



U.S. Department of Energy

~~OFFICE OF RIVER PROTECTION~~

P.O. Box 450, MSIN H6-60  
Richland, Washington 99352

07-WTP-209

AUG 27 2007

Mr. C. M. Albert, Project Manager  
Bechtel National, Inc.  
2435 Stevens Center Place  
Richland, Washington 99354

Dear Mr. Albert:

CONTRACT NO. DE-AC27-01RV14136 – TRANSMITTAL OF THE U.S. DEPARTMENT OF ENERGY, OFFICE OF RIVER PROTECTION (ORP) DESIGN ASSESSMENT REPORT NUMBER D-07-DESIGN-039: REVIEW BECHTEL NATIONAL, INC. (BNI) GLASS FORMER FACILITY (GFF) SUPPORTING THE PROPOSED LOW-ACTIVITY WASTE (LAW) AND HIGH-LEVEL WASTE (HLW) DESIGN CAPACITIES

ORP conducted an assessment of BNI's GFF design to evaluate whether the GFF and Glass Former Reagent transfer system can support the proposed Waste Treatment and Immobilization Plant (WTP) operating scenarios. The results of this assessment are identified in Section 4.0, "Results," of the GFF Report (Attachment 1). The GFF plan by which the assessment was performed is also attached (Attachment 2). ORP did not identify any Findings or Observations. However, ORP identified two recommendations for follow up actions by ORP, which are described throughout Section 4.0 and Section 6.0, "Recommendations, Assessment Follow-up Items, Observations, or Findings," of the GFF Report. Additional action, by BNI, as a result of this assessment is not required.

If you have any questions, please contact me, or your staff may contact Robert W. Griffith, Acting Director, WTP Project Engineering Division, (509) 372-2821.

Sincerely,

John R. Eschenberg, Project Manager  
Waste Treatment and Immobilization Plant Project

WTP:MAR

Attachments: (2)

cc w/attachs:  
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BNI Correspondence

**Attachment 1  
to  
07-WTP-209**

**Review  
Bechtel National, Inc.  
Glass Former Facility (GFF)  
Supporting Increased  
Low-Activity Waste (LAW) and High-Level Waste (HLW) Design Capacities**

**July 2007**

**Design Assessment Report: D-07-Design-039**

U.S. Department of Energy, Office of River Protection

**DESIGN OVERSIGHT REPORT**

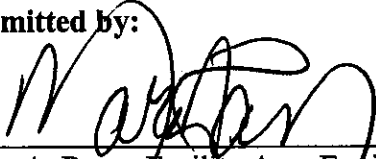
**REVIEW  
BECHTEL NATIONAL, INC.  
GLASS FORMER FACILITY (GFF)  
SUPPORTING INCREASED  
LOW-ACTIVITY WASTE (LAW) AND HIGH-LEVEL WASTE  
(HLW) DESIGN CAPACITIES**

**JULY 2007**


**Design Assessment: D-07-DESIGN-039**

Submitted by:

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## EXECUTIVE SUMMARY

The GFF is comprised of glass former handling equipment used to receive, store, blend, and transfer the Glass Former Chemicals (GFC) to the LAW and HLW Vitrification Facilities. Large quantities of GFCs are required to convert LAW and HLW into a stable glass form. The Glass Formers Reagent (GFR) System will transfer GFC batches with a consistent and reliable composition to the vitrification facilities. The GFR is part of the GFF, which includes: 1) the glass former handling equipment in Balance of Facilities; 2) the glass former melter feed mixers located in the LAW and HLW Facilities; and 3) the inert fill supply hoppers located in the LAW Facility. The current WTP Contract<sup>1</sup> (DE-AC27-01RL14136) requires the GFF and related systems to be capable of supporting two LAW melters at 30 MTG/day and two HLW melters at 6 MTG/day. The purpose of this assessment was to evaluate the design capacity and on-line availability of the GFF and determine if the GFR can support the U.S. Department of Energy (DOE), Office of River Protection (ORP) proposed increased throughput requirements at the following operating scenarios:

1. Proposed LAW Vitrification Facility design capacities of 45 MTG/day.
2. Proposed HLW Vitrification Facility design capacities of 7.5 MTG/day.

The Design Oversight Team analyzed whether the GFF and GFR transfer system can support the proposed operating scenarios by evaluating the following: 1) Bechtel National, Inc. (BNI) GFF and GFR operation and design documentation as well as design calculations; 2) ORP's 2003 design oversight, D-03-DESIGN-002, *WTP LAW Facility Melter Support Systems*; and 3) the GFF model, which utilized WITNESS 2004 (Release 1.0) software. The WITNESS software was specified so that the GFF model when complete can be linked with the WTP process model.

The Team determined that the number of batches and time between batches necessary to support the proposed increased throughput requirements is achievable utilizing the current GFF and GFR transfer system design. The current design can transport enough GFCs to the HLW Facility to achieve 7.5 MTG/day. However, transporting GFCs to meet the LAW Facility throughput capacity of 45 MTG/day will utilize all of the GFF and GFR performance capability. In addition, the previous D-03-DESIGN-002 Assessment Team concluded that the current GFF design would support the proposed increased throughput requirements. However, since silica will be the most used chemical, the D-03-DESIGN-002 Team recommended adding a silica silo and related equipment as optional items within BNI's GFF specification. DOE letter to BNI<sup>2</sup> allowed for space on the GFF foundation for the optional items. Currently BNI's GFF foundation has space for a future silica silo (3500 ft<sup>3</sup>), weight hopper, transporter, air compressor and related equipment. During the life of the WTP, if DOE purchases a silica silo and related equipment this will increase the performance capabilities of the GFF and GFR transfer system.

