# *Drawings and Documents*

## Operating Unit Group 10 – Appendix 10.7
## High Level Waste Building
## Specifications

The documents listed in the following table are incorporated by reference into this permit and are subject to the requirements set forth in Part I Standard Conditions, Part II General Facility Conditions, and Part III Operating Unit Group 10 Conditions. Upon request, copies of the documents can be viewed at the Nuclear Waste Program Resource Center located at 3100 Port of Benton Blvd. Richland, WA. Appointments for viewing can be scheduled by calling (509) 372-7950.

| ***Drawing/Document Number*** | ***Description*** |
|---|---|
| 24590-HLW-3PS-AE00-T0001, Rev 5 | Engineering Specification for HLW Melters |
| 24590-HLW-3PS-MBT0-TP001, Rev 2 | Engineering Specification for Silver Mordenite Column Design and Fabrication |
| 24590-HLW-3PS-MBTV-T0002, Rev 1 | Engineering Specification for Thermal Catalytic Oxidizer/Reducers |
| 24590-HLW-3PS-MEE0-T0001, Rev 1 | Engineering Specification for HEPA Filter Preheaters |
| 24590-HLW-3PS-MQR0-T0002, Rev 4 | Engineering Specification for HLW System HDH Canister Rinse Bogie |
| 24590-QL-HC4-W000-00011-04-00266, Rev 00B | HLW ADS Pump Procurement Specification |
| RESERVED | RESERVED |

Source documents (which do not include a "P" in the last set of numbers, e.g. "-P0001," or "-TP001") should be used in conjunction with any document change notices issued against them.

We are currently transitioning from permit documents (which do include a "P" in the last set of numbers) to source documents. At the end of the transition period, permit submittals will contain source documents and will be incorporated into the permit as described in Ecology Publication # 07-05-006 (www.ecy.wa.gov/biblio/nwp.html).

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R11139183

# RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

ISSUED BY
RPP-WTP PDC

## ENGINEERING SPECIFICATION

FOR

## High Level Waste Melters

**Content applicable to ALARA?** ☒ Yes ☐ No

**ADR No.**
24590--HLW-ADR-M-02-0031 KU 12-16-09

**Rev**
3

**Specification changes retroactive?** ☒ Yes ☐ No
☐ N/A (alpha revision or revision 0)

**Quality Level**
Q

DOE Contract No.
DE-AC27-01RV14136

| REV | DATE | BY | CHECK | REVIEW | E&NS | DPEM/EM |
|---|---|---|---|---|---|---|
| 5 | 12/16/09 | L. Curtis | for K. Clarke | A. Bronner | D. Carlstrom | T. Hughes |
| 4 | 02/23/09 | K. Clarke | L. Donovan | R. D. Peters | D. Carlstrom | T. Hughes |
| 3 | 12/04/04 | R. P. Casassa | M. Hall | R. D. Peters | N/A | J. Schneider |
| 2 | 04/28/03 | K.Clarke | J. Pullen | D. Carl | N/A | W. Eaton |
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**SPECIFICATION No.**
24590-HLW-3PS-AE00-T0001

**Rev**
5

**Revision History**

| Revision | Reason for Revision |
|---|---|
| 0 | Initial Issue - supersedes SP-W375HV-M00002, Rev. D |
| 1 | Reissued with Technical Requirement Changes and Clarifications |
| 2 | Reissued for multiple melters, with general editing, minor changes to reflect current design and design interface details |
| 3 | Reissued to incorporated SCNs 24590-HLW-3PN-AE-0001 & 24590-HLW-3PN-AE-0002 |
| 4 | In accordance with contract modification M083 (04/2007), increased design production capacity of the melters from 3 MT/day to 3.75 MT/day (the number of bubblers increased from 5 to 7, and the design power requirement increased from 600kW to 800 kW). Incorporated 24590-HLW-3PN-AE00-00003, 00004 and 00008. Adjusted melter wieghts and heat loss values in Appendix B. |
| 5 | Incorporated SCN 24590-HLW-3PN-AE00-00011, Revised for editing to align with the Basis of Design. |

# Notice

Please note that source, special nuclear, and by product materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the US Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

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## Appendices

Appendix A Melter Services and Connections Interface Details (4 pages total) ..... A-i
Appendix B Melter Design Interface Details (10 pages total) ..... B-i

# 1 General

## 1.1 Scope

A. This Specification provides performance requirements for the design of High Level Waste (HLW) vitrification melters for the River Protection Project - Waste Treatment Plant (RPP-WTP) at the Hanford, Washington Site of the Department of Energy (DOE). The performance requirements cover all phases of melter life, including assembly, transport, startup, commissioning, operation and maintenance, decommissioning, and disposal.

B. This Specification has been written for Contract No. 24590-101-TSA-W000-0010 and is supported by Ref 2.2D. Controls and instrumentation requirements for melter design have been incorporated into Ref 2.2B.

C. The melters include, but are not limited to, the following major structures, systems, and components (SSCs): glass containment, glass and glass discharge heating, refractory cooling, instrumentation, offgas cooling and collection, waste and glass feed, glass frit addition for startup, glass discharge, and seismic restraint.

D. The subcontractor shall base the design on the information provided in this Specification, the referenced documents herein and the current contract documents.

E. See Ref 2.2D for melter design scope of work.

F. Additional research and technology testing by the subcontractor, to aid in the design, shall be in accordance with the contract documents.

## 1.2 Definitions

A. Base - Structural platform that supports the melter during transport and operation. Base includes structural steel and bracing, and cooling water panel structures. Base also includes plates that provide a portion of the gas barrier. The base has elements that restrain the melter during operation.

B. Contractor - Bechtel National, Inc.

C. Design Life - The baseline time, based on calculation, analysis, experience or testing, over which the SSC will safely maintain its original function.

D. Transportation System - Melter components that aid in the transport and positioning of the melter during transportation, installation, operation, decommissioning and disposal.

E. Lid - Structural cover over the top of the melter plenum space that supports lid plenum refractory and all components mounted through it. Lid also includes plates that provide a portion of the gas barrier.

F. Normal Operation - constitutes all regular and scheduled melter activities geared towards production of glass product at or near design throughput, i.e., feeding, pouring, idling, and scheduled SSC changeout.

G. Walls - Melter and discharge chamber exterior structural steel.

H. Overpack - Portable structural enclosure mounted on rail wheels that will be used for transporting new melters and disposing of failed or spent melters. Overpack will provide restraint, containment, contamination control, and radiation shielding during melter transport and disposal activities.

I. Subcontractor - Duratek, Inc.

J. Vendor - A manufacturer or supplier providing materials and/or services to the subcontractor.

K. Gas Barrier - Structural steel plate consisting of the walls and the internal surfaces of the lid and base. The gas barrier serves to support the offgas-related function of the shell, while providing controlled air in-leakage to the melter plenum.

L. Frit - Glass particulate of a size and geometry suitable for direct feed into the melter.

M. Shell - Structural elements of the melter that ensure confinement of bulk molten glass, should it migrate through the refractory. Also supports the offgas system by providing a confinement boundary to direct offgas into the melter offgas system. The shell is comprised of the base, walls, and lid.

### 1.3 Acronyms

Acronyms used in this Specification include:

| | |
|---|---|
| CCTV | Closed Circuit Television |
| DOE | Department of Energy |
| ICD | Interface Control Document |
| HLW | High Level Waste |
| RPP-WTP | River Protection Project-Waste Treatment Plant |
| SC | Seismic Category |
| SSC | Systems, Structures, and Components |
| wg | Water Gage (pressure measurement) |

# 2 Applicable Documents

### 2.1 Referenced Codes and Industry Standards

Unless otherwise noted, all codes and standards referenced herein, and in the documents referenced in Section 2.2, shall be to the latest editions, addenda, and supplements at the time of award.

A. Deleted

B. Deleted

C. American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

1. IEEE Std 141, *Recommended Practice for Electric Power Distribution for Industrial Plants* (1986)
2. IEEE Std 260.1, *American National Standard Letter Symbols for Units of Measurement* (1993)
3. IEEE Std 315, *Graphic Symbols for Electrical and Electronics Diagrams* (reaffirmed 1993)
4. IEEE Std 399, *Recommended Practice for Industrial and Commercial Power Systems Analysis* (1997)
5. IEEE Std 1202, *Standard for Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies* (1991)

D. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
   1. ASME B31.3, Process Piping (1996)
   2. ASME Section III, Division I, Subsection NC, Rules for Construction of Nuclear Facility Components (2001)
   3. ASME Section VIII, Division I, Rules for Construction of Pressure Vessels (2001)
   4. ASME NQA-1, Quality Assurance Program Requirements for Nuclear Facilities(1989)
   5. ASME NQA-2a, Part 2.7, Quality Assurance Requirements of Computer Software for Nuclear Facility Applications (1990)
   6. ASME Section II, Material Specifications (2001)

E. Code of Federal Regulations (CFR) - 29 CFR 1910, Subpart S, *Occupational Safety and Health Administration, Electrical* (most current revision)

F. National Electrical Manufacturers Association (NEMA):
   1. NEMA WC, *Wire and Cable Standards* (1999)
   2. NEMA/ICEA (Insulated Cable Engineers Association), *Power Cable Ampacities* (1999)

G. National Fire Protection Association (NFPA)
   1. NFPA 70, *National Electrical Code* (1999)
   2. NFPA 497, *Recommended Practice for Classification of Hazardous Locations for Electrical Installations in Chemical Process Areas* (1997)

H. Underwriters Laboratories Inc (UL) - UL 508, *Standard for Safety Electric Industrial Control Equipment* (1999)

I. American Welding Society (AWS)
   1. AWS D1.1, *Structural Welding Code - Steel* (2000)
   2. AWS D1.6, *Structural Welding Code - Stainless Steel* (1999)

J. American National Standards Institute/American Institute of Steel Construction (ANSI/AISC)
   1. AISC N690, Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities (1994)

K. American Institute of Steel Construction (AISC) -AISC M016-89, Manual of Steel Construction - Allowable Stress Design, Ninth Edition (as tailored in Appendix C of Ref. N)

## 2.2 Other Reference Documents/Drawings

A. Deleted

B. Document No. 24590-WTP-3PS-J000-T0001, Rev 1, *Engineering Specification for Melter Systems C&I Work Specification*

C. Deleted

D. Statement of Work for Subcontract No. 24590-CM-SRA-HM00-00001-01-01, *Basis of Estimate For Detailed Design*

E. Deleted

F. Deleted

G. Contractor Correspondence No. 025802, *Contract No. DE-AC27-01RV14136 - Letter Subcontract Number 24590-101-TSA-W000-0010-01, Purchase Requisition for Continuation of LAW and HLW Melter Design Work*

H. Document No. 24590-HLW-S0C-S15T-00009, Rev 0D, *HLW Vitrification Building Seismic Analysis-In-Structure Response Spectra (ISRS)*

I. Document No. 24590-WTP-3PS-SS90-T0001, Rev. 2, *Engineering Specification for Seismic Qualification of Seismic Category I/II Equipment and Tanks*

J. Document No. 24590-WTP-DC-ST-04-001, Rev. 3, *Seismic Analysis and Design Criteria*

K. Drawing No. 24590-HLW-DD-S13T-00071, Rev. 6, *HLW Vitrification Building Structural Melter Seismic Restraint Embed Sections and Details*

L. Calculations No. 24590-HLW-DDC-S13T-00034, Rev. C, *Melter Seismic Restraint Embeds*
M. Document No. 24590-WTP-3PS-FB01-T0001, Rev. 4, *Engineering Specification for Structural Design Loads for Seismic Category III & IV Equipment and Tanks*
N. Document No. 24590-WTP-SRD-ESH-01-001-02, Rev 31, *Safety Requirements Document, Volume II*
O. Document No. 24590-HLW-RPT-PE-07-001, Rev. 0, *High Level Waste Vitrification Plant Capacity Enhancement Study*
P. Document No. 24590-HLW-3PS-AE00-T0002, Rev., 0, *Engineering Specification for Seismic Qualification of High Level Waste Melters* (Used for Revised Ground Motion Seismic Analysis, 01/2008)
Q. Document No. 24590-HLW-Z0C-80-00003, *Shielding Assessment for The HLW Melter.*

# 3 Design Requirements

The body of this specification identifies the functional design requirements for melter design. Appendices A and B, "Melter Services and Connections Interface Details" and "Melter Design Interface Details" respectively, identify detailed design requirements and interfaces that have evolved from the functional design requirements for achieving the specified melter operating life and availability. The detailed design requirements and interfaces also provide a basis for designing the services and facilities that will support melter handling and operations.

## 3.1 General Functional Requirements

A. Other Functional Requirements - Other design requirements are defined in the melter design work performed in accordance with Contract No. 24590-101-TSA-W-000-0010 and submitted as the 30 percent design package, and contractor comments to the 30 percent design package (Ref. 2.2G). The package is referred to as the baseline design in this Specification. See also Ref 2.2D.

B. Containment System: The containment system will serve to support the credited safety functions of the melter shell, which are to ensure bulk confinement of radioactive materials during normal, abnormal and accident conditions, and to prevent exposures that may result in consequences to the co-located worker and facility worker above radiation exposure standards in the SRD. The containment system includes the melter shell and other elements: the refractory (and refractory thermocouples), cooling panels, jack bolts, and offgas ventilation. **The external metal walls and lid covers of the melter are designated as gas and glass confinement boundaries.**

1. Coordinate with contractor to include design features for simplifying remote disassembly of a failed melter.
2. The melter shell shall provide bulk confinement of glass in the event of refractory failure. The melter is not required to operate after a seismic event exceeding certain lateral acceleration limits, as defined in section 3.5; however, the shell shall maintain structural integrity and remain in place in accordance with the structural requirements outlined herein.
3. Jack bolts: Design jack bolt system to prevent formation of significant gaps between refractory bricks. Bolt adjustment shall allow for:
   a. Remote operation in the melter cave.
   b. Support and adjustment of cooling panels and refractory during assembly, installation, startup, and operation.
4. Melter Lid: Design shall include, but not be limited to, the following functions:
   a. Support all melter components mounted on and through it.

b. Support refractory overhanging melter plenum, and thermal expansion of refractory during operation.
c. Provide a continuous gas barrier in conjunction with wall and base gas barrier plates.
d. Provide refractory cooling.

5. Deleted.
6. Melter Base: Base will perform the following functions:
   a. Support melter during transport, operation and maintenance, decommissioning, and disposal phases.
   b. Accommodate integrated transportation system.
   c. Provide contractor-coordinated interfaces with overpack and facility restraints.
   d. Provide flatness tolerances for refractory installation.
   e. Provide refractory cooling.
   f. Provide support for refractory during melter assembly, transport, installation, and operation.
   g. House melter services including drains and refractory water-cooling panels.
7. Confinement of offgas is provided by the gas barrier portions of the shell, with engineered in-bleeds. In-bleed openings shall be limited so that bulk flow of glass will be controlled should it leak from the refractory.

C. Heating System
1. Heating system includes the electrodes (including extensions), startup heaters, discharge chamber heaters, and thermocouples.
2. After melter startup, glass shall be direct joule-heated.
3. Thermocouples shall provide continuous temperature monitoring while the melter is in service.

D. Feed System
1. Feed system includes temporary configuration for frit addition at startup, feed nozzles, associated feed lines (internal to melter only) for operation, and plenum thermocouples.
2. Subcontractor shall use best available information for locating feed nozzles over the glass pool to optimize processing rates.

E. Glass Pour System
1. Glass pour system includes glass pool level detectors, risers and airlift lances, troughs, dams, and discharge chamber structures.
2. Metallic Membrane (dam): Dam between the glass pool and discharge chamber shall prevent leakage of glass from the melt pool to the discharge chamber. Dam shall also limit leakage of air directly into the melter plenum through refractory seams over the melter lifetime.
3. Discharge Trough: Design trough to aid in maintaining glass temperature during pouring. Optimize trough slope and cross section for pouring and reduction of glass fiber formation.

F. Melter Disposal and Decommissioning: Coordinate with contractor to define general design requirements for melter disposal and decommissioning. Contractor will define specific disposal and decommissioning criteria after design is complete.

G. Melter Controls and Instrumentation: See Ref 2.2B for specific melter-related functional requirements for controls and instrumentation.

H. Transportation System: System will perform the following functions:
1. Support roller/wheel assemblies for melter transport on facility and overpack rails.
2. Guide and position melter on facility and overpack rails.
3. Interface with contractor-supplied drive systems that conform to subcontractor-defined melter movement criteria (see Appendix B).

4. Remain functional after an operational earthquake event as defined in Section 3.5A5: roller/wheel bearings shall remain functional and the rollers/wheels shall remain on the rails.
5. Allow for replacement by an identical melter after end-of-life or failure.

I. General Melter Component Design
1. Components requiring replacement during the design life of the melter shall be designed for ease of remote replacement and disposal. Where required, provide installed spare capacity.
2. Use of commercially available components and equipment without modifications will be optimized to the extent practical, except for components requiring optimization/value engineering studies per Ref 2.2D.
3. Subcontractor shall coordinate with contractor to determine applicability of modular design to minimize assembly and replacement times.
4. A power manipulator and an overhead maintenance crane will accommodate remote removal/replacement of modular components and equipment during startup and operation. Subcontractor shall coordinate with contractor to determine individual handling, routing, and access requirements so as not to exceed the operating parameters of the handling equipment.
5. Conductive individual components and equipment in contact with the molten glass shall be electrically isolated from the melter structure, base and lid, and from SSCs physically connecting the melter to the rest of the facility.
6. All components shall be designed to withstand thermal expansion during normal operations and function within established design parameters (e.g., interface locations and positioning features).
7. Deleted.

J. Agitation System
1. Agitation system includes bubblers and glass pool viewing system.
2. Arrangement and configuration of bubblers shall aid in optimizing melter throughput.
3. Each bubbler assembly, in coordination with the contractor, shall be designed for individual removal and replacement.

K. Restraint System
1. Subcontractor shall design an anchor system, per the structural requirements below, to lock melter in place during operation, including pin, restraint, and interface to building embedments as shown in Ref. 2.2 K.
2. In order to fully account for construction tolerances, interfacing dimensions shall be placed on hold for fabrication until after placement of the embedments in the field. As-built dimension will be provided by the project when available.

## 3.2 Performance Requirements

A. Design Life
1. The facility is expected to operate for approximately 40 years.
2. The melter, excluding consumable SSCs specified by the subcontractor, shall have a minimum 5-year design life.
3. Refer to Appendix B for predicted subcontractor-defined design lives of selected SSCs to support target availability.
4. Deleted.
5. Subcontractor shall document bases for declaring the design lives of the melter and all associated SSCs.

B. Melter Throughput and Availability

1. Baseline throughput shall be 1.5 metric tons of glass/day, per melter. The melter shall be designed to allow production rates of 3.75 metric tons of glass/day (Ref. 2.2.O) with an increase in agitation/bubbling rate.
2. Melter shall transform a slurry mixture of pretreated high level waste (HLW) and blended glass formers into a homogeneous glass melt. See Appendix B for waste and test feeds and glass composition data. Contractor will be responsible for controlling the feed chemistry composition within referenced boundary limits.
3. Target baseline availability for the melter is 83%. Subcontractor shall interface with contractor to ensure that melter design supports goal.

## 3.3 Design Conditions

A. Site Data (Applicable to Melter Transport in Overpack)
1. Elevation: 662 to 684 feet above mean sea level.
2. Site Climatological Data:

| | |
|---|---|
| Ambient Air Temperature | Minimum: - 23 °F, Maximum: 113 °F |
| Rate of Increase | Maximum: 26 °F per 20 min |
| Rate of Decrease | Maximum: 24 °F per hour |
| Relative Humidity | Maximum: 100 %, Minimum 5 % |

B. Facility Data
1. Building layouts and equipment general arrangements are predicated on the melter and melter component dimensions shown in Appendix B. Subcontractor shall notify contractor of any changes to dimensions and/or equipment maintenance envelope requirements.
2. Melter Ventilation:
   a. Melter will be operated as part of a cascaded ventilation system.
   b. Melter cave will be a primary confinement zone, held at a nominal 1 to 1.4-in. wg negative pressure with respect to surrounding secondary confinement zones.
   c. Melter plenum pressure will be maintained at a nominal 5-in wg negative pressure with respect to the cave.
3. Indoor Temperatures: See Appendix B for melter cave temperature range.
4. Radiation Dosages: See Appendix B for radiation design interface requirements impacting melter design.
5. Melter Utility Services:
   a. Contractor is currently providing the following services to the melters: electrical power, cooling water, process water, demineralized water, purge air, instrument air, and argon.
   b. Pressure, flow, conditioning, and other control requirements will be adjusted by contractor to suit application at the delivery point.
   c. Subcontractor shall identify any other liquids or gases required over the melter lifetime.
   d. Subcontractor shall coordinate with contractor to define utilities that require normal service or backup services.

e. Subcontractor shall identify critical melter services where stoppage would result in rapid failure of associated component or melter system (see Appendix B). Include estimates of time to failure.

f. Subcontractor shall specify required service operating parameters at contract boundary, with contractor input on selected design operating criteria.

6. Deleted

## 3.4 Mechanical Requirements

See Appendix A for melter service and connection interface details and Appendix B for the balance of melter design interface details.

A. Discharge Chamber

1. For baseline discharge chamber operation, glass discharge will alternate between the two chambers for every other canister. The switch between chambers will not occur until a canister has been filled.
2. Each discharge chamber shall be designed for a throughput of 3.75 metric tons of glass per day.
3. **Discharge Cambers can be enclosed in refractory.**

B. Feed Nozzles

1. Feed nozzles shall be designed for a throughput of 3.75 metric tons of glass per day, with all nozzles operating.
2. Contractor will provide the following to each feed nozzle:

a. A dedicated feed line and pump.
b. Cooling water.
c. Air and water purge.

3. Subcontractor shall coordinate with contractor to design glass frit addition system, for use during melter startup. Subcontractor shall be responsible for design of frit discharge "nozzle" that will penetrate the melter lid.

C. Viewing Systems

1. Design one (1) closed circuit television (CCTV) and associated system for viewing plenum area and cold cap.
2. CCTV will be used on an intermittent basis, as operation and maintenance requirements dictate. It will be removed from the melter when not in use. Design CCTV to be removable and replaceable with remote handling equipment.
3. Coordinate with contractor for design and incorporation of glass discharge viewing equipment, to be supplied by contractor.
4. Viewing ports shall be purged to prevent buildup of solids and other contaminants.
5. Cool CCTV ports as required.

D. Refractory Expansion Control System

1. Design jack bolts to actively control refractory expansion without operator intervention. Remote operation of, and access to, the bolts shall be maintained.
2. Coordinate with Contractor to provide a means of locally monitoring cooling panel and refractory movement with visual indicators.

E. Melter Cooling Water System

1. Contractor will be responsible for water supply to the panels.
2. Cooling panels shall be designed in accordance with Ref 2.1D3.
3. Cooling panel design shall be such that internal pressure and/or temperature induced distortions will not place undue stress against the melter refractory.
4. Design cooling panels to be emptied at melter changeout or decommissioning.

5. Coordinate with contractor for overall cooling water system design, including instrumentation and controls, external to the melter.

F. Melter Offgas System

1. See Appendix A for sizes of primary and standby offgas pipes.
2. Each pipe shall accommodate anticipated melter in-leakage and purge streams. In-leakage streams include, but are not limited to, room air inflow from lid-mounted component removal/replacement operations, and inflow from the discharge chambers. Purges include gas inflows from the film coolers, feed nozzles, bubblers, and airlift lance.
3. Offgas pipe routing from the melter to the submerged bed scrubbers will be defined by the contractor.
4. Primary offgas film cooler **design and configuration will reduce the offgas temperature and minimize solids deposition during the various modes of operation to support downstream offgas system operation.** See Appendix B for additional requirements affecting film cooler design.
5. Film cooler design shall incorporate a means for internal cleaning. This operation may be assisted with remote handling equipment in the melter cave.
6. Provide redundant pressure measurement for the melter plenum.

G. Piping

1. All cooling water piping, feed piping and pour flanges shall be per Ref 2.1D1. Piping seismic design shall be in accordance with Ref 2.1D2, Appendices N and F. See Appendix A for piping fluid service categories. Subcontractor shall provide documentation for justification of service class selected where different than what is shown.
2. Joints: Use of all joints other than butt-welded shall be submitted for contractor review and approval.
3. Piping Nozzle Slopes: See Appendix B for slopes of selected utility and service lines.
4. Disconnects: Coordinate with contractor to define remote disconnect requirements at the melter-facility boundaries.
5. Drains: Provide low-point "floor" drains between the gas barrier and the refractory for the maximum credible leak from a complete break of one cooling water panel pipe. Coordinate with contractor to provide leak detection equipment at the drains. Design drains to prevent clogging from particle waste and to minimize inflow of air due to the melter operating at a vacuum.

H. Material Requirements

1. Subcontractor shall define all melter SSC material requirements in accordance with this Specification and applicable codes and standards. Where deviations are required, subcontractor shall notify contractor before proceeding with design.
2. **Materials of construction shall be able to withstand the radioactive, thermal, and corrosive environment caused by the melter feed, glass, and offgases as required by sound engineering principles to ensure adequate performance and lifetime. Corrosion and/or erosion allowances are included in the design as required by sound engineering principles to ensure adequate performance and lifetimes** given in Section 3.2A2 and Appendix B. **Refractory corrosion rates, based on rigorous engineering evaluation of available pilot melter and/or lab scale testing are documented to meet established performance requirements for the melter designs.** Combustible materials shall not be used without prior approval from contractor.
3. Subcontractor shall consider environmental, durability, corrosion and erosion factors during material selection. At a minimum, subcontractor shall evaluate the following characteristics:
   a. Surface finish

b. Chemical resistance
c. Radiation resistance
d. Pressure effects (cyclical)
e. Temperature effects
f. Hardness (possibility of galling and fretting)
g. Fatigue (cyclic stresses both with and without the presence of aggressive chemicals).

4. Corrosion monitoring capability during operations is not required.

I. Bubblers

1. Bubbler assemblies shall be isolated from the melter lid and lid jumpers to prevent electrical short-circuiting.
2. Coordinate with contractor to define air/gas supply requirements.

## 3.5 Structural Requirements

See Appendix A for melter service and connection details and Appendix B for the balance of melter design interface details.

**Seismic Analysis shall be in accordance with 24590-WTP-DC-ST-04-001, *Seismic Analysis and Design Criteria*.**

**For Revised Ground Motion (RGM) Seismic Analysis Requirements (Current Melter Design), Load Combinations, Response Curves... etc. (01/2008), See Ref. 2.2.P. Prerevised Ground Motion seismic requirements as noted in the specification A thru E shown below, are being retained in the specification for historical reference.**

A. General

1. In order to perform its credited safety function, the melter shell must maintain structural integrity and remain in place to preclude potential impacts to SC-I items during and after a seismic event. Thus the melter shell and restraints are SC-II, and shall be seismically qualified in accordance with Ref. 2.2.I.
   a. The "appropriate in-structure response spectra" cited by Ref. 2.2.I for dynamic analysis shall envelope the 3 % damped ISRS at building lines 10 & C and 11 & M from reference 2.2.H.
   b. Subcontractor shall submit a Seismic Qualification Report consistent with the requirements of Ref. 2.2.I.
2. Maintaining structural integrity as required above does not preclude limited yielding of the gas barrier portion of the melter shell during a seismic event, providing the following general and safety requirements are met:
   a. Permanent effects resulting from SC-II loading shall not prevent the melter from being removed from the facility and placed in its overpack.
   b. Permanent effects resulting from SC-II loading shall not allow for the bulk flow of molten glass.
   c. In order to maintain the integrity of the offgas system, which is an SC-III system, the shell shall maintain an appropriate factor of safety against yield when subjected to appropriately combined SC-III loadings.
3. During transport and normal operating conditions, the deflection under load shall be limited to allow for proper refractory performance.
4. Subcontractor shall design an anchor system, per SC-II, to lock melter in place, including pin, restraint, and interface to building embeds.

5. Subcontractor shall verify through analysis that the melter will remain capable of normal operation after a lateral seismic acceleration at the base of the melter of 0.061g in any horizontal direction.
6. For melter transport into the facility, subcontractor shall conduct analyses and provide documentation to ensure that refractory arrangement and integrity is maintained. Notify contractor if additional or temporary means of refractory restraint are advantageous.
7. The design of the electrodes and the melter dam shall address creep over the life of the component.

B. Melter Base
1. See Appendix B for additional structural related interface details.

C. Transportation System
1. Rollers/Wheels:
   a. Subcontractor shall consider worst potential load type combination in determining roller/wheel load capacity.
   b. Provide vertical adjustment capability (passive and/or active) to accommodate slight differences in transport rail elevation.
2. Fasteners, Anchors, and Positioning Devices: Coordinate with contractor to establish design and interface requirements for all phases of melter life.
3. See Appendix B for transportation system interface details.

D. Loadings
1. Dead Loads: Design shall consider the combined weight of all melter SSCs. Other static loads to be considered include:
   a. Temporary rigging equipment during transport.
   b. Weight corresponding to maximum glass volume during operations.
   c. Circulated cooling fluids during operations.
   d. Encasement of all voids with grout during decommissioning.
2. Live Loads: Subcontractor shall coordinate with contractor to develop loading requirements and limits related to transport, maintenance, decommissioning, and jumper attachment.
3. **Deleted (Ref SCN - 00011)**
4. Pressure Gradients: The gas barrier walls shall be evaluated to withstand the operating pressure range of the offgas lines identified in Appendix A.
5. Other Loads:
   a. Thermal induced loads to be experienced during startup, normal operations, and idling.
   b. Piping reaction loads during normal operation.
   c. Impact wrench load. Maximum design load is 450 ft-lbs.
6. See Appendix B for melter static and live load detail requirements.
7. **Deleted (Ref SCN - 00011)**
8. **Deleted (Ref SCN - 00011)**
9. **Deleted (Ref SCN - 00011)**
10. **Deleted (Ref SCN - 00011)**

E. Other
1. Buckling
   a. To ensure that elements in the load path maintain their structural integrity, appropriate methods of analysis shall be employed to analyze elements subject to buckling and other failure modes that are not predictable by FEA
      i. To preclude buckling due to shear loads, plate elements shall be stiffened as required in the Code

ii. The allowable stress of elements subject to buckling due to compressive loads shall be reduced appropriately as required by the Code.

b. Highly localized areas of stress determined by FEA to be above the allowable stress, are to be considered according to the Code commentary (Reference 2.1.J.1, section CQ1.5), providing that engineering judgments are documented and justified where used.

