-of-project hotel load level, it is likely the included schedule contingency cost allowance will be consumed quickly if schedule risks are in fact realized earlier in the project.

**Recommendation:** Complete a schedule risk analysis that fully evaluates all potential schedule uncertainties from a realistic, experience-based perspective. Include appropriate schedule contingency allowances in project forecasted costs and milestone dates.

**Observations:**

The BNI contingency analysis process is sound.

The use of the Bechtel Risk Analysis Contingency tool has been standardized, training has been provided, and the responsibilities for application of the tool have been assigned to each facility team to establish better contingency estimates and more contingency ownership as the project moves forward. The terms and variables used for this EAC effort appear much more realistic and have a sounder basis than prior contingency analyses for the project.

The estimated contingency allowance appears reasonable.

At 15 percent of the ETC, the estimated EPCC contingency appears reasonable for this project. This level of contingency would appear warranted given the current level of project definition and development. The IR team notes, however, that this contingency is not adequate to fulfill the entire suite of remaining programmatic risks. Rather, this contingency is only meant to capture the uncertainty associated with the estimates to accomplish the known, defined EPCC contract work scope.

(For detailed methodology and discussions, see appendix A, paragraph A2.19.)

**3.5.2. Review of Technical and Programmatic Risk Assessment (TPRA)**

The IR team reviewed the methodologies and processes used to develop the most recent TPRA updated by BNI for the 2005 EAC. Overall, the processes and methodologies used for the TPRA are sound and well applied by the BNI team. However, the current TPRA is limited in that it only evaluates some of the risks and uncertainties that continue to confront the project.

**Findings:** The current TPRA is limited and does not address all potential programmatic risks.

The BNI TPRA update that supports the 2005 EAC is based on a re-evaluation of the residual risk impacts for the currently identified project technical, programmatic and commissioning risks. The processes used are sound; however the BNI approach limits the risk identification and incorporation to those risks that appear to be directly associated with their contract work scope and are able to be controlled and managed at



the project level. The analysis ignores many larger risks and uncertainties that may be outside of the control of the project. These risks have potentially significant cost and schedule impacts that the project must recognize and plan to accommodate as execution proceeds. Many programmatic risks that have been identified are not included in the TPRA analysis at this time. This is because either the risk is perceived as outside of BNI control, or because BNI has chosen instead to include a specific resolution or decision by DOE regarding the issue as the basis for the proposed EAC. Some of the more significant of these assumptions have been included in a separate section of the 2005 EAC document entitled "Critical Decisions." Other risks and uncertainties appear to have not been recognized at this time. The IR team was not provided with any DOE/ORP level risk assessment that would appear to be necessary for a project as large and complex as the WTP. Although BNI is the prime contractor for the project, it should not be expected to identify, evaluate and manage the full spectrum of potential risks and uncertainties that may confront the project as it moves forward.

**Recommendation:** Implement a DOE managed programmatic risk management and assessment process that results in the inclusion of all programmatic risks in the project cost and schedule estimate.

### **Observations:**

BNI's risk management processes and procedures are sound.

The risk management processes in place at BNI are mature and integral to the management of the project and the BNI contract. Overall, the risk management process is sound and the BNI management team appears fully engaged relative to risk awareness and mitigation. Although the process does not appear to capture all potential programmatic risks, as noted above, the process is sound and could be appropriately adapted for the DOE programmatic risk management and assessment effort.

The TPRA analysis is based on the evaluated residual risk cost and schedule impacts.

The quantification of residual risk impacts assumes that the proposed or planned risk handling strategies are successful. As a result, the full potential consequences of a particular risk event are not usually modeled, even for new, emerging risks where the risk handling strategy has not been deployed or initiated as yet. This process may result in an understatement of potential risk impacts in certain situations.

The TPRA contingency allowance is not used as a management tool.

To date, no TRPA risk events have been realized to the extent that TPRA contingency funds have been allocated or transferred to the contractor. It would appear that the TPRA contingency process is not being used as a real management tool to effect or implement contract changes resulting from realized risk events.

(For detailed methodology and discussions, see appendix A, paragraph A2.20.)





### 3.5.3. Independent Assessment of DOE Programmatic Risks

The IR team attempted to evaluate the potential for additional programmatic risk contingency requirements for the WTP, beyond those addressed by the EPCC, Schedule Contingency included in the 2005 EAC and the BNI recommended TPRA Contingency. This analysis is based on an independent assessment of those risks and uncertainties identified by the IR team, which do not appear to have been fully recognized by the project team and do not appear to have been reflected in the EAC, the EPCC schedule, or TPRA contingency allowances proposed by BNI. The IR team is not suggesting that the results of this independent analysis should necessarily be included in the proposed Total Project Cost (TPC) for the WTP Project, but DOE-ORP, DOE-HQ and Congress should be aware that potentially significant cost and schedule risks remain beyond those already captured by the BNI 2005 EAC. This potential liability is on the order of \$1.3 billion at the 80 percent confidence level. It represents an amount that is in addition to the forecasted TPC being proposed by the project team at this time. The TPC includes approximately \$780 million in EPCC, schedule and TPRA contingency allowances. Many of these programmatic risks have schedule implications even though they have been captured only in terms of associated cost impacts. If these risks are realized, the scheduled completion date for the project will also slip, although a true schedule risk analysis was not done and a schedule probability profile is not being provided.

This programmatic risk analysis is predicated on continued project funding at approximately \$690 million per year in accordance with Scenario B provided in the 2005 EAC documentation. Any cuts in annual funding over the remaining project life will likely result in an even longer project schedule and higher project costs. Conversely, if additional project funding can be secured, it could be possible to accelerate the project schedule and reduce final project costs. There are also numerous areas where the IR team concluded that costs may be conservatively overestimated or that may offer significant cost reduction opportunities. If these areas are aggressively investigated and meaningful improvements can be achieved, the significant additional cost and schedule exposure identified by the IR team's independent programmatic risk contingency analysis might be appreciably offset.

**Findings:** There are significant risks and uncertainties that have potential to increase project costs and lengthen project schedule well beyond the current 2005 EAC forecast by BNI.

As described and documented in appendix C, the IR team identified numerous areas of programmatic risk and uncertainty that do not appear to have been adequately captured or addressed by the most recent contingency and TPRA analyses that support the 2005 EAC effort by BNI. Based upon the review, it appears that BNI has done an adequate job of evaluating known uncertainties and risks within the current project plan and contract scope, and has appropriately documented key assumptions and exclusions to qualify the proposed EAC. However, it is now important for DOE to recognize the potential for additional risks and uncertainties that may impact the project as it moves



forward, as well as to learn from the experiences to date that future performance and progress may not meet planning expectations. These uncertainties comprise a set of risks that need to be addressed by additional programmatic level contingency allowances. These allowances should be controlled by DOE and planned for, incorporated into funding profiles and requests, and used as necessary to react to future project problems, changes, and arising issues. The inclusion of an appropriate project programmatic risk contingency allowance in the TPC estimate that will be communicated to Congress and used to establish renegotiated TPA milestones will enable the project to avoid future cost and schedule increase surprises and improve future project credibility with its many constituent stakeholders.

The IR team suggests the project consider the addition of approximately \$1.3 billion to the BNI proposed EAC, based on the results of the independent programmatic risk contingency analysis presented in appendix C. However, whatever additional programmatic risks and contingency are eventually included, DOE should ensure the contingency allowance is appropriately considered, evaluated, documented and managed as the project moves forward. This process should also carefully evaluate and consider those assumptions and critical decisions identified in the 2005 EAC documentation that could not be quantitatively analyzed by the IR team (see appendix C and the observation below).

**Recommendation:** Include an appropriate level of programmatic risk contingency beyond that proposed by the BNI EAC analyses in the TPC that will be communicated to DOE-HQ and Congress. Ensure any renegotiated TPA milestones reflect schedules that incorporate appropriate programmatic risk contingency allowances. Incorporate appropriate programmatic risk allowances in future budget requests and projections, and implement effective contingency management processes for the project.

**Findings:** A significant remaining uncertainty that has not been reflected in the 2005 EAC is future cost escalation impacts.

The BNI 2005 EAC has been developed using the escalation rate forecasts published by DOE in January 2004. These rates are not reflective of the excessive and abnormal impacts on construction costs experienced in 2004 as steel and other construction material prices increased at levels unseen in recent years. There has also been a ripple effect on many construction commodities and plant equipment from this price escalation and rising energy prices that are not captured by those DOE rates. DOE's Office of Engineering and Construction Management (OECM) has recently modified or clarified its escalation position and now will no longer publish escalation rates for its projects to use. Rather, the current guidance to projects essentially reinforces earlier options presented in DOE cost estimating guidance, which allowed the use of indices and forecasts that each project assumes will best predict future wage and pricing increases for that project. At this time, BNI has not yet applied this guidance to the 2005 EAC and has used rates that appear to significantly understate future cost escalation if recent history, experience and industry forecasts are to be believed.



As an example, in FY 2004 the Engineering News Record (ENR) Construction Cost Index increased 3-4 percent in the Northwest, as compared to the DOE forecasted escalation rate of 2.5 percent. Over this same time frame, the ENR Material Cost Index increased 11 percent with steel prices increasing 16 percent. Over the last 12 months, the ENR Construction Cost Index has increased 4.8 percent. It was also observed that many of the craft hourly labor rates for the WTP Project have been increasing at higher rates than the DOE Escalation rate forecasts. In particular, over the past 4 years, the wage rate for electricians and pipe fitters has been increasing at over 5 percent per year. While this is somewhat offset by lesser increases for other crafts, these are the crafts that will predominate the work in the latter years of construction.

The IR team modeled the potential impacts of differing levels of future cost escalation (ranging from 2.5 to 6 percent) using the cost profiles for both Scenarios A and B of the BNI 2005 EAC. These results are presented in appendix C and show that if actual escalation averages 4-5 percent per year, as compared to the 2.6 percent per year used for the EAC, the 2005 EAC may be understated by \$300 to \$700 million, depending on whether Scenario A or B is used. The 2005 EAC may be understated by approximately \$500 million at this time due to the use of forecasted escalation rates that may not be reflective of future economic conditions.

**Recommendation:** Consider revising the 2005 EAC to use/reflect more realistic future cost escalation forecasts and incorporating appropriate escalation uncertainty into risk and contingency analyses. Alternatively, ensure the proposed revised TPC for the WTP Project includes adequate contingency allowances to account for likely future cost escalation levels that exceed the 2004 DOE forecasted rates.

**Findings:** Based on the experience of the project to date, future scope evolution and engineering perturbations and performance issues should be anticipated.

The WTP Project has continued to experience significant growth in engineering effort and resultant growth in construction costs from growing construction quantity estimates. Many of these increases have been related to specific issues and difficulties encountered by the project (e.g., HPAV, fireproofing, RGM, etc.). Additionally, there has been a great deal of normal design evolution impacts as the project has proceeded and the full requirements, complexities, and realities of the project have been confronted and recognized. Simultaneously, BNI has experienced continued engineering performance impacts that were not anticipated or that did not meet planned performance levels. Some of this may have been the result of the significant learning curve associated with a large, complex nuclear facility and others may have been the result of the aggressive project schedule that was being attempted. Regardless of the reason, it is clear that engineering hours and costs have continued to grow and that there has been a somewhat corresponding growth in estimated construction costs as a result. The IR team concludes that there is no reason to believe that similar events and performance impacts will not continue to be experienced as the project proceeds. Accordingly, the independent contingency analysis conducted by the IR team has



included both engineering growth impacts and less than planned performance impacts as future uncertainties to be accommodated by the project contingency allowance.

**Recommendation:** Make sure the programmatic risk contingency allowance is adequate to address future scope growth, design evolution and engineering performance impacts that may be experienced by the WTP Project.