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<sup>1</sup> DE-AC27-01RV14136, 2000, *Bechtel National, Inc., Design, Construction, and Commissioning of the Hanford Tank Waste Treatment and Immobilization Plant*, U.S. Department of Energy, Office of River Protection, Richland, Washington.

<sup>2</sup> 04-WED-064, "Expandability Option for the Glass Former Storage Facility," October 20, 2004.

The Design Oversight Team identified the following recommendations:

- **D-07-DESIGN-039-R01** recommends that ORP perform an evaluation to analyze the internal wear on the GFF and GFR equipment due to an increase of GFCs transported through the system to meet the proposed increased throughput requirements.
- **D-07-DESIGN-039-R02** recommends that ORP perform an evaluation regarding whether the LAW Facility and systems can support the proposed increased throughput requirements.

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**ACRONYMS**

BNI	Bechtel National, Inc.
BOF	Balance of Facilities
BTT	Batch Turnaround Times
DOE	U.S. Department of Energy
GFC	Glass Former Chemical
GFF	Glass Former Facility
GFR	Glass Formers Reagent System
HLW	High-Level Waste [Facility]
LAW	Low-Activity Waste [Facility]
ORP	Office of River Protection
WTP	Waste Treatment and Immobilization Plant

**UNITS OF MEASURE**

ft <sup>3</sup>	cubic feet
kg	kilogram
lb	pounds
MTG/day	metric tons of glass per day

## 1.0 INTRODUCTION

The U.S. Department of Energy (DOE), Office of River Protection's (ORP) mission is to retrieve and treat Hanford Site tank waste and close the tank farms to protect the Columbia River. In order to complete one major component of this mission, ORP awarded Bechtel National, Inc. (BNI) a contract for the design, construction, and commissioning of the Waste Treatment and Immobilization Plant (WTP) Project at the Hanford Site in Richland, Washington. In order to meet the requirement of the WTP Contract, DE-AC27-01RV14136, to support the continuous vitrification process, BNI is constructing the Balance of Facilities (BOF). BOF consists of various utilities and service facilities such as the Glass Former Facility (GFF). This facility will handle large quantities of dry Glass Forming Chemicals (GFC) that will be transported to the Low-Activity Waste (LAW) and High-Level Waste (HLW) Vitrification Facilities to be combined with LAW and HLW waste concentrates, respectively, to make borosilicate glass.

## 2.0 BACKGROUND

A design/build subcontractor is designing the GFF and Glass Formers Reagent (GFR) System. When complete, the GFF's GFR will pneumatically transfer GFCs to the LAW and HLW Facilities to make borosilicate glass and to support glass throughput requirements. The current WTP Contract is in the process of being modified, and one proposed modification is to the glass throughput capacity requirements. This Team completed this assessment to gain an understanding of whether the current design of the GFF and GFR transport system will support the proposed increased throughput requirements. The Design Assessment Team analyzed the GFF and GFR transport system only and did not evaluate possible impacts to the LAW or HLW Facilities.

## 3.0 OBJECTIVES, SCOPE AND APPROACH

### 3.1 Objectives

The Design Assessment Team's objectives for this assessment were to: 1) understand the current GFF and GFR design capacity and 2) estimate the capability of the GFF and GFR transfer system in support the following proposed operating scenario:

- LAW Vitrification Facility and HLW Vitrification Facility design capacities of 45 MTG/day and 7.5 MTG/day, respectively (proposed WTP Contract requirement)

In addition, the Team only evaluated whether the GFF and GFR could support LAW and HLW at the proposed increased throughput requirements. The Team did not evaluate whether the proposed borosilicate glass increased throughput requirements is achievable within the LAW or HLW Facilities.

### 3.2 Scope

The scope of this assessment was to evaluate the following GFF and GFR documents: 1) BNI's GFF and GFR operational and system design documents as well as design calculations; 2) ORP's 2003 design oversight, D-03-DESIGN-002, *WTP LAW Facility Melter Support Systems*; and 3) the GFF model that utilized WITNESS 2004 (Release 1.0) software.



### 3.3 Approach

To understand the glass former transfer capacity, the Design Assessment Team evaluated information related to glass former equipment sizing and the chemical transfer system referred to as the GFR. The Team first evaluated the previous GFF assessment, D-03-DESIGN-002, and the WTP Contract. In addition, the Team evaluated the following documents:

- 24590-BOF-3PS-G000-T0007, *Engineering Specification for the Glass Former Storage Facility*;
- 24590-BOF-3YD-GFR-00001, *System Description for the WTP Glass Formers Reagent System (GFR)*;
- 24590-CM-POA-MH00-00001-09-00017, *Manual – Model Design Document*; and
- 24590-CM-POA-MH00-00001-12-00003, *Witness Model Verification and Validation Report*.

### 4.0 RESULTS

The GFF and GFR are currently designed to transport up to four batches of GFCs (two HLW and two LAW) during a 16-hour time frame. Evaluating referenced documents and the GFF Simulation Model enabled the Team to estimate whether an adequate amount of GFCs could be transported to the LAW and HLW Facilities in support of the proposed operating scenarios. Below is the Team's evaluation of: 1) the current GFF and GFR design; 2) evaluation of the GFF and GFR ability to support the proposed WTP operating scenarios; and 3) results of the GFF WITNESS 2004 model demonstration.