2. Structural welding shall be per Refs. 2.1.I.1 and 2.1.I.2
3. Material properties for structural analysis shall be per Ref. 2.1.D.6

## 3.6 Electrical Requirements

See Appendix A for melter service and connection details and Appendix B for the balance of melter design interface details.

A. General
1. The following code references apply to this section: Refs 2.1C1 through 2.1C5, 2.1E, 2.1F1, 2.1F2, 2.1G1, 2.1G2, and 2.1H.
2. Subcontractor shall specify the following:
   a. Minimum and maximum values of the following electrical parameters associated with the Joule heating process for HLW glass envelopes: AC/DC power, voltage, current, waveform, and frequency.
   b. Melter protective interlocks required on the power source to the melter electrodes.
   c. Electrode firing configuration.
   d. Instrumentation and control requirements for the power source to the electrodes, discharge heaters, and startup heaters.

B. Electrode Power
1. Electrodes and extension buses shall be capable of carrying the current at the voltage required for all modes of melter operation.
2. Minimize connection resistance if the extension bus and electrode are two separate components.
3. Connector for making external connections to the extension buses shall allow for expansion and contraction of the extension bus.
4. Magnetic Coupling: Extension buses shall not cause magnetic coupling with the materials through which they pass.
5. Electromagnetic Interference: To the extent practical, the configuration of the extension buses shall maximize magnetic field cancellation.

C. Discharge Heater Power
1. Discharge heaters shall be matched to the extent practical with respect to resistance, operating current, and voltage.
2. Each discharge heater assembly shall be designed with a plug-type connector integral to the heater assembly.
3. The discharge heaters shall be electrically isolated from each other and from the melter structure.

D. Startup Heater Power
1. Startup heaters shall be matched to the extent practical with respect to resistance, operating current, and voltage.
2. Design power connectors to each heater assembly, with coordination from Contractor.
3. The startup heaters shall be electrically isolated from each other and from the melter structure.

E. Cable

1. Refer to Ref 2.1F1 for general cable design standards.
2. Cables routed within the melter envelope shall be rated for the maximum ambient temperature encountered.
3. Cable insulation and jacket material shall be of the low flammability type, per Ref 2.1C5.
4. Cable insulation and jacket material shall be resistant to heat, moisture, impact, radiation, and ozone as required for the expected operating environment.
5. Cables shall be supported or routed in raceway within the melter structure.
6. Power cables of size # 2/0 and larger will be single conductor or triplexed.
7. Instrument cables shall be single-pair, triad-twisted and shielded, or multi-pair with shielded pair and overall shield and drain wire.
8. Control cables shall be multi-conductor and color coded in accordance with Ref 2.1F1, Standard Method. Coordinate with contractor to determine requirements for spare conductors that shall be included in multi-conductor control and instrumentation cables.
9. Instrument and thermocouple cables will be single pair twisted and shielded, or multi-pair cable with individual pair shielded and overall shield.
10. Minimum Conductor Sizes:
    a. #12 AWG for power circuits.
    b. #14 AWG for control circuits (120 VAC, 125 VDC) and instrument power circuits.
    c. #18 AWG for instrumentation - single pair cable.
    d. #20 AWG for instrumentation - multi pair cable.

    Note: Instrumentation conductors include low-level voltage, current, or digital electrical signal connections to sensing and actuating devices.
11. See Appendix A on conductors for normal and instrument power circuits, control circuits, and instrumentation (both single pair cable and multi pair cable). Instrumentation conductors include low level voltage, current, or digital electrical signal connections to sensing and actuating devices.
12. Cables shall be physically separated in accordance with the function and voltage class as follows:
    a. Low-voltage power AC and DC cables.
    b. High-level signal and control or discrete on/off control cables (120 VAC, 125 VDC).
    c. Controls with critical safety requirements as determined by contractor.
    d. Cables for general instrumentation (i.e., low-level analog and digital signals and data communication).

F. Deleted

G. Grounding

1. Metal sections of melter lid, base, structure, and containment system shall be electrically interconnected.
2. The HLW melters are grounded via contact between the facility rails and the wheels of the melter base.
3. Deleted
4. Deleted.

## 3.7 Controls and Instrumentation Requirements

A. Controls Requirements: For melter design requirements, related to control logic, sequence of operations, and control software and hardware, see Ref 2.2B. Controls system design is in contractor's scope of work unless stated otherwise in Ref 2.2B.

B. Instrumentation Requirements
   1. For melter design requirements related to instrumentation see Ref 2.2B.
   2. Appendix A contains instrumentation connection interface details related to specific melter SSCs.

## 3.8 Maintenance Requirements

A. General
   1. **All nonstructural SSCs are designed for safe and effective maintenance per 24590-WTP-RPT-OP-01-001, *Operations Requirements Document.*** To the extent practical, the design will utilize techniques for minimizing maintenance labor to reduce the time, number and type of crafts required to perform work:
      a. Minimize downtime, and impacts to overall operation of the facility.
      b. Keep maintenance activities simple and straightforward, suitable for a power manipulator and an overhead maintenance crane.
      c. Minimize requirement for special tools and equipment for maintenance.
      d. Modularize SSCs for remote maintenance, access, and replacement.
      e. Demonstrate best possible access to controls, protective interlocks, and SSCs for maintenance.
      f. Minimize impact on interfacing SSCs while performing maintenance on targeted SSCs.
      g. Allow for the gathering of diagnostic information where possible to determine melter life.
      h. Incorporate features to aid in replacement of SSCs that do not meet the melter design life requirement of five years.
   2. Subcontractor shall perform failure modes and effects analyses on the critical SSCs identified in Ref 2.2D:
      a. Specify what critical SSCs need to be maintained and inspected, specify maintenance and inspection requirements, and provide data on predicted availability.
      b. Identify potential failures for critical SSCs, and recovery sequences.
      c. Identify and implement sufficient redundancy requirements to minimize impact on glass production.
   3. Subcontractor shall interface with contractor to ensure that access around melters is sufficient for inspection of all external melter surfaces, per Appendix B.
   4. Subcontractor shall identify all special tools and equipment for maintenance.
   5. All removable or replaceable components and equipment shall have lifting bails designed to interface with the overhead maintenance crane or power manipulator. See Appendix B for maintenance handling criteria.
   6. Subcontractor shall coordinate with contractor to optimize melter maintenance access, taking into account facility layout and maintenance support equipment and services outside of the subcontractor's scope of work.

B. Baseline Component Design Lives: See Appendix B for melter component design lives. Subcontractor shall advise contractor of changes, including component additions and deletions as well as improvements in baseline lifetimes.

# 4 Quality Assurance

## 4.1 General

A. Subcontractor and sub-tier vendors shall perform all design work in accordance with a contractor-approved quality assurance plan which meets the applicable requirements of Ref 2.1D4, and in accordance with Ref. 2.1D5.

B. Subcontractor shall be responsible for all sub-tier vendor quality assurance requirements during design.

C. See Ref 2.2D for quality assurance requirements pertaining to specific melter SSCs.

D. The contractor reserves the right to review design work in progress to assess the effectiveness of the subcontractor's quality system at any time during the design process. Assessments performed by the contractor shall in no way relieve the subcontractor of any contractual responsibilities.

# 5 Documentation and Submittals

## 5.1 General

A. See Ref 2.2D for submittal format, transmission, and review requirements.

## 5.2 Submittals

A. See Ref 2.2D for specific melter system submittal requirements not specified herein.

# Appendix A

## Melter Services and Connections Interface Details (4 pages total)

**Melter Engineering Specification Appendix Note:**

**The details given in this appendix were needed early in the project when the melters and the surrounding plant were being designed concurrently and remain in this specification for historical purposes only. The detailed design documents that have subsequently been produced contain the current, verified/approved design interface information Since design of the surrounding plant continues to develop, and the melter designs are being updated as fabrication continues, details from the following table should not be used. Refer to issued design drawings and any associated change documents.**

**A review of the included details has been conducted, and updates have been incorporated where practical; however, the following data should not be relied upon as it may no longer reflect current requirements or interfaces.**

| ITEM IDENTIFIER | DESCRIPTION | CONNECTION NUMBER | LINE SIZE, INCH | OPS MODE | SERVICE TYPE | NOMINAL FLOW / AMPS | NOMINAL PRESSURE / VOLTS AT POINT OF USE | NOMINAL TEMPERATURE, F | DESIGN LIMIT FLOW / AMPS ~~(NOTE 59)~~ | DESIGN LIMIT PRESSURE / VOLTS ~~(NOTE 59)~~ | DESIGN LIMIT TEMPERATURE, F | CRITICAL SERVICE | FLUID SERVICE CATEGORY (NOTE 59) | CONNECTION TYPE | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| por18 | AIR SUPPLY - AIR LIFT/RISER PURGE GAS (TYPICAL OF 2) | N12, N13 | 3/8 | INTERMITTENT | IA-2 | 3 SCFM | 3 PSIG | 113 | N/A | <15 PSIG | 240 | NO | D | STAUBLI | 14, 53, 24 |
| agi13 | AIR SUPPLY - BUBBLER (TYPICAL OF 5) | N05, 6, 7, 8, 9 | 1/2 | CONTINUOUS | IA-2 | 3 SCFM | 10 PSIG | 113 | N/A | <15 PSIG | 240 | YES | D | STAUBLI | 29 |
| agi08 | AIR SUPPLY - BUBBLER OR STARTUP HEATER, SPARE | N11 | 1/2 | SPARE | IA-2 | 3 SCFM | 10 PSIG | 113 | N/A | <15 PSIG | 240 | NO | D | STAUBLI | 29 |
| htm18 | AIR SUPPLY - ELECTRODE COOLING (TYPICAL OF 2) | N/A | 1 | CONTINUOUS | IA-2 | 50 SCFM | N/A | 113 | N/A | 25 PSIG | 113 | NO | D | STAUBLI | |
| htm19 | AIR SUPPLY - ELECTRODE EXTENSION COOLING (TYPICAL OF 2) | N/A | 1 | CONTINUOUS | IA-2 | 10 SCFM | N/A | 113 | N/A | 25 PSIG | 113 | YES | D | STAUBLI | |
| ogp12 | AIR SUPPLY - FUTURE STANDBY FILM COOLER | N03B | 2 | SPARE | IA-1 | N/A | N/A | 113 | N/A | <15 PSIG | 240 | YES | D | SPECIAL | |
| ogp13 | AIR SUPPLY - ITS PLENUM PRESSURE TAP | N10A | 1/2 | CONTINUOUS | IA-1 | 0.2 SCFH | 5 PSIG | 113 | N/A | 5 PSIG | 240 | YES | D | STAUBLI | |
| ogs03 | AIR SUPPLY - LINE PURGE, STANDBY OFFGAS | N/A | 2 | CONTINUOUS | IA-1 | 30 - 160 SCFM | 5 PSIG | 113 | N/A | <15 PSIG | 240 | NO | D | SPECIAL | |
| ogp09 | AIR SUPPLY - PLENUM (STAND BY OFF GAS) VACUUM MEASUREMENT | N56 | 3/8 | CONTINUOUS | IA-2 | 0.2 SCFH | 0 PSIG | 113 | N/A | <15 PSIG | 240 | NO | D | STAUBLI | 34 |
| vew01 | AIR SUPPLY - PLENUM CCTV COOLING (IF INSTALLED) OR BUBBLER | N36 | 1/2 | CONTINUOUS (IF CCTV INSTALLED) | IA-1 | 15 SCFM OR 3 SCFM | 10 PSIG | 113 | N/A | <15 PSIG | 240 | YES | D | STAUBLI | 28 |
| ogp03 | AIR SUPPLY - FILM COOLER | N03A | 2 | CONTINUOUS | IA-1 | 309 SCFM | 0 PSIG | 113 | N/A | <15 PSIG | 240 | NO | D | SPECIAL | 36 |
| lkd01 | AIR SUPPLY - SHELL LEAK DETECTOR (REDUNDANT PLENUM VACUUM) | N33 | 3/8 | CONTINUOUS | IA-1 | 0.2 SCFH | 1 | 113 | N/A | <15 PSIG | 240 | NO | D | STAUBLI | |
| por19 | ARGON SUPPLY - AIR LIFT/RISER PURGE GAS (TYPICAL OF 2) | N12, N13 | 3/8 | CONTINUOUS | IA-2 | 0.2 SCFH | 0 PSIG | 113 | N/A | <15 PSIG | 240 | YES | D | STAUBLI | 14 |
| lvl01 | ARGON SUPPLY - LEVEL DETECTOR, DENSITY LEG | N34B | 3/8 | CONTINUOUS | Ar | 1 SCFH | 2 PSIG | 113 | N/A | <15 PSIG | 240 | YES | D | STAUBLI | |
| lvl02 | ARGON SUPPLY - LEVEL DETECTOR, LEVEL LEG | N34A | 3/8 | CONTINUOUS | Ar | 1 SCFH | 3 PSIG | 113 | N/A | <15 PSIG | 240 | YES | D | STAUBLI | |
| drn01 | DRAIN - MELTER SHELL | N32 | 1 | RARE (ONLY IF LEAK OCCURS) | N/A | N/A | 0 PSIG | 113 | N/A | N/A | 113 | NO | N/A | N/A | 40 |
| fed16 | FEED SUPPLY - FEED NOZZLE (TYPICAL OF 2) | P01, P02 | 3/4 | CONTINUOUS | N/A | 1 GPM | 35 PSIG | 113 | N/A | 166 PSIG | 360 | NO | D | STAUBLI | 64 |
| fed07 | FRIT ADDITION FUNNEL | P02 | 3 | STARTUP ONLY | N/A | N/A | N/A | N/A | N/A | N/A | N/A | NO | N/A | 3-BOLT FLANGE | 6, 30 |
| htd21 | POWER - DISCHARGE CHAMBER HEATER (TYPICAL OF 8 FOR EAST & WEST, PAIRED CONNECTIONS) | | N/A | CONTINUOUS | ELECTRICAL | 30-50 A | 0 - 202 V | N/A | 50 A | 600 V | 500 | NO | N/A | MULTI-CONTACT | |
| htd22 | POWER - DISCHARGE CHAMBER HEATER, AUXILIARY, TYPICAL OF 2 | | N/A | RARE | ELECTRICAL | 20 A | 208 V | N/A | 35 A | 600 V | 500 | NO | N/A | MULTI-CONTACT | 11 |

| ITEM IDENTIFIER | DESCRIPTION | CONNECTION NUMBER | LINE SIZE, INCH | OPS MODE | SERVICE TYPE | NOMINAL FLOW / AMPS | NOMINAL PRESSURE / VOLTS AT POINT OF USE | NOMINAL TEMPERATURE, F | DESIGN LIMIT FLOW / AMPS ~~(NOTE 59)~~ | DESIGN LIMIT PRESSURE / VOLTS ~~(NOTE 59)~~ | DESIGN LIMIT TEMPERATURE, F | CRITICAL SERVICE | FLUID SERVICE CATEGORY (NOTE 59) | CONNECTION TYPE | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| hts06 | POWER - STARTUP HEATER (TYPICAL OF 5) | P05, 6, 7, 8, 9 | N/A | STARTUP ONLY | ELECTRICAL | 115 A | 320 V | N/A | 150 A | 600 V | 113 | NO | N/A | NONE | 6, 29 |
| ogp11 | OFFGAS - MAIN PORT | P03 | 8 | CONTINUOUS | N/A | N/A | -5 IN W.G. | 400 - 1000 | N/A | -100 IN. W.G. | 1000 | NO | M | 3-BOLT FLANGE | 37 |
| ogs02 | OFFGAS - STANDBY PORT | P04 | 8 | RARE | N/A | N/A | -5 IN W.G. | 400 -1000 | N/A | -100 IN. W.G. | 1000 | NO | M | 3-BOLT FLANGE | 37 |
| ogp10 | POWER - FILM COOLER CLEANER | N58 | N/A | RARE | ELECTRICAL | 6 A | 480 VAC | N/A | N/A | N/A | N/A | NO | N/A | LEMO | |
| vew02 | POWER - CCTV, PLENUM | N59 | N/A | CONTINUOUS (IF CCTV INSTALLED) | ELECTRICAL | 3 A | 120 VAC | N/A | N/A | N/A | N/A | NO | N/A | LEMO | |
| htm20 | POWER - ELECTRODE (TYPICAL OF 2) | N/A | N/A | CONTINUOUS | ELECTRICAL | 1500 - 6100 A | 75 - 200 VAC | N/A | 6500 | 300 VAC | N/A | YES | N/A | SPECIAL | 65 |
| vew05 | SIGNAL - CCTV, PLENUM | N60 | N/A | CONTINUOUS (IF CCTV INSTALLED) | ELECTRICAL | N/A | 1 V | N/A | N/A | N/A | N/A | NO | N/A | LEMO | |
| ogp01 | SIGNAL - FILM COOLER CLEANER LIMIT SWITCH, DOWN | N59 | N/A | RARE | SIGNAL | 2 A | 120 VAC | N/A | N/A | 10 PSIG | N/A | NO | N/A | LEMO | |
| ogp02 | SIGNAL - FILM COOLER CLEANER LIMIT SWITCH, UP | N59 | N/A | RARE | SIGNAL | 2 A | 120 VAC | N/A | N/A | 25 PSIG | N/A | NO | N/A | LEMO | |
| ogs07 | SPARE SERVICE - CONNECTION TO STANDBY OFFGAS | N57 | 3/8 | RARE | IA-2 | N/A | -5 IN W.G. | 113 | N/A | N/A | 150 | NO | D | STAUBLI | |
| agl14 | SPARE SERVICE - PORT (TYPICAL OF 4) | N/A | 1/2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 150 | NO | N/A | STAUBLI | |
| tmp49 | TC - EAST DISCHARGE CHAMBER, THERMOWELL #1 (TYPICAL OF 2 VIA COMMON CONNECTION) | N/A | N/A | CONTINUOUS | THERMOCOUPLE SIGNAL | N/A | N/A | N/A | N/A | N/A | N/A | NO | N/A | LEMO | |
| tmp50 | TC - EAST DISCHARGE CHAMBER, THERMOWELL #2 (TYPICAL OF 2 VIA COMMON CONNECTION) | N/A | N/A | CONTINUOUS | THERMOCOUPLE SIGNAL | N/A | N/A | N/A | N/A | N/A | N/A | NO | N/A | LEMO | |
| tmp45 | TC - EAST ELECTRODE, (3 FOR ELECTRODE, 2 FOR COOLING AIR EXHAUST ALL VIA COMMON CONNECTION) | N/A | N/A | CONTINUOUS | THERMOCOUPLE SIGNAL | N/A | N/A | N/A | N/A | N/A | N/A | NO | N/A | LEMO | |
| tmp53 | TC - EAST REFRACTORY THERMOWELL (TYPICAL OF 5 VIA COMMON CONNECTION) | N/A | N/A | CONTINUOUS | THERMOCOUPLE SIGNAL | N/A | N/A | N/A | N/A | N/A | N/A | NO | N/A | LEMO | |
| tmp47 | TC - GLASS POOL & PLENUM, EAST THERMOWELL (TYPICAL OF 5 VIA COMMON CONNECTION) | N/A | N/A | CONTINUOUS | THERMOCOUPLE SIGNAL | N/A | N/A | N/A | N/A | N/A | N/A | NO | N/A | LEMO | |
| tmp48 | TC - GLASS POOL & PLENUM, WEST THERMOWELL (TYPICAL OF 5 VIA COMMON CONNECTION) | N/A | N/A | CONTINUOUS | THERMOCOUPLE SIGNAL | N/A | N/A | N/A | N/A | N/A | N/A | NO | N/A | LEMO | |
| tmp51 | TC - WEST DISCHARGE CHAMBER, THERMOWELL #1 (TYPICAL OF 2 VIA COMMON CONNECTION) | N/A | N/A | CONTINUOUS | THERMOCOUPLE SIGNAL | N/A | N/A | N/A | N/A | N/A | N/A | NO | N/A | LEMO | |

| ITEM IDENTIFIER | DESCRIPTION | CONNECTION NUMBER | LINE SIZE, INCH | OPS MODE | SERVICE TYPE | NOMINAL FLOW / AMPS | NOMINAL PRESSURE / VOLTS AT POINT OF USE | NOMINAL TEMPERATURE, F | DESIGN LIMIT FLOW / AMPS ~~(NOTE 59)~~ | DESIGN LIMIT PRESSURE / VOLTS ~~(NOTE 59)~~ | DESIGN LIMIT TEMPERATURE, F | CRITICAL SERVICE | FLUID SERVICE CATEGORY (NOTE 59) | CONNECTION TYPE | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| tmp52 | TC - WEST DISCHARGE CHAMBER, THERMOWELL #2 (TYPICAL OF 2 VIA COMMON CONNECTION) | N/A | N/A | CONTINUOUS | THERMO-COUPLE SIGNAL | N/A | N/A | N/A | N/A | N/A | N/A | NO | N/A | LEMO | |
| tmp46 | TC - WEST ELECTRODE (3 FOR ELECTRODE, 2 FOR COOLING AIR EXHAUST, ALL VIA COMMON CONNECTION) | N/A | N/A | CONTINUOUS | THERMO-COUPLE SIGNAL | N/A | N/A | N/A | N/A | N/A | N/A | NO | N/A | LEMO | |
| tmp54 | TC - WEST REFRACTORY THERMOWELL (TYPICAL OF 5 VIA COMMON CONNECTION) | N/A | N/A | CONTINUOUS | THERMO-COUPLE SIGNAL | N/A | N/A | N/A | N/A | N/A | N/A | NO | N/A | LEMO | |
| por06 | VENT - EAST DISCHARGE CHAMBER | N47A | 2 | CONTINUOUS | N/A | 17 SCFM | N/A | 907 | 17 SCFM | -5 PSIG | 1000 | NO | N/A | 3 BOLT FLANGE | - |
| por14 | VENT - WEST DISCHARGE CHAMBER | N46A | 2 | CONTINUOUS | N/A | 17 SCFM | N/A | 907 | 17 SCFM | -5 PSIG | 1000 | NO | N/A | 3 BOLT FLANGE | - |
| clg32 | WATER RETURN - COOLING PANEL TOTAL BASED ON 95 F SUPPLY | N/A | N/A | N/A | CW | 45 GPM | N/A | 120 | 45 GPM | 150 PSIG | 366 | YES | NS | | |
| clg01 | WATER RETURN - COOLING BASE | N21 | 1 | CONTINUOUS | CW | 10 GPM | 50 PSIG | 120 | 10 GPM | 150 PSIG | 366 | YES | NS | | |
| clg24 | WATER RETURN - COOLING, EAST WALL | N25 | 1 | CONTINUOUS | CW | 10 GPM | 50 PSIG | 120 | 10 GPM | 150 PSIG | 366 | YES | NS | | |
| clg26 | WATER RETURN - COOLING, NORTH WALL | N24 | 1 | CONTINUOUS | CW | 10 GPM | 50 PSIG | 120 | 10 GPM | 150 PSIG | 366 | YES | NS | | |
| clg28 | WATER RETURN - COOLING, SOUTH WALL | N23 | 1 | CONTINUOUS | CW | 5 GPM | 50 PSIG | 120 | 5 GPM | 150 PSIG | 366 | YES | NS | | |
| clg30 | WATER RETURN - COOLING, WEST WALL | N22 | 1 | CONTINUOUS | CW | 10 GPM | 50 PSIG | 120 | 10 GPM | 150 PSIG | 366 | YES | NS | | |
| clg02 | WATER SUPPLY - COOLING, BASE | N16 | 1 | CONTINUOUS | CW | 10 GPM | 50 PSIG | 95 | 10 GPM | 150 PSIG | 366 | YES | NS | STAUBLI | |
| clg25 | WATER SUPPLY - COOLING, EAST WALL | N20 | 1 | CONTINUOUS | CW | 10 GPM | 50 PSIG | 95 | 10 GPM | 150 PSIG | 366 | YES | NS | STAUBLI | |
| clg27 | WATER SUPPLY - COOLING, NORTH WALL | N19 | 1 | CONTINUOUS | CW | 10 GPM | 50 PSIG | 95 | 10 GPM | 150 PSIG | 366 | YES | NS | STAUBLI | |
| clg29 | WATER SUPPLY - COOLING, SOUTH WALL | N18 | 1 | CONTINUOUS | CW | 5 GPM | 50 PSIG | 95 | 5 GPM | 150 PSIG | 366 | YES | NS | STAUBLI | |
| clg31 | WATER SUPPLY - COOLING, WEST WALL | N17 | 1 | CONTINUOUS | CW | 10 GPM | 50 PSIG | 95 | 10 GPM | 150 PSIG | 366 | YES | NS | STAUBLI | |
| fed14 | WATER SUPPLY - FEED NOZZLE FLUSH TYPICAL OF 2 | N/A | N/A | INTERMITTENT | DIW | 2 GPM | 35 PSIG | 95 | 2 GPM | 150 PSIG | 366 | NO | N/A | N/A | |
| ogp04 | WATER SUPPLY - FILM COOLER WASH (INJECTED VIA FILM COOLER AIR LINE) | N/A | N/A | INTERMITTENT | DIW | 1 GPM | 25 PSIG | 95 | 1 GPM | 135 PSIG | 366 | NO | N/A | N/A | |
| fed06 | WATER SUPPLY -PREFEED PLENUM COOLING WATER, EAST FEED | N01B | 3/4 | INTERMITTENT | DIW | 1 GPM | 25 PSIG | 95 | 1 GPM | 135 PSIG | 366 | NO | N/A | STAUBLI | |

| ITEM IDENTIFIER | DESCRIPTION | CONNEC-TION NUMBER | LINE SIZE, INCH | OPS MODE | SERVICE TYPE | NOMINAL FLOW / AMPS | NOMINAL PRESSURE / VOLTS AT POINT OF USE | NOMINAL TEMPER-ATURE, F | DESIGN LIMIT FLOW / AMPS ~~(NOTE 50)~~ | DESIGN LIMIT PRESSURE / VOLTS ~~(NOTE 50)~~ | DESIGN LIMIT TEMPER-ATURE, F | CRITICAL SERVICE | FLUID SERVICE CATEGORY (NOTE 59) | CONNEC-TION TYPE | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| fed09 | WATER SUPPLY -PREFEED PLENUM COOLING WATER, WEST FEED | N02B | 3/6 | INTERMITTENT | DIW | 1 GPM | 25 PSIG | 95 | 1 GPM | 135 PSIG | 366 | NO | N/A | STAUBLI | |
| ogs01 | WATER SUPPLY - STANDBY OFFGAS PIPE SPRAY, SAME CONNECTION AS ogs03 | N/A | N/A | INTERMITTENT | DIW | 1 GPM | 25 PSIG | 95 | 1 GPM | 135 PSIG | 366 | NO | NS | STAUBLI | |

SERVICE TYPE

| | |
|---|---|
| Ar | WELDING GRADE ARGON |
| CW | COOLING WATER, DEMINERALIZED, FILTERED TO <2 MICRON, NO CORROSION INHIBITORS, CL < 40 PPM, SULFATE <100 PPM, TDS <340 PPM, TOTAL SUSPENDED SOLIDS, <300 PPM, TOTAL HARDNESS < 170 PPM |
| IA-1 | INSTRUMENT AIR PER ANSI/ISA-S7.0.01-1996 |
| IA-2 | INSTRUMENT AIR WITH EXTRA FILTRATION FOR PARTICULATE, WATER, AND HYDROCARBONS |
| DIW | DEMINERALIZED WATER |

1 COOLING WATER SUPPLY TEMPERATURE IS TO BE GREATER THAN MELTER GALLERY AIR TEMP TO PREVENT CONDENSATION
6 INSTALLED DURING MELTER STARTUP
11 DISCHARGE CHAMBER AUX HEATERS NOT NORMALLY CONNECTED. HEATER TO BE USED FOR POUR FLANGE GLASS BLOCKAGE RECOVERY
14 AIR LIFT DISCHARGES ARE OPERATED INTERMITTENTLY ONE AT A TIME. ARGON IS PURGED THROUGH THE AIR LIFT AT 0.2 SCFH WHEN GLASS IS NOT BEING DISCHARGED
24 N/A = NOT APPLICABLE
28 CCTV COOLING AIR WILL BE EXHAUSTED INTO MELTER CAVE
29 BUBBLER AND STARTUP HEATERS FIT THE SAME LID NOZZLES
30 FRIT ADDITION AND FEED NOZZLES FIT SAME LID NOZZLES
34 LEVEL DETECTOR REFERENCE LEG AND MELTER PLENUM PRESSURE COMBINED MEASUREMENT FROM STANDBY OFGFGAS PORT
35 MAY INCLUDE WATER FLUSH FOR FILM COOLER
37 TEMP MAY BE HIGHER IF FILM COOLER AND AIR INJECTION STOPS DURING PRESSURE TRIP
40 SEAL POT OR TRAP REQUIRED
50 ONCE PER 4 HOURS THE FEED LINES ARE FLUSHED. THIS OCCURS FOR EACH OF THE 6 ADS PUMPS/FEEDLINES, OR 1.5 GPH PER MELTER. APPROX ONCE PER MONTH, FLUSH EACH FEED NOZZLE FOR APPROX 30 MIN.
53 AIR FLOWS DURING POURS ONLY, APPROX. 30 MIN EVERY 3 HR. ARGON USED AS A CONTINUOUS PURGE, EVEN DURING POURS (ABOUT 1 SCFH)
54 WATER USED TO COOL PLENUM AFTER IDLE. FLOW FROM ONLY 1 NOZZLE IS SUFFICIENT, DURATION APPROX 30 MIN.
59 DELETED
64 PROCESS VALUES ARE BASED ON PILOT MELTER DATA AND DESIGN DEVELOPMENT. ACTUAL MELTER OPERATING/DESIGN CRITERIA MAY VARY DEPENDING ON FINAL SYSTEM DESIGN BY RPP-WTP
65 WITH DESIGN LIMIT OF 7,000 AMPS NOT TO EXCEED 3% OF TOTAL OPERATING TIME

# Appendix B

## Melter Design Interface Details (10 pages total)

**Melter Engineering Specification Appendix Note:**

**The details given in this appendix were needed early in the project when the melters and the surrounding plant were being designed concurrently and remain in this specification for historical purposes only. The detailed design documents that have subsequently been produced contain the current, verified/approved design interface information Since design of the surrounding plant continues to develop, and the melter designs are being updated as fabrication continues, details from the following table should not be used. Refer to issued design drawings and any associated change documents.**