**Findings:** Schedule risks and associated cost impacts associated with Commissioning and Operational Readiness Reviews (ORR) are not adequately reflected in the current EAC.

Although the Commissioning estimate and schedule have been extensively redone for the most recent EAC, the overall Commissioning duration of 26 months from start of Integrated Water Runs through completion of Hot Commissioning has not changed. It appears the Commissioning effort is still viewed from an optimistic, success-oriented perspective. There are neither significant allowances included for unexpected events or perturbations, nor for necessary design and construction rework resulting from problems encountered during Commissioning. The schedule is also predicated on a single ORR accomplished in parallel with the Cold Commissioning effort and not assumed to affect the project critical path. These assumptions may in fact be realized, but in the opinion of the IR team, they represent a significant project risk, and it is likely that the Commissioning schedule will be somewhat longer than now estimated. Experience also indicates DOE-HQ may require multiple ORRs (rather than a single ORR) and some form of ORR after the completion of Cold Commissioning and before the initiation of Hot Commissioning. These potential schedule impacts and the costs associated with those impacts for increased Commissioning effort and hotel loads for the project have been captured in the independent contingency analysis completed by the IR team and presented in appendix C. These impacts are viewed as additional to the nominal six months of schedule contingency included in the EAC, which are expected to be used prior to commencement of the Commissioning phase.

**Recommendation:** Incorporate appropriate schedule and associated programmatic risk contingency allowances in the proposed TPC for the WTP Project to allow for problems that may be encountered during the Commissioning phase and for more ORR impacts and requirements than are now included in the BNI plan.

**Observations:**

Higher contingency levels are warranted for the WTP Project.

As discussed in section 3.5.1, the level of EPCC Contingency recommended by BNI for the 2005 EAC appears appropriate for the project at this time within the constraints, assumptions and exclusions that form the basis for the EAC. At approximately 15 percent of remaining project costs, this contingency would seem to be adequate given a more typical project environment and schedule. However, for a large, complex and challenging project that is anticipated to last another ten years,



this contingency allowance does not appear to capture the potential impact of the full suite of risks, uncertainties and challenges that still confront the project. Accordingly, an additional programmatic risk contingency allowance would appear to be warranted. The IR team has completed an independent contingency assessment that concludes there is a need for an additional \$1.3 billion for the project at this time. The addition of this amount will raise the overall contingency allowance to approximately 40 percent of remaining project costs and appears to be more reflective of recent project experience and forecasts for future project cost increases, including the significant potential for higher cost escalation than is now estimated.

Other potentially significant programmatic risks exist that have not been fully evaluated and considered.

In addition to the risks and uncertainties captured in the IR team's independent contingency analysis, there are other risks noted in BNI documentation that have not been analyzed and quantified by the IR team. It appears these risks, if realized, may represent significant cost impacts for the project. Thus, it is imperative that the DOE-ORP project team fully recognize and reflect these potential impacts in subsequent DOE level risk analyses to the extent that they are viewed as realistic and possible project risks. In particular, the following issues were identified as "Critical Decisions" in the 2005 EAC document and appear to represent uncertainties that the IR team was unable to fully quantify:

- Potential impacts of BNI compliance or non-compliance with Contract Clause H., which requires a 60/40 ratio for subcontracted versus self-performed work.
- Acceptance and implementation of the Sequential Commissioning Team concept and structure.
- Potential implementation of Worker Health and Safety Program in accordance with 10 CFR Part 851.
- Whether or not the requirement to characterize and vitrify AY-101/C-104 will be eliminated.

Future funding levels and annual budgets for the WTP Project continue to represent both additional programmatic risks and potential opportunity.

The independent contingency analysis by the IR team is based on the current EAC schedule predicated on constrained funding of \$690 million per year (Scenario B). It has been reported that the 2006 budget may be cut by approximately 10 percent. If realized, this reduction will likely have an additional cost and schedule impact that has not been recognized in either the EAC or the IR team's analysis. In addition, any future reductions in funding may have cost and schedule impacts that are not now captured by either the BNI or IR team's analysis. However, if the project is



successful in obtaining higher funding levels in the future, there will also be opportunities for shortening the project schedule and reducing project costs.

There are significant cost savings opportunities that may help to offset the impacts of future programmatic risks and increases.

Through the analyses and reviews conducted by the IR team, and as documented throughout this report, there have been many areas identified that appear to have been conservatively estimated or scheduled. There are also areas that would appear to represent significant cost savings opportunities if more efficient work practices can be implemented and better performance can be realized that meets or exceeds benchmarks. Because of the high level of future cost risk identified by this review and independent analysis, it is imperative that the project team (BNI and DOE-ORP working both independently and collaboratively) aggressively pursue cost reduction initiatives that may help to offset the likely future cost growth the project may encounter.

The BNI Risk Management process is sound, but DOE needs to strengthen the overall programmatic risk management processes.

The IR team was impressed by the quality and maturity of the overall BNI Risk Management processes. It appears that risk management is properly focused on risk handling and mitigation strategies for identified risks. Risk management concepts and philosophies appear to be ingrained in the overall BNI management processes and approaches; however, it is not clear that a similar risk management framework exists within DOE-ORP. Because of the nature of the BNI contract, not all risks and uncertainties are or should be captured and managed within the scope of the BNI effort. There needs to be a broader project-level perspective and appreciation of risks that may confront the project. These risks may be the result of environmental and programmatic factors and influences, or they may simply reflect a more realistic appreciation of project challenges and performance issues. DOE's risk management process needs to be strengthened to handle or mitigate those risks that have not been included in the current EAC. DOE-ORP is encouraged to institute a robust risk management process that identifies, quantifies, and manages and tracks all potential project risks and uncertainties, especially those not already addressed by BNI.

(For detailed methodology and discussions, see appendix A, paragraph A2.21.)

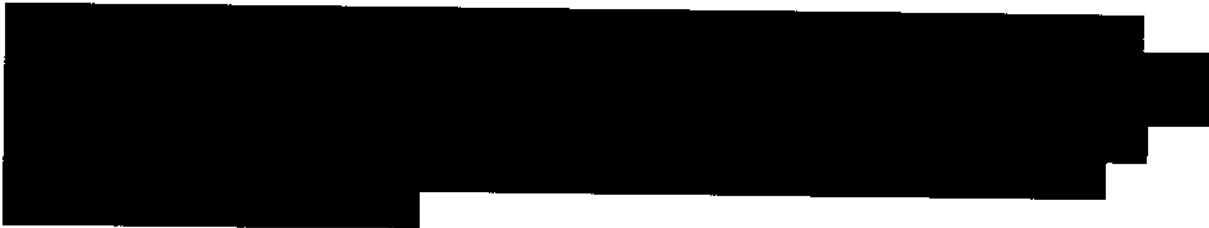
### **3.6. Funding Levels and Schedule Scenarios**

This section provides the perspectives of the IR team on the proposed funding requirements and associated schedule analyses provided as part of the 2005 EAC by BNI. The IR team reviewed funding profile data and related P3 schedule scenarios provided in the 2005 EAC documentation. Data tables containing information for this review was partially provided in the 2005 EAC scheduling notebook distributed by BNI. The IR team based the schedule analysis on the Scenario A P3 schedule provided by BNI.



**Findings:** The proposed Scenario A 2005 EAC is based on improbable funding profile assumptions.

By letter, DOE-ORP directed BNI to provide a schedule reflecting unconstrained funding and to include six months of schedule contingency. Annual project costs exceed the annual funding in FY05, FY06, FY07, FY08, and FY09. Schedule contingency appears to be \$49 million and is included in the total project cost of \$7.8 billion.



ORP's purpose for Scenario A is unclear because this is an estimate that does not conform to funding limits of the current contract and most likely understates the total project cost, due to the lack of fee for BNI. The FY05 budget is relatively fixed at \$695 million. Project cost in FY05 is \$1,165 million. The opportunity for an additional \$470 million available throughout FY05 appears highly unlikely. Also, this ambitious schedule may cause/create risks, or have more inherent unknown risks.

**Recommendation:** Direct BNI to develop a fully detailed and documented EAC based on realistic funding profiles for the WTP, including available FY 05 and expected FY 06 funding levels.

**Findings:** A savings of nearly \$300 million could possibly be achieved by correcting or modifying the schedule logic, reducing the excess float for Scenario A, and by not extending the schedule for an additional 2 years per Scenario B.

Total Float is the number of days that an activity can be delayed before it impacts the project completion date. Excess Total Float is an indication that the schedule may not be the most efficient sequence of arranging activities for completing the scope of work. This also indicates that there may be no sense of urgency in completing the project. Due to what appears to be excess total float, Scenario A has added approximately 2 years to the previous PMB scheduled completion of the WTP.

There are a total of 30,790 activities in the Scenario A schedule, which include delays for redesign due to revised seismic design criteria. Of the remaining 18,666 open activities, there are 9,527 activities (51 percent) that have more than 300 days (1.2 years) of total float; 6,520 activities (35 percent) that have more than 500 days of total float; and some activities have total float that exceed 2,000 days. The overall range is from 1.2 years to 8.5 years of float. It seems possible that some of these activities may have significant dollars associated with them, and if the total float were adjusted by refining the detail logic, some of the excessive spending in FY06 and FY07 on Scenario A could be moved out (moved to a later installation date).



A cursory review showed that a large number of these activities have late finish dates in the 2008 to 2010 range. This would indicate that many of these activities and their cash flow can be moved out to help correct the spending profile problem without adding an additional two years as proposed in Scenario B.

**Recommendation:** BNi project scheduling staff needs to review the excessive float values. Some of these paths may be related to the use of early constraints but most appear to be the result of inaccurate logic flow. (Additional information can be found in section 3.3 - Schedule, Release, and Installation Curves Review.)

**Observations:** None.

(For detailed methodology and discussions, see appendix A, paragraph A2.22.)





## **Appendix A Project Description, Detailed Methodology, and Discussions**

### **PROJECT DESCRIPTION**

The Hanford Waste Treatment and Immobilization Plant (WTP) project was initiated by the Department of Energy - Office of River Protection (DOE-ORP) on August 31, 2000. The WTP Project is one of the largest and most complex radiochemical plant design and construction project currently in the United States, and possibly the world. The WTP will process a variety of materials with different chemistries to produce immobilized waste products that meet stringent disposal specifications.

The Hanford Site has 177 waste tanks containing approximately 53 million (M) gallons of high-level radioactive waste, generated during production of nuclear materials between 1943 and 1989. DOE-ORP's mission is to safely remove, stabilize, and dispose of this waste in a safe and cost effective manner before the 2028 Tri-Party Agreement (TPA) milestone. The WTP is an essential element in the DOE system designed to accomplish this mission.

In December 2000, DOE-ORP awarded Bechtel National Incorporated (BNI) a contract to design, construct, and commission the WTP. Since project inception, cost and schedule have continued to increase. The design has gone through several major and minor changes/modifications, and the BNI estimated project cost has steadily increased from December 2000 total cost of \$4.35 billion to March 2005 Scenario B total cost of \$8.35 billion (see table 1-1). Estimated Schedule completion date has extended from July 2011 to Scenario B date of July 2015.

The WTP consists of a pretreatment (PT) facility (designed to separate tank waste into high- 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 River Protection Project (RPP) requires additional facilities and services for waste treatment. The costs to design, build, commission, and operate these facilities are not included in the WTP baseline and are not included in this review. These facilities and services include:

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 percent of the LAW will be vitrified. Another facility must be designed and constructed to vitrify the remaining 60 percent.

Effluent Treatment Facility – Condensate generated by the tank farm operations and WTP must be sent to a separate facility for processing and disposal.

Analytical Services – The 222-S Laboratory supports the tank farm operation, which is separate from WTP laboratory.