#### 4.1 Current GFF and GFR Design and Melter Throughput Requirements

The GFF specification states that the GFF and GFR transfer system design will support the current WTP Contract throughput requirements of 30 MTG/day for LAW and 6 MTG/day for HLW. Below are some key GFF and GFR design features that the Team estimates will also support the proposed LAW and HLW increased throughput requirements. Section 4.2 of this report further identifies the Team's conclusions in relation to the GFF and GFR supporting the proposed WTP operating scenarios.

- The GFR has instrumentation and interlocks to indicate and/or prevent conditions that would cause system downtime and subsequent loss of glass production. The GFF engineering specification, 24590-BOF-3PS-G000-T0007, Section 3.2.1.6, states that the GFF system is designed to provide an overall system availability of 90% minimum. The 90% includes an applied factor for downtime (measured as the total sum downtime of each component failure plus total maintenance time). The system 90% availability and downtime has been simulated through GFF model runs. The design features that help prevent downtime as well as the 90% availability gives added assurance that the GFF and GFR will be available to meet current and proposed operating scenarios.

- 24590-BOF-3PS-G000-T0007, Section 3.4.7 and 3.4.8 states that the GFF system is designed to operate 24 hours per day, 7 days per week, 365 days per year, and have a 40-year life with normal maintenance. The transfer piping is designed to operate during the same time but with a 5-year life on components subject to wear. The Team determined that with this percentage of on-line availability the GFF and GFR would be available when additional GFCs are required.
- 24590-BOF-3PS-G000-T0007, Section 3.4.3 states that batches of GFCs shall be made up and delivered in 3 hours or less. Total cycle time includes all processes such as: recipe entry, feeding from storage silos to weigh hopper, time for weight confirmation, transfer from weigh hoppers to blending silo, time for blending, and transfer from blending silo to LAW or HLW Facility mixers. Up to four batches of GFCs (two LAW and two HLW) may be requested during a 16-hour time span, requiring the GFF to operate continuously to support Operations. The GFF is capable of blending and transporting batches of GFCs in the following range of sizes:
  - a. 24590-BOF-3PS-G000-T0007, Section 3.4.5: Two LAW (330 ft<sup>3</sup> to 470 ft<sup>3</sup>)
  - b. 24590-BOF-3PS-G000-T0007, Section 3.4.5: Two HLW (170 ft<sup>3</sup> to 320 ft<sup>3</sup>) except for minor changes to account for trimming needs
- 24590-BOF-3PS-G000-T0007, Section 3.4.2 states that an inert fill (silica) batches of 43 ft<sup>3</sup> shall be transferred every 24 hours (one for each of the two inert fill day hopper). The Team did not evaluate the inert fill since the height requirement within the canister has been relaxed. The inert fill requirement is listed in the WTP Contract, Specification 2, Section 2.2.2.5, "Void Space."
- 24590-BOF-3PS-G000-T0007, Section 3.4.10.1 states that all silo sizing is based on a glass production rate for LAW at 30 MTG/day and HLW at 6 MTG/day. In addition, a 25% allowance is included and rounded up to the nearest 100 ft<sup>3</sup>.
- 24590-BOF-3PS-G000-T0007, Section 3.2.8.3 states that GFF compressed air will be supplied by three compressors. The compressor design is such that two air compressors will meet the demand of the highest demand scenario. In addition, the three air compressors will be equally operated.

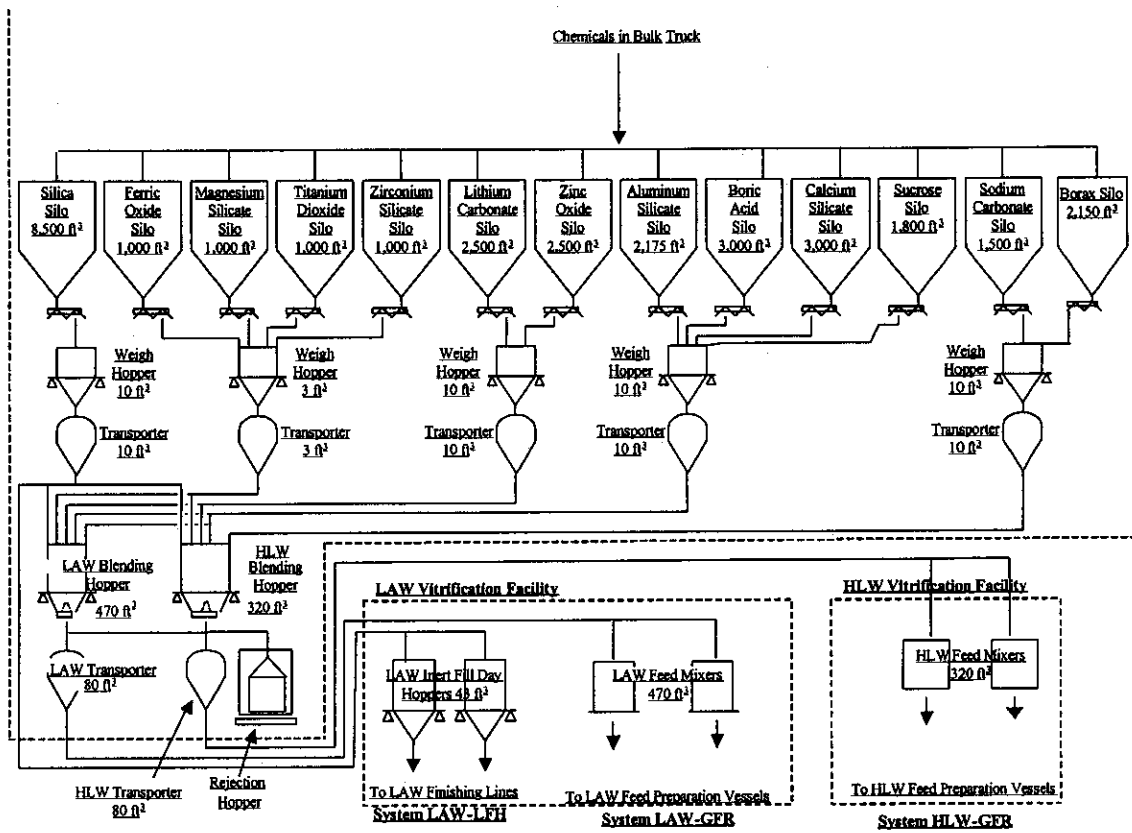
#### 4.2 GFF and GFR Capability of Supporting Proposed Operating Scenarios