**A review of the included details has been conducted, and updates have been incorporated where practical; however, the following data should not be relied upon as it may no longer reflect current requirements or interfaces.**

| Tag | Component (2, 3) | Interface Detail (2, 3) | Interface Criteria | System/ Area Locators | Comments |
|---|---|---|---|---|---|
| agi07 | bubbler | component weight | 290.31 lb. | HSH | |
| agi08 | bubbler | intermediate in-facility storage criteria | consumable template has storage positions for 8 consumables with 11 in dia. bases | HSH | note 5 |
| agi02 | bubbler | operating life | MTTF - 2 mos | HSH | |
| agi03 | bubbler | remote handling requirements | 3 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook | HSH | |
| vew09 | cctv - for melter plenum | component weight | 250 lb. max | HSH | |
| vew07 | cctv - for melter plenum | dimensions - envelope | 16.75" dia. X 34.31" tall | HSH | |
| vew14 | cctv - for melter plenum | intermediate in-facility storage criteria | consumable template has storage positions for 8 consumables with 11 in dia. bases | HSH | note 5 |
| vew02 | cctv - for melter plenum | operating life | MTTF - 12 mos | HSH | |
| vew05 | cctv - for melter plenum | remote handling requirements | 2 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook | HSH | |
| enc49 | cooling panel expansion indicators | adjustment interface/connection | adjustments to indicators not necessary | HSH | |
| enc46 | cooling panel expansion indicators | quantity | 21 total - 6 on east wall, 9 on north wall, 6 on west wall | HSH | |
| enc48 | cooling panel expansion indicators | viewing criteria | need to view a 4" diameter wheel at a steep viewing angle. Approximately 60-90 degrees | HSH | jumper placement by project may affect view |
| enc17 | datum point - facility reference | coordinates of melter datum in plant coordinate system | melter 1: N. 3806' - 7 1/4" E. 10149' - 1" Elev. 2' - 11" melter 2: N. 3806' - 7 1/4" E. 10042' - 1" Elev. 2' - 11" | 30 | note 5. |
| enc18 | datum point - facility reference | description of physical location | located 7.75 inches to south of pour spouts center line on west rail center line at elev. 2'-11" | 30 | |
| enc38 | datum point - facility reference | dimensional tolerance for locating datum point in melter cave | to be determined by project after completion of melter design | HSH | note 5 |
| enc21 | datum point - melter reference | description of physical location (x,y,z location from which all melter dimensions originate from) | point on top center of west rail, on centerline of seismic restraint pin. See enc18 and res04 | 30 | |
| enc41 | datum point - melter reference | fabrication/ assembly dimensional tolerances | +/- 0.031" (0.0156" for the hole on the end truck and 0.0156" for the holes(s) in the restraint | 30 | |
| por24 | discharge chamber lid | component weight | 1642 lb. | HSH | |
| por23 | discharge chamber lid | dimensions - envelope | 33.125" x 40.0" plan, 19.125" high from bottom of refractory to top of cover, 34.25" high from bottom of refractory to top of lifting lugs | HSH | |
| por06 | discharge chamber lid | operating life | MTTF - 30 mos | HSH | |
| por05 | discharge chamber lid | remote handling requirements | 5 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook; alignment device will protect heater elements from damage during installation (see maintenance tools) | HSH | |
| enc26 | drain - for annulus spaces | drain configuration | elbow directed downward with "flapper valve" on end, drains onto pour cave cover | HMP | |

| Tag | Component (2, 3) | Interface Detail (2, 3) | Interface Criteria | System/ Area Locators | Comments |
|---|---|---|---|---|---|
| enc36 | drain - for annulus spaces | leak detection configuration for drain | shell leak detector level probe will be located with its tip roughly in elbow of drain. If leak develops, water will build up to about 5" wc, then any additional water will drip out of flapper valve. | HMP | |
| enc51 | drain - for annulus spaces | physical location | lower northwest corner of melter | HMP | |
| enc52 | drain - for annulus spaces - leak detection equipment | operating life | MTTF - life of melter | HSH | |
| env32 | facility rails | configuration | rectangular, 2.5" wide, flat, top of rail elevation 2'-11", east/west rail stops 11-3/4"/11-3/4" north of building grid K | HMH | |
| env33 | facility rails | load limits - horizontal | Design anchorage of rail for 10% of vertical load on wheel | HMH | conforms to wheel vendor design recommendations and Crane Manufacturers Association of America (CMAA) |
| env67 | facility rails | load limits - vertical | Assume 2 times wheel rating in env52 for occasional overload | HMH | |
| env36 | facility rails | material/finish/coating/heat treating | 17-4PH stainless, condition H900, yield stress = 183ksi, RMS 63 to 125, no coating. | HMH | |
| env39 | facility rails | maximum rail gap | 8 inches | HMH | Subcontractor comfortable crossing any rail gap smaller than 20.5 inches (wheel spacing), less 2 inches (load distribution per CMAA 70, 3.3.2.3), less any rail tapers used. A 7.5 inch rail gap between the HLW melter overpack and the HLW vitrification facility rails will be acceptable. |
| env40 | facility rails | size/configuration | 2.5" wide, must be flat, no more than a 1/32" chamfer (or radius) on edges, at least 1" tall for rail flange clearance. Top of rail elevation 2'-11", rails stop 11-3/4" north of building grid K. | HMH | |
| env41 | facility rails | tolerances - horizontal lateral /parallel | horizontal lateral deviation +/- 0.04" over a 6 foot rail span, parallelism of rails in horizontal plane +/- 0.04" for each 16 foot span (non-cumulative) | HMH | |
| env34 | facility rails | vertical/levelness tolerance | 0.060" | HSH/HMH | Requirement driven by facility rail flatness tolerance |
| fed14 | feed nozzle | component weight | 108 lb. | HSH | |
| fed11 | feed nozzle | dimensions - envelope | 13" dia. flange X 23.88" long | HSH | |
| fed21 | feed nozzle | intermediate in-facility storage criteria | consumable template has storage positions for 8 consumables with 11 in dia. bases | HSH | note 5. Feed nozzle to be stored in Consumable Template |
| fed03 | feed nozzle | operating life | MTTF - life of melter | HSH | |
| fed07 | feed nozzle | remote handling requirements | 5 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook | HSH | |

| Tag | Component (2, 3) | Interface Detail (2, 3) | Interface Criteria | System/ Area Locators | Comments |
|---|---|---|---|---|---|
| fed19 | feed nozzle - glass frit addition | component weight | 132 lb. | HSH | |
| fed16 | feed nozzle - glass frit addition | configuration | project design requirement. Will be configured to interface with subcontractor port design. | HSH | shall interface with consumable bucket with gate valve on bottom to accept bulk charge of frit w/o metering |
| fed20 | feed nozzle - glass frit addition | intermediate in-facility storage criteria | consumable template has storage positions for 8 consumables with 11 in dia. bases | HSH | note 5. Storage location will be determined by project operations |
| fed05 | feed nozzle - glass frit addition | remote handling requirements | 4 inch across flats for captive fasteners, 1 1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook | HSH | |
| ogs13 | film cooler | component weight | 251 lb. | HSH | |
| ogs11 | film cooler | dimensions - envelope | 22" dia. flange x 23.5" long, from bottom to top of flange | HSH | |
| ogs36 | film cooler | intermediate in-facility storage criteria | consumable template has storage positions for 8 consumables with 11 in dia. bases | HSH | note 5 |
| ogs03 | film cooler | operating life | MTTF - 60 mos | HSH | |
| ogs05 | film cooler | remote handling requirements | 2 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook | HSH | |
| ogs17 | film cooler cleaner | component weight | 1000 lb. max | HSH | |
| ogs16 | film cooler cleaner | dimensions - envelope | to be verified after melter design is complete | HSH | |
| ogs37 | film cooler cleaner | intermediate in-facility storage criteria | consumable template has storage positions for 8 consumables with 11 in dia. bases | HSH | note 5. On hold |
| ogs06 | film cooler cleaner | operating life | MTTF - 12 mos | HSH | |
| ogs08 | film cooler cleaner | remote handling requirements | 3 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook | HSH | |
| plv05 | glass pool level detector | component weight | 102 lb. | HSH | |
| plv07 | glass pool level detector | dimensions - envelope | 76.2" long to bottom of flange, 87.22" long to top of fixed lifting bail, 13" dia flange, total width is 13.94" | HSH | |
| plv09 | glass pool level detector | intermediate in-facility storage criteria | consumable template has storage positions for 8 consumables with 11 in dia. bases | HSH | note 5 |
| plv02 | glass pool level detector | operating life | MTTF - 12 mos | HSH | |
| plv04 | glass pool level detector | remote handling requirements | 4 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook | HSH | |
| por28 | glass riser airlift lance | component weight | 81 lb. | HSH | |
| por27 | glass riser airlift lance | dimensions - envelope | 87.75" long to top of plug, 8 IN. MINIMUM LIFTING BAIL HOOK CLEARANCE | HSH | |
| por31 | glass riser airlift lance | intermediate in-facility storage criteria | consumable template has storage positions for 8 consumables with 11 in dia. bases | HSH | note 5 |

| Tag | Component (2, 3) | Interface Detail (2, 3) | Interface Criteria | System/ Area Locators | Comments |
|---|---|---|---|---|---|
| por10 | glass riser airlift lance | operating life | MTTF - life of melter | HSH | |
| por12 | glass riser airlift lance | remote handling requirements | 6 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook | HSH | |
| enc45 | jackbolt | adjustment interface/connection | PaR 3000 with parallel grip hand interfaces directly with adjuster. Max torque 185 in-lb. | HSH | |
| enc27 | jackbolt | monitoring plan during startup and for general maintenance | final plan to be determined. May only need periodic (monthly basis) monitoring using in-cave cctv's | HSH | |
| enc44 | jackbolt | quantity | 21 total - 6 on east wall, 9 on north wall, 6 on west wall | HSH | |
| enc28 | jackbolt | viewing criteria | direct visual with in-cave camera | HSH | Direct visibility or visibility with melter cave CCTV |
| enc03 | melter - castable refractory | allowable sit times before bakeout | 12 months+ | BOF | Subcontractor design objective |
| enc54 | melter - general | bolt torque limit for use of remote impact wrench | 450 ft-lb. max | HSH | |
| env08 | melter - general | clearance criteria for maintenance and equipment access | limited or no access at sides or under jumpers to east. Items on east side requiring visual monitoring to be angled to north or south. | HSH | Cable attachment points front and rear. Accessible with 300-750 ft-lb. variable torque impact wrench at jackbolt sites and jumper sites |
| env61 | melter - general | clearance criteria for services under melter | no services or obstructions to exist between top of rails up to bottom of melter base (cross beams), except for tailhooks. | HSH | |
| env55 | melter - general | component/consumable lifting design criteria | lifting bales/devices designed to 3 times yield | HSH | |
| enc10 | melter - general | design for remote breakdown of melter in event of catastrophic failure | lid designed to be removed for decontamination and for access to pool for glass removal using remote operated in-cave equipment. Actual process for lid removal to be defined by project after melter design is complete. | HSH | Open issue for alternate molten glass removal; drawings cited do not include cradle concept |
| enc31 | melter - general | dimensions - envelope | 172" N-S x 164" E-W x 146" high (installed component height from top of rail). 157" high to top of extended lifting bails, 134" high to top of melter shell. | HMH | |
| env13 | melter - general | electrical grounding connections - location and connection details | use off-gas jumper, standby off-gas jumper, and two feed jumpers, requires that the submerged bed scrubber and feed tank be grounded. | GRE | |
| env14 | melter - general | guard rails and safety barriers - configuration and loads for startup | guard rails and safety barriers are not a project requirement | HSH | note 5 |
| enc16 | melter - general | lifting bail design for consumables/ replaceable equipment | listed separately for each component - see remote handling criteria | HSH | |
| env05 | melter - general | maintenance tool needs | discharge heater assembly handling stands, spreader bar and installation alignment/ guide tool; cover plates; melter wheel power package; electrode thermocouple installation and guide tool; commissioning glass pool sampler | HSH | |
| env68 | melter - general | Radiation dose rate - external | sides: 39.6 rem/hr, front/back: 65.3 rem/hr, bottom: 12.5 rem/hr, top (no decon): 84.0 rem/hr, top (w/ decon) 4.50 rem/hr | HSH | Combined dose for 0" shielding. For other cases, see reference 2.2.P, p. 33 of 36. |

| Tag | Component (2, 3) | Interface Detail (2, 3) | Interface Criteria | System/ Area Locators | Comments |
|---|---|---|---|---|---|
| enc39 | melter - general | thermal movement (maximum) of any nozzle, from centroid of melter | 0.156" | HSH | |
| enc42 | melter - general | tolerances - fabrication/assembly dimensional tolerances for flexible connections from melter datum point | +/- 0.078" (includes melter datum point location tolerance, +/- 0.032" for positioning lid wrt melter datum, 0.015" for position tolerance for each hole from machining) | HMH/HMP | specific tolerances defined on Subcontractor melter assembly drawings |
| enc43 | melter - general | tolerances - fabrication/assembly dimensional tolerances for hard connections from melter datum point | +/- 0.078" (includes melter datum point location tolerance, +/- 0.032" for positioning lid wrt melter datum, 0.015" for position tolerance for each hole from machining) | HMH/HMP | specific tolerances defined on Subcontractor melter assembly drawings |
| enc15 | melter - general | use of common ports between operating modes | bubblers and startup heaters are the only consumables that utilize a common port | HMP | |
| enc01 | melter - general | weight - empty and operating | 174,000 lb. without glass, 198,000 lb. with glass | HMH | approximate - tolerances not included |
| env58 | melter - lid | handling cradle configuration | handling cradle will be attached to melter lid for flipping and shipping. Lifting/ transportation devices to bolt to cradle. | BOF | |
| env62 | melter - lid | handling cradle requirements for assembly/transport | accommodates flipping of melter lid 180 degrees; does not interfere with castable refractory installation; protects lid studs, lid and refractory during bake-out and transportation; supports discharge chamber top surface to prevent buckling of lid side walls | BOF | |
| env63 | melter - lid | handling cradle requirements for decommissioning | imported into cave via overpack; interfaces with in-cave embeds; is handled in cave with 12' lifting beam and remote tooling (impact wrench, etc.); able to be decontaminated; designed for high-cycle vibration from jackhammer during refractory breakout | HSH | |
| env57 | melter - lid | handling criteria | melter lid must be safely flipped during assembly, transportation, and decommissioning (see env62 and env63 for specific requirements) | BOF | |
| env59 | melter - lid | lifting/flipping loads | total lifted weight not to exceed 17 tons (capacity of in-cave crane) | HSH | |
| ogs18 | melter - operation | annular space in-leakage air quality | unfiltered cave air | HOP | |
| gls01 | melter - operation | glass composition - forming chemicals by waste envelope | reference composition for envelope D tank AZ101 is glass 98-31 | HMP | |
| gls07 | melter - operation | glass electrical conductivity | 0.1 – 0.7 S/cm @ 1100 – 1200°C | HMP | |
| gls13 | melter - operation | glass frit composition | $Al_2O_3$ - 13.57%, CaO - 0.40%, $K_2O$ - 2.01%, MgO - 2.11%, $P_2O_5$ - 3.42%, ZnO - 3.12%, $B_2O_3$ - 17.29%, $Fe_2O_3$ - 0.70%, $Li_2O$ - 2.51%, $Na_2O$ - 15.88%, $SiO_2$ - 38.99%; Viscosity ~ 50 poise @ 1125°C, Conductivity ~0.35 S/cm @ 1125C, Liquidus < 900°C | HMP | **Composition subject to change based on long term idling requirements during commissioning.** |
| por26 | melter - operation | glass pool level range during operation | 43" - 43.8" | HMP | |
| gls09 | melter - operation | glass pool liquidus temperature, range | <950°C | HMP | |
| htg13 | melter - operation | glass pool temperature range | 1100 - 1200° C w/ setpoint at 1150° C | HMP | |
| gls11 | melter - operation | glass viscosity @ operating temp, range | 10 to 150 Poise at 1100°C | HMP | |
| vnt04 | melter - operation | heat loss through melter shell to cave, feed mode | 35 kW max, excludes removal of lid components | C5V | |

| Tag | Component (2, 3) | Interface Detail (2, 3) | Interface Criteria | System/ Area Locators | Comments |
|---|---|---|---|---|---|
| vnt05 | melter - operation | heat loss through melter shell to cave, idle mode | 35 kW max, excludes removal of lid components | C5V | |
| env60 | melter - operation | maximum/minimum ambient temperatures in melter cave | 113F / 59F | C5V | |
| ogs24 | melter - operation | offgas temperature downstream of film cooler - during feed - normal and design ranges | 207 - 249 C | HOP | |
| ogs25 | melter - operation | offgas temperature downstream of film cooler - during idle - normal and design ranges | 313 C | HOP | |
| ogs20 | melter - operation | offgas temperature in plenum - during feed - normal and design ranges | 300 - 600 C | HOP | |
| ogs21 | melter - operation | offgas temperature in plenum - during idle - normal and design ranges | 1000 C | HOP | |
| wst06 | melter - operation | waste feed characteristics - normal waste | per simulated waste used in pilot melter tests. will depend on actual composition of tank waste delivered to project. Tank AZ101 with 98-31 glass adequately defines waste composition for melter design purposes | HMP | |
| wst07 | melter - operation | waste feed characteristics - range of feed variation | will depend on actual composition of tank waste delivered to project. Tank AZ101 with 98-31 glass adequately defines waste composition for melter design purposes | HMP | |
| fed12 | melter - operation | waste feed distribution through feed nozzles with respect to operating modes | two nozzles are required for proper plenum pool cold cap distribution, regardless of operating mode | HMP | |
| env54 | melter - seismic | in-structure seismic response spectra | Ref. 2.2.H, Plots 106, 107, 108 @ 0' elevation, Joint J-12-1, Node 5423 | 30 | "Seismic Qualification of Seismic Category I/II Equipment and Tanks" |
| env66 | melter - seismic | remote handling requirements for seismic restraints | hex head bolt, 2" across flats for engaging seismic pin with remote impact wrench. | HSH | pins are provided with each melter |
| res03 | melter - seismic | restraint loads | west pin 180,317 lb. east/west, 109,012 lb. north/south, 210,708 lb. resultant. East pin 0 lb. east/west, 109,012 lb. north/south, 109,012 lb. resultant applied at 1'-5 1/2" above top of embedded plate (elev. 4'-2"). Vertical load at each tailhook restraint: 56,870 lb. upward | HSH | |
| res04 | melter - seismic | restraint location | pins: 7.75" South of Col. Line K, on centerlines of rails; Tailhooks: pin centerlines 8.25" inboard of rail centerlines at elev. 2'-11.395" (0.395" above rail), south face mounts at 136.23" north of melter datum. North face of facility pin receiver plate to be 135.5" north of melter datum. | HSH | |
| res05 | melter - seismic | restraint quantity | four restraints, including two "tailhooks" for overturning | HSH | |

| Tag | Component (2, 3) | Interface Detail (2, 3) | Interface Criteria | System/ Area Locators | Comments |
|---|---|---|---|---|---|
| env56 | melter - seismic | seismic restraint bracket envelope | pins: east embed horiz mounting surface - 1'-8" x 4'-6" at elev. 2'-8 1/2"; West horiz - 1'-8" x 4'-6" at elev. 2'-8 1/2", vertical surface 1'-6" high x 4'-6" at 7'-2" from melter centerline.North edge of east/west embed at 10 3/4" / 4 1/4" south of building grid K. Tailhook: 6" wide bracket with pin hangs below melter 2.605" below top of rail just inside of wheels. Tailhook receiver dimension: 7.5" wide bracket w/ 3"dia. hole and 3.75" edge distance (including at clipped corners). Mat'l: 1.5" thk. 304L SS. | HSH | |
| env69 | melter - seismic | seismic restraint embedment tolerances for manufacture | East embed: top of plate at flat to within 0.015"; West embed: top of plate east of vertical plate flat to within 0.015"; perpendicularity and flatness of east face if vertical plate: +/- 1/16" of 90 degree plane. Excluded from above areas of horizontal and vertical surfaces: A 45 degree dianonal 3/8" fillet plane at the intersection corner of the two plates. Fillet weld build-up shall not penetrate this plane. Plate length dimensions not listed above +/- 1/8". | CS&A | tolerances are needed to ensure that no additional modification of seismic lug assemblies is required in field. |
| env 70 | melter - seismic | seismic restraint embedment tolerances for placement in field | East embed: location of north and west edges of plate +/- 1/8". Top of plate elevation +0", -1/8" and level within 1/16"; West embed: location of north and east edges of plate +/- 1/8". Top of plate at lug base area (east of vertical plate): elevation +0", -1/8" and level within 1/16", location of east foace of vertical plate +1/8", -0" of indicated distance from melter centerline and parallel to melter centerline within 1/16" | CS&A | |
| res06 | melter - seismic | seismic restraint installation requirements | Restraint lug base north edge to be installed 5.5" south of melter datum; center of tongue to align with rail centerline. Hole in lug is marked with melter moved into position, then removed from base for machining hole. Lug base is welded in place and lug is realigned horizontally using shims on sides; belleville spring washers are used to lock in final vertical position. Lug base welds are bevel welds along pour cave walls and at top edge of west base, fillets elsewhere. | HSH | one-time set up required for first melter in cave will not apply to subsequent melters |
| res02 | melter - seismic | seismic restraint interface configuration | Subcontractor designed pin attachment (WTP-M-21730) welds to embed in melter cave. Tailhook for uplift on north end: 2.5" dia. 3" long pins facing south and fitting into 3" dia. receiving holes. See env56 | HSH | |
| env51 | melter - transport | guidance system - criteria for locating and setting melter in facility | guidance and location tolerances of flanged wheels on west rail and seismic pins | HMH | |
| env28 | melter - transport | loads and moments transferred to melter | Towing lug on north side of melter designed for 0.23 times melter weight | HMH | load is to drag full melter with some, but not all wheels seized up. |

| Tag | Component (2, 3) | Interface Detail (2, 3) | Interface Criteria | System/ Area Locators | Comments |
|---|---|---|---|---|---|
| env65 | melter - transport | loads and moments transferred to melter | Towing lug on south side of melter designed for 0.5 times melter weight | HSH | load is to drag full melter from overpack with all of the wheels seized. Must overcome static friction of wheels on overpack rails. Lubrication will be applied to overpack rails prior to insertion of spent melter. |
| env19 | melter - transport | max acceleration/deceleration x/y/z during transport (new melter only) | 0.1 g | HMH | |
| env27 | melter - transport | remote handling requirements for cave import | use PaR installed "shepherds hook" with capacity to drag melter from overpack. | HSH | |
| env31 | melter - transport | stop/deceleration mechanism for melter import (into cave) | proximity switch/stop switch mounted on in-cave wall | HSH | |
| clg02 | piping - cooling water | slope of cooling water piping | no slope required for operational purposes | PCW | must have the ability to blow out dry with air |
| enc40 | piping - offgas nozzle | thermal movement | 0.076" | HMP | |
| ogs38 | piping - standby offgas | operating life | MTTF - life of melter | HSH | |
| prm05 | plenum pressure sensor | component weight | 170 lb., about the same as a blank plug | HSH | |
| prm07 | plenum pressure sensor | dimensions - envelope | 26" dia. x 64" tall | HSH | |
| prm09 | plenum pressure sensor | intermediate in-facility storage criteria | consumable template has storage positions for 16 consumables with 7 in dia. bases | HSH | note 5 |
| prm02 | plenum pressure sensor | operating life | MTTF - life of melter | HSH | |
| prm04 | plenum pressure sensor | remote handling requirements | 7 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook | HSH | |
| enc53 | plugs - lid spares | operating life | MTTF - life of melter | HSH | |
| htg18 | startup heater | component weight | 1074 lb. for 5 heaters, 215 lb. each | HSH | |
| htg14 | startup heater | dimensions - envelope | 16.75" dia. flange x 64.0" to top of cable enclosure | HSH | |
| htg19 | startup heater | intermediate in-facility storage criteria | consumable bucket and template to be devised by project | HSH | note 5 |
| htg02 | startup heater | operating life | MTTF - 3 mos | HSH | operating life is for heater elements. Rest of heater should last life of melter |
| htg04 | startup heater | remote handling requirements | 6 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook | HSH | |
| htg21 | thermocouple - discharge chamber | component weight | 16 lb. | HSH | |
| htg24 | thermocouple - discharge chamber | intermediate in-facility storage criteria | consumable template has storage positions for 16 consumables with 7 in dia. bases | HSH | note 5 |
| tmp29 | thermocouple - discharge chamber | operating life | MTTF - 12 mos | HSH | |
| htg25 | thermocouple - discharge chamber | remote handling requirements | use standard lifting bail for 5 ton and 17 ton crane hook | HSH | |

| Tag | Component (2, 3) | Interface Detail (2, 3) | Interface Criteria | System/ Area Locators | Comments |
|---|---|---|---|---|---|
| htg22 | thermocouple - discharge chamber thermowell | dimensions - envelope | 5.25" dia plug x 58.19" from bottom of thermocouple to top of lifting bail | HSH | |
| tmp31 | thermocouple - electrode extensions | component weight | 16 lb. | HSH | |
| tmp32 | thermocouple - electrode extensions | dimensions - envelope | 5.25" dia plug x 61.69" from bottom of thermocouple to top of lifting bail | HSH | |
| tmp33 | thermocouple - electrode extensions | intermediate in-facility storage criteria | consumable template has storage positions for 16 consumables with 7 in dia. bases | HSH | note 5 |
| tmp34 | thermocouple - electrode extensions | operating life | MTTF - 12 mos | HSH | |
| tmp35 | thermocouple - electrode extensions | remote handling requirements | horizontal insertion | HSH | |
| tmp17 | thermocouple - plenum/pool | component weight | 16 lb. | HSH | |
| tmp26 | thermocouple - plenum/pool | intermediate in-facility storage criteria | consumable template has storage positions for 16 consumables with 7 in dia. bases | HSH | note 5 |
| tmp37 | thermocouple - plenum/pool | operating life | MTTF - 4 mos | HSH | |
| tmp06 | thermocouple - plenum/pool | remote handling requirements | use standard lifting bail for 5 ton and 17 ton crane hook | HSH | |
| tmp19 | thermocouple - refractory | component weight | 16 lb. | HSH | |
| tmp27 | thermocouple - refractory | intermediate in-facility storage criteria | consumable template has storage positions for 16 consumables with 7 in dia. bases | HSH | note 5 |
| tmp07 | thermocouple - refractory | operating life | MTTF - greater than 12 mos | HSH | |
| tmp09 | thermocouple - refractory | remote handling requirements | use standard lifting bail for 5 ton and 17 ton crane hook | HSH | |
| tmp30 | thermowell - discharge chamber | operating life | MTTF - 60 mos | HSH | |
| tmp39 | thermowell - plenum/pool | component weight | 99 lb. | HSH | |
| tmp15 | thermowell - plenum/pool | dimensions - envelope | 13" dia flange x 94.52" long from bottom to top of fixed lifting bail | HSH | |
| tmp38 | thermowell - plenum/pool | operating life | MTTF - 9 mos | HSH | |
| tmp18 | thermowell - refractory | dimensions - envelope | 7.0" dia x 113.84" long | HSH | |
| vnt07 | vent insert - discharge chamber | operating life | MTTF - 60 mos | HSH | |

| Tag | Component (2, 3) | Interface Detail (2, 3) | Interface Criteria | System/ Area Locators | Comments |
|---|---|---|---|---|---|
| vnt06 | vent line - discharge chamber | operating life | MTTF - 60 mos | HSH | |
| env42 | wheels | friction coefficient between melter and facility melter rails | 0.23 | HMH | estimated value |
| env11 | wheels | remote handling requirements | no remote adjustments required | HSH | |
| env47 | wheels | type/materials | Demag Model DRS315, cast iron | HMH | |
| env52 | wheels | wheel load capacity | 48,500 lb. for Demag Model DRS315. | HMH | |
| env43 | wheels | wheel load distribution - over all wheels | Max - 26,800 lb. | HMH | |
| env44 | wheels | wheel location and spacing | outside, 148" rail span (c-c), east/west side: south wheel centerline 22.5"/24.5" from seismic pin respectively | HMH | |
| env45 | wheels | wheel quantity | 7 wheels per side, spaced approximately 20.55" center-to-center | HMH | |

**Notes**

1 Column Descriptions
"Tag" - Detail identifier. Not to be reused.
"Component" - Description of specific melter SSC for which the interface detail is associated, use as a sorting column.
"Interface Detail" - Description of interface/design detail in question. Use "Component" column for complete detail description.
"Interface Criteria" - Interface/design data, based on requirements in the specification.
"System/Area Locators" - developed in accordance with project procedures, identifies impacted discipline.
"Comments" - For providing status and/or additional clarification.

2 Write key words first, followed by secondary description if necessary.
3 Use these columns together to fully define interface detail.
4 N/A - not applicable
5 Interproject interface detail, not a subcontractor/project interface detail.