Integrated Disposal Facility – LAW canisters from WTP will be disposed of 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 proposed permanent storage facility at Yucca Mountain.

Infrastructure – Roads and utilities associated with the construction and operation of the WTP.

DOE-ORP guidance to BNI for the development of the 2005 EAC included the following:

On January 7, 2005, DOE-ORP requested BNI prepare an Estimate at Completion (EAC) for (fiscal year) FY 2005. Clarification of the guidance to prepare the 2005 EAC was provided to BNI on February 22, 2005. The guidance included the following: the EAC will consist of two funding scenarios: (a) unconstrained funding and 6 months of schedule contingency; and (b) funding constrained to \$690 million and 6 months of schedule contingency.

The EAC (including detailed schedule information) is to be defensible and credible in order to withstand the rigors of an independent baseline review.

Prepare the EAC and schedule taking into account impacts from schedule slippages related to the following: (a) revised seismic design criteria; (b) overly optimistic unit rates for all installs; (c) engineering performance; (d) late equipment procurement/receipts; and (e) commodity price growth due to design evolution.

Increase contingency as a percent of the remaining (To Go) work, and delete the currently proposed contingency returns.

Focus attention on high-risk areas.

DOE's 2005 EAC preparation guidance represents BNI's Class 2<sup>11</sup> estimate that incorporates detailed engineering design, site productivity, labor wage rate, escalation, fee, and other factors that influence the job costs, detailed material take-offs for all major commodities, installation hours based on performance assessments by trade, skill levels, and actual construction equipment usage.

## DETAILED METHODOLOGY AND DISCUSSIONS

<sup>11</sup> Based on Contractor's internal guidance.



### **A2.1. Current Management of the Contract**

As previously stated, the uncertainties associated with the WTP Project made the use of a cost-reimbursable contract appropriate. The use of cost-reimbursable contracts is, however, subject to a qualifying limitation under Federal Acquisition Regulation (FAR) Subpart 16.301-3(2). This limitation states: "Appropriate Government surveillance during performance will provide reasonable assurance that efficient methods and effective cost controls are used." Surveillance of BNI's methods and efforts must exist as a consistent Government effort that parallels BNI's data and cost reporting system.

Surveillance of a cost-reimbursable contract is determined by the degree of importance of cost control to the Government. In order to provide the appropriate level of surveillance, specific and detailed contract administration actions must take place that parallel the Contractor's actions. These contracting actions include:

- Preparation of Independent Government Estimates (IGE)
- Audits of BNI proposals
- Technical analysis of BNI proposals to ensure a complete scope of work and allowable costs
- Comparisons of IGEs to BNI proposal in order to establish the negotiation objectives
- Preparation of business clearance memoranda to establish the goals for the negotiations
- Conduct negotiations and documentation of negotiations showing agreement
- Processing of the contract modifications

Contract funds and schedule are managed parallel to the contractor's effort. It is incumbent on the Government's contract administrative effort to control the movement of funds between work breakdown structure (WBS) elements. The control of the funding must be at a level that ensures accuracy in the reporting of BNI's efforts and findings. Failure to provide control at this level allows BNI to manage funds movement independently of Government oversight.



### **A2.2 WTP Change Control Processes**

#### **WTP Baseline Change Control Program Plan**

BNI and DOE-ORP current guidance for the change control documentation are:



WTP Baseline Change Control Program Plan (BCCPP) (24590-WTP-PF-CT-03-001, Rev 2), dated January 26, 2004, prepared by BNI

Trend Program (24590-WTP-GPP-GAB-00103, Rev 4), dated November 11, 2003, prepared by BNI

The document used by DOE-ORP for internal guidance is:

ORP Project Reviews and Baseline Change Control (ORP M 413.3-1), dated September 25, 2003, prepared by DOE-ORP.

The WTP BCCPP, which provides the basic guidance for BNI to manage the overall contract change control, was submitted to DOE-ORP as Contract Deliverable 1.11. This plan provides the guidance to manage trends, implement trends into the baseline, and manage contingency. A trend is a change or potential change that will have an impact on the PMB and possibly on the WTP Project Baseline. The WTP BCCPP document is being reviewed by DOE-ORP, and they have initiated an action to rewrite this document; however, this process has just begun.

The jointly managed change control process utilizes BNI's Trend Program as the foundation of the BCCPP to identify, document, and disposition changes to the WTP Project Baseline. This change control process ensures there is a mutual understanding of the scope, cost, and schedule impacts associated with each trend presented. This process, WTP-BCCPP, allows BNI/ORP to:

- Review potential changes for impact on the baseline
- Develop cost-saving alternatives
- Document changes to the WTP Project Baseline

The WTP baseline forms the basis for the funding profile (not to exceed funding limitations in WTP Contract Section B) and requirements to complete the Contract Scope. The funding profile includes baseline costs and commitments, 80 percent confidence level contingency, and estimated fees paid to BNI. The funding profile does not include the TPRA managed by DOE-ORP.

The DOE-ORP M 413.3-1 Project Reviews and Baseline Change Control was issued on September 25, 2003 with the expressed purpose of establishing minimum requirements for implementing the critical decision process and providing guidance for baseline change control and estimate reviews. The features of the DOE-ORP baseline change control process that are implemented by this manual are:

- BNI Deliverable 1.11 (WTP BCCPP) is recognized as the WTP change control process.
- The DOE-ORP and BNI are required to jointly manage change control and contingency.
- The DOE-ORP Federal Project Managers (FPMs) are responsible for managing trends relating to their facility.



The FPM is responsible for ensuring that the Integrated Project Team (IPT) performs its responsibilities coordinating trend tasks.

This DOE-ORP manual is intended to provide DOE's companion process to the WTP BCCPP prepared by BNI. Common baseline change control processes are described together with the roles and responsibilities of DOE-ORP personnel. Guidance in this manual for preparing cost estimates requires DOE-ORP to formally estimate those trends that are determined to be a Contract Scope Change. The manual Attachment 9.2 WTP Scope Change Procedure, states: "The DOE-ORP Cost Engineer will prepare a Government Fair Cost Estimate (GFCE) reflecting the changed work." The FAR provides clear language regarding the preparation of Government estimates for construction contracts. FAR Part 36.203 requires: "An independent Government estimate of construction costs shall be prepared and furnished to the contracting officer at the earliest practicable time for each proposed contract and for each contract modification anticipated costing \$100,000 or more."

In addition, this manual also requires that DOE-ORP personnel perform the following activities:

- Ensure BNI submits a detailed proposal for the changed work.
- Ensure a proper technical evaluation is conducted per FAR.
- Negotiate an equitable settlement in accordance with the WTP contract.
- Develop a price negotiation memorandum documenting negotiations.
- Require BNI to provide certified cost or pricing data as needed.
- Prepare all contract documents in support of any settlements.
- Invoke Contract Clause I.83 for all changes that exceed \$100,000.

### **A2.3. CONTRACT COST PERFORMANCE INCENTIVES**

#### **Current Status of BNI Target Cost and Fees Paid**

The WTP Contract DE-AC27-01RV14136, Section B was reviewed for the current Target Cost (TC) and Fees. Since the incorporation of Modification A029 in March 2003, the TC of \$5.0 billion and the Upper Cost Limit (UCL) of \$5.4 billion remain unchanged. Only the latest Modification A049, which is still in draft form, will change the contract amount. Specifically deductive scope changes totaling \$5,047,878 and additive changes totaling \$348,000 will be incorporated.

The current fee status indicates that BNI has been paid an earned fee of \$25 million, plus a provisional fee of approximately \$48 million. Earned fee has been paid for meeting two Schedule Performance Milestones: Setting four Feed Receipt Tanks on foundations in the PT Facility (\$10 million), and setting Melter #1 Condensation Collection Vessel on its foundation in the HLW Facility (\$15 million). Payment of provisional fee has been paid in accordance with Modification A029 Section B,



beginning in March 2003. That modification allowed a one-time payment of \$15 million, plus quarterly payments of \$3 million. These quarterly payments (which also include Washington State B&O tax) have been made based on "satisfactory progress against the Level 3 Project Schedule." Determination of provisional fee, in accordance with Paragraph B.7 will be re-evaluated after October 1, 2006 by DOE-ORP. The paragraph also states: "In the event that the Contractor demonstrates unacceptable performance, the Contracting Officer reserves the right to withhold Provisional Fee payments."

The last quarterly provisional fee payment, dated April 4, 2005, was reduced by 10 percent for less than satisfactory safety performance.

**BNI Cost Performance Incentives**

The WTP contract under Section B.6 allows for the increase in Cost Performance Fee, if contract scope changes increase the TC by over \$100 million. Based on the probable amount of the seismic RGM change, the TC and UCL will require an upward adjustment, and this portion of the fee will be shifted vertically upward only by the amount that such changes exceed \$100 million.

Under the provisions of section B.4 the maximum fee that BNI can earn is defined. The total amount of potential fee is broken down into three basic areas:

Cost Performance Elements	\$200 million
Schedule Performance Milestones	\$114 million
<u>Operational Performance Milestones</u>	<u>\$111 million</u>
TOTAL MAXIMUM FEE	\$425 million

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]



[REDACTED]

### **Review the Status of Major Scope Change Issues**

The February 2005 Monthly Status Report was reviewed to determine the trended performance baseline and amounts of current forecasted trends. Those trends involving specific technical issues that could lead to a contract scope change were also reviewed in more detail.

Based on this monthly report the Trended PMB was \$5.038 billion. In addition, an incomplete list of priced Potential Trends was included that totaled over \$1.6 billion. Technical issues that pose a major cost impact to the 2005 EAC were combined into four basic areas: seismic, non-Newtonian mixing, hydrogen in piping and ancillary vessels (HPAV), and fireproofing of structural steel. A brief discussion of each issue and its current status with DOE-ORP is as follows:

#### **Seismic**

DOE-ORP provided new RGM criteria to BNI for use in structural calculations in Seismic Class I and II designs. Horizontal and vertical ground motion forces were increased as a result of additional geotechnical studies and analysis performed by DOE. The full impact of new design criteria will not be available until new RGM analyses are currently scheduled for mid-August 2005. DOE-ORP provided direction to BNI to use new RGM criteria in February 2005.

The DOE-ORP sent a letter dated March 10, 2005, to BNI requesting that it develop methods to track the costs of seismic impacts. This letter requests that BNI account for costs attributable to this change in accordance with WTP Contract Clause I.83 and FAR 52.243-6 CHANGE ORDER ACCOUNTING.

#### **Non-Newtonian Mixing**

Some of the vessels in the black cells require unique mixing techniques because the wastes are non-Newtonian. This issue became fully realized at the end of calendar year 2003. Redesign of the vessels included utilizing both PJMs and air sparging tubes which has effectively solved the problem. The basis of design was finalized in May 2004 and confirmatory testing was completed in December 2004. There were no further issues.

[REDACTED]



[REDACTED]

**HPAV**

[REDACTED]

[REDACTED]

**Fireproofing**

Structural steel at the WTP has always required fireproofing to meet DOE and building codes requirements. After contract award BNI attempted to find an equivalency approach, such as fire sprinkler systems to save costs; however, between award of a subcontract by BNI in 2003 and late 2004 no mutually agreeable alternative was produced by BNI. During that time period, BNI took unilateral actions to suspend their fireproofing subcontractor and submitted unapproved specifications to steel suppliers.