The Design Oversight Team evaluated the current GFF and GFR design to determine if the design can support the proposed operating scenarios for LAW at 45 MTG/day and HLW at 7.5 MTG/day. The following documentation supports the Team's analysis that the GFF and GFR can support the proposed operating scenarios.

- The GFF system description, 24590-BOF-3YD-GFR-00001, Section 4.1.2, "Expansion of Capacity," states, "The Contractor shall design the WTP to ensure that the plant is designed and built with features to provide increased waste treatment capacities, or which

allow for expansion to support increased treatment capabilities. [Section C.7(c), DOE/BNI Contract].”

- a. ORP letter 04-WED-064 clarifies the WTP Contract requirements and ensures that an option is available to add additional GFF equipment if required during WTP operations. Currently, the GFF foundation has space available to add an extra silica silo, weight hopper, transporter, air compressor and associated utilities if required.
  - b. 24590-BOF-3PS-G000-T0007, Section 3.2.3.14 allows for the addition of a secondary silica storage silo (sized at 3,500 ft<sup>3</sup>), air compressor and miscellaneous equipment in order to meet increased throughput requirements.
- 24590-BOF-3PS-G000-T0007, Section 3.2.8.3 states that two of the three air compressors can meet the demand for the highest demand scenario within the current contract. The Team determined that the three air compressors would meet the demands of the proposed operating scenarios. Adding a fourth air compressor would increase the compressed air availability.
    - a. BNI included a fourth equipment pad on the GFF foundation for an additional air compressor if needed to support demand requirements.
  - Below is the number of batches and batch range sizes required to support the proposed operating scenarios within the LAW and HLW Facilities (both are within the current GFF and GFR design capabilities):
    - a. Two LAW (330 ft<sup>3</sup> to 470 ft<sup>3</sup>) batches needed every 12-hour period to support 45 MTG/day.
    - b. One HLW (170 ft<sup>3</sup> to 320 ft<sup>3</sup>) batch, prior to trimming, needed every 22-hour time frame to support 7.5 MTG/day.
  - 24590-BOF-3PS-G000-T0007, Section 3.4.9 states the GFF receiving station is designed to unload a minimum of 22 bulk truck deliveries per week. To meet increased capacity production rates, some of these GFC deliveries may increase. The GFF and GFR are designed to allow for an increase in GFC truck deliveries if required.
  - Below is a GFF and GFR flow diagram depicting silo volumes and GFC constituents. This diagram is also listed in the BNI document 24590-BOF-3YD-GFR-00001, *System Description for the WTP Glass Formers Reagent System (GFR)*.



- Shown below is batch calculations showing the daily silica amount used in the LAW and HLW Facilities at the throughput rate of 45 MTG/day and 7.5 MTG/day, respectively. The largest amount of GFC used in LAW and HLW batches is silica from recipe LAW A44 and HLW 98-80:

- The largest GFC amount used in the LAW Facility is silica. The LAW glass formulation that uses the most silica is LAW/A44, which equals 376.5 kg/MTG. The following calculation depicts the silica pounds used per day at the LAW production rate of 45 MTG/day.

$$\text{LAW Silica Daily Usage (x) Melter Throughput (x) Conversion Factor} = \text{Usage per day}$$

$$376.5 \text{ kg/MTG (x) } 45 \text{ MTG/day (x) } 2.205 \text{ lb/kg} = 37,358 \text{ lb/day}$$

- The largest GFC amount used in the HLW Facility is silica. The HLW glass formulation that uses the most silica is HLW 98-80, which equals 477.3 kg/MTG. The following calculation depicts the silica pounds used per day at the HLW production rate of 7.5 MTG/day.

$$\text{HLW Silica Daily HLW Usage (x) Melter Throughput (x) Conversion Factor} = \text{Usage per Day}$$

$$477.3 \text{ kg/MTG (x) } 7.5 \text{ MTG/day (x) } 2.205 \text{ lb/kg} = 7,893 \text{ lb/day}$$

- c. The total of a and b above equal the LAW and HLW Silica estimated quantity of **45,251 lb/day** required to meet the increased treatment capabilities.