R11334856

ISSUED BY
RPP-WTP PDC

# RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

## ENGINEERING SPECIFICATION

FOR

## HLW Thermal Catalytic Oxidizers/Reducers

**Content applicable to ALARA?** ☒ Yes ☐ No

**ADR No.**
24590-HLW-ADR-HV-02-002

**Rev**
1

| Quality Level |
|---|
| CM |
| DOE Contract No. DE-AC27-01RV14136 |

NOTE: Contents of this document are Dangerous Waste Permit affecting.

| REV | DATE | BY | CHECK | REVIEW | E&NS | QA | DPEM |
|---|---|---|---|---|---|---|---|
| 1 | 2/25/11 | Tim Henry | Dennis Rickettson | Grant Goolsby | | N/A | J. Schneider ~~Janet Roth~~ DJR 2/25/11 |
| 0 | 5/4/09 | Darryl Nelson | Dennis Rickettson | Grant Goolsby | Dick Carlstrom | N/A | Janet Roth |

**SPECIFICATION No.**
24590-HLW-3PS-MBTV-T0002

**Rev**
1

**Revision History**

| Revision | Reason for Revision |
|---|---|
| 0 | This new specification changed from Q to enhanced CM and deals with the TCO and Ammonia /Air Injection units for HLW only. Section 6, Tests and Inspections, is a complete re-write. Section 10, Submittals, is clarified by removing requirements which are redundant to the daughter specifications and adding detail to some requirements.<br>Issued for Purchase |
| 1 | This revision incorporates the following:<br>• TCN's 24590-CM-MRA-MBT0-00002-T0002, T0 004, T0007, & T0009, ~~SDDR #24590-WTP-SDDR-MS-10-00004, SDDR #24590-WTP-SDDR-MS-10-00115~~ TH 3/11/11<br>• Revise sample tap size in paragraph 3.7.1.8 to match with suppliers P&ID submittal number 24590-CM-POA-MBT0-00002-04-00003<br>• Corrected typing error in section 3.7.1.9<br>• Incorporate by reference SDDR# 24590-WTP-SDDR-MS-10-00004, 24590-WTP-SDDR-MS-10-00115<br>Issued for Purchase |
| | |

# Notice

Please note that source, special nuclear, and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the US Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

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## Figures

**Deleted**

## Attachments

1. 24590-WTP-SRD-ESH-01-001-02, pages C.34-1 thru C.34-5, tailoring of ANSI-K61.1
2. 24590-WTP-SRD-ESH-01-001-02, pages C.26-1 thru C.26-7, tailoring of ASME-B31.3
3. 24590-WTP-SRD-ESH-01-001-02, page C.9-1, tailoring of AISC M016
4. HLW Skid Interface Connections
5. Connection For Non-Routine Sample Extraction
6. Connection For Sample Extraction-Permanent Typical
7. Certificate of Analysis for BASF Catalysts, LLC (VOCat 300S)

# 1 Scope

## 1.1 Project Description and Location

The Hanford Tank Waste Treatment and Immobilization Plant (WTP) is a complex of waste treatment facilities where the Department of Energy's (DOE) Hanford site tank waste will be pretreated and immobilized into stable glass form via vitrification. The WTP Contractor will design, build, and start up the WTP pretreatment and vitrification facilities for the US Department of Energy's (DOE) Office of River Protection (ORP). The waste treatment facilities will pre-treat and immobilize the Low-Activity Waste (LAW) and High-Level Waste (HLW) currently stored in underground storage tanks at the Hanford Site.

The Hanford Site occupies an area of about 560 square miles and is located along the Columbia River, north of the city of Richland. The WTP Facility will be constructed at the East End of the 200 East Area of the Hanford Site. Benton, Franklin, and Grant counties surround the Hanford Site.

## 1.2 Equipment, Material, and Services Required

This specification provides the requirements for the design, analysis, materials selection, appurtenances selection, project management, quality control, quality assurance, inspection, fabrication, testing and labeling of 2 ea. HLW Thermal Catalytic Oxidizers/Reducers and the associated Ammonia/Air Dilution Skids.

The scope of work for the SELLER includes all work specifically defined in this specification and its addenda and attachments. Work shall include, but is not limited to, the following:

1.2.1 NOT USED

1.2.2 High Level Waste: 2 ea. Thermal Catalytic Oxidizer/Reducer Skids, 24590-HLW-MX-HOP-SKID-00005 and 24590-HLW-MX-HOP-SKID-00007. 2 ea. Ammonia/Air Dilution Skids, 24590-HLW-MX-HOP-SKID-00006 and 24590-HLW-MX-HOP-SKID-00008. 2 ea. Heater Control Panels, HOP-PNL-00004 and HOP-PNL-00008 (if vendor panel is provided). Components are Seismic Category III as denoted on the MDS in Section 2 of the MR.

1.2.3 NOT USED

1.2.4 Provide an analysis from a Thermal Catalytic Oxidizer/Reducer expert of the design to determine expected catalyst changeout frequency.

1.2.5 NOT USED

1.2.6 NOT USED

1.2.7 NOT USED

1.2.8 NOT USED

1.2.9 NOT USED

1.2.10 NOT USED

1.2.11 Provide certified material test reports, welding procedures, insulation installation procedures, surface preparation and coating procedures, testing procedures, testing results, quality assurance procedures, quality assurance inspection results, and all other procedures and documentation required per this specification and its addenda and attachments.

1.2.12 Provide transportation, storage, and installation instructions for the Thermal Catalytic Oxidizers/Reducers and the Ammonia/Air Dilution Skids per manufacturer's recommendation and this specification.

1.2.13 Provide packaging and prepare the Thermal Catalytic Oxidizer/Reducers Skids, the Ammonia/Air Dilution Skids, control panels, shim pack, gaskets, special tools (if required), and catalyst bed for shipment to the WTP site. Packaging shall be sufficient to allow outdoor storage for a period of up to 12 months at the WTP site, without BUYER action except routine inspection. Environmental conditions for storage are found in Section 3.6 of this specification. SELLER shall provide specific guidelines for storage beyond 12 months.

1.2.14 Provide special tools required for installation and maintenance.

1.2.15 Provide Material Safety Data Sheets (MSDSs) for the catalyst cartridges and any other potentially hazardous chemicals or materials which will be delivered to the BUYER.

1.2.16 Provide a thermal analysis of the Thermal Catalytic Oxidizer/Reducer, and support frame in accordance with the requirements of this specification and Mechanical Data Sheets (MDSs) in Section 2 of the Material Requisition (MR). Select insulation material (i.e. calcium silicate, refractory brick, mineral wool, etc.) to meet thermal requirements of this specification.

1.2.17 Provide detailed installation procedure for insulation, complete with design drawings and insulation map.

1.2.18 Provide a seismic analysis of the Thermal Catalytic Oxidizer/Reducer and ammonia supply/dilution skids in accordance with the requirements of this specification.

1.2.19 Provide shop painting of carbon steel surfaces.

1.2.20 Provide an equipment reliability assessment for all major components and subcomponents including expected catalyst life of the Thermal Catalytic Oxidizers/Reducers. The definition of components and sub-components is at SELLER's discretion.

1.2.21 Provide junction boxes to accommodate wiring to remote-mounted SELLER control panel. SELLER shall provide wiring schedule, diagrams, and documentation to facilitate installation of wiring from equipment to remote control panel.

1.2.22 Provide ASME Sec VIII and B31.3 analysis of the Thermal Catalytic Oxidizer/Reducer and the associated Ammonia/Air Dilution supply piping in accordance with the requirements of this specification.

## 1.3 Work by Others

Specific activities and materials excluded from the scope of this specification include:

1.3.1 Shipping to WTP jobsite

1.3.2 Material unloading and storage at jobsite

1.3.3 Installation labor

1.3.4 Foundation embeds

1.3.5 NOT USED

1.3.6 NOT USED

1.3.7 Ammonia vapor supply to skid connection

1.3.8 Electric power supply

1.3.9 Off skid external wiring

1.3.10 External connection to BUYER's instrumentation and controls

1.3.11 Installation of supplier provided removable / replaceable insulation for flanges, manholes, doors, access openings, as required.

1.3.12 ABB Control System Components, software and programming for normal (PCJ) and safety control (PPJ) systems

1.3.13 Containment Tent, portable HEPA filter exhauster

1.3.14 Grounding cable

## 1.4 Acronyms

| | |
|---|---|
| AISC | American Institute of Steel Construction |
| ANSI | American National Standards Institute |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing and Materials |
| AWS | American Welding Society |
| CGD | Commercial Grade Dedication |
| CM | Commercial |

| | |
|---|---|
| COA | Certificate of Analysis |
| DBE | Design Basis Event |
| DRE | Destruction and Removal Efficiency |
| FAT | Factory Acceptance Test |
| FF | Foundation® Fieldbus |
| FMEA | Failure Mode and Effects Analysis |
| HEPA | High Efficiency Particulate Air |
| HLW | High Level Waste |
| ISA | Instrument Service Air |
| LAW | Low Activity Waste |
| MACT | Maximum Achievable Control Technology |
| MDS | Mechanical Data Sheet |
| MR | Material Requisition |
| MSDS | Material Safety Data Sheet |
| MTBF | Mean-Time Between Failure |
| NACE | National Association of Corrosion Engineers |
| NDE | Non-Destructive Examination |
| NEMA | National Electrical Manufacturers Association |
| NFPA | National Fire Protection Association |
| NOx | Nitrogen Oxides |
| P&ID | Piping and Instrumentation Diagram |
| PCJ | Process Control System |
| PIP | Process Industry Practices |
| PMI | Positive Material Identification |
| PPE | Personnel Protection Equipment |
| PPJ | Programmable Protection System |

| | |
|---|---|
| PQR | Procedure Qualification Record |
| PSA | Process Service Air |
| QAP | Quality Assurance Program |
| Q | Quality |
| QL | Quality Level |
| RPP | River Protection Project |
| SC | Safety Class |
| SCO | Selective Catalytic Oxidation |
| SCR | Selective Catalytic Reduction |
| SDDR | Supplier Deviation Disposition Request |
| SS | Safety Significant |
| SSCs | Systems, Structures, and Components |
| SVOCs | Semi-Volatile Organic Compounds |
| TCO | Thermal Catalytic Oxidizer |
| UL | Underwriters Laboratories, Inc. |
| VOCs | Volatile Organic Compounds |
| VSL | Vitreous State Laboratory |
| WAC | Washington Administrative Code |
| WPS | Welding Procedure Specification |
| WTP | Hanford Tank Waste Treatment and Immobilization Plant |

## 1.5 Definitions

The equipment covered by this specification will be used in the WTP, where the following definitions are applicable:

*Quality Level (QL)*: The quality level identifies the quality requirements to be applied to the equipment. The identified quality levels are Q (Quality), and CM (Commercial). Quality requirements are specifically defined on the associated MDSs and supplier Quality Assurance Program (QAP) requirements data sheets.

*Seismic Category (SC)*: Specific requirements for each seismic category are defined in reference documents listed in Sections 2.3.12 and 2.3.26 of this specification.

*Thermal Catalytic Oxidizer/Reducer Expert:* One who has extensive knowledge regarding the characteristics and application of Thermal Catalytic Oxidizers/Reducers. Must have a minimum of five (5) years experience.

### 1.6 Safety/Quality Classifications

1.6.1 Refer to the MDS in Section 2 of the MR for Safety Class, Quality Level and Seismic Category classifications related to the HLW Thermal Catalytic Oxidizers/Reducers and the Ammonia/Air Dilution skids.

1.6.2 NOT USED

## 2 Applicable Documents

### 2.1 General

2.1.1 Work shall be done in accordance with the referenced codes, standards, and documents listed below, which are an integral part of this specification.

2.1.2 When specific chapters, sections, parts, or paragraphs are listed following a code, industry standard, or reference document, only those chapters, sections, parts, or paragraphs of the document are applicable and shall be applied. For the codes and standards listed in Section 2, the specific revision or effective date identified shall be followed. If a date or revision is not identified, the latest issue, including addenda, at the time of quotation, shall apply.

### 2.2 Industry Standards

2.2.1 AISC M016 - 9th Edition, *Manual of Steel Construction, Allowable Stress Design*, as tailored in Appendix C of 24590-WTP-SRD-ESH-01-001-02, *Safety Requirements Document Vol. II* (see Attachment 3)

2.2.2 NOT USED

2.2.3 NOT USED

2.2.4 NOT USED

2.2.5 NOT USED

2.2.6 ASME B31.3 – 1996, *Process Piping Code*, as tailored in Appendix C of 24590-WTP-SRD-ESH-01-001-02, *Safety Requirements Document Vol. II* (see Attachment 2)

2.2.7 ASME B & PVC, Section VIII-200, Division 1: *Rules for Construction of Pressure Vessels*

2.2.8 NOT USED

2.2.9 ASME Y14.100-2004, *Engineering Drawing Practices*

2.2.10 ASTM – E84-08, *Surface Burning Characteristics of Building Materials*

2.2.11 ASTM - A240-07, *Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels*

2.2.12 AWS D1.6-1999, *Structural Welding Code, Stainless Steel*

2.2.13 NOT USED

2.2.14 NEMA 250-2003, *Enclosures for Electrical Equipment (1,000 Volts Maximum)*

2.2.15 NOT USED

2.2.16 NFPA 70 – 1999, *National Electrical Code*

2.2.17 NFPA 497-2007, *Recommended Practice for Classification of Hazardous Locations for Electrical Installations in Chemical Process Areas*

2.2.18 NOT USED

2.2.19 UL 467-2007, *Standard for Safety Grounding and Bonding Equipment*

2.2.20 UL 508-2007, *Standard for Safety Electric Industrial Control Equipment*

2.2.21 UL 508A-2007, *Standard for Industrial Control Panels*

2.2.22 ANSI K61.1 - 1999, *Safety Requirements for the Storage and Handling of Anhydrous Ammonia*, as tailored in Appendix C of 24590-WTP-SRD-ESH-01-001-02, *Safety Requirements Document Vol. II* (see Attachment 1)

2.2.23 IEEE 384-1992, *Standard Criteria for Independence of Class 1E Equipment and Circuits*, as tailored in referenced specification 24590-WTP-3PS-EKP0-T0001

2.2.24 NOT USED

2.2.25 NOT USED

2.2.26 NOT USED

2.2.27 NOT USED

2.2.28 NOT USED

2.2.29 NOT USED

2.2.30 NOT USED

2.2.31 AWS D1.1-2000, *Structural Welding Code – Steel*

2.2.32 29 CFR 1910, *Occupational Safety and Health Standards for General Industry*

## 2.3 Reference Documents/Drawings

2.3.1 24590-WTP-3PS-AFPS-T0001, *Engineering Specification for Shop Applied Special Protective Coating for Steel Items and Equipment*

*2.3.2* 24590-WTP-3PS-G000-T0001, *General Specification for Supplier Quality Assurance Program Requirements*

*2.3.3* 24590-WTP-3PS-G000-T0002, *General Specification for Positive Material Identification (PMI)*

*2.3.4* 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling and Storage Requirements*

*2.3.5* 24590-WTP-3PS-JQ07-T0001, *Engineering Specification for Instrumentation for Package Systems*

*2.3.6* 24590-WTP-3PS-EKP0-T0001, *Engineering Specification for Electrical Requirements for Packaged Equipment*

2.3.7 NOT USED

*2.3.8* 24590-WTP-3PS-NN00-T0001, *Engineering Specification for Thermal Insulation for Mechanical Systems*

2.3.9 24590-WTP-3PS-PS02-T0001, *Engineering Specification for Shop Fabrication of Piping*

*2.3.10* 24590-WTP-3PS-SS00-T0001, *Engineering Specification for Welding of Carbon Structural Steel*

2.3.11 24590-WTP-3PS-SS00-T0002, *General Specification for Welding of Structural Stainless Steel and Welding of Structural Carbon Steel to Structural Stainless Steel*

2.3.12 24590-WTP-3PS-FB01-T0001, *Engineering Specification for Structural Design Loads for Seismic Category III & IV Equipment and Tanks*

*2.3.13* 24590-WTP-3PS-NWP0-T0001, *Engineering Specification for General Welding and NDE Requirements for Supplier Fabricated Piping*

2.3.14 NOT USED

*2.3.15* 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication*

*2.3.16* 24590-WTP-3PS-MVB2-T0001, *Engineering Specification for Welding of Pressure Vessel, Heat Exchangers and Boilers*

2.3.17 NOT USED

2.3.18 NOT USED

2.3.19 NOT USED

2.3.20 NOT USED

2.3.21 NOT USED

2.3.22 NOT USED

2.3.23 VSL-08R1390-1 *Small Scale Melter Testing for Allyl Alcohol Method Verification*

2.3.24 NOT USED

2.3.25 NOT USED

*2.3.26* 24590-WTP-3PS-MV00-T0002, *Engineering Specification for Seismic Qualification Criteria for Pressure Vessels*

2.3.27 24590-WTP-LIST-CON-08-0001, *Restricted Materials List WTP Safety Assurance*

*2.3.28* 24590-WTP-3PS-JQ06-T0005, *Environmental Qualification of Control and Electrical Systems and Components*

2.3.29 24590-WTP-3PS-G000-T0015, *Environmental Qualification of Mechanical Equipment*

# 3 Design Requirements

## 3.1 General

3.1.1 The Thermal Catalytic Oxidizers/Reducers and the associated Ammonia/Air Dilution units shall be designed per this specification, the applicable documents listed in Section 2 of this specification, and the MDSs in Section 2 of the MR.

3.1.2 The WTP facility is designed for a minimum service life of 40 years. Structural and pressure boundary components related to the Thermal Catalytic Oxidizer/Reducer and the associated Ammonia/Air Dilution units shall be engineered with a design life of 40 years. Catalyst used in the Thermal Catalytic Oxidizers/Reducers shall have a minimum design life of one year. Other mechanical components shall have a minimum service life of five years with periodic maintenance. Components that cannot be guaranteed for a minimum service life of five years shall be identified in accordance with the following requirements:

- Failure rate or Mean-Time Between Failure (MTBF), whichever is available, and the basis for the rate including specific references to any sources.
- Estimated modes of failure (example, dielectric breakdown, element overheat, etc.). This may be delineated in a Failure Mode and Effects Analysis (FMEA). The method used to perform the FMEA (Example, MIL-STD-1629) and the year shall be specified. All assumptions used to perform the FMEA shall be clearly stated.

- Recommended maintenance and frequency, as applicable.
- Estimated time to perform the recommended maintenance, as applicable.

The data above shall be based on the physical and environmental conditions delineated in this specification and MDSs. Where possible, the SELLER shall compare the figures for the equipment in this specification to similar equipment sold and serviced by the SELLER. The source for all estimates and any underlying assumptions shall be stated. If software is used to perform the FMEA, the SELLER shall specify the software used and the version (example software, Relex, Isogen, Reliasoft, etc.).

3.1.3 Operation of the Thermal Catalytic Oxidizers/Reducers and the associated Ammonia/Air Dilution units shall be continuous for one year. Refer to MDSs in Section 2 of the MR for thermal cyclic conditions.

3.1.4 The thermal and seismic analyses to be provided per this specification must verify that the final detailed design of the Thermal Catalytic Oxidizers/Reducers and the associated Ammonia/Air Dilution units meet the requirements set forth in this specification and its addenda and attachments.

3.1.5 The maximum pressure drops across the Thermal Catalytic Oxidizers/Reducers shall be in accordance with the requirements of the MDSs.

3.1.6 The following requirements shall be met:

- Pressure boundary shall be designed in accordance with the requirements of ASME B&PVC, Section VIII, Div. 1 and BUYER specification 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication.* Code stamp is not required

- Non-Destructive Examination (NDE) requirements for the pressure boundary shall be in accordance with BUYER specification 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication*, Commercial Grade (CM) Vessels

- Seismic analysis shall be per BUYER specification 24590-WTP-3PS-MV00-T0002, *Engineering Specification for Seismic qualification Criteria for Pressure Vessels*

- The structure supporting the pressure boundary shall be designed per BUYER specification 24590-WTP-3PS-MV00-T0002, Section 7.2.2, *Engineering Specification for Seismic Qualification Criteria for Pressure Vessels*

3.1.7 Penetrations in the pressure boundary (i.e. access doors, sample ports, etc.) shall be designed and reinforced in accordance with the requirements of ASME B&PVC, Section VIII, Div. 1, and BUYER specification 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication.* In addition, access doors shall be designed for ease of operation by one person.

3.1.8 If determined necessary by thermal analysis, SELLER shall design the Thermal Catalytic Oxidizers/Reducers to be externally insulated so the external surface temperature does not exceed 140°F. Insulation shall meet applicable requirements of BUYER specification

24590-WTP-3PS-NN00-T0001 *Engineering Specification for Thermal Insulation for Mechanical Systems.*

3.1.9 Internal bracing shall be minimized. Where internal bracing is required, bracing members of circular cross section are preferred.

3.1.10 NOT USED

3.1.11 NOT USED

3.1.12 The SELLER shall select insulation and design the Thermal Catalytic Oxidizers/Reducers and support frame to prevent the BUYER's concrete foundation from reaching a maximum temperature of 150°F.

3.1.13 SELLER shall design and supply necessary outlet piping for sample nozzles located downstream of the recuperative heat exchanger required for ammonia control. SELLER shall include pipe supports and Tied Expansion joints for both the offgas process inlet and outlet connections. Tied Expansion joints shall be 2 ply or greater.

3.1.14 The following are the Safety Significant functions of the HLW Thermal Catalytic Oxidizer/Reducer and the Ammonia/Air Dilution units. (Note: Only root components are listed below. See P&ID 24590-HLW-M6-HOP-00008 / -20008 for the remaining components):

a) Confinement of Melter Offgas: TCO housing, piping, and appurtenances shall be designed to maintain offgas confinement during normal operation, and during and after a seismic event. Structural failure of internals shall not breach confinement boundary.

b) Confinement of Ammonia: The ammonia supply piping, valves, and appurtenances shall maintain confinement of ammonia during normal operation, and during and after a seismic event.

c) Heater High Temperature Interlock: TE0514(Z), JY0520(Z), TE2514(Z), JY2520(Z). Heater to be shut down at a given high temperature setpoint to prevent an over temperature condition.

d) Low Dilution Air Flow Interlock: YV0504(Z), YV2504(Z), YV0509(Z), YV2509(Z), FT0517(Z), FT2517(Z), FT0518(Z), FT2518(Z). Ammonia supply to be shut off at a given low dilution air flow setpoint.

e) NOT USED

f) Low SCR Temp Interlock: TE0336(Z), TE2336(Z). Ammonia supply to be shut off at a given low SCR temperature setpoint.

g) NOT USED

h) NOT USED

i) NOT USED

3.1.15 NOT USED

## 3.2 Offgas Treatment System Description

Offgas is generated from the vitrification of radioactive waste in Joule heated ceramic melters.

3.2.1 NOT USED

3.2.2 HLW Thermal Catalytic Oxidizer/Selective Catalytic Reduction Units:

The feed to the HLW Thermal Catalytic Oxidizer/Reducer is primarily melter offgas that has been treated by a Submerged Bed Scrubber (SBS), Wet Electrostatic Precipitator (WESP), High Efficiency Mist Eliminator (HEME), HEPA Filters, Activated Carbon Bed Adsorber, and Silver Mordenite column.

## 3.3 Basic Function

Each Thermal Catalytic Oxidizer/Reducer unit shall consist of four primary components, a recuperative heat exchanger, electric heater, VOC selective catalytic oxidation (SCO) bed, and $NO_X$ selective catalytic reduction (SCR) bed. The rating of each component shall be determined by the SELLER to meet the performance requirements specified in Section 3.4 of this specification. SELLER shall also include ammonia dilution and mixing appurtenances necessary to meet performance requirements of this specification.

3.3.1 Recuperative Heat Exchanger

The recuperative heat exchanger is primarily employed to recover heat from the SCR hot exhaust gas for the Thermal Catalytic Oxidation/Reducer unit. The heat exchanger shall cool down the hot SCR exhaust gas and heat the incoming offgas.

3.3.2 Electric Heater

The electric heater is downstream of the recuperative heat exchanger and is employed to heat the offgas feed to the final desired oxidation and reduction temperatures. After startup, the electric heater shall function as a trim control to raise the offgas temperature to the required oxidizing temperature. Required oxidizing and reduction temperatures shall be per performance criteria specified in Section 3.4 of this specification.

3.3.3 Oxidation Catalyst

The SCO, containing oxidation catalyst, is downstream of the Electric Heater and will oxidize volatile and semi-volatile organic compounds creating water and carbon dioxide. The residence time and number of catalyst beds shall be as specified in Section 3.4 of this specification.

3.3.4 $NO_X$ Selective Catalytic Reduction Unit

The SCR, containing reduction catalyst, is downstream of the Oxidation Catalyst and shall use ammonia injection to reduce the $NO_X$ to Nitrogen, Oxygen, and water through catalytic reaction with ammonia.

3.3.5 Ammonia Dilution System

The BUYER will supply ammonia gas to the HLW SCRs. SELLER shall specify dilution air flow rates and pressures if required for the Ammonia/Air Dilution system. SELLER shall supply necessary equipment required to meet performance requirements.

## 3.4 Performance

3.4.1 Refer to the Thermal Catalytic Oxidizers/Reducers MDSs for design data and gas stream properties.

3.4.2 The organic Destruction and Removal Efficiency (DRE) performance shall be based on inlet loadings specified in the MDSs.

3.4.3 The Thermal Catalytic Oxidizers/Reducers shall meet the DRE for Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs) as required in the MDSs as well as residence time and minimum oxidizing temperatures specified.

3.4.4 The NOx SCR unit shall meet the reduction efficiency at less than the specified ammonia slip concentration required in the MDSs.

3.4.5 Detection limits used to verify the Thermal Catalytic Oxidizers/Reducers guaranteed performance shall be based on BUYER information (MDS General Note 9).

3.4.6 SELLER shall provide curves plotting efficiency versus inlet operating temperature for the Thermal Catalytic Oxidizer and Selective Catalytic Reducer catalysts.

3.4.7 SELLER shall provide ammonia slip curves for SCR performance.

3.4.8 NOT USED

3.4.9 NOT USED

3.4.10 The ammonia slip exiting the HLW systems shall be specified by the SELLER to meet the NOx reduction efficiencies specified in Section 3.4.4 of this specification.

3.4.11 BUYER's residence time, specified in the MDSs, is the minimum for VOC and SVOC destruction and therefore shall be used by SELLER if it exceeds the SELLER's calculated required residence time.

3.4.12 As specified in the MDSs, concentrations of certain chemical compounds are subject to large step increases and spikes. The SELLER's calculation shall account for these increases and spikes.

3.4.13 SELLER shall identify if additional NOx analyzers are required outside the boundaries of the SELLER's equipment to meet the specified $NO_X$ reduction efficiency and ammonia slip MDS requirements. SELLER shall obtain BUYER's approval for additional $NO_X$ analyzers.

## 3.5 Design Conditions

3.5.1 Refer to the Thermal Catalytic Oxidizers/Reducers and the associated Ammonia/Air Dilution MDSs in Section 2 of the MR.

3.5.2 NOT USED

3.5.3 Shim plates will be placed on the BUYERS foundation embed plates for leveling the HLW TCO skids and the HLW TCO ammonia skids. The SELLER shall provide the shim plates and the design detailing how the shims are welded to the BUYERS embed plates and how the equipment is connected to the shim plates.

The embed plate design location and elevation for HLW TCO skids and ammonia skids is shown on drawing 24590-HLW-DD-S13T-00067. The design elevation for the top of the embed plates is 0 feet - 0 inches, in plant elevation. The existing embed elevations vary from plate to plate. Some embed plates are on design elevation, some embed plates are 1/8 inch low and some embeds are 1/4 inch low. To account for embed elevations and waviness of the concrete floor the bottom elevation for the HLW TCO skids and the HLW TCO ammonia skids shall be set at + 0 feet, +1/2 inch in plant elevation.

The BUYERS existing embed plates for the HLW TCO skids and HLW TCO ammonia skids are coated carbon steel plates, stock code: EBPNS01CH, shown on drawing 24590-PTF-DD-S13T-00201. The carbon steel embed plates are coated with one layer of inorganic zinc primer. When attachments are welded to the existing embed plates, WTP site welding procedures require inorganic zinc primer to be removed within 2- 4 inches of the weld area. Only carbon steel can be welded to the carbon steel embed plates where the inorganic zinc primer has been removed. It is acceptable to weld a carbon steel skid frame or stainless steel skid frame to the top of the carbon shim welded to the BUYERS embed.

SELLER shall provide shims specified below for the HLW TCO skids and HLW TCO ammonia skids. The shims are generic and can be used under any skid frame as required.

All shim material shall be carbon steel, ASTM A572, grade 50, bare steel, no coating required. Shim thickness is nominal.

(13) 1/2 inch thick shims (this quantity includes 2 spare shims)
(24) 5/8 inch thick shims (this quantity includes 4 spare shims)
(3) 3/4 inch thick shims (this quantity includes 2 spare shims)

3.5.4 NOT USED

## 3.6 Environmental Conditions

3.6.1 The Thermal Catalytic Oxidizer/Reducer Skids and Ammonia/Air Dilution Skids will be located indoors. Refer to MDSs for specific room environmental design conditions.

3.6.2 Thermal Catalytic Oxidizers/Reducers and components, except catalysts, and the Ammonia/Air Dilution Skids may be stored outdoors prior to installation at ambient extreme temperatures ranging from minus 23°F dry-bulb to 113°F dry-bulb and a relative humidity of 0 to 100%.

3.6.3 Refer to Sections 3.7, 3.9 and 3.10 of this engineering specification for enclosure, instrumentation and electrical requirements and related environmental qualification requirements.

3.6.4 Safety Significant instrumentation that is required to meet environmental qualification shall be qualified in accordance with engineering specification 24590-WTP-3PS-JQ06-T0005, *Engineering Specification for Environmental Qualification of Control and Electrical Systems and Components.*

## 3.7 Mechanical Requirements

3.7.1 General

3.7.1.1 Due to access restrictions for installation, the Thermal Catalytic Oxidizer/Reducer units shall be fabricated in such a manner that will allow delivery in three to five sections that comply with the bounding dimensions specified in MDSs. Each section of the Thermal Catalytic Oxidizer/Reducer shall be skid mounted.

3.7.1.2 The catalyst bed shall be designed for manual removal and replacement. The catalyst bed shall be designed to meet service life requirements outlined in Section 3.1.2 of this specification. The weight of a catalyst module shall not exceed 50 pounds for lifting manually. BUYER prefers side access for replacing the catalysts. If weights exceed 50 pounds, lifting beams or rigs shall be designed and supplied by the SELLER.

3.7.1.3 SELLER shall provide transitions for connection to BUYER's piping and gas analyzer instrumentation. All flanges required for connection to BUYER's piping and gas analyzers shall have raised face flanges. See Attachment 4 (HLW Skid Interface Connections). See also Attachments 5 and 6 (Connection for Non-Routine Sample Extraction and Connection for Sample Extraction - Permanent Typical, respectively) for non-routine and permanent analyzer connection details.

3.7.1.4 SELLER shall provide TCO drain lines. Drain lines shall be welded to the housing at low points. Penetrations by drains shall be arranged and individually sealed so that catalysis beds cannot be bypassed. Drain lines shall be piped to skid edge and flanged.

3.7.1.5 NOT USED

3.7.1.6 SELLER shall design and supply recuperative heat exchanger outlet piping as specified in the MDSs. Pipe fabrication and supports shall be designed in accordance with ASME B31.3 and BUYER specification 24590-WTP-3PS-PS02-T0001 *Shop Fabrication of Piping*, and be included in the SELLER's scope of supply. SELLER shall include pipe supports and tied expansion joints for both offgas process inlet and outlet connections.