[REDACTED]

**Estimated Cost Impacts**

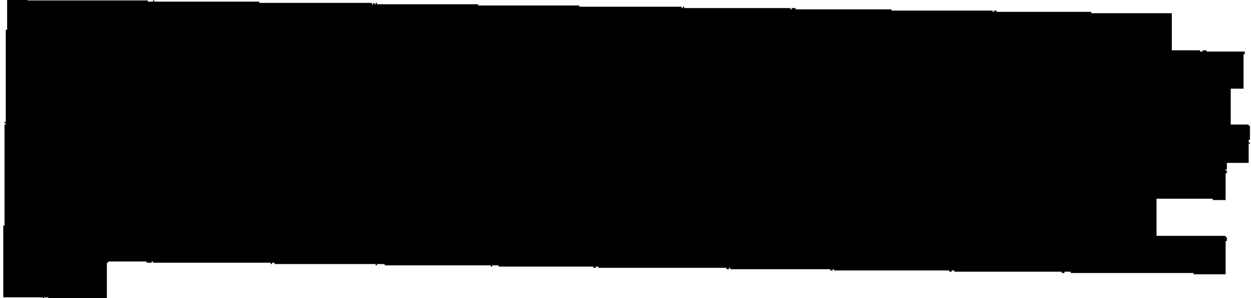
The four issues listed above were incorporated into the 2005 EAC by BNI. Costs associated with these issues have not been realized by BNI through the current Trended PMB. BNI's current estimate of impacts was examined and the To Go costs taken from their 2005 EAC are as follows:





<u>RGM Issues</u> – BNI Estimate without contingency	\$753 million
<u>Non-Newtonian Mixing</u> - BNI Estimate without contingency	\$190 million
<u>HPAV</u> - BNI Estimate without contingency	\$ 90 million
<u>Fireproofing</u> - BNI Estimate without contingency	\$ 70 million

**Review of WTP Contract Terms**





Paragraph B.10 (FEE RISK ALLOCATION)

**(c) Changes in Laws, Regulations, Codes, Standards and Directives**  
 A Contract change (subject to equitable adjustment in accordance with Clause I.82) shall be deemed to have occurred as the result of any changes in laws, regulations, codes, standards, and Directives (other than Regulatory Actions covered by paragraph (d) below) in accordance with the Changes clause.

**(d) Regulatory Actions.**  
 (1) A Contract change (subject to equitable adjustment in accordance with Clause I.82) is deemed to have occurred upon unreasonable regulatory delays/interpretations/demands/new requirements in responding to and/or approving permit and other applications (“Regulatory Actions”) after reasonable collaboration with DOE to avoid such impacts. This includes, but is not limited to, impacts resulting from implementation of Maximum Available Control Technology (MACT) standards.  
 (2) Absent Contractor’s reasonable collaboration with DOE to avoid such impacts, Contractor shall not be entitled to an equitable adjustment to Target Cost or Cost Performance Fee for the first \$5,000,000 of impact for any such single regulatory action (per occurrence).

**(e) Technology.**  
 (1) A contract change (subject to equitable adjustment under Clause I.82) is deemed to have occurred as the result of shortcomings or failures in the performance of process technologies that were not anticipated after best reasonable design and Research and Technology (R&T) efforts in accordance with sound industry practice (e.g., design professional standard).  
 (2) Should the Government demonstrate the Contractor’s failure to use sound industry practice (e.g., design professional standard), Contractor shall not be entitled to an equitable adjustment to Target Cost or Cost Performance Fee for the first \$10,000,000 of impact for any such single technology shortcoming or failure (per occurrence).

**(h) RFP Deficiencies and Due Diligence Review**  
 Except as otherwise set forth in (a), (b), (c), (d), (e) and (f) above, the Contractor shall bear the full fee risk for cost and schedule impacts resulting from any actual or purported deficiencies, whether or not known to Contractor and whether or not such deficiencies were identified by Contractor during its due diligence review under Section C.5. (a)(3), which arise out of solicitation defects, specification defects, Conceptual Design defects, or deficient historical pricing or cost estimate information in any form.

Other than as set forth above, the Contractor shall not be entitled to an equitable adjustment for those items described in (d)(2) and (e)(2) above which do not exceed the dollar thresholds provided therein. Provided, however, the Contractor’s aggregate fee risk liability under paragraphs (d)(2) and (e)(2) above is limited to the fee risk associated with the first \$100,000,000 of aggregate cost impact.

**Figure A-1 Fee Risk Allocation**

**A2.4. ENGINEERING, PROCUREMENT, AND CONSTRUCTION MANAGEMENT CONTROLS**

The QAIS system is comprised of several modules designed to manage the condition, analysis, tracking, and trending for the WTP. Below is a list of the modules:

**Corrective Action Report (CAR) Module**

The CAR module provides a centralized data resource for the collection, analysis, reporting, and trending of corrective action information. The primary objective of the



module is to develop a single-point-of-access for all WTP personnel and subcontractors to initiate a deficiency or condition report.

### **Recommendation and Issues Tracking System Module**

The primary objective of the Recommendation and Issues Tracking System Module (RITS) module is to provide a tracking system that allows the WTP to track recommendations, issues, and actions from management assessments, correspondence, DOE commitments, and other issues. The RITS is used to assist the control of work processes and support the management of issues related to the WTP.

### **Observation Tracking System (OTS) Module**

The primary objective of the module is to provide a tracking system that allows WTP department personnel to track observations.

### **The Matrix Module**

The objective of this module is to provide an electronic system that allows WTP personnel to track implementation of the Quality Assurance (QA) Requirements and Description through the Quality Assurance Manual and to the paragraph level of implementing procedures. The Matrix will be used to assist the tracking of requirement implementation at the WTP.

### **QA Document Review Module**

The objective of the QA Document Review module is to provide electronic tracking of procedure reviews and checklists within the QA department. This module is intertwined with the Matrix module, because once the reviews are completed and approved, the checklist data updates the Matrix data. Surveillance and Audit checklist information will also be added to the Matrix through input screens in this Module. The Document Review module will be used to assist the tracking of requirement implementation at the WTP.

### **Price Anderson Amendment Act Screening Module**

The objective of this module is to provide electronic tracking of documents that have been reviewed by Price Anderson Amendment Act (PAAA) personnel, and whether these documents and issues should be tracked as a PAAA or potential PAAA issue. This module is independent of the system, but interfaces with the CAR, RITS, and OTS modules to aid in the reviews. Only personnel assigned as PAAA reviewers within the system can access this module.



### **Root Cause Analysis Module (RCAM)**

The objective of the RCAM is to provide management with an electronic tracking tool for Root Cause Analyses performed on the WTP project.

### **Nonconformance Reporting Module (NCR)**

The objective of this Module is to provide electronic tracking of nonconforming conditions identified at the WTP Project. The primary interfaces of the module are Quality Control, Field Engineering, and Design Engineering. The NCRs identified in an audit or surveillance will be tracked in the Matrix Module of QAIS.

### **Lessons Learned Module**

The primary objective of the lessons learned module is to provide a tracking system that allows the WTP to track lessons learned from input to approval, including distributions for information only, acknowledgement, and specific actions, which are specifically tracked in RITS.

## **A2.5. SEISMIC ANALYSIS**

The written correspondence, the 2005 EAC, and the verbal presentations are not consistent on requirements or the process that exists to identify and remove excessive margins or conservatisms in the existing design to minimize the impact of the RGM and the interim seismic criteria or the approach that is intended to be taken to address these margins. The 2005 EAC states in part that the "only changes that will be implemented will be those directly related to the increased ground motion and revised soil properties. No new or additional design, verification or resolution of items or issues not directly related to the increased RGM will be required."

A number of conservatisms are not identified in the Table of Potential Conservatisms date January 18, 2005 and reproduced in appendix B, figure 5. Typically, conservatisms incorporated at the final design level other than demand to capacity (D/C) ratios are not included in the table. When these options are exercised in the design, they are typically only documented by the statement "This is conservative." (See appendix B for additional discussion.)

One example of the compounding of conservatism is demonstrated in calculation Design of Pipe Rack Framing Below El. 98'-0", 04/22/04 (24590-PTF-SSC-S15T-00017). In addition, to the conservatisms added by BNI to the selected industry and government criteria, the conservatisms included in the development of the in-structure response spectra and those conservatisms included in other calculations which provide input to this calculation, in this calculation the designer adds an additional 10 percent to the vertical acceleration selected from the in-structure response spectra and uses values from the 4 percent damping spectra rather than the 7 percent spectra allowed by the, Seismic Analysis, and Design Approach. In this case, the difference between using the different damping values results in a 38 percent increase in demand in the vertical



factor and a 21 percent increase in the horizontal factor. The additional 10 percent factor added to the vertical acceleration results in a 53 percent overall increase in the vertical factor used in design over the vertical factor shown in the in-structure response spectra. The preceding represents only a portion of the conservatisms included in this calculation. Conservatisms are also referred to as design margins are incorporated throughout the calculation.

Although conservatisms appear throughout the design, the prevalent conservatisms employed by BNI in the design of PC-3, SC-I, are ASCE-4 conservatism, capacity margins guidelines, and the SRD guidance of no credit for inelastic action. The ASCE-4 conservatism is inherent in the application of ASCE-4. The capacity margin guidelines are outlined in BNI's Structural Design Criteria to account for the design build process uncertainties. This practice results in a minimum over design factor of  $(1/0.90)*(1/0.90)*(1.50) = 1.85$ . Without the inelastic credit the over design factor is  $(1/0.90)*(1/0.90) = 1.23$

Vessels were identified as being a primary contributor to the increase in costs due to the seismic ground motion change and the increase in schedule. The following information was provided in briefings and handout materials by BNI: (1) the vessels, themselves are over designed; (2) the minimum plate thickness specified by BNI results in a rigid tank; (3) the vendor designs tend to meet minimum standards with little or no conservatism on the part of the vendors; and (4) BNI believe that the principle areas of concern are the nozzles and components within the vessels.

The allowable nozzle loads are provided by BNI specifications to the supplier or manufacturer. Information was requested documenting the development of the nozzle loads specified by BNI in the vessel procurement standards and the nozzle loads specified in document 24590-WTP-DC-PS-01-001, Rev. 4, Pipe Stress Design Criteria including "Pipe Stress Criteria" and "Span Method Criteria." The response to the request was that there was no "official" documentation of the development of the nozzle load requirements for the vessels. Documentation of the development of the nozzle loads it is a significant factor in assessing the impact of the increase in seismic demand on the design of the vessels. Without this documentation, it is not reasonable to be able to assess or document the schedule and cost impact of the change in seismic demand to the vessels.

There are three potential areas of conservatism that could be investigated with respect to the manufacturer procurements.

Review the in-structure response spectra.

Specifically, allow the reduction of the peaks of the existing response spectra in accordance with ASCE 4; remove unnecessary conservatism from the existing spectra by removing any additional unexplained amplification factors, if any that have been included in the in-structure response spectra provided to the manufacturer for testing or calculation verification. The reduction of the peaks may not have a large effect since the vessels are rigid, but it is important to assure that the increases typically



added by BNI to the in-structure response spectra for conservatisms were not included in the requirements provided to the manufacturer or vendor.

Since the vessels are considered rigid, the frequency of the vessels could be reviewed to determine whether the vessel falls within the range likely to be affected by the maximum increase or whether a lower increase is more appropriate.

Documentation of BNI's development of the nozzle loads used in the piping design and the vessel procurement requirements should be provided to DOE-ORP as part of the documentation of the impact of the change in seismic demand on the vessel procurement.

Additional information is provided in appendix B.

## **A2.6. RGM COST IMPACT REVIEW**

### **RGM Cost Impacts**

By letter, dated January 7, 2005, DOE-ORP requested the annual EAC update. In addition, the letter stated, "given that the contract requires the EAC to represent the best possible cost forecast, BNI should include the ROM impacts from uncertainties in the seismic design basis".

On March 7, 2005, clarification of the direction was provided that indicated that the EAC and schedule were to be prepared taking into account impacts from schedule slippages related to the revised seismic design criteria among other factors.