Total daily usage of silica for LAW and HLW in ft<sup>3</sup>/day equals lb/day (x)

$$\text{ft}^3/49.6 \text{ lb} = \text{ft}^3/\text{day}$$

$$45,251 \text{ lb/day (x) ft}^3/49.6 \text{ lb} = 912 \text{ ft}^3/\text{day}$$

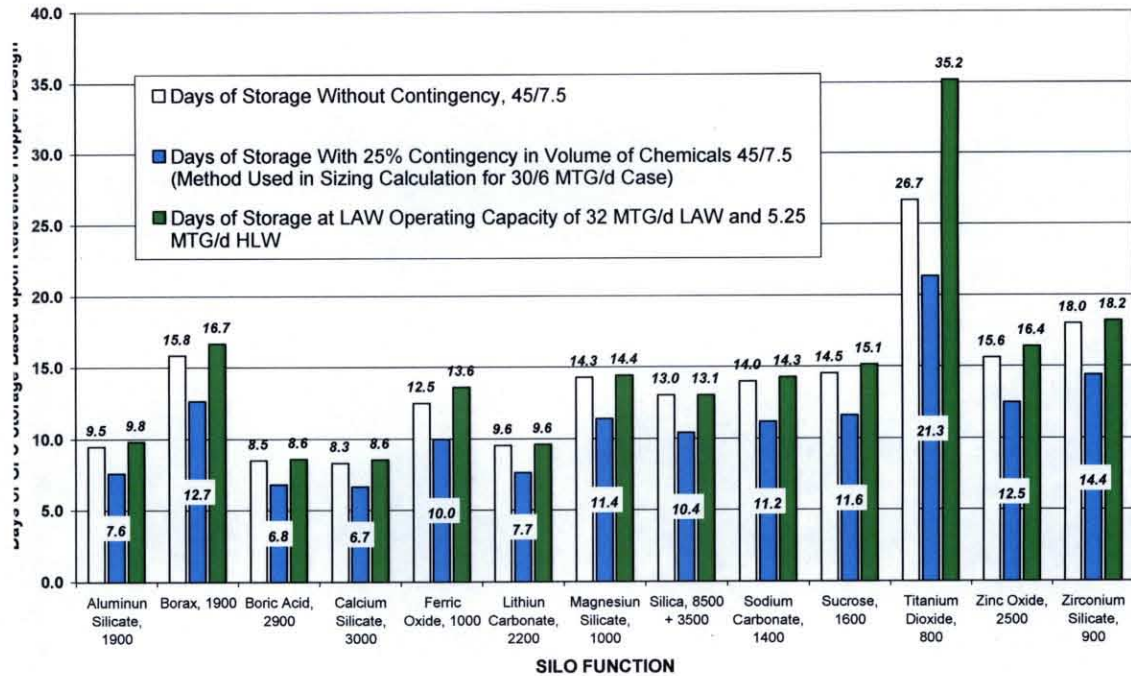
Calculating a 10-day supply equals  $\text{ft}^3/\text{day (x) 10 days} = \text{ft}^3$

$$912 \text{ ft}^3/\text{day (x) 10 days} = 9,123 \text{ ft}^3$$

Adding 25% contingency equals:  $\text{ft}^3 \text{ (x) } 1.25 = \text{ft}^3 + 25\% \text{ contingency } 9,123 \text{ ft}^3 \text{ (x) } 1.25 = 11,404 \text{ ft}^3 = 10\text{-day supply of silica which includes a 25\% contingency.}$

**NOTE:** The current silica silo's 10-day supply is 8,500 ft<sup>3</sup> for the current throughput capacities. Since the proposed throughput capacities exceed the current 10-day silica usage, DOE has the following options: (1) add the optional 3,500ft<sup>3</sup> silica silo that the current GFC design allows, at some time during the life of the WTP, or (2) accept the silica silo will need to be refilled within less than 10 days. The Team determined that an increase in GFC truck deliveries would be an acceptable alternative.

- d. Each GFC calculation in the graph below uses the sequence shown in Section 4.2. The graph below depicts the usage of each GFC for the LAW and HLW Facilities for the following scenarios:
1. Days of GFC storage without contingency for proposed increased throughput capacities (white);
  2. Days of GFC storage with 25% contingency for proposed increased throughput capacities (blue); and
  3. Days of GFC storage for the proposed increased LAW and HLW throughput capacities at 70% operating capacity (green).



- Although silica is the most used chemical in both LAW and HLW, GFCs such as boric acid and calcium silicate have less storage capacity due to silo size, as shown in the graph above. By increasing the throughput capacities for LAW and HLW, the amount of storage days per GFC silo decreases. However, this can be mitigated by increasing scheduled GFC deliveries. Currently all GFC silos have been sized for a 10-day supply or a 5-day supply plus truckload, whichever is greater (a truckload equals 48,000 lb). The current silo storage sizes are based on a LAW production rate of 30 MTG/day and HLW production rate of 6 MTG/day.

#### 4.3 GFF Model Simulation Demonstration

The GFF Simulation Model was completed utilizing Lanner Group's WITNESS 2004 (Release 1.0) software. BNI demonstrated the GFF model to the Design Oversight Team, including the following simulations in relation to the current throughput capacities of LAW 30 MTG/day and HLW 6 MTG/day.

- System availability was measured as a total time available and as a percent of scheduled time, with scheduled operating time being 24 hours per day, 7 days per week, 365 days per year.
- Downtime was measured as the total sum downtime of each component failure plus total maintenance time.
- System availability and downtime were simulated in the GFF model. The model simulated overall system availability in excess of 90%.
- GFC Batch Cycle Time includes all processes such as recipe entry, storage silos transfers, hoppers transports, weight confirmations, and batch transfers.