3.7.1.7 Mechanical components required to meet the Safety Significant functions of containment of melter offgas shall be designed and fabricated to meet environmental qualifications in accordance with engineering specification 24590-WTP-3PS-G000-T0015, *Engineering Specification for Environmental Qualification of Mechanical Equipment.*

3.7.1.8 A containment tent or series of containments tents will be erected by the BUYER to control the work area for catalyst removal and replacement after permanent installation of the TCO units. The BUYER will supply and set up a portable HEPA filtered exhauster for containment tent ventilation with discharge port monitoring. The TCO unit will be ventilated using permanently installed process fans. Prior to opening the catalyst access doors on the TCO unit, the TCO unit air will be sampled using an up stream, 1/4 inch pre-installed sample tap. The air sample will be used to determine the level of airborne radioactive material inside the TCO unit. After the air samples are taken and deemed acceptable, opening the catalyst access doors will take place inside the containment tent once stable air flow conditions are established.

The SELLER shall supply the following for each TCO unit:

- One 3/4 inch air sample tap per TCO unit. Include one 3/4 inch ball valve. The sample tap shall extend 12 inches inside the TCO unit. The accessible end of the 3/4 inch ball valve shall include a cap. There shall be at least 3 inches of clearance, for tightening bolts, between the insulating jacketing and the underside of the flange.

Catalyst removal / installation:

- The catalyst bed (s) shall be designed for manual removal and replacement without entering the TCO unit for contact maintenance. It is acceptable for hands and arms to break the plane of the catalyst access door to reach inside the TCO to operate jack bolts with hand tools or use tools with extended handles to remove /replace catalyst modules. It is acceptable to split the movable catalyst frame to minimize the weight of the frame being moved for catalyst module removal / replacement. Pulling the Catalyst module forward to unsnap the tongue and groove connection is not desirable. A jack bolt system that applies pressure to the movable frame to hold the catalyst modules in place is desired.

3.7.1.9 To facilitate process troubleshooting and to obtain additional data during testing and operations, the SELLER shall supply the following for each TCO unit:

- One thermowell between each of the VOC catalyst beds to be provided to take temperature readings during non-routine evolutions. Thermowells shall be located to minimize flow disturbance and not interfere with the manipulation of the catalyst access doors. The location shall consider optimum accessibility. However, it is acceptable to locate the thermowell on the top of the TCO.

- One sample port between each of the VOC catalyst beds to be used to measure offgas concentrations during non-routine evolutions. Sample ports shall be located to minimize flow disturbance and not interfere with the manipulation of the catalyst access doors. The location shall consider optimum accessibility. However, it is acceptable to locate the sample ports on the top of the TCO. Include ball valve, blind flange, gaskets and bolts for each sample port. See Attachment 5 (Connection for Non-Routine Sample Extraction) for temporary connection details.

3.7.2 Recuperative Heat Exchanger

3.7.2.1 Unless otherwise specified, the heat exchanger pressure boundary shall be designed in accordance with ASME B&PVC, Section VIII, Div. 1.

3.7.2.2 The recuperative heat exchangers in the Thermal Catalytic Oxidizer/Reducer units are expected to have a design life of 40 years. If the design life is less than 40 years, the SELLER shall provide provisions for cleaning, maintenance, repair or unit replacement. The SELLER shall submit options for cleaning, maintenance, repair or provisions for total unit replacement of the recuperative heat exchanger. Options to be considered, but not limited to, include:

- Body flanges that allow for total unit replacement,
- Clean out doors for maintenance access,
- Automatic wash systems/particulate collection hoppers, and
- Bolted connection to skid support frame.

3.7.2.3 Heat exchangers shall be designed for full differential pressure, with one side at the design pressure and the other side at atmospheric pressure.

3.7.2.4 NOT USED

3.7.2.5 NOT USED

3.7.2.6 NOT USED

3.7.3 Ammonia/Air Dilution Equipment

3.7.3.1 Design and fabrication of ammonia piping and valves shall be in accordance with ANSI K61.1, ASME B31.3, and BUYER specification 24590-WTP-3PS-PS02-T0001, *Shop Fabrication of Piping.*

3.7.3.2 NOT USED

3.7.3.3 Piping and components required for the HLW Ammonia/Air Dilution shall be located on a separate skid away from the Thermal Catalytic Oxidizer/Reducer skid. Refer to MDS for space envelope and equipment layout requirements. SELLER shall include necessary equipment to meet performance requirements of this specification.

3.7.3.4 NOT USED

3.7.3.5 NOT USED

3.7.3.6 NOT USED

3.7.3.7 NOT USED

3.7.3.8 NOT USED

3.7.3.9 NOT USED

3.7.3.10 NOT USED

3.7.3.11 NOT USED

3.7.3.12 NOT USED

3.7.3.13 NOT USED

3.7.3.14 NOT USED

3.7.3.15 NOT USED

3.7.3.16 NOT USED

3.7.3.17 NOT USED

3.7.3.18 NOT USED

## 3.8 Loading

3.8.1 The Thermal Catalytic Oxidizers/Reducers (24590-HLW-MX-HOP-SKID-00005/7) and the associated Ammonia/Air Dilution assemblies shall be self-supporting, capable of carrying the static loads of components and the stress imposed during shipment, installation, and operation. See Section 2.3.26.

3.8.2 The Thermal Catalytic Oxidizer/Reducer and the associated Ammonia/Air Dilution skids shall be designed in accordance with the requirements of specification 24590-WTP-3PS-FB01-T0001, *Structural Design Loads for Seismic Category III & IV Equipment and Tanks*.

3.8.3 The SELLER shall provide a seismic analysis in accordance with Section 3.8.2 of this specification. The SELLER shall provide the documented results of the seismic analysis in report form to the BUYER.

3.8.4 The Thermal Catalytic Oxidizer/Reducer units shall be designed in accordance with the nozzle load requirements as specified in the MDSs in Section 2 of the MR.

## 3.9 Electrical Requirements

3.9.1 Electrical components and appurtenances furnished with the Thermal Catalytic Oxidizer/Reducer and the associated Ammonia/Air Dilution units shall conform to the requirements of specification 24590WTP-3PS-EKP0-T0001, *Electrical Requirements for Packaged Equipment*. Electrical components shall also meet applicable sections of NFPA 70, and requirements outlined in NFPA 497.

3.9.2 Electric heaters shall be of the element type and mounted on removable flanged plates for ease of maintenance. BUYER will supply a 480V 3-wire wye grounded power circuit. If SELLER's supplied heaters are rated for a lower voltage, SELLER shall supply the necessary components to step the electricity down to the necessary voltage.

3.9.3 Electrical enclosures shall be NEMA 4X rated.

3.9.4 The Thermal Catalytic Oxidizer/Reducer control panel components shall be UL 508 listed and certified. Control panels as a whole shall be UL 508A labeled.

3.9.5 Safety Significant electrical systems/components are required to meet environmental qualification and shall be qualified in accordance with engineering specification 24590-WTP-3PS-JQ06-T0005, *Engineering Specification for Environmental Qualification of Control and Electrical Systems and Components.*

3.9.6 NOT USED

3.9.7 SELLER shall provide a grounding lug or boss, in accordance with UL 467, on the equipment housing or frame to facilitate attachment of grounding cable by the BUYER.

3.9.8 SELLER shall provide total electric load for each Thermal Catalytic Oxidizer/Reducer.

## 3.10 Instrumentation and Control Requirements

3.10.1 Instrumentation and controls furnished with the Thermal Catalytic Oxidizer/Reducer and the associated Ammonia/Air Dilution units shall meet the requirements of engineering specification 24590-WTP-3PS-JQ07-T0001,Rev. 2, *Instrumentation for Package Systems.* BUYER shall provide the appropriate ABB control system components (i.e. I/O modules, power supplies) to the SELLER for fabrication into the SELLER's heater control panel as described in Section 3.4.2.1.1 of 24590-WTP-3PS-JQ07-T0001, Rev. 2. SELLER shall provide non-ABB manufactured equipment (fiber optic converters, fiber optic patch cables and plates, terminals, circuit breaker, wiring, etc.) and panel fabrication.

3.10.2 SELLER shall design the heater control panel to utilize the ABB control system equipment and provide a panel arrangement drawing with Bill of Material identifying all parts to be provided by the BUYER. SELLER shall provide an I/O list on the panel arrangement drawing for all instruments. Reference BUYER's P&IDs in Section 2 of the MR for additional information regarding instrument locations and types.

3.10.3 SELLER shall provide control narrative, logic drawings, termination drawings, and related items as specified in 24590-WTP-3PS-JQ07-T0001, *Instrumentation for Package Systems* for normal (PCJ) and safety control system (PPJ) operation. BUYER shall provide programming for normal operation (PCJ) via software included with BUYER supplied ABB components, and for safety operation via BUYER's safety control system (PPJ), according to SELLER's specification of the monitoring and control requirements. BUYER shall provide controller, software, and attend and support the factory test of the equipment at the SELLER's facility.

3.10.4 NOT USED

3.10.5 In-line instruments shall be wired or tubed to the skid edge. Tubing shall terminate with a bulkhead connection. Wiring shall terminate in a junction box.

3.10.6 NOT USED

3.10.7 NOT USED

3.10.8 NOT USED

3.10.9 NOT USED

3.10.10 NOT USED

3.10.11 NOT USED

3.10.12 NOT USED

3.10.13 NOT USED

3.10.14 Safety Significant instrumentation is required to meet environmental qualification and shall be qualified in accordance with engineering specification 24590-WTP-3PS-JQ06-T0005, *Engineering Specification for Environmental Qualification of Control and Electrical Systems and Components.*

## 3.11 Lifting Requirements

3.11.1 Lifting lugs shall be installed on the Thermal Catalytic Oxidizers/Reducers and Ammonia/Air Dilution skid packages for balanced lifting and handling. SELLER shall identify the weight and center of gravity of each package. All lifting points shall be designed in accordance with the requirements of BUYER specification 24590-WTP-3PS-G000-T0003, *General Specification for Packaging, Handling, and Storage Requirements.*

3.11.2 Lifting eyes or lugs shall be certified to be suitable for the safe, balanced lifting and handling of the equipment without distortion or damage to the components.

3.11.3 All lifting attachments shall have either a safety factor of three (3), based on material ultimate strength, or five (5), based on the material yield strength, whichever is more conservative. The lifting points and center of gravity shall have a label clearly identifying its safe working load.

3.11.4 Lifting lugs must accept standard commercial lifting equipment. Chain blocks or braiding shall not be permitted.

3.11.5 The lifting lugs for the packages must be accessible from the top, without removal of components or covers.

3.11.6 NOT USED

3.11.7 SELLER to provide calculations for the lift lug design.

## 3.12 Thermal Analysis Requirements

3.12.1 Method of thermal analysis shall be proposed by the SELLER.

3.12.2 Refer to MDS for thermal analysis technical information and heat loss requirements (i.e. thermal conductivity values, room temperatures, etc.).

3.12.3 The thermal analysis shall include the effects of stresses resulting from potential variations in temperatures due to startup, normal operation, shutdowns, and thermal cycling of the

Thermal Catalytic Oxidizer/Reducer. Analysis shall show that the Thermal Catalytic Oxidizers/Reducers are adequate for the design life specified in Section 3.1.2 of this specification. Analysis shall also establish design temperature of the TCOs.

3.12.4 The thermal analysis shall include thermal expansion of the Thermal Catalytic Oxidizers/Reducers and resulting nozzle loadings in X, Y, and Z planes with deflections at normal operating conditions and design conditions.

3.12.5 NOT USED

3.12.6 The thermal analysis shall determine the thickness and extent of insulation required on the sides, ends, top and bottom of the Thermal Catalytic Oxidizers/Reducers to ensure that the insulation jacket temperature and all exterior uninsulated portions with potential for personnel exposure, do not exceed 140 °F at maximum design temperature.

3.12.7 The thermal analysis shall determine the thickness and extent of insulation required on the bottom of the Thermal Catalytic Oxidizers/Reducers so that the temperature of the concrete does not exceed 150 °F.

3.12.8 The SELLER shall provide the documented results of the thermal analysis in report form to the BUYER. The thermal analysis report shall provide a complete thermal analysis of the Thermal Catalytic Oxidizers/Reducers and shall include 3-D graphical results of models and all calculations performed, as applicable to the analysis approach chosen.

3.12.9 All assumptions shall be plainly identified and data presented (including their uncertainty) with precise logic.

3.12.10 The final thermal analysis report shall convey information to several disciplines, many of whom may be less familiar with the general subject than the authors. Care shall be taken to use simple statements and expressions and to make statements as concise as possible. If highly technical terms are necessary, they shall be adequately explained and defined.

## 3.13 Thermal Catalytic Oxidizer/Reducer Design Analysis Requirements

3.13.1 The SELLER shall conduct and submit Thermal Catalytic Oxidizer/Reducer design analyses for the HLW units. The design analysis of the Thermal Catalytic Oxidizers/Reducers shall be conducted by a Thermal Catalytic Oxidizer/Reducer expert to determine the expected catalyst changeout frequency for the final Thermal Catalytic Oxidizer/Reducer design. SELLER shall provide personnel qualifications to the BUYER for review.

3.13.2 Analysis shall be conducted considering operation of the Thermal Catalytic Oxidizers/Reducers at design conditions outlined in this specification and MDSs.

3.13.3 Analysis shall determine expected catalyst changeout frequency based on the gas composition and load information specified in the MDSs in Section 2 of the MR.

3.13.4 The design analysis for expected catalyst changeout shall assume that the offgas flow through the Thermal Catalytic Oxidizers/Reducers may vary as much as ±10% from the design flowrate specified in the MDSs in Section 2 of the MR.

3.13.5 The SELLER shall provide the documented results of the Thermal Catalytic Oxidizer/Reducer analysis with any graphical results, as applicable, in report form to the BUYER prior to fabrication.

### 3.14 Accessibility and Maintenance

3.14.1 BUYER's layout allows for necessary access and space requirements to facilitate maintenance during normal plant operation or scheduled shutdown.

3.14.2 Supplier's recommended accessibility and maintenance requirements for each piece of equipment shall be included in the SELLER's design and shown on layout drawings. Side access for replacement of the catalyst and related gaskets is required.

3.14.3 NOT USED

3.14.4 SELLER shall provide instructions and frequency of maintenance including lubrication, rotation, heating, and any other type of preventative maintenance that will preserve the equipment until the time it is put into operation, including:

- Up to 12 months outdoor storage prior to installation
- Outdoor preservation maintenance and inspection schedule
- Indoor (installed) but not operating preservation maintenance and inspection schedule
- Operating preservation maintenance and inspection schedule

3.14.5 Frequency of inspection and maintenance intervals during operation shall be in accordance with equipment SELLER's recommendations.

3.14.6 Equipment, instrumentation, and electrical components that are six feet over from ground level and require routine maintenance shall be provided with permanent work platforms with fixed ladders/stairs to perform maintenance.

3.14.7 Maintenance platforms and ladders, if applicable per 3.14.6, shall be designed to meet the requirements set forth in 29 CFR 1910, Occupational Safety and Health Standards for General Industry and AISC 9th Edition.

3.14.8 The maintenance platforms, if applicable per 3.14.6, shall be attached without welding after the equipment is installed in the HLW facility.

# 4 Materials

### 4.1 General

4.1.1 SELLER shall comply with specification 24590-WTP-3PS-G000-T0002, *Positive Material Identification (PMI)*.

## 4.2 Construction

4.2.1 Materials of construction shall have properties suitable for the service conditions defined in the MDSs.

4.2.2 The ASME and/or ASTM material numbers and grades shall be identified and a "Manufacturer's Material Certificate of Compliance" shall be provided for the housing, ducts, weld filler metal, and support framing integral to the Thermal Catalytic Oxidizer/Reducer and the associated Ammonia/Air Dilution assemblies. Material designations shall be indicated on the fabrication drawings and in the material lists.

4.2.3 Thermal Catalytic Oxidizer/Reducer and the associated Ammonia/Air Dilution skids shall be fabricated from structural steel shapes and plates properly reinforced to be self-supporting, capable of carrying the static loads of components and the stresses imposed during shipment, installation, and operation.

4.2.4 Thermal Catalytic Oxidizer/Reducer and the associated Ammonia/Air Dilution housings and outlet piping shall be fabricated from materials specified in the MDSs in Section 2 of the MR.

4.2.5 NOT USED

4.2.6 Where the BUYER has not specified material types, the SELLER shall select materials giving consideration to the design life of the equipment, compatibility with adjacent materials, compatibility with the process materials and conditions, environmental conditions, and coating requirements.

## 4.3 Prohibited Materials

4.3.1 As applicable, mercury, zinc, cadmium, or other low melting point materials and halogens shall not be used in direct contact with stainless steel. This prohibition also applies to use of tools, fixtures, paints, coatings and sealing compounds, and any other equipment or materials used by the SELLER in handling, assembly and storage of stainless steel parts or components.

4.3.2 Asbestos shall not be used in any component of the Thermal Catalytic Oxidizers/Reducers, the associated Ammonia/Air Dilution units, and appurtenances.

4.3.3 The prohibited materials list excludes materials that might be used for bearings, brazed joints, or instruments.

4.3.4 The equipment provided to the BUYER shall not contain any of the materials listed in 24590-WTP-LIST-CON-08-0001, *Restricted Materials List WTP Safety Assurance* unless BUYER (Safety Assurance) approval is obtained.

### 4.4 Insulation

4.4.1 The SELLER shall provide detailed insulation installation procedures complete with drawings showing methods and details for applying and securing insulation. Installation procedures and drawings shall include details related to applying and securing metal jacketing (if externally insulated), to the Thermal Catalytic Oxidizers/Reducers. The insulation procedures shall be in accordance with BUYER specification 24590-WTP-3PS-NN00-T0001 *Thermal Insulation for Mechanical Systems*, and this specification. The insulation installation procedures shall be reviewed by the BUYER prior to commencement of work to install insulation on the Thermal Catalytic Oxidizers/Reducers.

4.4.2 SELLER shall provide shop fabricated and installed insulation to the maximum extent possible, in an effort to minimize field insulation.

4.4.3 NOT USED

4.4.4 NOT USED

4.4.5 Provide for removable/replaceable insulation on flanges, manholes, doors, and access openings.

4.4.6 DELETED

4.4.7 DELETED

4.4.8 DELETED

4.4.9 DELETED

4.4.10 NOT USED

4.4.11 NOT USED

4.4.12 NOT USED

4.4.13 NOT USED

4.4.14 DELETED

# 5 Fabrication

### 5.1 General

5.1.1 Fabrication of the thermal catalytic oxidizer/reducer units shall be in accordance with the requirements of 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication.*

5.1.2 Fabrication of piping shall meet the requirements of BUYER specifications 24590-WTP-3PS-PS02-T0001 Shop Fabrication of Piping, 24590-WTP-3PS-NWP0-T0001 *General Welding and NDE Requirements for Supplier Fabricated Piping*, and ASME B31.3.

5.1.3 NOT USED

5.1.4 NOT USED

5.1.5 All stainless steel metal working, grinding, cutting, machining and welding shall use tools and consumables dedicated and segregated from all others to prevent cross contamination. A dedicated work area for tools, equipment storage, parts storage and raw materials must be established to control contamination. Welding consumables for stainless steel welding must be segregated from other consumables.

## 5.2 Welding

5.2.1 Design and fabrication of the TCO pressure boundary shall be in accordance with specification 24590-WTP-3PS-MV00-T0001, *Pressure Vessel Design and Fabrication*

5.2.2 Welding of the TCO pressure boundary shall be in accordance with specification 24590-WTP-3PS-MVB2-T0001, *Welding of Pressure Vessels, Heat Exchangers and Boilers.*

5.2.3 Fabrication of TCO piping shall be in accordance with 24590-WTP-3PS-PS02-T0001, *Shop Fabrication of Piping.*

5.2.4 Welding and NDE of TCO piping shall be in accordance with specification 24590-WTP-3PS-NWP0-T0001, *General Welding and NDE Requirements For Supplier Fabricated Piping.*

5.2.5 Procedures for welding, control and storage of filler material, nondestructive examination (NDE) and postweld heat treatment (PWHT) are not required for commodities obtained from a sub-supplier which are not part of the external pressure boundary. Commodities which are not part of the external pressure boundary including the following, but are not limited to the: recuperative heat exchanger, electric heater, catalyst modules. Although procedures for welding of the recuperative heat exchanger are not required to meet basic requirements as stated above, weld procedures for the recuperative heat exchanger shall be submitted to the buyer for review. WTP has decided to go above the basic requirements by reviewing the recuperative weld procedures.

5.2.6 NOT USED

5.2.7 NOT USED

5.2.8 NOT USED

5.2.9 NOT USED

5.2.10 Welding of carbon structural steel shall be in accordance with AWS D1.1 and specification 24590-WTP-3PS-SS00-T0001, *Welding of Carbon Structural Steel.*

5.2.11 Welding of structural stainless steel shall be in accordance with AWS D1.6 and BUYER specification 24590-WTP-3PS-SS00-T0002, *Welding of Structural Stainless Steel and Welding of Structural Carbon Steel to Structural Stainless Steel.*

5.2.12 NOT USED

5.2.13 NOT USED

### 5.3 Painting

5.3.1 Shop painting shall be in accordance with 24590-WTP-3PS-AFPS-T0001, Shop Applied Special Protective Coating for Steel Items and Equipment.

5.3.2 NOT USED

### 5.4 Assembly

5.4.1 NOT USED

5.4.2 NOT USED

5.4.3 NOT USED

5.4.4 The Thermal Catalytic Oxidizers/Reducers and the associated Ammonia/Air Dilution units shall have edges that are both smooth and not sharp to the touch.

5.4.5 NOT USED

5.4.6 NOT USED

# 6 Tests and Inspections

### 6.1 General

6.1.1 The SELLER shall provide all instruments, cables, and facilities necessary to perform any shop tests, the Factory Acceptance Tests (FAT) and NDE.

6.1.2 SELLER shall provide the necessary hardware, fan, pre heater, power, controls, temporary insulation, piping, and ductwork for the HLW TCOs and test equipment to set up and operate the HLW TCOs at the design conditions specified in the HLW MDS at the supplier's shop. The HLW TCOs shall operate at a negative pressure so the test shall include a temporary fan(s) setup which meets the HLW MDS design conditions and a temporary pre-heater to simulate the hot gas from the melters (as specified in the MDS).

6.1.3 SELLER shall provide the necessary hardware, power, controls and test equipment to set up and operate the Instrument Service Air (ISA) supply on the Ammonia/Air Dilution Skid at the conditions prescribed in the MDS.

6.1.4 Any non-conforming work shall be redone by the SELLER at SELLER's cost.

## 6.2 Personnel Qualifications

6.2.1 NDE personnel performing NDE shall work in accordance with the following BUYER specifications:

- 24590-WTP-3PS-MV00-T0001, *Pressure Vessel Design and Fabrication,*
- 24590-WTP-3PS-MVB2-T0001, *Engineering Specification for Welding of Pressure Vessel, Heat Exchangers and Boilers,*
- 24590-WTP-3PS-SS00-T0001, *Engineering Specification for the Welding of Carbon* Structural *Steel,*
- 24590-WTP-3PS-SS00-T0002, *Engineering Specification for the Welding of Structural Stainless Steel and Welding of Structural Carbon Steel to Structural Stainless Steel,*
- 24590-WTP-3PS-NWP0-T0001, *Engineering Specification for General Welding and NDE Requirements for Supplier Fabricated Piping,* and
- 24590-WTP-3PS-PS02-T0001, *Engineering Specification for Shop Fabrication of Piping.*

## 6.3 Non-Destructive Examinations

6.3.1 NDE shall be in accordance with the following BUYER specifications:

- 24590-WTP-3PS-MV00-T0001, *Pressure Vessel Design and Fabrication,*
- 24590-WTP-3PS-MVB2-T0001, *Engineering Specification for Welding of Pressure Vessel, Heat Exchangers and Boilers,*
- 24590-WTP-3PS-SS00-T0001, *Engineering Specification for the Welding of Carbon* Structural *Steel,*
- 24590-WTP-3PS-SS00-T0002, *Engineering Specification for the Welding of Structural Stainless Steel and Welding of Structural Carbon Steel to Structural Stainless Steel,*
- 24590-WTP-3PS-NWP0-T0001, *Engineering Specification for General Welding and NDE Requirements for Supplier Fabricated Piping,* and
- 24590-WTP-3PS-PS02-T0001, *Engineering Specification for Shop Fabrication of Piping.*

6.3.2 NDE procedures shall be submitted to BUYER for review prior to use.

6.3.3 Submittal of exposed radiographs is required. Original set of exposed radiographic film must be sent, along with technique and reader sheets. Film must be packaged in such a manner as to preclude moisture and handling damage.

## 6.4 Shop Tests

6.4.1 SELLER shall perform the FAT that demonstrates the function of the equipment. These tests shall be conducted in accordance with Section 6 of 24590-WTP-3PS-JQ07-T0001 Rev. 2, Section 6 of 24590-WTP-3PS-EKP0-T0001, Rev. 3, and additional requirements identified within this specification.

6.4.2 BUYER's Supplier Quality (SQ) representative shall witness the FAT, and BUYER's Engineering shall be present for the Functional Testing portion of the FAT.

6.4.3 Prior to notification by SELLER that a unit is ready for the BUYER to witness the Functional Test portion of the FAT, SELLER shall perform all other FAT mechanical and electrical inspections to ensure completed equipment is functioning and ready for the Functional Test. Any deficiencies shall be corrected prior to the Functional Test.

6.4.4 SELLER shall have unit up and ready for Functional Testing prior to the BUYER's team arriving on the day the Functional Test is to commence.

6.4.5 SELLER shall submit FAT inspection plan and Functional Test procedure for BUYER review prior to use by the SELLER. SELLER shall provide a signed copy of completed FAT inspection report (information only) to BUYER at time of notification that SELLER is ready for the Functional Test.

6.4.6 SELLER shall submit a report of FAT results.

6.4.7 Functional Test procedures shall be prepared by the SELLER in accordance with 24590-WTP-3PS-JQ07-T0001, Rev. 2, Section 11.3.2. As stated in 24590-WTP-3PS-JQ07-T0001, Rev. 2, the scope of functional testing shall be agreed to between the BUYER and SELLER via review of the proposed test procedure.

6.4.8 The following is a list of preliminary BUYER expectations for the HLW TCO Functional Test. This list is subject to change by the BUYER during review of proposed test procedure. Changes to these expectations, agreed to during review of the proposed test procedure, do not need to be reflected in a revision to this specification.

a. Test setup shall simulate the melter operating conditions per the mechanical data sheet.

i. Pressure testing shall be performed in accordance with required testing specified in ASME B31.3-1996 or ASME BPV Code Section VIII Division I as applicable. In addition to these codes required pressure tests, additional testing shall be performed to further demonstrate the pressure boundary integrity of equipment which will be subject to internal pressure above atmospheric during normal equipment operation. Record on FAT datasheet.

ii. Sensitive Leak Testing shall be performed on piping in accordance with ASME B31.3-1996 Section 345.8. Record on FAT datasheet.

iii. Bubble Testing shall be performed on equipment designed and fabricated in accordance with ASME BPV Code Section VIII, Division I in accordance with ASME BPV Code Section V, Article 10. Record on FAT datasheet.

iv. Obtain unit pressure drop measurements at ambient conditions and at heatup intervals specified by the BUYER. Record on FAT datasheet.

v. Obtain catalyst bed seal measurements at ambient conditions and at heatup interval specified by the BUYER. Record on FAT datasheet.

vi. Preheat the incoming air, prior to HOP-HTR-00001 and HOP-HTR-00007, to simulate the hot offgas from the melter.

vii. Provide power and temporary controls for heater HOP-HTR-00001 and HOP-HTR-00007.

viii. Run the HLW TCO for 24 hours under this setup, prior to test objective testing.

b. Test objectives:

i. Verify the TCO heater, HOP-HTR-00001 and HOP-HTR-00007 provides the required heat to maintain temperature within the operating range as specified on the MDS.

ii. Verify the melter maximum flowrate of approximately 3092 ACFM can be achieved. The flowrate provided here is for information only and subject to change. Refer to the MDS for the actual flowrate.

iii. Verify the actual differential pressure drop is less than the allowable differential pressure drop of 12 inch water gauge. The pressure drop provided here is for information and subject to change. Refer to the MDS for the actual pressure drop. Record on FAT datasheet.

iv. Verify the TCO outlet temperature at TE 0336 or TE 2336 is less than 426 °F. The temperature provided here is for information and subject to change. Refer to the MDS for the actual temperature. Record on FAT datasheet.

v. NOT USED

vi. Verify no leaks at the access doors under operating conditions. Ultrasonic leak detectors like AccuTrak VPE-1000, SON-TECTOR 123 or equal are acceptable for leak testing around the access door gaskets.

vii. Verify unit pressure drop is within acceptable limits as stated in BUYER-approved FAT. Record on FAT datasheet.

viii. Verify the floor temperature under the TCO is less than 150°F. Record on FAT datasheet.

c. After the TCO unit has cooled, verify unit pressure drop is within acceptable limits as stated in BUYER-approved FAT. Record on FAT datasheet.

d. After the TCO unit has cooled, verify no deformation or degradation to the housing and internal components. Document findings on FAT datasheet.

e. After the TCO unit has cooled, obtain catalyst bed seal measurements and compare to measurements taken in Section 6.4.8.a.ii. Record on FAT datasheet.

f. After the TCO unit has cooled, demonstrate the catalyst can be removed and replaced with out a person breaking the plane of the access doors. It is acceptable if arms break the access door plane during catalyst removal or installation.

   i. Supplier to submit a catalyst installation and removal procedure.

6.4.9 The following is a list of expectations for the Ammonia Skid Functional Test. This list is subject to change by the BUYER during review of proposed test procedure. Changes to these expectations, agreed to during review of the proposed test procedure, do not need to be reflected in a revision to this specification.

a. Test set up:

   i. Pressure testing shall be performed in accordance with required testing specified in ASME B31.3-1996 or ASME BPV Code Section VIII Division I as applicable. In addition to these codes required pressure tests, additional testing shall be performed to further demonstrate the pressure boundary integrity of equipment which will be subject to internal pressure above atmospheric during normal equipment operation. Record on FAT datasheet.

   ii. Sensitive Leak Testing shall be performed on piping in accordance with ASME B31.3-1996 Section 345.8. Record on FAT datasheet.

   iii. It is acceptable to use temporary air and controls to open and close valves on the Ammonia/Air Dilution Skid.

b. The SELLER shall provide the following air source:

   i. NOT USED

   ii. Dry, oil and dust-free Instrument Service Air (ISA) at 90-150 psig and with a dew point value of -40°F at 100 psig based on ISA 7.0.01.

c. Test objectives:

   i. Satisfactory results for 6.4.9.a criterion stated above.

   ii. Actuated valves are full-cycled a minimum of 3 times and flow instrument loops respond per the design.