The 2005 EAC states this forecast represents a Class 2 estimate that incorporates detailed engineering design, *etc.*, but the presentation of major changes from the December 2004 Trended PMB states that the RGM cost allowance is \$253 million. An allowance is appropriate for a Class 4 estimate. A good faith estimate (directly from the EAC) is admirable. However, it is not a common estimating methodology or a level of estimate detail.

Initial information showing a basis for RGM cost impacts included a single trend, being a ROM, and several spreadsheets. Some of this initial review data intended to demonstrate the basis for the RGM cost impact provided to the IR team was not provided with the 2005 EAC. Because of this, the IR team could not evaluate the RGM cost impact in the issued 2005 EAC.

February 11, 2005, DOE-ORP issued revised ground motion spectra to BNI. The 2005 EAC states that the project (BNI) completed an initial review of the anticipated impact to Seismic Class I and II structures and equipment; however, there was insufficient documentation provided to support the review, the interpretation of the review, or the results of the review. The results of these reviews produced a direct cost allowance that was included in the 2005 EAC. This allowance includes costs for the following:



Additional bulk commodities and equipment

Rework of completed and in-progress work

An estimate for design hours

Support to design tasks, documenting, procuring, planning, implementing, and managing

The 2005 EAC states that time related costs are included in the 2005 EAC because of additional duration to the overall project resulting from a RGM impact. Time related cost impacts include:

Extension of Management, Supervision and Support Staff

Escalation on direct work that shifted as a result of vessel delivery dates (Completion of Pretreatment Construction / Startup and WTP Plant Cold / Hot Commissioning)

Estimated costs for the delays related to RGM schedule impacts are \$500 million.

Included in the 2005 EAC EPCC contingency Evaluation is a table showing contingency cost by facility. This table shows the "Seismic" component of the contingency evaluation. The estimated costs for contingency associated with the RGM are \$59 million. It should be noted that in addition to the contingency, the 2005 EAC establishes a number of bounding conditions on the ROM estimate provided. These bounding conditions are not consistent with the background material described in presentations that formed the basis of the estimates.

#### **A2.7. RGM SCHEDULE IMPACT REVIEW**

The tentative schedule for the revisions to the calculations was reviewed and compared to the timeframe established for the interim seismic criteria. This data was taken from the Waste Treatment Project Revised Ground Motion Preliminary schedule, but not all associated subtasks are shown. The scheduled completion and the status of BNI meeting that schedule was confirmed during a number of meetings. The preliminary schedule supports the DOE-ORP decision to only allow the use of the interim seismic criteria through mid- September 2005. This information tentative completion was validated during a number of briefings. This is shown in figure A-2.

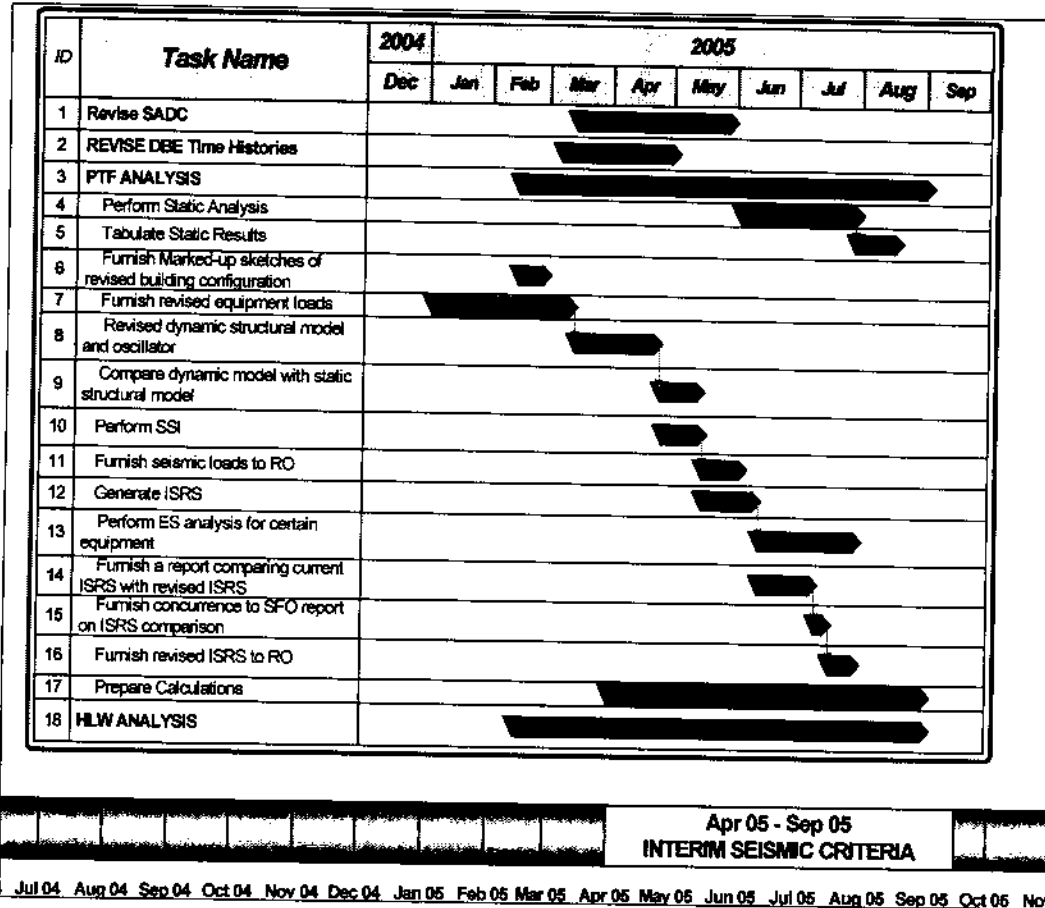


Figure A-2 Seismic Analysis and Design Schedule Tasks

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 February 17, 2005, and an early finish of February 16, 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 distribution, the increases in the scheduled time for the vessel procurement, and the fact that the activities are established as sequential without overlap. In addition, the actual increase in the seismic demand on the component and the specific impact is not yet clear. Typically, in the schedule there is no explanation or justification for the establishing the activities as sequential and not overlapping activities. In addition, there is no clear indication of why the schedule should include over two months to revise the Material Requisitions after the scheduled completion of the revised in-structure response spectra (See figure A-3).

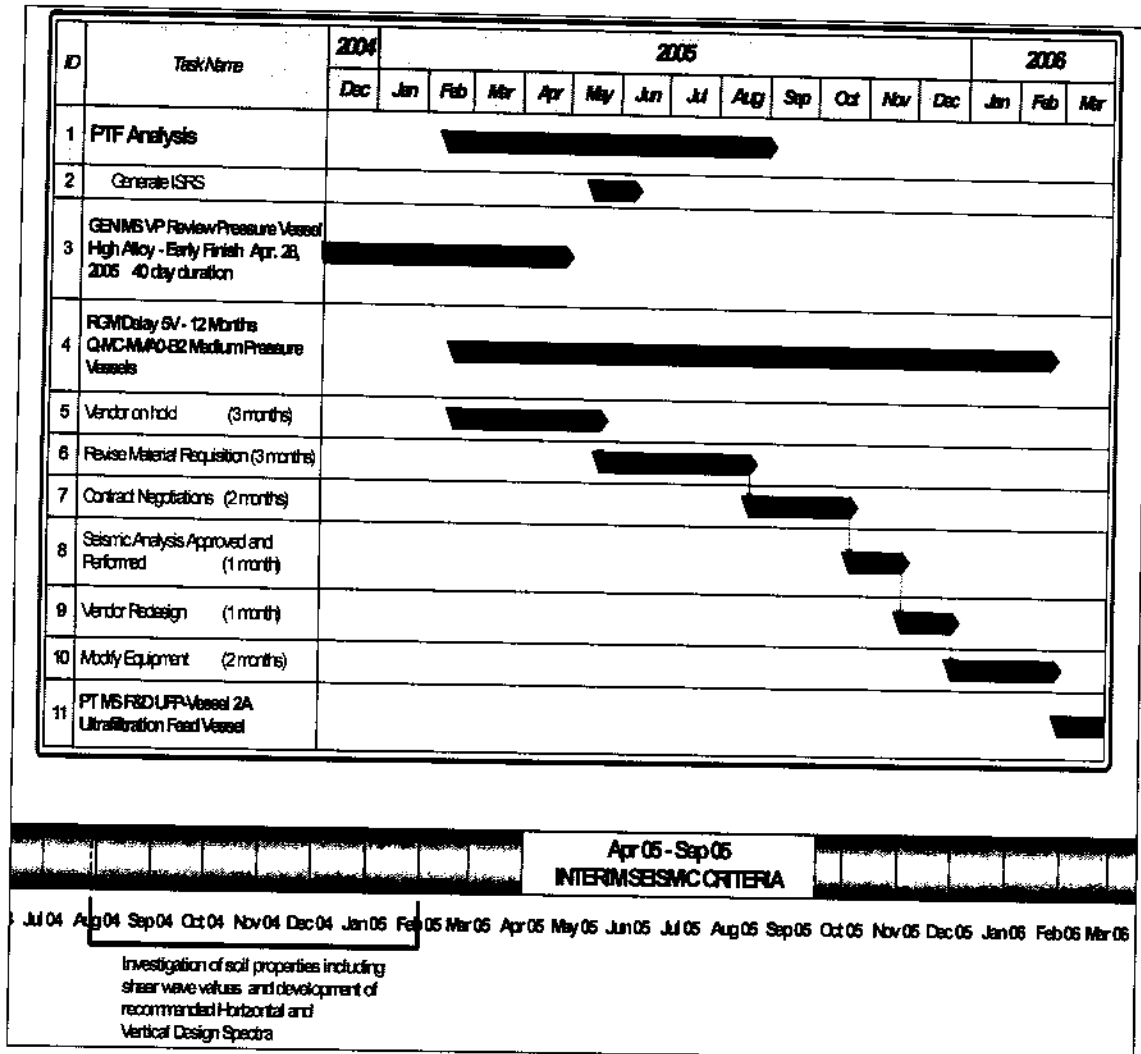


Figure A-3 Medium Pressure Vessel Schedule Impacts

A2.8. SCHEDULE, RELEASE, AND INSTALLATION CURVES REVIEW

Meetings were held with the three main facility-scheduling groups to discuss their methods of approach to developing, maintaining, and reporting schedule status. The IR team analyzed the constraints applied in the level 4 schedule to determine if constraints



are driving any critical or near critical paths and to assess the impacts. Each of the Facilities: HLW, LAW, and PT have unique critical paths to completion. The IR team's analysis focused on the PT facility to determine if the critical path is logically driven from activities currently underway to the completion of Hot Commissioning and the impacts of the added seismic ground motion.

The IR team analyzed the constraints applied in the level 4 schedule to determine if constraints are driving any critical or near critical paths and assess any the impacts to the critical path.

Each of the Facilities: HLW, LAW, PT have unique critical paths to completion. The IR team's analysis focused on the PT facility to determine if the critical path is logically driven from activities currently underway to the completion of Hot Commissioning and the impacts of the added seismic ground motion.

The IR team compared the schedule structure of the baseline schedule to the scheduling notebook provided. The WBS structure and schedule hierarchy were among elements reviewed.

The level 3 reporting schedule is developed through an activity code rollup. The IR team analyzed the schedule to determine if the activity code field structure has been accurately applied. The IR team reviewed the process BNI used to develop and maintain the level 3 schedule.

The IR team reviewed the processes in place to maintain the baseline schedules. Monthly/periodic progressing and change control processes were reviewed.