- **Batch Turnaround Times (BTT)** – 24590-BOF-3PS-G000-T0007, Section 3.4.3 states that the GFCs will be batched and delivered within 3 hours or less with up to four batches being requested during a 16-hour time span. Below is a chart listing the average BTTs per recipe.

RECIPE	AVERAGE TURNAROUND TIME (hours)
LAW A44	2.40
LAW A88	2.37
LAW A102	2.49
LAW B83	2.62
LAW B96	2.62
LAW C22	2.39
LAW C31	2.60
HLW 98-77	2.59
HLW 98-80	2.61
HLW 98-96	2.49
Inert Fill (if needed)	0.72
Trimming (if needed)	0.08

- BNI did not show the Team a model simulating the proposed throughput capacities of LAW at 45 MTG/day and HLW at 7.5 MTG/day. However, BNI did simulate: 1) batch cycle times for a number of the GFF recipes; 2) GFF on-line availability and reliability (including downtime for routine maintenance and failures); 3) GFC deliveries; and 4) GFC blending, including transfer to the vitrification facilities.
- After viewing the model, the Team determined that the GFF and GFR could easily support the current contract throughput requirements. Currently the delivery time required for one batch is every 3 hours or less, and the system is capable of supplying up to four batches (two LAW and two HLW) within a 16-hour period. After reviewing design documents, calculations and GFF model, the Team determined that the current GFF and GFR design could support the proposed increased throughput requirements. The proposed increased throughput would require two LAW batches every 12 hours and one HLW batch every 22 hours.

## 5.0 CONCLUSION

The Design Assessment Team concluded that the GFF and GFR could adequately transport the amount of GFCs required to support the proposed LAW throughput of 45 MTG/day and HLW throughput of 7.5 MTG/day. There are no WTP sample and analysis processes required for the GFCs once they arrive on site. The operating procedure relies on the GFC delivery company to provide a GFC analysis report. The average time between GFC batches for LAW and HLW, shown in Section 4.3, is well within the proposed increased throughput batch requirements. BNI has designed the silos with a 25% contingency capacity (at current throughput capacities) and the blend silos have a 40% excess capacity for working/blending.

Most of the waste GFC batches will be from recipe LAW A44. Taking this into account, and reviewing the LAW batch requirements versus silo storage capacities, the most limiting GFCs are boric acid and calcium silicate. The bar graph shown in Section 4.2 of this report also reflects these two GFCs as being the most limiting. Both of these GFCs show about a 7-day supply at the increased throughput capacities. However, the LAW Facility is the only facility that uses these two GFCs and chemical deliveries can be increased if required. One design element related to additional GFCs transferred through the system the Team did not evaluate, is the internal wear on the equipment due to an increase of GFCs transported through the equipment. The Team recommends completing an evaluation of the internal wear on the GFF equipment due to an increase in the number of chemical transfers. **D-07-DESIGN-039-R01** identifies this recommendation.

The Design Assessment Team only analyzed whether the GFF and GFR could transfer the GFCs required to meet the proposed increased throughput requirements. The Team did not analyze whether the LAW and HLW Facilities could meet the increased throughput requirements. BNI and ORP previously analyzed the HLW Facility's design capability of meeting the proposed increased throughput requirements. The Team briefly reviewed BNI document 24590-HLW-RPT-PE-07-001, *High Level Waste Vitrification Plant Capacity Enhancement*. This BNI document illustrates that the HLW Facility's design capacity can meet the throughput requirement of 7.5 MTG/day. The bullets below are conclusions listed within this BNI document:

- "HLW should be capable of supporting an increased throughput up to 7.5 MTG/day with minor design changes."
- "However, much of the operational and design margins in all HLW systems are utilized."

The Team concluded that both BNI and ORP have demonstrated through analysis that HLW's design can meet the proposed increased throughput requirements. However, there has not been an analysis completed evaluating whether the current LAW Facility design could support the proposed throughput requirement. The Team recommends that ORP evaluate whether the current LAW design can support the proposed increased throughput capacity of 45 MTG/day. **D-07-DESIGN-039-R02** identifies this recommendation. A few suggested design elements to evaluate as part of this recommendation are:

- Evaluate any increases related to heat removal within the container pour caves/tunnels and/or lag storage area resulting from increasing the LAW Facility throughput requirements.
- Evaluate melter changes and electrical requirements within the LAW Facility.
- Permitting changes.



## 6.0 RECOMMENDATIONS, ASSESSMENT FOLLOW-UP ITEMS, OBSERVATIONS, OR FINDINGS

The Design Assessment Team did not identify any findings, follow-up items, or observations during this assessment. However, the Team identified the following recommendations.

- **D-07-DESIGN-039-R01** recommends that ORP perform an evaluation to analyze the internal wear on the GFF and GFR equipment due to an increase of GFCs transported through the system to meet the proposed increased throughput requirements.
- **D-07-DESIGN-039-R02** recommends that ORP perform an evaluation regarding whether the LAW Facility and systems can support the proposed increased throughput requirements.