6.4.10 NOT USED

6.4.11 NOT USED

6.4.12 NOT USED

6.4.13 SELLER provided lifting equipment such as, but not limited to, spreader beams, strong backs, and yokes, shall be tested in accordance with Section 9.4 of 24590-WTP-3PS-G000-T0003.

6.4.14 All overhead lifting points shall be proof tested. Test and examination certificates/documentation shall be provided to the BUYER for review. Lifts shall be conducted in accordance with a BUYER reviewed handling procedure.

6.4.15 Deleted

6.4.16 After the proof tests, the lifting points shall be inspected:

6.4.17 The welds on fabricated lifting lugs shall be dye penetrant tested. Acceptance criteria shall be from the prevailing weld design code or standard.

6.4.18 Lift points shall be inspected for visual permanent plastic deformation of the material that may invalidate the design analyses for the lift point.

### 6.5 Site Tests

6.5.1 The BUYER startup personnel shall perform acceptance tests after initial installation to confirm the Thermal Catalytic Oxidizers/Reducers and the associated Ammonia/Air Dilution units meet the performance requirements specified in Section 3.4 of this specification.

# 7 Preparation for Shipment

### 7.1 General

The Thermal Catalytic Oxidizers/Reducers, catalysts, assemblies and the associated Ammonia/Air Dilution units shall be packaged, handled, and stored in accordance with BUYER specification 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling, and Storage Requirements*.

### 7.2 Tagging

7.2.1 A stainless steel nameplate shall be attached in a visible location to each Thermal Catalytic Oxidizer/Reducer and Ammonia/Air Dilution unit showing the manufacturer's name, shop location, date of manufacture, serial number, equipment rating, equipment tag numbers, weight of assembly and purchase order number. Instruments shall be tagged per 24590-WTP-3PS-JQ07-T0001, Rev. 2, Section 8.

7.2.2 Electrical/Control panels shall be tagged with component identification numbers per 24590-WTP-3PS-JQ07-T0001, Rev. 2, Section 3.6.8.

7.2.3 Mechanical subcomponents (valves, strainers, expansion/flex joints, filters, mixing chambers, etc) shall have component identification number engraved on a 1/16" minimum thick stainless steel tag with ¼" minimum character height, securely attached with 1/16" minimum diameter aircraft cable and ferrules.

7.2.4 Component identification numbers shall be as shown on BUYER's P&IDs or MDSs attached to the MR, or will be provided via BUYER mark up of SELLER submitted drawings.

### 7.3 Documentation

SELLER shall ensure that appropriate documentation is prepared and signed by the appropriate person(s), if required. The shipping documentation shall accurately reflect specific traceability to the items being shipped. Drawings (wiring diagrams), showing external terminations for BUYER use to connect to SELLER provided instrumentation, shall be marked with the BUYER's instrument tag numbers.

# 8 Quality Assurance

### 8.1 General Requirements

8.1.1 The SELLER's QAP Requirements are included in BUYER specification 24590-WTP-3PS-G000-T0001, *General Specification for Supplier Quality Assurance Program Requirements*.

8.1.2 SELLER's QAP Manual shall be submitted to BUYER for review in accordance with BUYER specification 24590-WTP-3PS-G000-T0001, *General Specification for Supplier Quality Assurance Program Requirements*.

8.1.3 SELLER's QAP, as a minimum, shall contain the requirements detailed on the CM Datasheet of Quality Assurance Program Requirements, attached to Section 2 of the MR.

8.1.4 For items designated quality level commercial (CM), no additional QA program requirements are mandated by BUYER beyond SELLER's commercial QA program.

### 8.2 Quality (CM) Requirements

8.2.1 SELLER shall have in place a QAP meeting the requirements of BUYER specification 24590-WTP-3PS-G000-T0001, *General Specification for Supplier Quality Assurance Program Requirements*.

8.2.2 NOT USED

8.2.3 The successful bidder must pass a pre-award survey by the BUYER. SELLER shall demonstrate that its quality program is in compliance with the quality requirements listed in the Supplier Quality Assurance Program Requirements Data Sheet.. The SELLER shall allow the BUYER, its agent, and DOE access to their facility and records pertaining to this purchase order for the purpose of Quality Assurance Audits and Surveillance at mutually agreed times.

8.2.4 SELLER shall submit their QAP and work plan to BUYER for review prior to commencement of work. The plan shall include documents and procedures to implement the work and include a matrix of essential Quality Assurance elements cross referenced with the documents/procedures.

8.2.5 NOT USED

8.2.6 NOT USED

8.2.7 NOT USED

### 8.3 Supplier Deviation

Each SELLER shall be required to identify and promptly document all deviations from the requirements of the procuring documents. In addition, the supplier shall be required to describe the recommended disposition for BUYER's acceptance based on appropriate analysis. Submittals of request for deviations from lower-tier suppliers shall be through the prime supplier to WTP. SELLER-proposed deviations from procurement documents shall be initiated by use of Supplier Deviation Disposition Request (SDDR) form in Section 2 of the MR.

# 9 Configuration Management

Equipment and/or components covered by this specification are identified with plant item numbers shown in the MDSs. Each item shall be identified in accordance with Tagging in Section 7.2 of this specification.

# 10 Documentation and Submittals

### 10.1 General

SELLER shall submit to BUYER Engineering and Quality Verification documents in the forms and quantities shown in Form G-321-E, *Engineering Document Requirement*, and Form G-321-V, *Quality Verification Document Requirements*, attached to the MR.

### 10.2 Submittals

The SELLER shall submit the following:

10.2.1 Drawings

Drawings shall be in accordance with ASME Y14.100 and show the following information:

10.2.1.1 The outline dimensions of each Thermal Catalytic Oxidizer/Reducer and Ammonia/Air Dilution units, including outline and detail drawings for each component. These drawings shall reflect the "as-shipped" configuration of the equipment and instrumentation.

10.2.1.2 Details of construction.

10.2.1.3 Mounting dimensions and information required for the design of supports and foundations.

10.2.1.4 Operating weight and center of gravity of each Thermal Catalytic Oxidizer/Reducer and Ammonia/Air Dilution unit.

10.2.1.5 The space required for the removal of components.

10.2.1.6 The location of access doors.

10.2.1.7 Thermal insulation and interface points with BUYER's foundation.

10.2.1.8 NOT USED

10.2.1.9 NOT USED

10.2.1.10 Wiring and schematic diagrams. Diagrams shall include wire gauges and fuse sizes applicable to the supplied units only.

10.2.1.11 The ASTM or equivalent designation for materials.

10.2.1.12 Nozzle locations for connections to BUYER's process and utility piping including electrical and instrumentation connections.

10.2.1.13 Piping and instrumentation diagrams (P&IDs).

10.2.2 Procedures

Procedures shall include but are not limited to:

10.2.2.1 SELLER's shipping preparation and storage procedures.

10.2.2.2 Startup, operation, shutdown and idle procedures/manual.

10.2.2.3 Catalyst changeout procedures.

10.2.2.4 Performance test procedures and acceptance criteria for shop tests.

10.2.2.5 Insulation installation procedures.

10.2.2.6 Surface preparation and coating procedures for components specifically fabricated for the TCOs/SCRs.

10.2.3 Inspection and Test Reports

10.2.3.1 NOT USED

10.2.3.2 NOT USED

10.2.3.3 Performance test reports for shop tests.

10.2.3.4 NOT USED

10.2.3.5 Reliability assessment.

10.2.3.6 NOT USED

10.2.3.7 NOT USED

10.2.4 Calculations

10.2.4.1 Seismic and Thermal analyses/calculations shall be submitted for BUYER's review and permission to proceed. Analyses shall include nozzle loadings and deflections for normal operation and design conditions.

10.2.4.2 NOT USED

10.2.4.3 NOT USED

10.2.5 Manuals

Manuals and instructions shall include:

10.2.5.1 Erection and installation manuals which provide complete, detailed procedures for installing and placing equipment in initial operation. The manuals shall include all erection and installation drawings. Refer to BUYER specification 24590-WTP-3PS-G000-T0003 *General Specification for Packaging, Handling and Storage Requirement*, for additional requirements.

10.2.5.2 Operation, accessibility and maintenance manuals which provide complete, detailed descriptions of components and appurtenances with data sheets showing design, construction and performance data for equipment. Manuals shall include drawings required for operation, maintenance and repair, maintenance requirements, instructions and operational troubleshooting guides.

10.2.5.3 Instruction manuals shall cover items purchased, including materials that the SELLER has obtained from a subcontractor. The SELLER shall obtain such manuals and lists, and submit them to the BUYER.

10.2.5.4 The SELLER shall provide instructions regarding transportation, site storage and preparation, and protection of equipment after installation and prior to operation. Refer to BUYER specification 24590-WTP-3PS-G000-T0003 *General Specification for Packaging, Handling and Storage Requirement*, for additional requirements.

10.2.6 Certificates of Conformance and Acceptance

10.2.6.1 SELLER shall provide Certificates of Conformance demonstrating compliance with all applicable standards, specifications, and drawings.

10.2.6.2 SELLER shall certify lifting eyes or lugs and/or spreader bars are suitable for the safe, balanced lifting, and handling of the equipment.

10.2.6.3 Attachment 7 provides the Certificate of Analysis (COA) for BASF Catalysts, LLC (VOCat 300S) used in Catholic University's Vitreous State Laboratory (VSL) testing. Prior to release for shipment SELLER shall provide the COA demonstrating the performance of the oxidation catalyst is equal to or better than the oxidation catalyst used in the reference VSL testing (Ref. MDS General Note 9) for BUYER's acceptance.

10.2.7 Schedules

Lists and schedules shall include:

10.2.7.1 Schedule of engineering and fabrication.

10.2.7.2 Parts list, and cost for parts and items subject to deterioration and replacement.

10.2.7.3 List of recommended spare parts. The spare parts list shall include names of the original equipment manufacturer with appropriate part numbers.

10.2.8 Materials Certificates/Statistics

10.2.8.1 Material Certificate of Compliance shall be submitted for components of each Thermal Catalytic Oxidizer/Reducer unit and each Ammonia/Air Dilution unit. Certificate shall include certified material test reports of chemical and physical properties for all stress components.

10.2.8.2 Manufacturer's Material Certificate of Compliance with ASME and/or ASTM material numbers and grades shall be provided for the housing, ducts, weld filler metal, and support framing integral to each Thermal Catalytic Oxidizer/Reducer and each Ammonia/Air Dilution assembly.

10.2.8.3 Material Safety Data Sheets (MSDSs).

10.2.9 Data

Data shall include:

10.2.9.1 BUYER's Mechanical Data Sheets, completely filled out by the SELLER, showing all information required to determine that the units are of the design and materials specified herein.

10.2.9.2 All data compiled during FAT testing.

10.2.9.3 NOT USED

10.2.10 NOT USED

# 11 References

Design changes incorporated by reference:

24590-WTP-SDDR-MS-10-00004

## 34.0 ANSI K61.1, American National Standard Safety Requirements for the Storage and Handling of Anhydrous Ammonia

Revision: 1999
Sponsoring Organization: Compressed Gas Association, Inc.

WTP Specific Tailoring

The following tailoring of ANSI K61.1 is required for use by the WTP project as an implementing standard for the safety related systems design.

**Page 9; Section 5.1 Equipment and systems**

Revise Section 5.1 as follows:

Not Applicable

**Justification:** Section allows the continued use or reinstallation of containers and systems designed and installed under earlier versions of codes and ANSI standards. WTP does not plan on using previously installed or design equipment. Therefore, Section 5.1 of this standard will not be implemented for this project.

**Page 19; Section 6.3 Pressure relief devices**

Revise Section 6.3.2 as follows:

Not Applicable

**Justification:** Section specifies relief valve design for underground containers. WTP does not plan to install underground containers. Therefore, Section 6.3.2 of this standard will not be implemented for this project.

Revise Section 6.3.3 as follows:

Not Applicable

**Justification:** Section specifies manhole design for relief for underground containers. WTP does not plan to install underground containers. Therefore, Section 6.3.3 of this standard will not be implemented for this project.

**Page 19, Section 6.4 Installation of storage containers**

Revise Section 6.4.4 as follows:

Not Applicable

**Justification:** Section specifies design requirements for the installation of underground containers. WTP does not plan to install underground containers. Therefore, Section 6.4.4 of this standard will not be implemented for this project.

Revise Section 6.4.5 as follows:

Not Applicable

**Justification:** Section specifies design requirements for the installation of underground containers. WTP does not plan to install underground containers. Therefore, Section 6.4.5 of this standard will not be implemented for this project.

Revise Section 6.4.7 as follows:

Not Applicable

**Justification:** Section specifies design requirements for the installation of underground storage systems. WTP does not plan to install underground storage system. Therefore, Section 6.4.7 of this standard will not be implemented for this project.

Revise Section 6.4.8 as follows:

Not Applicable

**Justification:** Section specifies design requirements for the installation of underground tanks. WTP does not plan to install underground tanks. Therefore, Section 6.4.8 of this standard will not be implemented for this project.

**Page 20, Section 6.5 Reinstallation of containers**

Revise Section 6.5 as follows:

Not Applicable

**Justification:** Section specifies requirements for reinstallation of containers. WTP does not plan to use previously used containers. Therefore, Section 6.5 of this standard will not be implemented for this project.

**Pages 21-26; Section 7 Refrigerated storage**

Revise Section 7 as follows:

Not Applicable

**Justification:** This section establishes design requirements for system using tanks for the storage of anhydrous ammonia under refrigerated conditions. WTP does not plan on a system using tanks for the storage of anhydrous ammonia under refrigerated conditions. Therefore, Section 7 of this standard will not be implemented for this project.

**Pages 26-28; Section 8 Systems mounted on railcar structures (tank cars), other than DOT class 106A, for transportation of ammonia**

Revise Section 8 as follows:

Not Applicable

**Justification:** This section establishes design requirements for tank cars for the rail transportation of ammonia. WTP does not plan to receive anhydrous ammonia by rail car. Therefore, Section 8 of this standard will not be implemented for this project.

**Pages 31-32; Section 10 Systems using DOT portable tanks and cylinders**

Revise Section 10 as follows:

Not Applicable

**Justification:** This section establishes requirements for cylinders (less than 1000 pounds), DOT portable tanks and DOT containers. WTP does not plan to receive anhydrous ammonia by container or cylinder. Therefore, Section 10 of this standard will not be implemented for this project.

**Pages 32-34; Section 11 Systems mounted on farm wagons (implements of husbandry) for the transportation of ammonia**

Revise Section 11 as follows:

Not Applicable

**Justification:** This section establishes requirements for equipment mounted on farm wagons for the transportation of ammonia. WTP does not plan to use farm wagons for the transportation of ammonia. Therefore, Section 11 of this standard will not be implemented for this project.

**Pages 34-35, Section 12 Systems mounted on farm wagons (implements of husbandry) for the application of ammonia**

Revise Section 12 as follows:

Not Applicable

**Justification:** This section establishes requirements for equipment mounted on farm wagons for the application of ammonia. WTP does not plan to use farm wagons for the application of ammonia. Therefore, Section 12 of this standard will not be implemented for this project.

**Pages 35-37, Section 13 References**

The references listed shall be constrained to the approved versions listed in the SRD or approved changes and equivalencies.

The following references shall be excluded:

ANSI/ASHRAE 15, American National Standard Safety Code for Mechanical Refrigeration

ANSI/IIAR 2, American National Standard for Equipment, Design and Installation of Ammonia Mechanical Refrigeration Systems

ANSI/ASME B31.5, American National Standard for Refrigeration Piping

ANSI/SAE J1513f, Refrigeration Tube Fittings

API Standard 620, Design and Construction of Large Welded Low-Pressure Storage Tanks

**Justification:** The above references are for the design of refrigerated storage systems. WTP does not plan to use a refrigerated anhydrous ammonia storage system. Therefore, these references will not be implemented for this project.

The following references shall be excluded:

40 CFR Part 280, Technical standards and corrective action requirements for owners and operators of underground storage tanks (UST)

**Justification:** The above reference is for underground storage tanks. WTP does not plan to use underground storage tanks for anhydrous ammonia. Therefore, these references will not be implemented for this project.

The following references shall be excluded:

CGA G-7, Guide to the Preparation of Precautionary Labeling and Marking of Compressed Gas Containers

ANSI/CGA V-1, American National Standard Compressed Gas Association Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections

**Justification:** The above references are for the use of cylinders and small (less than 1 ton) containers. WTP does not plan to use cylinders or small containers for anhydrous ammonia storage. Therefore, these references will not be implemented for this project.

The following references shall be excluded:

ANSI/ASAE S276, Slow Moving Vehicle Identification Emblem
ANSI/ASAE S338.2, Safety Chain for Towed Equipment

**Justification:** The above references are for the use of ammonia systems mounted on farm equipment. WTP does not plan to use farm equipment for anhydrous ammonia storage. Therefore, these references will not be implemented for this project.

## 26.0 ASME B31.3-1996, Process Piping

Revision: 1996
Sponsoring Organization: ASME

WTP Specific Tailoring

The following tailoring of ASME B31.3, *Process Piping*, is required for use by the WTP contractor as an Implementing Standard for: (1) the fabrication and installation of those portions of the C5V ductwork that are being embedded in concrete, (2) the use of ASME B16.9 welding tees in accordance with ASME B31.3-2002, (3) use of vacuum box leak testing, and (4) the ASME B31.3-1998, paragraph 345.2.3(c), allowance for not leak testing closure welds outside of inaccessible areas.

- The tailored sections of ASME B31.3 applicable to embedded ductwork will only be utilized to the extent that it will cover the fabrication, installation, and inspection (and associated testing) of Category D fluid service piping being used as C5 ductwork. Air testing requirements for this ductwork will be compliant with ASME AG-1. Below is a description of those portions of ASME B31.3 that apply to fabrication, installation, and inspection of Category D fluid service piping and the sections of the SRD that they will apply to.
- The tailored sections of ASME B31.3 applicable to welding tees will only be used for ASME B16.9 welding tees. As long as the stress intensification factors from ASME B31.3-2002 are used in the stress analysis for the welding tees, welding tees fabricated to either the 1996 or the 2002 edition of ASME B31.3 can be used. Below is a description of those portions of ASME B31.3, Appendix D, Table D300, that apply to welding tees and the section of the SRD to which they will apply.
- The tailored paragraphs of ASME B31.3 applicable to vacuum box leak testing, in lieu of hydrostatic or pneumatic leak testing, will only be used to leak test full penetration circumferential piping field butt welds inside an inaccessible area (as defined in Appendix H, Section 6.0) out to the first isolation component outside the inaccessible area. Further, if the 100 % volumetric inspection using ultrasonic examination per ASME B31.3 paragraph 344.6, is conducted for welds to be vacuum box tested, then the ultrasonic examination shall be conducted using a method that creates and maintains a reproducible computerized image(s) of the entire weld in the axial and radial direction.
- The tailored paragraphs of ASME B31.3 adopting the provisions of ASME B31.3 (c) - 1998 Addendum paragraph 345.2.3(c) are applicable to all ASME B31.3 piping in all facilities except for closure welds in inaccessible areas.

**Piping providing a confinement function in accordance with SRD 4.4-3 will comply with the following sections of ASME B31.3-1996, *Process Piping*. These sections of ASME B31.3 are applicable for embedded ductwork.**

Chapter 3, Materials

Chapter 5, Fabrication

Table 341.3.2, Visual acceptance criteria for Category D fluid service piping

**Justification:** Due to wall thickness requirements of duct embedded in concrete, piping materials are required. ASME B31.3 will apply to materials, fabrication, and inspection standards as appropriate. Testing requirements for nuclear air treatment systems will be consistent with ASME AG-1.

**Piping providing a confinement function in accordance with SRD 5.1-2 will comply with the following sections of ASME B31.3-1996, *Process Piping*. These sections of ASME B31.3 are applicable for embedded ductwork.**

Chapter 3, Materials

Chapter 5, Fabrication

Table 341.3.2, Visual acceptance criteria for Category D fluid service piping

**Justification:** Due to wall thickness requirements of duct embedded in concrete, piping materials are required. ASME B31.3 will apply to materials, fabrication, and inspection standards as appropriate. Testing requirements for nuclear air treatment systems will be consistent with ASME AG-1.

**Piping providing a confinement function in accordance with SRD 4.2-2 will comply with ASME B31.3-1996, *Process Piping*, with the following modification:**

In Table D300, the description of welding tee per ASME B16.9 shall be revised so it is consistent with that shown in Table D300 of ASME B31.3-2002:

| | | Stress Intensification Factor [Notes (2), (3)] | | | |
|---|---|---|---|---|---|
| **Description** | **Flexibility Factor k** | **Out-of-Plane, $i_o$** | **In-Plane $i_i$** | **Flexibility Characteristic, $h$** | **Sketch** |
| Welded tee per ASME B16.9 [Notes (2), (4), (6), (11), (13)] | 1 | $\frac{0.9}{h^{2/3}}$ | $3/4\ i_o + 1/4$ | $3.1\frac{\overline{T}}{r_2}$ | Same as ASME B31.3-1996 |

This means that for welding tees per ASME B16.9, note 11 in Table D300 is also changed to:

(11) If $r_s \geq 1/8D_s$ and $T_c \geq 1.5\overline{T}$, a flexibility characteristic of $4.4\,\overline{T}/r_2$ may be used.

**Justification:** The use of a lower flexibility characteristic for welding tees per ASME B.16.9 in accordance with ASME B31.3-2002 will increase both the out-of-plane and in-plane stress intensification factors. The increased stress intensification factors will reduce the allowable out-of-plane and in-plane moments that can be applied to the welding tee and keep the calculated stress below the stresses allowable by ASME B31.3-1996.

**Safety piping within the scope of SRD 4.2-2 shall comply with ASME B31.3-1996, Chapter V, Paragraph 345, using the following approach for vacuum box leak testing. Vacuum box leak testing, in lieu of hydrostatic or pneumatic leak testing, may be used to leak test full penetration circumferential piping, field butt welds inside an inaccessible area (as defined in Appendix H, Section 6.0) out to the first isolation component outside the inaccessible area, only under the following conditions:**

Vacuum Box Leak Test Method - The vacuum box leak test shall be in accordance with a Bubble Test - Vacuum Box Technique method specified in ASME BPV Code, Section V, Article 10, Appendix II, subject to the requirements listed below:

(a) Sensitivity of the test shall be demonstrated to be not less than 1E-3 atm-ml/sec at 15 psig.

(b) The test pressure shall be a partial vacuum of at least 7 psi below atmosphere, applied to the outside of the weld.

(c) The required partial vacuum shall be maintained for at least 20 sec examination time.

In addition, the following limitations and restrictions shall apply to the application of vacuum box leak testing in lieu of a hydrostatic or a pneumatic leak test:

- Vacuum box leak testing will only be used to leak test circumferential piping field welds inside an inaccessible area (as defined in Appendix H, Section 6.0). This includes any welds in extensions of piping systems contained or originating in accessible areas between the inaccessible area boundary and the first isolation valve or device beyond the inaccessible area boundary;
- It shall only be used for piping field welds where required to avoid damage to components, ensure the safety to construction workers, perform leak tests of field welds where physical limitations prevent hydrostatic or pneumatic leak testing as prescribed in ASME B31.3-1996 paragraph 345.4 and paragraph 345.5 respectively;
- Pipe welds that are to be vacuum box leak tested will be assessed for suitability. The number of welds to be vacuum box leak tested shall be limited to a maximum of three welds between termination points (two termination or closure welds and one intermediate weld) on a given pipe system except where physical limitations prevent examination by hydrostatic or pneumatic leak testing. DOE will be informed of such exceptions, and may at its discretion and within 48 hours of being informed, respond to BNI on the suitability of the use of vacuum box leak testing for such instances. Termination points may be tanks, vessels, valves, etc. (Specifically excluded from the definition of termination points are junctions where the piping changes design class). This could be either the last two closure welds in an inaccessible area or the last closure weld in the inaccessible area and the last closure weld outside the

inaccessible area. In addition, vacuum box leak testing would be permitted for the connection welds between construction modules if this is limited to one module-to-module weld per piping run within the cells. This is in addition to termination welds on the piping run. A module is defined as a pre-leak-tested subassembly containing multiple pipe spools;

- Vacuum box leak testing shall be limited to full penetration girth butt welds, on straight pipe or between straight pipe and pipe components of the same nominal pipe size and same wall thickness on both sides of the weld at the weld location. The following configurations are candidates for vacuum box testing:

  (a) Straight pipe to straight pipe connection butt welds

  (b) Straight pipe to 90° elbow connection butt welds

  (c) Straight pipe to 45° elbow connection butt welds

  (d) Straight pipe to concentric reducer connection butt welds

  (e) Straight pipe to eccentric reducer connection butt welds

  (f) Straight pipe to butt welding tee connection butt welds

  (g) Straight pipe to butt welding reduced outlet tee connection butt welds

  (h) Straight pipe to valve nozzle connection butt welds

  (i) Straight pipe to tank or vessel nozzle connection welds

  (j) Straight pipe to safe-end of a weldolet connection butt welds - full penetration butt welded connection only

  (k) Straight pipe to pipe cap connection butt welds

  Prior to the application of vacuum box testing using any of the candidate configurations on piping butt welds at the WTP, the Contractor must successfully demonstrate to the DOE, for the candidate configuration, that (1) all portions of the weld to be inspected are visible and can be inspected in accordance with the ASME Boiler and Pressure and Vessel Code, Section V, Article 10, Appendix II - 1995; (2) the vacuum box can adequately maintain a partial vacuum of 7 psid; and (3) vacuum box leak testing can be accomplished in the time limits and other requirements established by this procedure. The DOE shall be advised at least 7 days in advance of any demonstration to qualify a new weld configuration so that they can witness the demonstration. The Contractor shall document any demonstration relied upon to justify the use of vacuum box leak testing on a new configuration. Further, vacuum box leak testing shall be conducted with a vacuum box that completely encapsulates the weld, at the test location;

- All welds shall be 100 % volumetrically inspected in accordance with ASME B31.3-1996, paragraphs 344.5 or 344.6. If the 100 % volumetric inspection is conducted using ultrasonic examination per ASME B31.3-1996 paragraph 344.6, then the ultrasonic examination shall be conducted using a method that creates and maintains a reproducible computerized image(s) of the entire weld in the axial and radial direction;

- It shall be limited to welds made using the Orbital welding machines. The only exception is that vacuum leak box testing may be used on manual welds if the 100 % volumetric inspection was conducted by radiography per ASME B31.3-1996 paragraph 344.5;

- The piping systems and or components on both sides of the weld to be vacuum box leak tested shall have been subjected to a hydrostatic leak test in accordance with ASME B31.3-1996

paragraph 345.4, a pneumatic test in accordance with ASME B31.3-1996 paragraph 345.5, a combination pneumatic-hydrostatic leak test in accordance with ASME B31.3-1996 paragraph 345.6, or in the case of components, leak tested in accordance with the Code or Standard applicable to the design of the component;

- At a minimum, a flexibility analysis in accordance with ASME B31.3-1996 paragraphs 319.4.2 (a) and (b) shall be required on any piping systems that contain welds that are to be vacuum leak box tested. In addition, a comprehensive flexibility analysis in accordance with ASME B31.3-1996 paragraphs 319.4.2 (c) and (d) shall be performed on any piping systems that contain welds that are to be vacuum box leak tested when the piping systems have a design temperature greater than or equal to 150 °F;
- For manual welds, the requirements of ASME B31.3-1996 paragraph 344.7.1 (a) through (g) shall be invoked on any weld to be vacuum box leak tested with the exception that the requirement of subparagraph 344.7.1 (e) "... aided by liquid penetrant or magnetic particle examination when specified in the engineering design" shall not be required. For welds made using Orbital welding machines, the requirements of ASME B31.3-1996 paragraph 344.7.1 (a), (b), (c), (d), and (g) shall be invoked. The requirements of 344.7.1 (e) and (f) shall not be required. The implementation of these requirements shall be documented in the weld inspection report;
- Pipe welds and the associated line numbers that are to be vacuum leak box tested shall be identified in advance of the testing. This identification shall be documented in the controlled document Weld List, which must include this information prior to the initiation of any vacuum box leak testing associated with those welds and line numbers. It is understood that the controlled document Weld List may need to be revised and updated periodically through the construction phase of the WTP Project; and
- The following special requirements shall be placed on the training programs used to certify the technicians that will be conducting the vacuum box leak tests:
  1. The BNI Construction Manager shall pre-approve the technician qualifying examination(s) for vacuum box leak testing;
  2. The BNI Construction Manager shall pre-approve the qualifications of each Level III technician preparing or giving the examinations for vacuum box leak testing;
  3. DOE ORP at their discretion shall reserve the right to observe any and/or all practical leak test examinations and review of the results of any and/or all written vacuum box leak test examinations;
  4. The minimum topical content of each Level II examination shall be specified by BNI, and approved by DOE;
  5. The 80 % correct criteria for passing the examination shall apply to each part of the three part examinations that are to be given;
  6. BNI shall provide reasonable assurance that they will take adequate measures to assure the integrity of written examination is maintained; and
  7. There shall be several versions of each examination in use to assure Level II knowledge and ability concerning vacuum box leak testing is confirmed.

**Justification:** The requirement for the vacuum box leak test sensitivity is consistent with the ASME B31.3 requirement for a sensitive leak test as given in ASME B31.3-1996 paragraph 345.8 and for at least 7 psi vacuum and an examination time of at least 20 seconds. The limitations in using vacuum box leak testing better define when this method can be used. DOE ORP may further change the definition and application of these special vacuum box leak testing criteria based on the Contractor's experience with their use, or the Contractor's request for a change.