#### **A2.9. QUANTITY REVIEW**

The review identified and compared quantities for the "seismic impact" in Attachment 2 and the "seismic impact" quantities in the BETK Rev -4. Also, BNI provided a trend, Impacts to Capital Costs Due to Change in Response Spectra, which is intended to provide additional quantity basis for the "seismic impact." The 2005 EAC Key Quantity Comparison Summary, includes this footnote: "Seismic scope includes additional quantities beyond those already established in commodity forecasts that, together, will help satisfy seismic response criteria." The reconciliation column of the spreadsheet for PT, LAW, HLW, BOF, and LAB simply state: "Seismic adjustment" without any additional narrative unlike other items in the reconciliation. Generally, the seismic impact key quantities shown in the supporting documents are traceable to the 2005 EAC. However, there are additional quantities shown in the BETK Rev-4 and some discrepancies in the trend reports provided as the basis for the "seismic impact."

Site work quantities [(5,800 cubic yard (CY)] identified as seismic impact in BETK Rev-4 are not shown in the commodity summary in the EAC. Trend – "Impacts to Capital Costs Due to Change In Response Spectra" indicates a site work quantity of 11,600 CY.



The most dramatic item in the BETK (Bechtel Estimating Tool Kit) Rev-4 data illustrating the EAC footnote is for piping bulk commodities. Two line items; “Additional Piping Material Costs not included in Forecast as a result of Seismic Design Spectra” show quantities of \$40,271,631 and \$20,349,000. Each item has a “Bulk Material Unit Cost” of 0.02 that is multiplied times the dollar quantity to arrive at “Total Estimated Cost” of \$805,433 and \$406,980 respectively. The rationale for this is unknown and not apparent. Dollars as a quantity is unusual in a cost estimate.

BETK Rev-4 shows 4,893 additional conduit supports that are not shown in the 2005 EAC. Also, the trend – Impacts to Capital Costs Due to Change in Response Spectra shows 2,947 conduit supports as impact to capital costs due to a change in response spectra.

Quantities in The Key Quantity Summary of the 2005 EAC, BETK Rev-4, and QDPs were compared one to another. The IR team reviewed each document provided and prepared spreadsheets entering quantity data into columns, to compare each for consistency and tracking. The methodology assumption is that the QDP quantity data is input to the BETK and BETK quantities are carried forward to the project quantities in the EAC. Generally, the quantity data is traceable and supports the 2005 EAC; however, several quantities in the 2005 EAC commodities were found to differ from the supporting data, and several quantities in the QDPs differ from the quantities in BETK. As data anomalies and discrepancies were discovered, this information was provided to BNI for clarification. On follow days BNI provided documentation explaining the differences for the Pretreatment facility quantities including:

- PT 12.1 – Formwork. The wrong spreadsheet was provided in the QDP, need to subtract metal floor deck from the QDP, add construction joints, shoring, add annex formwork, and add a construction quantity adjustment based on actuals for the PT facility basemat. All added to the QDP to match the quantity in BETK.
- PT 12.2 – Concrete; Additional quantities not shown in the QDP, add concrete quantity for the annex (trend 1123), add a construction quantity adjustment based on actuals for basemat, and add the seismic adjustment. All added to the QDP to match the quantity in BETK.
- PT 13.3 – Platform and Miscellaneous Steel: Square foot units of measure from the QDP were converted to tons in BETK. Grating, stair treads, and checker plate quantities were converted to tons.
- PT 18.17 – Special Protective Coatings: Initially the review could not reconcile the quantities. BNI provided supplementary information describing each coating by elevation in the Pretreatment Facility. The total quantity supports the BETK and EAC.
- PT 16.1 – Cable Tray; Subtract a quantity for cable tray covers from the QDP to equal the BETK quantity. The EAC has 33,418 LF. This is not correct. The quantity should be 36,705 LF (provided by BNI).



Resolutions of quantity issues provided by BNI for the Pretreatment facility were verified against the BETK. Similar discrepancies from the QDPs for HLW and LAW were identified. The review assumes that explanations BNI provided for the PT facility estimate would also be applicable to similar anomalies identified for HLW and LAW.

The 2005 EAC, Key Quantity Comparison Summary, lists panels, instruments, tubing, and control valve. In the attempt to track these quantities from supporting data, BNI indicated this was an error and these were not to be listed in the Key Quantity Summary. Subsequently, the IR team was provided a Plant Equipment List for the WTP. The Plant Equipment List was compared to the Plant Equipment Load File from the 2005 EAC. Total EAC dollars in the awarded worksheet plus the un-awarded total EAC dollars equals the Sum of Total EAC in the 2005 EAC. The dollar amounts for plant equipment are traceable.

The most costly BETK Rev-4 estimate line items that comprise 20 percent of the BETK Rev-4 total cost were identified and reviewed assuming the capital cost estimate to be a Class 2 estimate as stated in the 2005 EAC. To accomplish this review the BETK Rev 4 data was sorted in a descending order on "Total Estimated Cost" column. The total estimated cost was added cumulatively to determine the number of line items that represent 20 percent of the total cost in BETK Rev-4. Forty-six cost items in BETK Rev-4 comprise 20 percent of the summation of all cost line items in BETK Rev-4. The BETK Rev-4 costs were used only to sort and rank the cost items for this review. Because BETK Rev-4 is "load" data into COBRA, there is no attempt to compare or reconcile these amounts with cost information presented in the 2005 EAC document.

The basis for the review is the Bechtel Corporate Estimate Classification Matrix. Characteristics of estimating methodology for a Class 2 estimate are:

- Incorporates detailed engineering design, site productivity, labor wage rate, escalation, fee, and other factors, which influence the job costs.
- Detailed material take-offs are made for all major commodities.
- Installation hours based on performance assessments by trade, skill levels, and actual construction equipment usage.
- Materials are based on detailed quantity take-off from engineering design drawings and specifications.

The most costly line item in BETK Rev-4 is a subcontract cost for 105,196 square feet of 1/8" liner plate in the pretreatment facility – Out Cell Material Important to Safety. Total Estimated Cost is \$14,222,877 determined by an "SC" (designation for subcontract) Cost of \$135.00 per square foot. The basis for the unit cost was questioned. Subsequently BNI provided estimate information showing the revised target subcontract cost and revised quantities. Based on this information, a simple division of cost by quantity results in the unit price in BETK Rev-4. However, the quantity and cost in BTEK Rev-4 is not quite the same as the basis of estimate provided



by BNI, e.g. 105,196 SF vs. 108,688 SF and \$14,222,877 vs. \$14,695,008 respectively. It appears the “Cost Forecast” was used to determine the unit price (\$135.20). The difference in quantity was an unknown until BNI verbally indicated that there was another line item that made up the difference. This example clearly demonstrates that BNI can provide clarification and basis of estimate, but replicating the data to address specific inquires appears problematic.

The second most costly individual line item in the BETK Rev-4 is General Facility - Construction Distributables, 1 “Lot” \$13,000,000 without basis or explanation. Subsequently BNI provided the statement; “The basis for the \$13 million was based on 2 percent of the equipment cost in 2001. We [BNI] reviewed the current requirements for vendor reps off of current purchase orders, and there is not enough information to change the amount.” The overall project cost impact may be minimal.

A number of line items have in the “WBS” column the statement “Unit Rate Adjustment.” The amount and basis for adjustment is not shown. Explanation of this statement was not provided.

Included in this top 20 percent of cost items are 9,000 (ea) Additional Post-Installed Anchor quantities not included in Forecast as a result of Seismic Design Spectra. The code description associates this cost to Embeds - Cell and Non-Cell Walls in the Pretreatment Facility. The basis for the quantity is questioned because the unit of measure for embeds in the EAC is pounds. How this quantity is related is not shown. Subsequently BNI provided a detailed basis of estimate including description, assumptions, quantity breakdown, and rationale demonstrating an estimating methodology consistent with a Class 2 estimate.

## **A2.10. ENGINEERING**

### **Engineering Labor**

BNI developed its Engineering labor portion of the forecasted EAC in four phases, using a bottom-up approach:

Phase 1 – Quantified the To Go design work based on tabulating the number of deliverables not started, projecting revision rates for issued or in-progress work, and using experience to date when history was available.

Phase 2 – Evaluated the To Go work for supporting and supervisory activities related to design deliverable production and procurement support.

Phase 3 – Addressed the major scope changes that are not yet fully integrated into the production process, namely seismic RGM and HPAV issues.

Phase 4 – Examined engineering functions that extend beyond design deliverable completion, including support to construction, support to startup and commissioning, and regulatory activities related to plant commissioning and operation. This phase includes support to DNFSB.



The overall Engineering increase in labor hours, from the December 2004 Trended PMB to the 2005 EAC, was 3.6 million hours. This amounts to an increase in labor hours from the Trended PMB to the 2005 EAC of 34.4 percent in Scenario A. The December 2004 PMB represents an increase of 1.1 million (PJMs) hours from the March 2004 EAC, resulting in a total increase over the past year of 4.6 million hours, or 50.4 percent.

The Engineering resource demand curve provided in Scenario A indicates that the total number of To Go FTEs for 2005 through 2013 was 1,154 in the Trended PMB. The total amount in the 2005 EAC for the same period was 2,994 FTEs. This represents an increase of 1,840 full time equivalents (FTEs) over the remaining life of the contract.

### **Other Direct Cost (ODC)**

BNI Engineering developed ODCs by estimating cost elements using the trended baseline and including areas, such as seismic and HPAV work. Items of ODC work include materials and supplies, standards and software licenses, business travel, specialty subcontractors and consultants, relocation expenses, and temporary assignment costs. The overall adjustment to ODCs for all of these elements was included in the 2005 EAC. The total ODC increase over the 2004 PMB was 36.6 percent in Scenario A.

### **Key Assumptions**

The key basis and assumptions used by BNI Engineering in its cost and schedule development.

- Work is performed to current engineering procedures.
- EAC assumes vendor performance will continue as experienced to date.
- No major system design changes stemming from completion of design verification, external audits or acquisition of systems or equipment.
- Ability to retain key staff and obtain replacements as design matures.
- Qualified staff can be located and/or retained as needed, and overtime will not exceed 10 percent, including work on seismic and HPAV.
- A single ORR is assumed, and the engineering effort will be limited to internal readiness assessments and IR team coordination.
- Major modifications exceeding 200 design hours generated during Startup and Commissioning are not included.
- Deflections for pipe support design are predicted appropriately with no major redesign of pipe modules, heating, ventilation, and air conditioning (HVAC) duct and fire protection supports.



No significant design changes required during finalization of the Integrated Safety Management System.

### **Labor Cost Development**

The IR team reviewed the BNI Engineering hours under Addition of Revised Ground Motion Criteria. Those hours totaled 900,000 in the 2005 EAC, which represents slightly more than 25 percent of To Go total hours. The seismic hours were reviewed in detail, since that was the largest single category of increase, and it is being treated as a directed contract change.

After a meeting with the BNI Engineering management, the IR team was provided a supplemental handout that supported the development of seismic engineering hours, which included scope of work elements, quantities, unit rates, and man-hours distributed by functional area. Based solely on the backup provided in the EAC, a meaningful evaluation of Engineering labor cost would not have been possible without this handout. While the hours categorized as seismic in the 2005 EAC added up to exactly 900,000, the detailed backup totaled nearly 950,000 hours.

The IR team also reviewed the BNI Engineering hours for Startup and Commissioning Support. As with the seismic review, it was difficult to track the development of these hours. These two reviews indicate that the backup does not accurately track to the Final EAC, leaving the IR team to wonder if this pattern holds true for other areas. While these differences are not significant, the IR team was not able to fully understand either discrepancy. However, in both cases hours actually used in the 2005 EAC reflected a lower number than the backup developed. This example points out the difficulty in trying to track the development of Engineering labor hours in the EAC for defensibility and traceability.

In table A-1 are three OBS Level 2 elements of the Engineering ETC, along with the total hours at each level. These represent over 2.2 million hours, or nearly 40 percent of To Go Engineering efforts on the WTP Project.