## 7.0 REFERENCES

- 04-WED-064, *Expandability Option for the Glass Former Storage Facility*, October 20, 2004
- 24590-BOF-3PS-G000-T0007, *Engineering Specification for the Glass Former Storage Facility*, Rev. 4, August 7, 2006
- 24590-BOF-3YD-GFR-00001, *System Description for the WTP Glass Formers Reagent System (GFR)*, Rev. 0, March 26, 2003
- 24590-CM-POA-MH00-00001-09-00017, *Manual – Model Design Document*, Rev. 00C, Dynamic Air, April 25, 2007
- 24590-CM-POA-MH00-00001-12-00003, *WITNESS Model Verification and Validation Report*, Rev. 00C, Dynamic Air, April 25, 2007
- 24590-HLW-RPT-PE-07-001, *High Level Waste Vitrification Plant Capacity Enhancement Study*, February 28, 2007
- D-03-DESIGN-002, *WTP LAW Facility Melter Support Systems*, May 2003
- DE-AC27-01RV14136, *Bechtel National, Inc., Design, Construction, and Commissioning of the Hanford Tank Waste Treatment and Immobilization Plant Contract*, as amended
- DOE O 226.1, *Implementation of Department of Energy Oversight Policy*, September 15, 2005

### 7.1 Other Documents Reviewed

- 24590-BOF-FD-G-01-002, *Glass Former Facility (GFF) Facility Description*, Rev. A, January 29, 2002
- 24590-BOF-MTC-GFR-00002, *Glass Former Reagent System Equipment Calculation for the "2+2" Option*, December 08, 2005

- 24590-HLW-M4C-GFR-00002, *LAW Glass Former Reagent Hopper Batch Capacity Calculation*, February 4, 2004
- 24590-WTP-DB-ENG-01-001, *Basis of Design*, September 25, 2006
- 24590-WTP-PSAR-ESH-01-002-03, *Preliminary Safety Analysis Report to Support Construction Authorization; Law Facility Specific Information*, March 31, 2006
- 24590-WTP-PSAR-ESH-01-002-04, *Preliminary Safety Analysis Report to Support Construction Authorization; HLW Facility Specific Information*, March 31, 2006
- 24590-WTP-PSAR-ESH-01-002-05, *Preliminary Safety Analysis Report to Support Construction Authorization; Balance of Facility Specific Information*, March 31, 2006
- 24590-WTP-RPT-OP-01-001, *Operations Requirements Document*, Rev. 2, May 5, 2003
- 24590-WTP-RPT-PO-03-015, *Glass Former Reagent (GFR) Supply System Performance Assessment*, June 5, 2003
- 24590-WTP-SED-ENS-03-002-03, *Safety Envelope Document; LAW Facility Specific Information*, March 13, 2007
- 24590-WTP-SED-ENS-03-002-04, *Safety Envelope Document; HLW Facility Specific Information*, March 2, 2007
- 24590-WTP-SED-ENS-03-002-05, *Safety Envelope Document; Balance of Facility Specific Information*, February 21, 2007
- ORP DI 220.1, *Conduct of Design Oversight*, Rev. 1, January 26, 2006
- ORP M 412.1, *Consolidated Action Reporting System*, August 8, 2001

Attachment 2  
to  
07-WTP-209

Review  
Bechtel National, Inc.  
Glass Former Facility (GFF)  
Supporting Expanded  
Low-Activity Waste (LAW) and High-Level Waste (HLW) Design Capacities

April 2007

Design Assessment Plan: D-07-Design-039

U.S. Department of Energy, Office of River Protection

**U.S. DEPARTMENT OF ENERGY (DOE), OFFICE OF RIVER PROTECTION (ORP)  
DESIGN ASSESSMENT PLAN**

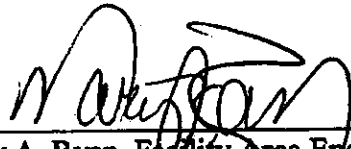
**REVIEW  
BECHTEL NATIONAL, INC.  
GLASS FORMER FACILITY (GFF)  
SUPPORTING EXPANDED  
LOW-ACTIVITY WASTE (LAW) AND HIGH-LEVEL WASTE  
(HLW) DESIGN CAPACITIES**

**APRIL 2007**

**Design Assessment: D-07-DESIGN-039**

**Submitted by:**

**Team Lead:**

  
\_\_\_\_\_  
Mary A. Ryan, Facility Area Engineer  
Waste Treatment and Immobilization Plant Project  
Engineering Division

**WTP Engineering Division Reviewer:**

  
Langdon Holton, Senior Technical Advisor  
WTP Engineering Division

## **1.0 BACKGROUND, PURPOSE, AND OBJECTIVES**

### **1.1 BACKGROUND**

The U.S. Department of Energy (DOE), Office of River Protection's (ORP) mission is to retrieve and treat Hanford Site tank waste and close the tank farms to protect the Columbia River. In order to complete one major component of this mission, ORP awarded Bechtel National, Inc. (BNI) a contract, DE-AC27-01RV14136, for the design, construction, and commissioning of the Waste Treatment and Immobilization Plant (WTP) at the Hanford Site in Richland, Washington. BNI is designing and constructing a Glass Former Facility (GFF) in support of meeting the WTP Contract vitrification requirements. The GFF glass former reagent system (GFR) will pneumatically transfer glass former chemicals (GFC) to the Low-Activity Waste (LAW) and High-Level Waste (HLW) Facilities to make borosilicate glass and to support glass throughput capacity requirements.

### **1.2 PURPOSE**

The purpose of this assessment is to evaluate the design capacity and on-line availability of the GFF to determine if GFR system transfers can support the DOE proposed expanded design capacities for the LAW Vitrification and HLW Vitrification Facilities.

### **1.3 OBJECTIVES**

The objective of this assessment is to evaluate the capability of the GFF to support the following operating scenario:

- LAW Vitrification Facility and HLW Vitrification Facility design capacities of 45 MTG/day and 7.5 MTG/day, respectively (proposed WTP Contract requirement).