**Piping system closure welds outside of inaccessible areas (as defined in SRD Appendix H, Section 6.0) shall comply with the requirements of ASME B31.3-1998, subparagraph 345.2.3(c). When ASME B31.3-1998, subparagraph 345.2.3(c) is invoked the following restrictions shall apply:**

- It shall not be invoked on any closure welds on piping systems in inaccessible areas as defined in Section 6.0 of Appendix H of the SRD. This includes any welds in extensions of piping systems contained or originating in inaccessible areas, between the inaccessible area boundary and the first isolation valve, or device beyond the inaccessible area boundary;
- It shall only be invoked on full penetration butt welds in straight pipe, full penetration butt welds at the safe-end of an equipment nozzle, or full penetration butt welds at the safe-end of branch connections. [The safe-end is defined as the piping to equipment nozzle connecting weld or the branch connection to branch piping connecting welds.];
- The requirements of ASME B31.3(c) - 1998, subparagraph 345.2.3 (c) shall be met;
- The piping systems and or components on both sides of the closure weld shall have been subjected to a hydrostatic leak test in accordance with ASME B31.3-1996 paragraph 345.4, a pneumatic leak test in accordance with ASME B31.3-1996 paragraph 345.5, a combination pneumatic-hydrostatic leak test in accordance with ASME B31.3-1996 paragraph 345.6, or in the case of components leak tested in accordance with the Code or Standard applicable to the design of the component;
- For manual welds, the requirements of ASME B31.3-1996 paragraph 344.7.1 (a) through (g) shall be invoked with the exception that the requirement of subparagraph 344.7.1 (e) "...aided by liquid penetrant or magnetic particle examination when specified in the engineering design" shall not be required. For welds made using the Orbital welding machines, the requirements of ASME B31.3 -1996 paragraph 344.7.1 (a), (b), (c), (d), and (g) shall be invoked. The implementation of these requirements shall be documented in the weld inspection report;
- Piping welds and the associated line numbers for which the closure weld classification is invoked shall be documented in a controlled document Weld List;
- Piping components may include mechanical elements other than piping; and
- In addition, BNI shall incorporate these requirements into the appropriate specification. DOE-ORP may further change the definition and application on the use of closure welds based on the Contractor's experience with their use or the Contractor's request for a change.

**Justification:** This change does not change the safety function of any pressure boundary components. The requirement to leak test pressure boundary field welds is primarily to ensure the reliability of the welds in addition to the reliability provided by the other required examinations. The exception allowed by ASME B31.3-1998, paragraph 345.2.3 that the final weld connecting piping systems or components which have been successfully tested in accordance with

paragraph 345 need not be leak tested provided the weld is examined in-process in accordance with paragraph 344.7 (a), (b), (c), (d), and (g) and passes with 100 % radiographic examination in accordance with paragraph 344.5 or 100 % ultrasonic examination in accordance with paragraph 344.6 provides adequate assurance that the weld is reliable and leak tight. The change continues to provide adequate safety since it requires that all piping closure welds that are not leak tested are in-process examined and 100 % volumetrically examined which exceeds the requirements of ASME B31.3-1996 for closure welds that are leak tested. The inability to hydrostatically or pneumatically leak test these closure welds does not affect the soundness of the welds.

**24590-WTP-SRD-ESH-01-001-02, Rev. 5, page C.9-1, tailoring of AISC M016**

Appendix C: Implementing Standards

## 9.0 AISC M016, Manual of Steel Construction, Allowable Stress Design (ASD)

Revision: 9th Edition
Sponsoring Organization: American Institute of Steel Construction

WTP Specific Tailoring

The following tailoring of M016 is required for use by the WTP contractor as an implementing standard for design of structural steel for Seismic Category III SSCs.

---

**No specific section**

Load combinations for design of structural steel members utilize those identified in UBC 97, Section 1612.3.

**Justification:** These load combinations represent the commercial requirements for allowable stress design of structural steel. Use of these load combinations will ensure compliance with the commercial design in accordance with the UBC.

---

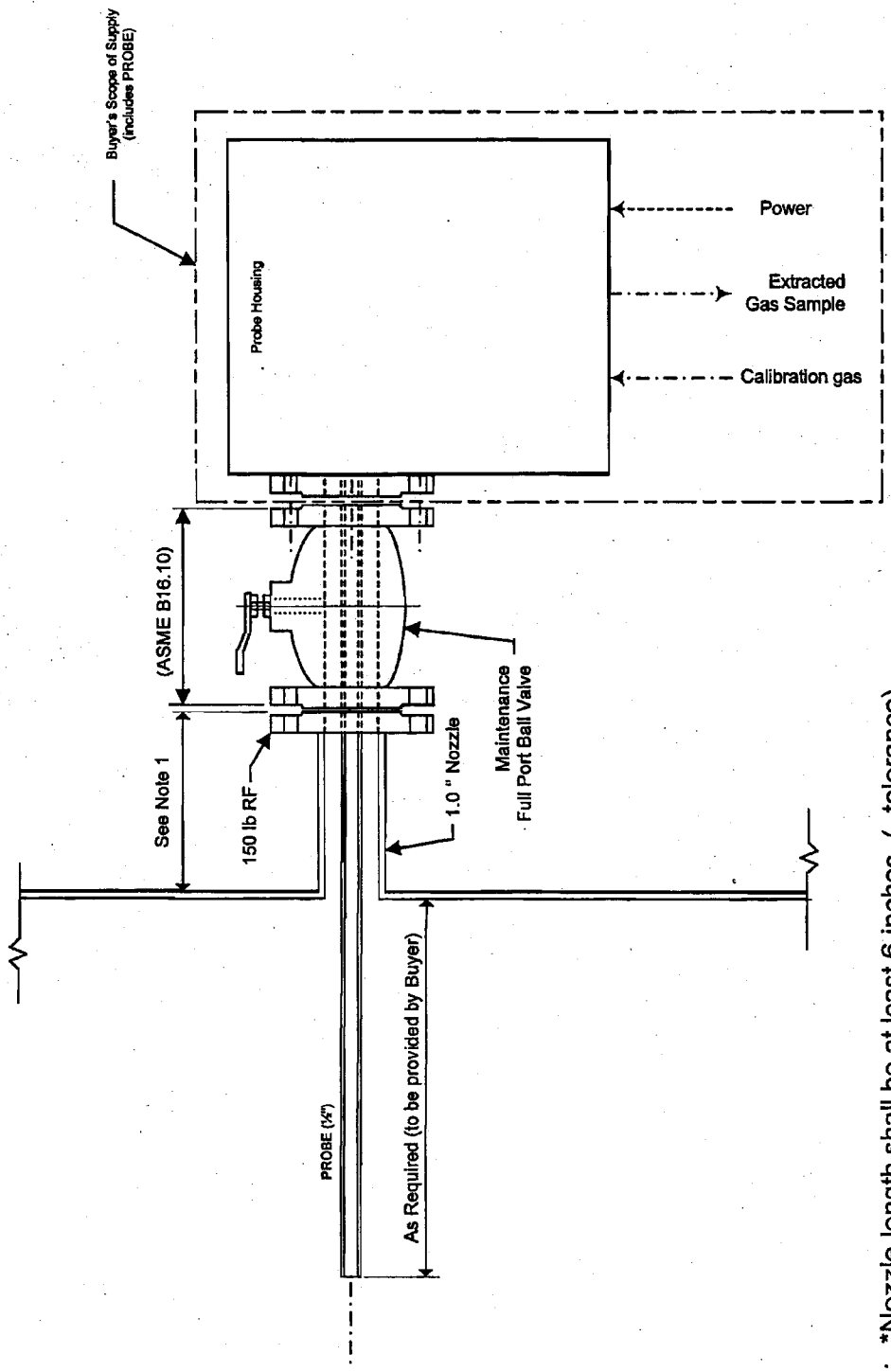
**No specific section**

Seismic detailing requirements shall be in accordance with UBC 97, Chapter 22, Division V, Section 2214, for moderate seismic risk structures.

**Justification:** The requirements contained in this section contain accepted industry practice for design of important commercial steel structures. Use of this section will ensure compliance with the commercial design in accordance with the UBC.

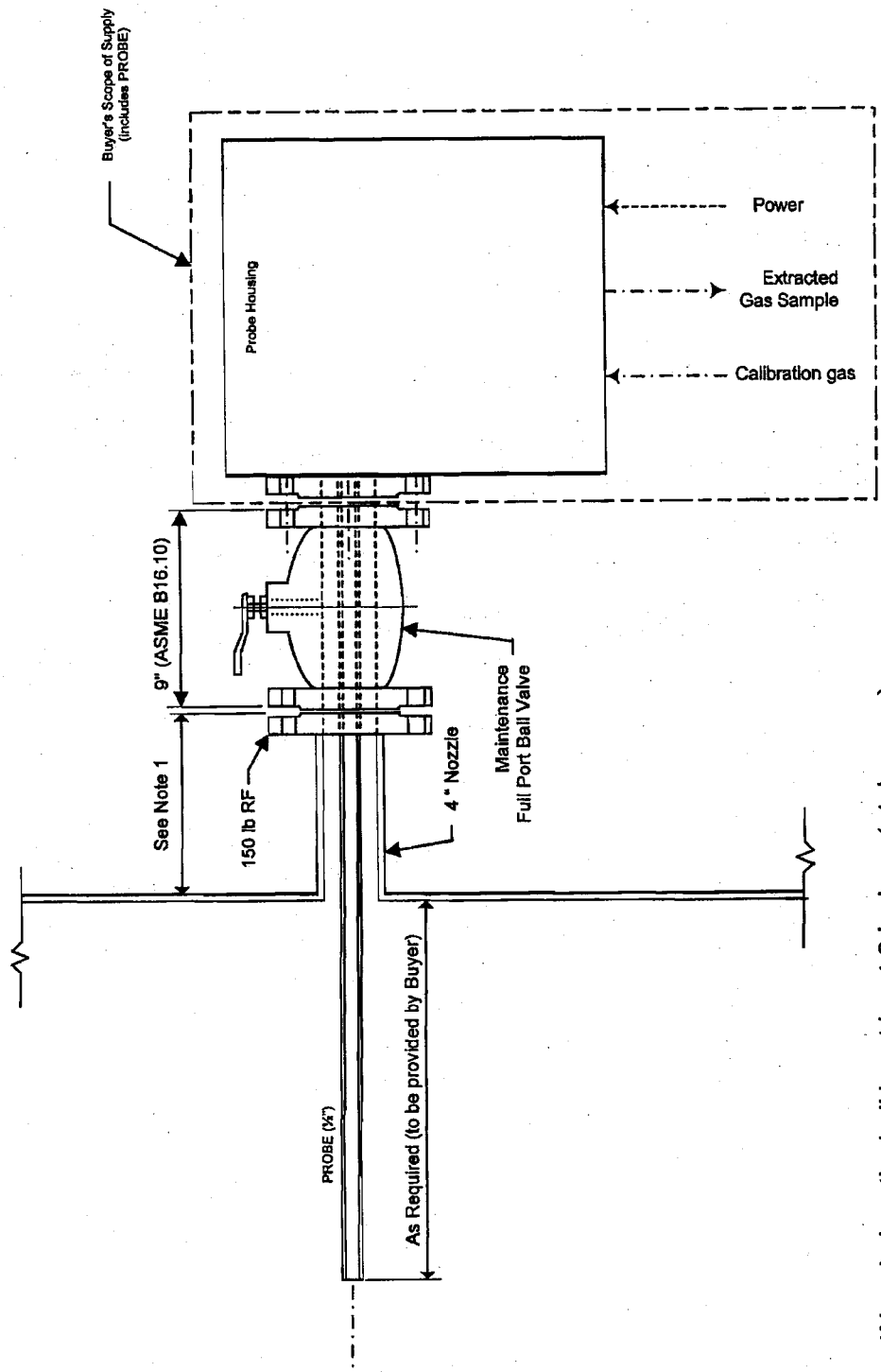
# HLW SKID INTERFACE CONNECTIONS

| SERVICE | NOZZLE NUMBER | SIZE | INTERFACE |
|---|---|---|---|
| **HLW-MELTER 1 & 2** | | | |
| AMMONIA GAS IN | NO 1 | 1" | FLG SW, A182-F304, 304L, CL300, SCH40S, RF |
| INST AIR IN | NO 2 | 2" | FLG WN, A105, CL150, STD WT, RF |
| PROCESS GAS IN | NO 1 | 14" | FLG WN, A182-F316/316L, CL150, .375", RF |
| PROCESS GAS OUT | NO 2 | 16" | FLG WN, A182-F316/316L, CL150, .375", RF |
| AMMONIA/AIR OUT | NO 3 | 6" | FLG WN, A182-F304/304L, CL300, SCH40S, RF |
| AMMONIA/AIR IN | NO 3 | 6" | FLG WN, A182-F304/304L, CL300, SCH40S, RF |




Note 1: *Nozzle length shall be at least 6 inches (- tolerance).
*There shall be at least 3 inches (- tolerance) of clearance, for tightening bolts, between the surface of the insulation jacketing and the underside of the flange.

| | |
|---|---|
| Scale: None | Connection for Non-Routine Sample Extraction |
| Secondary Offgas Flange Connection for Gas Monitor Probe with Ball Valve for Maintenance | |
| Gas Extraction Connection | |




Scale: None

Connection for Sample Extraction-Permanent Typical

Secondary Offgas Flange Connection for Gas Monitor Probe with Ball Valve for Maintenance

Gas Extraction Connection

Note 1: *Nozzle length shall be at least 6 inches (- tolerance).
*There shall be at least 3 inches (- tolerance) of clearance, for tightening bolts, between the surface of the insulation jacketing and the underside of the flange.

# Attachment 7

**Certificate of Analysis for BASF Catalysts, LLC (VOCat 300S)**

Seller's use of the COA is described in Section 10.2.6.3.

24590-HLW-3PS-MBTV-T0002, Rev. 1
Attachment 7
Page 2 of 2

Form #0697
Rev. 1

BASF
The Chemical Company

BASF
ENVIRONMENTAL CATALYST GROUP
9800 KELLNER ROAD
HUNTSVILLE, ALABAMA 35824
Main Phone # (256) 772-9373

# CERTIFICATE OF ANALYSIS

LOT CONTROL NO: 3642401500 HSV PART NO: 166204-001 Customer Part Numb N/A

PART SIZE: 5.91 X 5.91 X 3 CPSI: A200 Customer P/O Numb CUA-0000016866

**THIS IS TO CERTIFY THAT CATALYSTS DELIVERED MEET REQUIREMENTS OF:**

CATALYST DRAWING: **PS - 1118** REV. 3 SPECIFICATION: **PS - 057** REV. 8
FINAL INSPECTION PROC. **SOP - 0231** REV. 8

PRECIOUS METAL CONCENTRATION (SAMPLE OF ALL) IN g/ft3

| TOTAL PM CONCENTRATION | SPEC | SAMPLE |
|---|---|---|
| MAX. AVERAGE | NR | |
| MIN. AVERAGE | 32.51 | 35.53 |
| MIN AVERAGE TPM | NR | NR |
| MIN INDIVIDUAL TPM | 28.31 | 33.88 |

| DRY GAIN | SPEC | SAMPLE |
|---|---|---|
| MAX. AVERAGE | 2.15 | |
| MIN. AVERAGE | 1.29 | 1.72 |
| | | |
| | | |

DIMENSIONAL (AS PER AQL) IN INCHES

WASHCOAT ADHESION ( % LOSS )
SAMPLE OF 1

| | SPEC | SAMPLE |
|---|---|---|
| MAX. INDIVIDUAL | 2.0 | 1.0 |

BET SURFACE AREA IN mm2/cc
SAMPLE OF 1

| | SPEC | SAMPLE |
|---|---|---|
| | | |
| MIN. INDIVIDUAL | 4.0 | 11.9 |

MIN. FLOW (AFCM)

| | SPEC | SAMPLE |
|---|---|---|
| MIN. INDIVIDUAL | TBD | 381 |

CATALYTIC ACTIVITY IN DEG F
SAMPLE OF 1

| | SPEC | SAMPLE |
|---|---|---|
| MAX HEXANE T 20 | 289 | 200.0 |
| MAX HEXANE t 50 | 387 | 347.0 |
| MIN HEXANE CONV. @ 450c | 92 | 98.0 |

VISUAL ( AT 1.5 AQL ): ALL REQUIREMENTS FOR FLATNESS, CHIPS, WORKMANSHIP, GOUGES, CRACKS, WEB DEFECTS, AND PASSAGE DEFECTS HAVE BEEN MET OR EXCEEDED AS DEFINED ON THE APPROPRIATE DRAWING.

COMMENTS:

Jerry Webb 6-1-09
PROCESS QUALITY REPRESENTATIVE DATE

R11298341

# RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

## ENGINEERING SPECIFICATION

ISSUED BY RPP-WTP PDC

FOR

## HLW HOP & PJV HEPA Filter Preheaters

**Content applicable to ALARA?** ☒ Yes ☐ No

**ADR No.** 24590-HLW-ADR-M-04-0002 **Rev** 2

**Specification changes retroactive?** ☒ Yes ☐ No ☐ N/A (alpha revision or revision 0)

NOTE: Contents of this document are Dangerous Waste Permit affecting.

**Quality Level**

Q

DOE Contract No. DE-AC27-01RV14136

| REV | DATE | BY | CHECK | REVIEW | E&NS | DPEM/EM |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | 11/11/10 | | | | | |
| 1 | | Bernard Ip | James Krogness | Aaron Bronner | Chris Meng | Tom Hughes |
| 0 | 7/10/2004 | Anthony Cutrona | Kar Wei Chin | Chris Morley | N/A | Mark Hoffman |

**SPECIFICATION No.** 24590-HLW-3PS-MEE0-T0001 **Rev** 1

**Revision History**

| Revision | Reason for Revision |
|---|---|
| 0 | Issued for purchase. Changed test requirements in para. 6.3.5 from hydrostatic to pneumatic leak, deleted requirements for Seller to determine radiation shielding requirements, added requirement for environmental qualification per 24590-WTP-3PS-JQ06-T0005. |
| 1 | Re-issued for purchase.<br>This revision includes, but is not limited to:<br>1) Editorial/clarification changes throughout.<br>2) Updated Section 1.4: Acronyms, Abbreviations and Definitions.<br>3) Added Air Permit reference to Section 1.5.<br>4) Updated and added references to Section 2.2: Codes and Standards<br>5) Updated and added references to Section 2.3: Reference Documents/Drawings.<br>6) Incorporated the following SDDR's by reference, Section 2.4:<br>• 24590-WTP-SDDR-PROC-05-00069<br>• 24590-WTP-SDDR-PROC-05-00140<br>• 24590-WTP-SDDR-PROC-05-00142<br>• 24590-WTP-SDDR-PROC-05-00143<br>• 24590-WTP-SDDR-PROC-05-00148<br>7) Revised and updated Section 3 to incorporate additional scope and better define design and performance requirements.<br>8) Incorporated the following SDDR's with Design Changes:<br>• 24590-WTP-SDDR-PROC-05-00144: Revised Section 3.11.1.<br>• 24590-WTP-SDDR-PROC-05-00150: Revised Section 1.2.5.<br>• 24590-WTP-SDDR-PROC-05-00151: Revised Section 3.7.6.<br>9) Incorporated the following SCN's:<br>• 24590-HLW-3PN-MEE0-00001: Deleted Section 3.6.2 and 3.7.3. Incorporated change as new Sections 3.4.5 and 3.4.6.<br>• 24590-HLW-3PN-MEE0-00002: Added new Section 3.3.13; revised Sections 3.10.1, 3.10.4, and 3.10.5.<br>• 24590-HLW-3PN-MEE0-00004: Revised Section 1.2.5; added new Section 2.4; revised Sections 3.3.8 and 3.3.10; deleted Section 2.3.12 and revised Section 3.7.6; revised Sections 3.7.8 and 3.7.10; revised electrical isolation requirement as new Section 3.7.14; deleted Section 2.3.13 and revised Section 3.11.1; revised Section 4.1.4; deleted Section 6.3.6 and incorporated change as new Section 3.2.6.<br>• 24590-HLW-3PN-MEE0-00005: Revised Section 3.9.2.<br>• 24590-WTP-3PN-M000-00037: Added note for "Dangerous Waste Permit affecting". |

| Revision | Reason for Revision |
|---|---|
| | 10) Implemented 24590-WTP-GRCN-ENG-09-0008: removed reference to QA general specification 24590-WTP-3PS-G000-T0001; deleted Sections 8.1.1, 8.1.2, 8.2.1, and 8.2.4.; added Sections 8.2.5 and 8.2.6.<br>11) Deleted Sections 2.2.7, 2.2.8, 2.3.3, 2.3.15, and 10.2.1.<br>12) Added new Sections 1.3.5, 2.1.3, 2.1.4, 4.1.8, 4.2.6, 5.2.5, 6.3.10, 7.3.2, 10.2.2, 10.2.3, and 10.4.<br>13) Added Appendices (A thru D) and updated Table of Contents. |

## DOE Radioactive Materials Disclaimer :

Please note that source, special nuclear and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the US Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

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# 1 Scope

## 1.1 Project Description and Location

The Hanford Tank Waste Treatment and Immobilization Plant (WTP) is a complex of waste treatment facilities where the US Department of Energy (DOE) Hanford Site tank waste will be pretreated and immobilized into a stable glass form via vitrification. The WTP contractor will design, build, and start up the WTP pretreatment and vitrification facilities for the DOE Office of River Protection.

The Hanford Site occupies an area of about 560 square miles along the Columbia River, north of Richland, WA, in the USA. The WTP facilities will be constructed at the 200 East Area of the Hanford Site. The site elevation varies from 662 feet to 684 feet above mean sea level.

## 1.2 Equipment, Material, and Services Required

This specification establishes the minimum requirements for the performance, design, analysis, materials, fabrication, testing, inspection, quality assurance, qualification, documentation, and preparation for shipment of High Efficiency Particulate Air (HEPA) Filter Preheaters for the Melter Offgas Treatment Process System (HOP) and Pulse Jet Ventilation System (PJV) in the High-Level Waste (HLW) facility.

The scope of work for the Seller includes all work defined in this specification, its addenda, and attachments. The scope of work for the Seller shall include, but is not limited to, the following:

1.2.1 Provide design, materials, fabrication, testing, qualification, inspection, preparation for shipment, documentation, and submittals of HEPA Filter Preheaters (hereafter known as the "Preheaters") in accordance with this specification and its addenda, the Mechanical Data Sheets (MDS), Equipment Qualification Datasheets (EQD), purchasing documents, and referenced codes, standards, and documents.

1.2.2 Provide a breakdown (by paragraph) of the codes, standards, and referenced documents to be applied to each aspect of design, drawings, analyses, fabrication, quality assurance, inspection, testing, qualification, labeling, packaging, handling, and shipment of the Preheaters for review prior to beginning of detailed design. If an entire section or part of the listed codes and standards applies, a breakdown by paragraph is not required. Only the part or section shall be listed.

1.2.3 Each Preheater shall include, but is not limited to, the following:

- An in-cast liner
- A mounting frame
- A plenum with an inlet nozzle, an outlet nozzle, and heating element thermowells
- Electric heating elements
- Preheater control system
- Local control panel
- Temperature sensor thermowells (two each for inlet and outlet nozzles, one for the housing)
- Steel plating for radiation shielding
- Thermal insulation and insulation support lugs

1.2.4 Provide instructions for transportation, storage, handling, and installation of the Preheaters per Seller's recommendations and the requirements of this specification.

1.2.5 Packaging of the in-cast liner, plenum, shielding plates, and other bulk/structural steel parts shall be sufficient to allow for outdoor storage for a period of up to one (1) year at the WTP site (See Section 3.4.1 of this specification). Packaging of the power and controls components shall meet the requirements of ASME NQA-2-1989, *Quality Assurance Requirements for Nuclear Facility Applications*, Part 2.2, for Level B protection.

1.2.6 Provide and submit procedures, reports, manuals, and all documentation per this specification, and Forms G-321-E and G-321-V of the Material Requisition (MR).

1.2.7 Provide operating and maintenance manuals.

1.2.8 Each Preheater shall be assembled and wired to the fullest extent in the shop, requiring minimum assembly, installation, and connection to Buyer's piping, electrical power supply, and control interface.

1.2.9 Code stamp and National Board registration for the Preheaters are not required, unless otherwise noted in this specification.

## 1.3 Work by Others

Any item not specifically listed as being supplied by the Buyer shall be provided by the Seller. The Buyer shall supply the following:

1.3.1 Transportation of the Preheaters to the Buyer's premises .

1.3.2 Handling, storage, and installation of the Preheaters at the Buyer's job site.

1.3.3 Electric power to the Preheaters.

1.3.4 External wiring and cabling to the Preheaters.

1.3.5 Field testing of the Preheaters to ASME AG-1 Section TA.

## 1.4 Acronyms, Abbreviations and Definitions

### 1.4.1 Acronyms and Abbreviations

| | |
|---|---|
| ACI | American Concrete Institute |
| AISC | American Institute of Steel Construction |
| ALARA | As Low As Reasonably Achievable |
| ANSI | American National Standards Institute |
| ASME | American Society of Mechanical Engineers |
| CFR | Code of Federal Regulations |
| CMTR | Certified Material Test Report |
| DBE | Design Basis Events |
| DOE | US Department of Energy |
| EQ | Equipment Qualification |
| EQD | Equipment Qualification Datasheet |

| | |
|---|---|
| HEPA | High Efficiency Particulate Air |
| HLW | High-Level Waste |
| HOP | Melter Offgas Treatment Process System |
| ICN | Integrated Control Network |
| ISRS | In-Structure Response Spectra |
| ITS | Important To Safety |
| IEEE | Institute of Electrical and Electronics Engineers |
| MDS | Mechanical Data Sheet |
| MR | Material Requisition |
| MTBF | Mean Time Between Failure |
| MTTF | Mean Time to Failure |
| MTTR | Mean Time to Repair |
| NPT | National Pipe Thread |
| NQA | Quality Assurance Program Requirements for Nuclear Facilities |
| PJV | Pulse Jet Ventilation System |
| PMI | Positive Material Identification |
| PPJ | Programmable Protection System |
| QA | Quality Assurance |
| QAP | Quality Assurance Program |
| SC | Safety Class |
| SDDR | Supplier Deviation Disposition Request |
| SS | Safety Significant |
| SSC | Structure, System, or Component |
| UL | Underwriters Laboratories, Inc. |
| WTP | Hanford Tank Waste Treatment and Immobilization Plant |

### 1.4.2 Definitions

*Buyer:* Bechtel National Inc.

*Seller:* This term includes manufacturer, assembler, fabricator, supplier, vendor, contractor, sub-contractor, sub-supplier or equal who provides equipment, systems, components, services, or other products for delivery to the Buyer.

*Preheaters:* Refers to the High Efficiency Particulate Air (HEPA) Filter Preheaters.

*MR:* Refers to the material requisition for the Preheaters.

*MDS:* Refers to the mechanical data sheet for the Preheaters.

*EQD:* Refers to the equipment qualification datasheet included in the MDS for the Preheaters.

*C2:* Contamination classification for plant areas that are normally uncontaminated but have the potential to be contaminated. Equipment and personnel are confirmed to be uncontaminated before exit to uncontrolled areas.

*C5:* Contamination classification for plant areas that are considered high contamination areas. Personnel access to C5 areas is not normally permitted.

*R2:* Radiation classification for areas with a target dose equivalent rate of 0.250 mrem/hr. It is a controlled area with no limit on occupancy for general employees subject to compliance with basic procedures.

*R5:* Radiation classification for areas considered high or very high radiation areas. Personnel access to R5 areas is not normally permitted.

*Design Basis Events (DBE):* Postulated events providing bounding conditions for establishing the performance requirements of Safety equipment. The Design Basis Events also establish the performance requirements of the equipment whose failure under Design Basis Event conditions could adversely affect the function of Safety equipment.

DBEs include natural phenomena hazard (NPH) events. NPH events applicable to WTP are seismic, straight wind, wind-driven missile, snow, snow loading, ashfall, ashfall loading, and temperature extremes.

*Safety equipment:* Equipment that are necessary to: (1) ensure the integrity of the safety boundaries protecting the worker (2) place and maintain the facility in a safe state or (3) prevent or mitigate the event consequences so that the radiological exposures to the general public or the workers do not exceed established limits.

*Safety-class structures, systems, and components (SC SSC):* The structures, systems, or components, including portions of process systems, whose preventive or mitigative function is necessary to limit radioactive hazardous material exposure to the public, as determined from safety analyses. SC SSC is also designated as Important To Safety (ITS).

*Safety-significant structures, systems, and components (SS SSC):* The structures, systems, and components which are not designated as safety-class structures, systems, and components, but whose preventative or mitigative function is a major contributor to defense and/or worker safety as determined from safety analyses. SS SSC is also designated as ITS.

## 1.5 Quality Level

The quality level identifies the quality requirements to be applied to the equipment. Quality requirements are specifically defined on the associated mechanical data sheets (MDS) and supplier quality assurance program requirements data sheets. Structures, Systems, and Components identified as SC, SS and/or Air Permit affecting are Quality Level "Q" items. Refer to the MDSs for the quality level designations of the Preheaters.

## 1.6 Seismic Category

Specific requirements for the designated seismic categories are defined in 24590-WTP-3PS-SS90-T0001, *Engineering Specification for Seismic Qualification of Seismic Category I/II Equipment and Tanks.* Refer to the MDSs and EQDs for the seismic category designations of the Preheaters.

# 2 Applicable Documents

## 2.1 General

2.1.1 Work shall be done in accordance with the referenced codes, standards, and documents listed below, which are an integral part of this specification.

2.1.2 When specific chapters, sections, parts, or paragraphs are listed following a code, industry standard, or reference document, only those chapters, sections, parts, or paragraphs of the document are applicable and shall be applied. If a date or revision is not listed in Section 2, the latest issue, including addenda, at the time of request for quote shall apply. For material standards, if a later edition of the listed standard is required, the Seller shall obtain approval by SDDR prior to use of the material.

2.1.3 The effective dates and revisions listed in Section 2 shall apply to all subsequent references to codes and standards within this specification.

2.1.4 When more than one code, standard, or referenced document covers the same topic, the requirements for all must be met with the most stringent governing.

## 2.2 Codes and Standards

2.2.1 10 CFR 835, *Occupational Radiation Protection.*

2.2.2 Deleted.

2.2.3 ANSI/AISC N690-1994, *Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities - Tailored.* See Appendix B of this specification.

2.2.4 ASME AG-1-1997 with AG-1-a-2000 Addenda, Sections AA, CA and TA, *Code on Nuclear Air and Gas Treatment - Tailored.* See Appendix C of this specification.