**Table A-1 OBS Level 2 Elements of the Engineering ETC**

Level 2 OBS Element	Hours
EC – Civil/Structural	725,833
EJ – Controls & Instrumentation	692,600
EN – Mechanical Systems	751,437
Total Hours	2,269,870

For each Level 2 OBS element, BNI identified Unit Rates (e.g., Hours/Drawing, Hours/Calculation, etc.) for To Go Engineering efforts. These unit rates were based on an analysis of unit rates for similar work performed on the WTP Project to date. BNI also estimated To Go quantities for each of the identified unit rates, which were typically based on the existing identified inventory of drawings, calculations, and other unit rate bases. Numbers of revisions, which were calculated separately, were based on the best judgment of the Engineering staff. Total engineering hours were estimated using the product of the unit rates and To Go quantities. These hours were supplemented in most Level 2 OBS elements with additional hours that represent the incorporation of trends. Revised and updated hourly labor rates were applied.

Civil/Structural engineering identified an offset of more than 142,000 hours that represents overlap between To Go work on concrete and steel drawings and revisions based on RGM analysis. This represents nearly 1/4 of the total Engineering effort arising from the RGM criteria.

### ODC Cost Development

Review of the main cost elements that produced an increase of over 36 percent in ODC dollars from the 2004 PMB to the 2005 EAC focused on 4 items.

**Relocation Expenses** – The total increase in relocation costs of \$16.7 million is due to the additional permanent positions that are required in order to maintain the proper skill mix during the extended design completion period. However, based on an average relocation expense of \$50,000 this amount would move over 300 engineers.

**Ordinary Business Travel** – The total increase in travel costs of \$3.6 million is for supporting the time extension of the project, which is 32 months in Scenario A. This amounts to a travel budget for BNI engineers of over \$100,000 per month, which appears reasonable.

**Temporary Assignments** – The total increase in temporary assignments to support the RGM seismic effort is estimated by BNI to be \$11.7 million. That amount would provide \$10,000 in per diem to every added Engineering FTE, which is reasonable.

**Data Processing and Other Costs** – These items, which total \$2.6 million for increases in software licenses to support the time extension, appear reasonable.





The entire breakdown included in the EAC for just the Engineering ODC cost To Go was determined to be reasonable.

#### A2.11. PLANT EQUIPMENT

The Plant Equipment cost was developed from the project plant equipment list, which notes each piece of project equipment. The list is then summarized into packages for pricing and scheduling. The cost of plant equipment purchased to date is subtracted from the 2005 EAC cost to obtain the To Go cost, which is marked up by COBRA<sup>®</sup>.

The Plant Equipment, already procured by purchase order, was reviewed for any additional vendor costs and reviewed by the responsible BNI engineers to update the pricing and assure all awarded Plant Equipment was included in the “Awarded” Plant Equipment cost. The Plant Equipment that is not awarded for purchase was reviewed by the facility leads and incorporated the latest available pricing information into the cost.

Following is an analysis of the 2005 EAC Plant Equipment cost:

The 2005 EAC Plant Equipment cost of \$985 million is 31 percent or \$235 million greater than the December 2004 forecast.

The inception-to-date Plant Equipment cost through December 2004 is 26 percent (\$261 million).

The To Go cost for Plant Equipment is 74 percent (\$724 million).

Major cost drivers for the Plant Equipment increases are:

Code 17 Controls and Instrumentation + 8 percent (\$7.5 million).

Code 21 Pumps and drivers +69 percent (\$13 million).

Code 23 Heat exchangers +94 percent (\$7.2 million).

Code 27 HVAC +92 percent (\$20.2 million).

Code 36 Vessels +96 percent (\$69.3 million).

Code 45 Jumpers +49 percent (\$25.1 million).

Code 46 Melters +23 percent (\$14.3 million).

Code 47 Mechanical equipment, bulges +31 percent (\$35.1 million).

Code 48 Mechanical handling Equipment +14 percent (\$16 million).



## **A2.12. BULK MATERIALS**

The review was conducted to identify anomalies, discrepancies, and the traceability from detail documents to BETK and ultimately to the 2005 EAC.

A unit cost was computed using the quantity and cost data provided in the 2005 EAC supporting data. Cost guides and cost engineering judgment was used to evaluate the reasonableness of the computed unit price.

Engineering has produced the bulk material's quantities. They have used the 3-dimensional Triforma model for a large portion of the project quantity take-off supplemented by use of Set route for electrical bulks and INtools for instrumentation quantities. Quantities for un-designed project features were estimated projections based on installed-to-date (ITD) information and estimated using project sketches or lay-out drawings.

The majority of bulk material pricing is based on existing purchase orders adjusted for today's price level.

The only quantity growth allowance included is for LAW bulk electrical and includes:

- 30,000 LF of RGS conduits

- 150,000 LF of scheduled wire and cable

- 8,000 EA of scheduled connections and splices

- Structural steel pricing is for prime coated steel.

- There is no salvage value allowance for form work.

Nothing in the 2005 EAC shows unit pricing for bulk materials. BNI provided separately a Bulk material Summary, Revision 2, showing the material, unit of measure, quantity, and the bulk material cost for the March 2005 EAC. Using this information, the review can compute a unit price. Computed unit prices for the most part appear reasonable as compared with published estimating guides and an engineer's judgment.

## **A2.13. ACQUISITION/PROCUREMENT SERVICES**

### **Labor Discussion**

In order to forecast acquisition services labor in the out-years, BNI indicated the 2004 PMB staffing plan was reviewed to ensure compliance with revised schedule and milestone completion dates. After the To Go job hours and direct dollars were calculated, wages were updated and overhead rates were applied. BNI then combined To Go labor with the costs to date to arrive at the EAC.

Impacts to acquisition services due to the seismic RGM changes included 15 months of delay to the Pretreatment and HLW Facilities. Schedule impacts were greatest to



procurement of vessels, custom equipment, melters, liners, and mechanical handling equipment. The overall acquisition services increase in labor hours, from the December 2004 Trended PMB to the 2005 EAC, was 891,000 hours. This amounts to an increase in labor hours from the Trended PMB to the 2005 EAC of 69.3 percent in Scenario A. The resource demand curve provided in Scenario A indicates the total number of To Go FTEs for the period 2005 through 2013 was 262 in the Trended PMB. The total amount in the 2005 EAC for the same period was 737 FTEs. This represents an increase of 475 FTEs over the remaining life of the contract.

### **ODC Discussion**

In order to forecast acquisition services ODC expenditures, the estimated costs for the period January 2005 to March 2006 were replicated for the projected 15-month schedule extension. An adjustment was also made to the freight calculation. Instead of using 6 percent of the total cumulative plant equipment cost as an estimate, a more accurate method to match current freight costs was developed. The overall adjustment to ODCs for subcontracts, freight, supplies, communications, and employee related expenses were included. The total ODC increase over the 2004 PMB was 58.4 percent in Scenario A.

### **Key Assumptions**

The key basis and assumptions used by acquisition services in cost and schedule development were as follows:

The ODC forecast was based on a 15-month time extension.

Staffing plans that supported the December 2004 PMB were the starting point for the 2005 EAC.

Trends were developed to capture To Go budget requirements.

The 2005 EAC includes revised wage rates.

Detailed staffing plans did not include the required 6 months of schedule contingency.

### **Cost Analysis**

The initial review of the increase in the acquisition services costs from the 2004 PMB to the 2005 EAC focused on the overall increase of \$99.4 million. The draft 2005 EAC indicated a time-related impact of 34 months to labor and ODCs contributed to this total cost increase. Also included were project-approved changes and pending customer approved trends. Two trends accounted for some cost impacts, they are: Acquisition Services Extension - \$6.7 million and Supplier Performance Phase II- \$12.9 million. The cost development for acquisition services indicates a 34-month schedule extension was the basis for cost estimates.



While the actual amount of the estimated cost increase remained at \$99.4 million, some time-related impacts were based on a 15-month extension. Cost development for labor is still based on a 34-month extension, but the ODC assumptions indicate a 15-month extension. Further complicating this issue is the fact that the actual time-related extension, based on the Scenario A schedule, appears to be 32 months.

Assuming a 34-month schedule delay is correct. The estimated 2005 EAC for acquisition services costs uses a staffing plan to identify individual positions and includes the start and end date for each position. OBS Level 2 identifiers segregate these positions and for existing positions both original and revised start and end dates were estimated. For most of the existing positions, the original start date is March 17, 2003. Presumably, this is the date of the 2003 forecast. The revised start date for these positions is December 20, 2004. While the IR team has not done a detailed analysis, the logic behind the revised end dates is not apparent and bears investigation. The durations of the positions has changed as summarized below in table A-2.

**Table A-2 Schedule Duration**

	<b>No. of Positions</b>	<b>Avg. Original Duration</b>	<b>Avg. Revised Duration</b>	<b>Delta</b>
Unchanged	19	3.0 yrs	3.0 yrs	-
Truncated	55	3.2 yrs	2.4 yrs	0.8 yrs
Extended	78	2.4 yrs	3.4 yrs	1.0 yrs
New	83	-	3.2 yrs	3.2 yrs

Given that the construction and commissioning schedule has been extended by 34 months (in Scenario A; longer in Scenario B) and the plant size has remained the same, the IR team would have expected the duration of some existing positions would be increased (by up to 34 months) and some existing positions would be reduced or eliminated as the overall acquisition services workload takes place over a longer duration. This does not seem to be the case – only one position (out of approximately 150 existing positions) is eliminated.

Moreover, the dates from which the durations are calculated already include a *de facto* extension of 21 months (March 2003 to December 2004) for most of the continuing positions. An analysis similar to table A-2 can be generated if desired.

Finally, the number of new positions appears to represent a significantly larger effort than the Supplier Performance Phase II effort. The draft 2005 EAC indicates that Supplier Performance Phase II effort represents an additional 116,000 hours, but the new acquisition services positions reflect approximately 475,000 hours. The basis for this difference is not explained in the EAC.



## Quantity and Performance Review

In order to justify the estimated hours for acquisition services to complete To Go work, the following additional data was provided to the IR team.

### Significant Work Elements To Go as of February 2005

Bid/Evaluate/Award of 66 Material Requisitions

Award of 132 Purchase Orders

Award of 35 Major Subcontracts

125 Material Requisitions impacted by RGM issues (3,000 tagged and 1,000 awarded items)

### Significant Quantities To Go as of February 2005

Structural Steel      20,500 Tons or 72 percent remaining

Fabricated Pipe      663,000 LF or 77 percent remaining

Pipe Hangars          13,000 each or 87 percent remaining

Major Equipment      16,592 each or 91 percent remaining

However, based on the chart of on-time deliveries, which compares actual delivery dates to required on site (ROS) dates, the following items were noted:

Plant Equipment on-time delivery began to lag behind ROS to a significant degree beginning in mid-2004. That trend has held through March 2005, which indicates only 56.6 percent on-time deliveries that month. For the last 6 months, the average on-time delivery is achieved slightly over 48 percent of the time.

Bulk Materials on-time delivery has, for the most part, consistently lagged behind ROS. For the month of March 2005, only 42 percent on-time deliveries occurred. For the last 6 months, the average on-time delivery was achieved slightly over 45 percent of the time.

Out of the 1,629 major pieces of plant equipment delivered to the site to date, 504 were at least 1 day late. However, 187 pieces were over 90 days late.



### Issues Going Forward

The issues that acquisition services consider significant for present and potential future problems are as follows:

Small Business goals may be increased due to DOE changing the method of calculating the base.

Additional efforts to provide more qualified inspectors will be required.

Challenges to meet NQA-1 standards present issues with procuring engineered equipment.

Keeping suppliers to on-time deliveries and subcontractors on schedule.

Forecasting with any certainty the escalating prices for some commodities.