## **2.0 SCOPE**

The scope of this assessment will include a review and assessment of: (1) BNI and/or subcontractor design documents related to the GFF system, and (2) GFF, LAW, and HLW vitrification expanded design capacity throughput calculations and documentation.

## **3.0 PREPARATION**

- 1) Identify ORP Design Assessment Team members.
- 2) Notify BNI that ORP will be conducting this GFF Design Assessment, D-07-DESIGN-039.
- 3) Identify documents to review, including the results of previous contractor external or internal assessments.
- 4) Identify contract requirements.
- 5) Prepare and implement schedule of Design Assessment activities.

#### **4.0 EVALUATE AND IDENTIFY, RESOLVE, OR DOCUMENT ISSUES**

The ORP Design Assessment Team will evaluate the GFF in relation to proposed WTP Contract requirements, BNI design documents, and vitrification expanded design capacity documentation.

During ORP's evaluation, lines of inquiry (LOI) will be documented and given to the BNI point of contact (POC) for resolution. BNI's responses to LOI questions will be utilized as reference information during the Design Assessment Team's evaluation of GFF.

#### **5.0 REPORTING**

The Design Assessment Team Lead will periodically brief ORP management and the Contractor POC during the assessment. The Team Lead, with assistance from the team, will prepare a Design Assessment Report that summarizes review activities, results, and conclusions.

#### **6.0 SCHEDULE OF ACTIVITIES**

Table 1 lists the schedule of assessment activities.

#### **7.0 WTP CONTRACT REQUIREMENTS DE-AC27-01RV14136 AND WTP DESIGN DOCUMENTS**

The documents provided by BNI during this design assessment will be reviewed in relation to WTP contract requirements and BNI WTP design documentation, as follows:

- 1) WTP Contract DE-AC27-01RV14136, Section C.7 (c), "Waste Treatment and Immobilization Plant Expandability Requirements"; and Standard 5, "Commissioning."
- 2) Proposed WTP Contract, Section C.7 (c), "Waste Treatment and Immobilization Plant Expandability Requirements."
- 3) *Basis of Design*, 24590-WTP-DB-ENG-01-001, Section 6.2, "Plant Capacity."

#### **8.0 DOCUMENTATION**

The final Design Assessment Report will be formally issued once the draft review comments have been resolved and incorporated. Any concerns, findings and/or assessment follow-up items identified in the report will be assigned a number, and tracked to resolution through Corrective Action Reporting System (CARS) by DOE ORP. These assigned numbers shall also be tracked to resolution by the Contractor through the Correspondence Control Number that will be assigned to the transmittal of the report from ORP to the Contractor.

#### **9.0 CLOSURE**

The Assessment Team Leader, with concurrence of the WTP Engineering Division (WED) Director, shall confirm that any concerns, findings and/or assessment follow-up items resulting from this assessment are adequately resolved.

## 10.0 REFERENCES

- 24590-BOF-3YD-GFR-00001, *System Description for Glass Former Reagent (GFR) System*, March 26, 2003.
- 24590-BOF-FD-G-01-002, *Glass Former Facility (GFF) Facility Description*, Rev. A, January 29, 2002.
- 24590-WTP-DB-ENG-01-001, *Basis of Design*, September 25, 2006.
- 24590-WTP-PSAR-ESH-01-002-03, *Preliminary Safety Analysis Report to Support Construction Authorization; Law Facility Specific Information*, March 31, 2006.
- 24590-WTP-PSAR-ESH-01-002-04, *Preliminary Safety Analysis Report to Support Construction Authorization; HLW Facility Specific Information*, March 31, 2006.
- 24590-WTP-PSAR-ESH-01-002-05, *Preliminary Safety Analysis Report to Support Construction Authorization; Balance of Facility Specific Information*, March 31, 2006.
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- 24590-WTP-SED-ENS-03-002-05, *Safety Envelope Document; Balance of Facility Specific Information*, February 21, 2007.
- DE-AC27-01RV14136, *Bechtel National, Inc., Design, Construction, and Commissioning of the Hanford Tank Waste Treatment and Immobilization Plant Contract*, as amended.
- DOE O 226.1, *Implementation of Department of Energy Oversight Policy*, September 15, 2005.
- ORP DI 220.1, *Conduct of Design Oversight*, Rev. 1, January 26, 2006.
- ORP M 412.1, *Consolidated Action Reporting System*, August 8, 2001.

**ASSESSMENT ACTIVITIES**

**Table 1 – Schedule**

<b>Activity Description</b>	<b>Responsibility</b>	<b>Schedule</b>
Identify and notify team members.	Ryan/Griffith	04/16/07
Develop Design Assessment Plan and approve.	Ryan/Griffith	04/16/07
Obtain documents from Contractor and develop lines of inquiry (LOI).	BNI/Team	04/23/07
Entrance meeting with Contractor to outline objectives, scope, schedule, and establish points of contact.	Team	04/23/07
Review Contractor/Subcontractor GFF design documents, participate in relevant internal meetings and meet with Contractor as required.	Team	05/07/07
Team Lead completes draft Design Assessment Report.	Mary Ryan	05/14/07
Resolve comments and issue final Design Assessment Report including close out with Contractor.	Mary Ryan	05/21/07

**NOTES:**

- (1) Schedule subject to change.
- (2) Team Lead will notify BNI POC of schedule changes as applicable.