Pricing increases in 2004 for some items were significant:

Stainless Steel	Up 26% to 52%
Structural Steel	Up 23%
Rebar	Up 27%
Copper	Up 14%

#### A2.14. CONSTRUCTION

The concrete and steel direct craft labor unit rates (CUR) used for the 2005 EAC installations were developed for each product by using the CUR from the ITD unit rates and adjusting it to a completed project CUR using BNI experience factors. The difference between the total hours at completion (adjusted CUR times the completed EAC project quantity) and the total ITD hours produces the total hours to complete (To Go) the remaining project.

The piping CUR was not developed from ITD rates because of the small amount of above ground piping installed. Construction and senior WTP management have utilized their current knowledge of the project and determined that CUR be used based on the BNI experience from post-Three Mile Island nuclear plant construction. Additional adjustments were added for scaffolding, hydro testing of welds, and PT pipe module rigging.

The plant equipment installations CUR were developed by a construction team headed by the lead mechanical superintendent. Each piece of plant equipment on the engineering equipment list has been reviewed for installation and preventative maintenance during the construction period. See section 3.5.3 for additional discussions on plant equipment.



Subcontract 2005 EAC costs were developed by construction using the awarded subcontract amounts and estimating the additional future cost adjustments.

The craft labor is increased for project site overhead items for craft distributable labor, non-manual labor and other direct costs. Craft distributable labor is used for construction of temporary construction facilities and provides miscellaneous construction services that support all portions of the project. The non-manual labor includes supervisors, quality control, field engineering, safety and other construction oversight activities needed to control the some 1,000 plus craft labors working on the site. Other direct costs include material cost for temporary construction facilities, miscellaneous construction services and construction equipment tools and consumables. All of these costs were re-estimated using ITD costs and/or estimated using sound estimating principles.

The craft hourly labor rate is based on the current Hanford Master Labor agreement, plus labor payroll taxes and insurance and a 10 percent allowance for overtime. Rates have been escalated for future work using DOE specified rates.

CUR is the amount of crew hours per unit of measure to install a product. For example, a CUR of 1.5/CY means the crew is used for 1.5 hours to install 1 CY. This produces a crew production rate of 1/1.5 or 0.67 CY/Crew hour. Therefore, if the CUR is increased the hourly production rate decreases.

Crews may be composed of several different types of craft labor. For example one hour of concrete placing crew may include 0.5 hrs cement masons + 0.3 hrs labors + 0.2 hrs carpenters. The crew compositions were reviewed and revised as appropriate for the 2005 EAC cost estimate.

Changes from December 2004 Trended PMB to 2005 EAC:

Non-manual labor - +62%

Direct hire labor - + 54%

Distributable labor - + 85%

Other direct cost - + 51%

Estimated To Go cost as a percent of the 2005 EAC:

Non-manual labor - +73%

Direct hire labor - + 85%

Distributable labor - + 78%

Other direct cost - + 67%



Changes in craft unit rates (CUR)

Tables A-3 and A-4 represent comparisons to EAC rates to actual rates.

Percentage comparison between budgeted, ITD, To Go, and EAC unit rates.

**Table A-3 Comparison of Craft Unit Rates (CUR)**

Commodities	Percent changes from BNI forecast craft unit rates								
	To Date CUR			To Go CUR			EAC CUR		
	PT	LAW	HLW	PT	LAW	HLW	PT	LAW	HLW
	Delta %			Delta %			Delta %		
Formwork walls	21%	-5%	12%	39%	33%	27%	28%	0%	23%
Rebar-wall composite	4%	60%	-8%	72%	60%	9%	21%	60%	4%
Rebar elevated slab	10%	-9%	-1%	10%	15%	9%	10%	0%	7%
Embeds walls	-10%	10%	0%	60%	20%	60%	20%	20%	40%
Concret walls	13%	-6%	32%	57%	30%	59%	30%	1%	52%
Concrete elevated slabs	120%	-2%	103%	125%	24%	140%	125%	7%	134%
light steel -steel	68%	71%	12%	53%	44%	61%	53%	47%	60%
medum steel -steel	-23%	39%	4%	94%	86%	75%	79%	78%	73%
heavy steel - steel	-43%	-9%	28%	32%	50%	22%	24%	27%	22%
<b>pipe spooled out-call non ITS</b>									
small CS pipe -welded w/hangers							63%	22%	63%
small SS pipe weld w/hangers							63%	24%	63%
large CS pipe 4" dia sch 40							63%	24%	63%
Large SS pipe 4: dia sch 40							63%	24%	63%
<b>pipng spooled-call important to safety, (ITS)</b>									
small CS pipe -welded w/hangers							23%	0%	23%
small SS pipe weld w/hangers							23%	0%	23%
large CS pipe 4" dia sch 40							22%	0%	22%
Large SS pipe 4: dia sch 40							22%	0%	22%
<b>pipng spooled in-call</b>									
small CS pipe -welded w/o hangers							-1%		-1%
small SS pipe weld w/o hangers							-1%		-1%
large CS pipe 4" dia sch 40							-1%		-1%
Large SS pipe 4: dia sch 40							-1%		-1%

**Table A-4 Percentage to Complete of Major Commodities**

	Quantities								
	UOM	EAC Quantities				To-Go % of EAC Quantities			
		PT	LAW	HLW	Total	PT	LAW	HLW	Total
Formwork walls	SF	658,974	223,720	566,592	1,449,286	41%	14%	70%	48%
Rebar-wall composite	TN	11,895	1,254	9,670	22,819	28%	16%	72%	46%
Rebar elevated slab	TN	4,100	727	5,706	10,533	91%	37%	75%	79%
Embeds walls	LB	3,381,646	701,093	2,220,960	6,303,699	40%	2%	71%	47%
Concret walls	CY	44,622	8,512	36,665	89,799	39%	22%	74%	51%
Concrete elevated slabs	CY	20,281	5,192	23,168	48,641	96%	36%	83%	83%
light steel -steel	TN	782	190	346	1,318	99%	88%	98%	97%
medium steel -steel	TN	705	537	1,054	2,296	87%	83%	96%	90%
heavy steel - steel	TN	5,846	3,244	4,371	13,461	89%	61%	96%	85%

**A2.15. SAFETY, TECHNOLOGY, AND OPERATIONS COST REVIEW**

The 2005 EAC for Safety, Technology and Operations is summarized and compared to the December PMB in table A-5. Table A-6 illustrates the makeup of the EAC in terms





of actual costs to date and estimate of remaining To Go work, and indicates the percent of the total EAC that has been reported as costed to date.

**Table A-5 Safety, Technology and Operations 2005 EAC (\$000)**

Organization	PMB	EAC	Change %
Environmental & Nuclear Safety	152,218	174,438	15%
Research & Technology	256,141	267,859	5%
Startup and Commissioning	638,609	683,465	7%
<b>Total Safety, Technology and Operations</b>	<b>1,046,968</b>	<b>1,125,762</b>	<b>8%</b>

**Table A-6 Safety, Technology, and Operations 2005 EAC Components (\$000)**

Organization	To Date	To Go	% Costed
Environmental & Nuclear Safety	58,977	115,472	34%
Research & Technology	212,846	55,014	79%
Startup and Commissioning	37,649	645,816	6%
<b>Total Safety, Technology and Operations</b>	<b>309,472</b>	<b>816,302</b>	<b>27%</b>

The review is based on a study of the 2005 EAC documents supplemented by Q&A during a presentation meeting with some of the Start-up and Commissioning staff. The IR team summarized costs and reviewed and evaluated areas that changed and the bases for those changes. Specific attention was directed toward the estimated labor rate increases, and EAC labor rates were compared by looking at both to date and To Go labor rates to determine reasonableness. The IR team reviewed detailed backup estimates and associated data provided by BNI staff.

BNI developed a To Go estimate of labor hours for each area of Safety, Technology and Operations and applied updated labor rates and indirect cost adders. Other cost elements were either re-estimated or adjusted to reflect schedule changes and other influences. The level of detail provided to support the EAC varied for the three sub-elements addressed by this overall functional area.

**A2.16. MANAGEMENT AND SUPPORT SERVICES COST REVIEW**

The 2005 EAC for Management and Support Services is summarized and compared to the December PMB in table A-7. Table A-8, shows the makeup of the EAC in terms of actual costs to date and estimate of remaining work (To Go), and it indicates the percent of the total EAC that has been reported as costed to date.

**Table A-7 Management and Support Services 2005 EAC (\$000)**

Organization	PMB	EAC	Change %
Controller	9,698	14,692	51%
Project Controls	65,026	106,706	64%
Communications	8,027	11,006	37%
Project and Business Management	60,308	90,561	50%
Human Resources	67,824	79,491	17%
Project Document Control/Administration	72,683	99,219	37%
Support Services	116,309	156,110	34%
Information Systems & Technology	86,460	139,756	62%
Quality Assurance	69,993	103,561	48%
Contracts	9,361	12,206	30%
<b>Total Management and Support Services</b>	<b>565,689</b>	<b>813,308</b>	<b>44%</b>

**Table A-8 Management and Support Services 2005 EAC Components (\$000)**

Organization	To Date	To Go	% Costed
Controller	4,464	10,228	30%
Project Controls	44,047	62,659	41%
Communications	2,788	8,218	25%
Project and Business Management	32,597	57,963	36%
Human Resources	59,989	19,502	75%
Project Document Control/Administration	34,316	64,904	35%
Support Services	54,481	101,629	35%
Information Systems & Technology	49,283	90,473	35%
Quality Assurance	22,685	80,876	22%
Contracts	4,968	7,238	41%
<b>Total Management and Support Services</b>	<b>309,618</b>	<b>503,690</b>	<b>38%</b>

The IR team review was accomplished solely through review of the 2005 EAC document. Costs were summarized, and the IR team reviewed and evaluated areas that changed and the bases for those changes. Specific attention was directed toward the estimated labor rate increases and EAC labor rates were compared by looking at both to date and To Go labor rates to determine reasonableness. The IR team reviewed detailed backup estimates and associated data provided by BNI staff. No specific meetings were held to pursue follow-up questions since all issues appeared to be evident in the documentation.



For each of Management and Support Services elements, BNI developed a To Go estimate of labor hours and applied updated labor rates and indirect cost adders. However, the To Go hours and ODC estimates were not based on a bottom-up re-evaluation of needed project staffing and ODC. BNI extrapolated data from current staffing levels and PMB estimates and made adjustments mainly to reflect the extended project schedule. A few identified and potential trends were incorporated, but virtually all of the proposed cost increase has been attributed to the schedule extension.

**A2.17. PROJECT AND CORPORATE INDIRECT MARKUPS COST REVIEW**

Table A-9 is a summary of the indirect costs and how they were applied in the 2005 EAC pricing summary sheets.

**Table A-9 Applying Indirects**

Indirect Cost	Craft Manual Labor	Non-Manual Labor	Material & Equipment	Subcontracts	Other direct Cost -ODC
ESCALATION	X	X	X	X	X
SALES TAX			X		
LABOR ADDS		X			
BNI CORP OVHD		X			
WGI G&A					X**
BNI CORP G&A	X	X			X
B&O TAX WGI					X**
B&O TAX	X	X	X	X	X

\*\*WGI G&A and B&O Tax WGI are only applied to the following OBS accounts

- E Engineering
- B Acquisition Services
- H Environmental & Nuclear Safety
- I Research & Technology
- U Commissioning
- C Project Controls
- D Communications

**A2.18. FIELD OFFICE NON-MANUAL LABOR INDIRECT COST REVIEW**

BNI has prepared a detailed staffing plan for each field non-manual position, for each calendar year quarter, from 2005 through 2013. The total non-manual FTE varies from a maximum of 775 positions in second quarter of 2006 to a minimum of 1 position in third quarter of 2013. The non-manual positions are divided into ten OBS categories.

Table A-10 is an example of the non-manual labor distribution for second quarter of 2006.