2.2.5 ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, *Rules for Construction of Pressure Vessels.*

2.2.6 ASME NQA-1-1989, *Quality Assurance Program Requirements for Nuclear Facilities.*

2.2.7 Deleted.

2.2.8 Deleted.

2.2.9 ASTM E-119, *Standard Test Methods for Fire Tests of Building Construction and Materials.*

2.2.10 ASME NQA-2-1989, *Quality Assurance Requirements for Nuclear Facility Applications.*

2.2.11 ASME Boiler and Pressure Vessel Code, Section V, *Nondestructive Examination.*

2.2.12 ASME Boiler and Pressure Vessel Code, Section IX, *Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.*

2.2.13 ASME Boiler and Pressure Vessel Code, Section II, *Materials.*

2.2.14 ASME Code for Pressure Piping, B31.3-1996, *Process Piping.*

2.2.15 ASME Y14.100, *Engineering Drawing Practices.*

2.2.16 IEEE 384-1992, *Standard Criteria for Independence of Class 1E Equipment and Circuits - Tailored.* See Appendix D of this specification.

2.2.17 UL 499, Underwriters Laboratories Inc., *Electric Heating Appliances*

2.2.18 UL 834, Underwriters Laboratories Inc., *Heating, Water Supply, and Power Boilers - Electric*

## 2.3 Reference Documents/Drawings

2.3.1 24590-WTP-3PS-AFPS-T0001, *Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and Equipment*

2.3.2 24590-WTP-3PS-EKP0-T0001, *Engineering Specification for Electrical Requirements for Packaged Equipment*

2.3.3 Deleted

2.3.4 24590-WTP-3PS-G000-T0002, *Engineering Specification for Positive Material Identification (PMI) for Shop Fabrication*

2.3.5 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling, and Storage Requirements*

2.3.6 24590-WTP-3PS-JQ06-T0003, *Engineering Specification for Seismic Qualification of Seismic Category I Control and Electrical Systems and Components*

2.3.7 24590-WTP-3PS-JQ07-T0001, *Engineering Specification for Instrumentation for Package Systems*

2.3.8 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication*

2.3.9 24590-WTP-3PS-MVB2-T0001, *Engineering Specification for Welding of Pressure Vessels, Heat Exchangers and Boilers*

2.3.10 24590-WTP-3PS-NN00-T0001, *Engineering Specification for Thermal Insulation for Mechanical Systems*

2.3.11 24590-WTP-3PS-SS90-T0001, *Engineering Specification for Seismic Qualification of Seismic Category I/II Equipment and Tanks*

2.3.12 Deleted.

2.3.13 Deleted.

2.3.14 24590-WTP-3PS-JQ06-T0005, *Engineering Specification for Environmental Qualification of Control and Electrical Systems and Components*

2.3.15 Deleted.

2.3.16 24590-WTP-3PS-G000-T0014, *Engineering Specification for Supplier Design Analyses*

2.3.17 24590-WTP-3PS-G000-T0015, *Engineering Specification for Environmental Qualification of Mechanical Equipment*

2.3.18 24590-WTP-3PS-MV00-T0002, *Engineering Specification for Seismic Qualification Criteria for Pressure Vessels*

2.3.19 24590-WTP-3PS-MV00-T0003, *Engineering Specification for Pressure Vessel Fatigue Analysis*

2.3.20 24590-WTP-3PS-PX04-T0004, *Engineering Specification for Epoxy Coating of Stainless Steel Items That Are Buried, Embedded or Insulated*

2.3.21 24590-WTP-DC-ST-01-001, *Structural Design Criteria*

2.3.22 24590-WTP-3PS-P000-T0001, *Engineering Specification for Piping Material Classes General Description and Summary*

2.3.23 24590-WTP-3PB-P000-TS11V, *Piping Material Classification Pipe Class S11V*

2.3.24 24590-WTP-3PB-P000-TS11Z, *Piping Material Classification Pipe Class S11Z*

2.3.25 24590-WTP-3PB-P000-TN11F, *Piping Material Classification Pipe Class N11F*

2.3.26 24590-HLW-P1-P23T-00208, *HLW Vitrification Building Equipment Location Plan EL. 14'-0"/ Area 208*

2.3.27 24590-HLW-DB-S13T-00054, *HLW Vitrification Building Structural Concrete Forming Partial Plan EL 14'-0" Area 4*

2.3.28 24590-HLW-DB-S13T-00057, *HLW Vitrification Building Structural Concrete Forming Partial Plan EL 14'-0" Area 7*

2.3.29 24590-HLW-DB-S13T-00288, *HLW Vitrification Building Structural Concrete Forming Section WB East Face*

2.3.30 24590-WTP-DD-S13T-00002, *Civil/Structural Standards Standard Embed Plates*

2.3.31 24590-PTF-DD-S13T-00301, *Pretreatment Facility Structural Concrete Embedments Typical Details -SH 2*

2.3.32 24590-WTP-LIST-CON-08-0001, *Restricted Materials List WTP Safety Assurance*

2.3.33 24590-HLW-Z0C-30-00035, *HLW Filter Cave Preheater Shielding Analysis*

2.3.34 24590-HLW-MED-HOP-00013, *Mechanical Data Sheet HOP HEPA Preheater*

2.3.35 24590-HLW-MED-PJV-00002, *Mechanical Data Sheet PJV HEPA Preheater*

2.3.36 24590-WTP-3PS-G000-T0019, *Engineering Specification for Acquisition of Commercial Items and Services for Use in Safety Applications at WTP*

### 2.4 Design Changes Incorporated by Reference

- 24590-WTP-SDDR-PROC-05-00069
- 24590-WTP-SDDR-PROC-05-00140
- 24590-WTP-SDDR-PROC-05-00142
- 24590-WTP-SDDR-PROC-05-00143
- 24590-WTP-SDDR-PROC-05-00148

# 3 Design Requirements

### 3.1 Basic Function

3.1.1 The Preheaters are located upstream of their respective HEPA filters in the offgas stream. The Preheaters are used to ensure the offgas stream temperature is sufficiently above the dew point to prevent moisture condensation in the HEPA filters.

3.1.2 The Preheaters are located in a 48 inches thick 2-hour fire rated barrier concrete wall (see Section 3.2.5) that also serves as a radiation and contamination boundary to separate the *R5/C5* area from the *R2/C2* area (see Section 3.4.2).

3.1.3 The Preheaters are to ensure confinement of radioactive materials to prevent releases that may result in consequences to the public, co-located worker, and facility worker above radiation exposure standards in the WTP Safety Requirements Document.

3.1.4 The Preheaters shall provide secondary confinement of aerosols during normal, abnormal, accident conditions and to prevent exposures that may results in exposure consequences to the facility worker above standards in the WTP Safety Requirements Document. The Preheaters are part of the *C5* boundary.

3.1.5 The Preheater enclosure shall maintain a 2-hour fire rated barrier for the penetration of the Preheaters in the wall between the *R5/C5* area and the *R2/C2* area.

3.1.6 The Preheater controller shall provide overheating protection to ensure HEPA filters, filter housing, concrete and structural components around the Preheater housing, and the Preheater enclosure are not damaged due to overheating.

### 3.2 Performance

3.2.1 The Preheaters shall be designed, fabricated, and tested per the mechanical and performance requirements of this specification, the MDSs, the EQDs, and the purchasing documents. Seller shall submit updated MDSs with the required information for approval by the Buyer per Form G-321-E of the MR.

3.2.2 Seller shall recommend additional operating parameters to be monitored for the Preheaters to achieve their required performance.

3.2.3 The Preheaters, with exception of the heating elements, shall be designed to operate for a minimum service life of 40 years.

3.2.4 The required mean time to failure (MTTF) for each heating element is 5 years @ 8760 hours of use per year.

3.2.5 The Preheaters will be installed in a 2-hour fire rated barrier wall and shall be designed and tested to perform a 2-hour fire rated barrier function, while exposed to fire on the C2 corridor side, and on the C5 cave side, of the wall but not simultaneously on both sides. The Preheater shall be constructed and tested to achieve a 2-hour fire rating in accordance with ASTM E119 Standard *Test Methods for Fire Tests of Building Construction and Materials.* Testing shall be done by Underwriters Laboratory, Inc. (UL) or a nationally recognized testing laboratory (NRTL).

3.2.6 Seller shall demonstrate through design that the Preheaters are able to maintain the contamination and pressure boundaries between the *R5/C5* area and *R2/C2* area at all times.

## 3.3 Preheater Design

3.3.1 As Low As Reasonably Achievable (ALARA) principles shall be applied to the design of the Preheaters per 10 CFR 835, *Occupational Radiation Protection.*

3.3.2 Seller shall design the Preheaters to meet the requirements of:

a. this specification
b. ASME AG-1 Articles AA-4000 and CA-4400
c. ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 (for Preheater housing)
d. ASME Code for Pressure Piping, B31.3 (for piping associated with the Preheaters)
e. ANSI/AISC N-690 for Safety-Related Steel Structures (for steel structure of the Preheaters)
f. UL 499 or UL 834 as applicable for the heating elements of the Preheaters
g. Buyer specification 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication*
h. the MDSs and EQDs
i. the purchasing documents.

For the above listed, the more stringent of the requirements shall govern the design.

3.3.3 The Preheaters shall be designed to maintain contamination and pressure boundaries, and to maintain a 2-hour fire barrier rating, between the *R5/C5* area and *R2/C2* area at all times.

3.3.4 The offgas stream shall be contained within each Preheater plenum. The confinement boundary for the offgas stream shall be designed in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1. Seller shall submit code calculations per Form G-321-E of the MR.

3.3.5 Nozzle design, loading and reinforcement shall be in accordance with Buyer specification 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication.* Seller shall provide nozzle loading calculations per Form G-321-E of the MR.

3.3.6 The Preheaters shall meet Level B service limits as defined in ASME AG-1 Article AA-4214 .

3.3.7 Refer to the MDSs for corrosion allowance requirements.

3.3.8 Seller shall design the Preheaters to fit within the space envelope specified in the MDSs. The local control panels shall be located in the *R2/C2* area in close proximity with their respective Preheaters, refer to Buyer drawing 24590-HLW-P1-P23T-00208, *HLW Vitrification Building Equipment Location Plan EL. 14'-0"/Area 208*. Each control panel will be welded or bolted to steel embed plates in the floor, refer to Buyer drawings 24590-HLW-DB-S13T-00054, 24590-HLW-DB-S13T-00057, and 24590-WTP-DD-S13T-00002. The dimensions of each local control panel shall not exceed 24 inches wide by 24 inches deep by 90 inches high.

3.3.9 Seller shall provide the operating and shipping weights for the Preheaters.

3.3.10 Seller shall provide a detailed design of the in-cast liner in accordance with Buyer specification 24590-WTP-DC-ST-01-001, *Structural Design Criteria*, and ANSI/AISC N690 (see Appendix B of this specification). Only liquid penetrant (LP) nondestructive examination of the liner welds is required. The concrete compressive strength is 5000 pounds per square inch. Refer to MDSs for the material of construction of the in-cast liner.

3.3.11 Seller shall provide equipment reliability figures for all major components and sub-components of the Preheaters and the basis for those figures. Where possible, the Seller shall compare the figures for the equipment in this specification to similar equipment sold and serviced by the Seller. The definition of components and sub-components is at Seller's discretion. The reliability figures shall include, as a minimum, the following:

a. Mean time between failure (MTBF).

b. Estimated modes of failure (example; dielectric breakdown, element overheat, etc.).

c. Estimated time that is required to perform the recommended maintenance, as applicable (mean time to repair, MTTR).

The data above shall be based on the physical and environmental conditions delineated in this specification, the MDSs and EQDs. The source for all estimates and any underlying assumptions shall be stated.

3.3.12 Seller shall provide detailed operating and maintenance instructions, in the form of a manual, or similar, for the Preheaters per Form G-321-E of the MR.

3.3.13 Individual heating element and temperature sensor shall be installed inside a thermowell, and be accessible from the *R2* corridor side through a removable shield plug, without removing any of the shield plates. The shield plug shall be placed directly behind each heating element/temperature sensor. The element/sensor should be connected to the shield plug (e.g. bolted flange, NPT connection etc.) so that the element/sensor and shield plug can be removed as a single unit.

## 3.4 Environmental Conditions

3.4.1 The Preheaters shall be able to withstand outdoor storage at ambient temperature ranging from -23°F to 113°F with relative humidity ranging from 5% to 100%, without incurring damage from such conditions prior to installation. Storage of the power and controls components shall meet the requirements of ASME NQA-2-1989, *Quality Assurance Requirements for Nuclear Facility Applications*, Part 2.2, for Level B storage.

3.4.2 The Preheaters are cast into a 48" thick concrete wall which serves as the boundary between an *R2/C2* area and an *R5/C5* area.. Refer to the MDSs and EQDs for high and low temperatures, relative humidities, and air pressures which will be maintained in the *R2/C2* area and *R5/C5* area during normal and abnormal plant operating and DBE conditions.

3.4.3 Refer to the MDSs and EQDs for other environmental qualification data of the Preheaters during normal, abnormal, DBE, and post-DBE conditions (as applicable).

3.4.4 Deleted.

3.4.5 Control and electrical systems and components will be installed in the *C2/R2* corridor which is considered to be a mild environment (refer to service conditions in the MDSs and EQDs).

3.4.6 Safety control and electrical systems and components shall be designed and qualified for the environmental conditions listed on the MDSs and EQDs, in accordance with Buyer specification 24590-WTP-3PS-JQ06-T0005, *Engineering Specification for Environmental Qualification of Control and Electrical Systems and Components*. Seller shall submit environmental qualification (EQ) procedures, test plans, analysis, and/or operating experience data report for Buyer review. EQ documents shall be in accordance with the requirements of 24590-WTP-3PS-JQ06-T0005, Section 6.

3.4.7 Mechanical components shall be designed and qualified for the environmental conditions listed on the MDSs and EQDs, in accordance with Buyer specification 24590-WTP-3PS-G000-T0015, *Engineering Specification for Environment Qualification of Mechanical Equipment*. Seller shall submit environmental qualification (EQ) procedures, test plans, analysis, and/or operating experience data report for Buyer review. EQ documents shall be in accordance with the requirements of 24590-WTP-3PS-G000-T0015, Section 6.

## 3.5 Loading

3.5.1 Seller shall design the Preheaters to be self-supporting and be capable of handling the loads and moments imposed on the Preheaters during testing, packaging, shipping, handling, storage, installation, operation, and Design Basis Events. Seller shall provide calculations and/or test reports to support the design basis.

3.5.2 Loads to be considered for the structural design of the Preheaters shall be in accordance with the codes, standards, and referenced documents listed in Section 2 of this specification. As a minimum, loadings and stresses to be imposed shall meet Level B service limits as defined in article AA-4214 of ASME AG-1.

3.5.3 Seller shall perform and submit seismic analysis/testing and qualification per the requirements of Buyer specification 24590-WTP-3PS-SS90-T0001, *Engineering Specification for Seismic Qualification of Seismic Category I/II Equipment and Tanks*. Refer to Section 2 of the MR, the MDSs and EQDs, and the In-Structure Response Spectra (ISRS) figures referenced in the MR Technical Notes.

3.5.4 Load bearing steel components shall be designed in accordance with ANSI/AISC N690-94 as tailored in the SRD. See Appendix B of this specification.

a. The abnormal conditions shown on the EQDs are not consistent with the abnormal loads described in ANSI/AISC N690-94. Stresses due to abnormal conditions (if applicable)

documented on the EQDs are to be considered as normal conditions, however, stresses due to abnormal conditions need not be included in the seismic load combinations.

b. Stresses due to DBE conditions (if applicable) documented on the EQDs need not be included in the seismic load combinations unless the conditions are due to a high energy line break. If the DBE conditions are due to a high energy line break, this will be documented on the EQDs.

3.5.5 Seller shall provide nozzle displacement, including seismic anchor movement, for seismic loads.

## 3.6 Electrical Requirements

3.6.1 Electrical requirements for the Preheaters shall be in accordance with Buyer specification 24590-WTP-3PS-EKP0-T0001, *Engineering Specification for Electrical Requirements for Packaged Equipment.*

3.6.2 Deleted.

3.6.3 Seller shall determine the qualified life of Quality Level "Q" electrical equipment and components (refer to the Quality Level designation in the MDSs) that are susceptible to significant thermal and radiation aging in accordance with IEEE 323. Seller shall provide the Buyer a listing of such equipment and components.

3.6.4 The available power supply for the Preheaters are:

a. 120 Volts, alternating current, uninterrupted power supply (by others).
b. 480 Volts, alternating current (by others).

## 3.7 Instrumentation and Control Requirements

3.7.1 Seller shall design and fabricate each Preheater and respective heating control system in accordance with Buyer specification 24590-WTP-3PS-JQ07-T0001, *Engineering Specification for Instrumentation for Package Systems.*

3.7.2 Buyer specification 24590-WTP-3PS-JQ06-T0003, *Engineering Specification for Seismic Qualification of Seismic Category I Control and Electrical Systems and Components* shall apply to Seismic Category I instrumentation, control systems and components.

3.7.3 Deleted.

3.7.4 Seller shall provide instrumentation, controls, interlocks, and logic control required for the Preheaters to achieve their required performance.

3.7.5 Seller's design shall provide the ability for functional testing of the Preheaters, and the Preheater control system.

3.7.6 Thermowell design shall be by Seller. Inlet and discharge thermowells shall extend a minimum of 12 inches into respective piping. The housing thermowell shall be located on the housing skin at the maximum temperature location calculated by the Seller, for housing over-temperature protection. Seller shall submit proposed design to Buyer for review.

3.7.7 Design of the Preheater shall allow for continuous operation despite individual heating element failure, until the maximum element failure percentage as stated in the MDS is reached. Each heating element shall include an internal thermocouple to provide over-temperature protection.

3.7.8 Seller shall provide a local control panel for each Preheater. Control for the Preheater shall be via the local control panel or via the Integrated Control Network (ICN) from a remote location. Each local control panel (local) or ICN (remote) shall include, but is not limited to, the following:

a. Local/Remote (transfer selector for panel or ICN control) with electrically isolated indication to the ICN
b. Start/Stop control at local panel or from the ICN (electrical isolation required)
c. Hand/Off/Automatic Control (local)
d. Offgas inlet and outlet temperature indication
e. Preheater On/Off indication (local/remote)
f. Fault indication for each heating element and alarm for each heating element (local)
g. Inlet and Outlet temperature electrically isolated analog outputs to the ICN
h. Fault (any) electrically isolated discrete output to the ICN
i. Failure (any) electrically isolated discrete output to the ICN
j. All control set points shall be adjustable locally
k. Preheater differential temperature control shall be adjustable remotely at the ICN (electrical isolation required).

3.7.9 Deleted.

3.7.10 The HLW Melter Offgas Treatment Process System (HOP) Preheater control system shall maintain a delta temperature setpoint through the Preheater. Delta temperature setpoint will be maintained by the local Preheater controller. ICN 'Start' command shall be latched at the Preheater control system so the control system will continue to operate if the ICN were to fail. In 'Remote' mode the Preheater control system shall control to the last setpoint value on loss of ICN 'Setpoint'.

3.7.11 The HLW Pulse Jet Ventilation System (PJV) Preheater shall be designed to maintain offgas humidity at a level sufficient to preclude condensing conditions within the HEPA filters downstream of the Preheater. Humidity levels in the air stream shall be inferred from the air temperature measured at the inlet to the Preheater.

3.7.12 Components designated as Safety Class (SC) shall be designed and qualified to function as intended in the environments associated with the events for which they are intended to respond (normal, abnormal, and post DBE). In addition, components designated as Safety Significant (SS) shall be designed to function as intended in the environments associated with the events for which they are intended to respond. The effect of aging on normal and abnormal functioning shall be considered in design and qualification. Acceptance criteria for adequate performance of SC and SS components are in this specification, the MDSs, and the purchasing documents.

3.7.13 Safety (SC and SS) components shall be physically separated and electrically isolated from the non-Safety components. Separation and isolation between the Safety and non-Safety components shall be designed in conformance with Buyer specification 24590-WTP-3PS-JQ07-T0001, *Engineering Specification for Instrumentation for Package Systems* and IEEE 384 requirements.

3.7.14 Seller shall provide the following Safety components to interface with the Buyer's Programmable Protection System (PPJ):

a. Analog temperature indication output to PPJ for inlet offgas.

b. Analog temperature indication output to PPJ for outlet offgas.

c. Analog temperature indication output to PPJ for housing/pressure boundary (for preheater housing over-temperature protection).

The above Safety components shall use transmitters with appropriate output voltage isolation to provide the analog temperature indication signals. Safety signal cables shall be segregated from non-Safety cables, and shall be wired to a local junction box for interface with the Buyer's control system.

Safety components shall be Safety Integrity Level 2 (SIL-2) capable in accordance with International Electrotechnical Commission (IEC) 61508-2 and IEC 61508-3 as appropriate and documented as such by a certificate from a nationally recognized testing laboratory (NRTL).

3.7.15 All components that perform or support a Safety control or Air Permit function (such as temperature indicators and transmitters) are Safety or Air Permit affecting and shall be Quality Level "Q" items.

3.7.16 Seller shall prepare and submit Preheater control specification describing the process control, delta temperature control, over-temperature control, power control, and control logic diagram(s) illustrating the control logic scheme to Buyer for review and permission to proceed. Seller shall also provide detailed requirements for Buyer supplied external wiring and cabling to the Preheaters.

## 3.8 Thermal Analysis Requirements

3.8.1 Seller shall demonstrate, in the form of a calculation or similar, that the Preheaters are able to withstand all the thermal stresses in their 40 year service life.

3.8.2 Seller shall provide thermal analysis to:

a. Confirm the Preheaters perform to the requirements of this specification, the MDSs, the EQDs, the purchasing documents, and referenced codes, standards and documents.

b. Confirm the surface temperature of the concrete walls in contact with the Preheaters do not exceed the maximum allowed temperature per Section 3.9.2.

c. Determine the requirement for personal protection on the *R2/C2* side of the Preheaters.

3.8.3 The method of analysis shall be proposed by the Seller.

3.8.4 The thermal analysis shall include startup, normal operation, upset, and shutdown conditions.

3.8.5 Seller shall provide heater capacity and thermal stress calculations for the Preheater design.

3.8.6 Seller shall provide nozzle displacement, including thermal anchor movement, for normal operating and upset conditions.

## 3.9 Thermal Insulation Requirements

3.9.1 Seller shall provide insulation in accordance with Buyer specification 24590-WTP-3PS-NN00-T0001, *Engineering Specification for Thermal Insulation for Mechanical Systems.*

3.9.2 The maximum allowable surface temperature of the concrete wall in contact with the Preheaters is noted on the MDSs.

3.9.3 Seller shall determine the surface temperature of the Preheaters on the *R2/C2* corridor side. If the temperature exceeds 140°F, Seller shall provide and install removable blanket insulation for personnel protection.

3.9.4 Deleted.

3.9.5 Seller shall provide a method for easy and safe replacement of thermal insulation that does not meet the design life of 40 years and for insulation that will require removal for maintenance.

## 3.10 Radiation Shielding Requirements

3.10.1 Seller shall design and provide a minimum of 9.5 inches of equivalent steel (33 inches of concrete), radiation shielding on both the *R5* cell and *R2* corridor sides of the heater unit, as shown on the MDSs. The shielding on the *R5* cell side shall block all potential shine paths from in-cell sources during change out of the heating elements and temperature sensors. The shielding on the *R2* corridor side shall block all potential shine paths from in-cell sources, including those which shine through the offgas inlet and discharge nozzles.

3.10.2 Deleted.

3.10.3 Radiation shielding shall be designed using overlapping layers of shielding plates to achieve the required shielding thickness. The shielding design shall incorporate features for safe and easy assembly and removal of the shielding plates.

3.10.4 Shielding plugs that must be removed for Preheater maintenance shall not exceed 500 pounds each.

3.10.5 Shielding plates not routinely removed for Preheater maintenance shall not exceed 2500 pounds each. The minimum shielding plate thickness shall be 1 inch.

3.10.6 Each shielding component shall be uniquely identified using 1/2 inch high stamped characters to assist assembly and have suitable attachment points for balanced lifting and assembly.

3.10.7 Seller shall provide an assembly map to show the on-site assembly sequence of shielding components.

3.10.8 Penetrations through the shield plug for the heating element and temperature sensor lead wires shall not compromise shielding by allowing any direct radiation shine path through the shield plug. The lead wires shall come through the shield plug in a joggle penetration which conforms with the geometric configuration as shown on the sketch in the MDSs. The shield plug must be designed in a manner that maintains at least 4 inches of shielding behind each elbow of the joggle penetration.

### 3.11 Lifting Requirements

3.11.1 Design of lifting lugs shall be by Seller.

3.11.2 Lifting lug design shall be justified by calculation for eye pullout, bending, weld strength, and Preheater stress for the intended method of lift and material used.

3.11.3 Lifting lugs shall be stamped with the Preheater dry weight as defined by the Seller.

3.11.4 Lifting lugs shall be installed on each Preheater for balanced lifting and handling.

3.11.5 All lifting points shall be designed and tested in accordance with 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling, and Storage Requirements.*

### 3.12 Accessibility and Maintenance

3.12.1 Preheater maintenance including replacement of individual heating element and temperature sensor shall be performed from the *R2/C2* area. The Preheaters will not be accessible for maintenance from the *R5/C5* area once they are put in operational service.

3.12.2 Refer to Buyer drawing 24590-HLW-P1-P23T-00208, *HLW Vitrification Building Equipment Location Plan EL. 14'-0"/Area 208* and the MDSs for the allowable space for operations and maintenance of each Preheater in the *R2/C2* area.

3.12.3 Seller shall provide a list of equipment and components requiring maintenance or replacement over the 40 year minimum service life of the Preheaters. The list shall include recommendations for frequency of maintenance and replacement. Seller shall provide a spare parts list.

# 4 Materials

### 4.1 General

4.1.1 All materials of construction for the Preheaters shall conform to the requirements of:

- this specification
- ASME AG-1 Articles AA-3000, CA-3400 and CA-3500
- the MDSs and EQDs
- the purchasing documents

4.1.2 All materials used shall be new and free of defects.

4.1.3 All materials used shall be resistant to deterioration when used in a radioactive environment for a minimum service life of 40 years.

4.1.4 Seller shall furnish legible copies of Certified Material Test Reports (CMTR) or Material Manufacturers Certificate of Compliance for all bulk carbon and stainless steel materials (plate, shapes, pipe, bolts, nuts, threaded rod, etc.) used for the fabrication of the Preheater in-cast liner, shield plates and mounting hardware, plenum and mounting hardware, and control/power enclosure support steel and mounting hardware. All materials shall be traceable to the CMTR through markings or drawing prints.

4.1.5 Seller shall not substitute materials specified in this specification, the applicable documents, the MDSs, and the purchasing documents without written approval from the Buyer.

4.1.6 Seller shall maintain a positive system of identification of materials used in the fabrication of the Preheaters in accordance with Buyer specification 24590-WTP-3PS-G000-T0002, *Engineering Specification for Positive Material Identification (PMI) for Shop Fabrication.*

4.1.7 Seller shall provide Material Safety Data Sheets for all materials used in the construction of the Preheater housings (confinement boundary and exposure to offgas process flow) and in the heating element and temperature sensor thermowell assemblies (exposure to offgas process flow).

4.1.8 All material shall be controlled, issued, handled, and stored with proper identification and traceability. Seller shall prepare and submit material control procedures for Buyer review.

### 4.2 Prohibited Materials

4.2.1 Mercury, lead, aluminum, zinc, their alloys, or materials containing such metals as their basic constituents shall not be used in the construction of the Preheaters. Teflon shall not be used in the construction of the Preheaters.

4.2.2 Molybdenum, sulfides, and halides shall not be used in direct contact with stainless steel.

4.2.3 Materials that contain halides shall not be used in any component of the Preheaters.

4.2.4 Asbestos shall not be included in any component of the Preheaters or insulation.

4.2.5 Carbon steel shall not be included in any component of the Preheaters that comes into direct contact with the offgas stream.

4.2.6 Certain chemicals/materials are restricted from use at WTP. Refer to 24590-WTP-LIST-CON-08-0001, *Restricted Materials List* for the complete list of restricted chemicals/materials. The use of any restricted chemicals/materials requires authorization from the Buyer (WTP Safety Assurance).

## 5 Fabrication

### 5.1 General

5.1.1 Fabrication of the Preheaters shall conform to the requirements of:

- this specification
- ASME AG-1 Articles AA-6000 and CA-6000
- the MDSs and EQDs
- the purchasing documents

5.1.2 The confinement boundary for the offgas stream shall be fabricated to the requirements of ASME Boiler and Pressure Vessel Code Section VIII, Division 1, and Buyer specification 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication.*

5.1.3 All edges shall be rounded and smooth to the touch. All stainless steel surfaces shall be clean, free of stains, scale, and deposits. All weld spatter, slag, and heat affected zone oxides shall be removed.

5.1.4 Seller shall determine and specify tolerances, surface flatness, and finish requirements for assembly and fabrication of the Preheaters at the detailed design stage. At a minimum, all tolerances, surface flatness, and finishes shall be in accordance with all applicable codes, standards, and references documents in Section 2 of this specification.

## 5.2 Welding

5.2.1 Welding of the Preheaters other than the containment boundary for the offgas stream shall conform to the requirements of:

- this specification
- ASME AG-1 Articles AA-6300 and CA-6120
- the MDSs and EQDs
- the purchasing documents

5.2.2 The containment boundary for the offgas stream shall be welded to the requirements of Buyer specification 24590-WTP-3PS-MVB2-T0001, *Engineering Specification for Welding of Pressure Vessels, Heat Exchangers and Boilers,* where applicable.

5.2.3 Seller shall submit Welding Procedure Specification (WPS) and Procedure Qualification Requirements (PQR) per the applicable codes and specifications.

5.2.4 All welds along the contamination confinement boundary shall be continuous.

5.2.5 Major repairs using welding shall be in accordance with specification 24590-WTP-3PS-MVB2-T0001, *Engineering Specification for Welding of Pressure Vessels, Heat Exchangers and Boilers.* Repair plans shall be submitted for Buyer review. A review status of "Work May Proceed" must be obtained prior to use.

## 5.3 Cleaning, Finishing, and Coating

5.3.1 Cleaning, finishing, and coating of the Preheaters shall conform to the requirements of:

- ASME AG-1 Articles AA-6500 and CA-6200
- ASME NQA-2 Part 2.1 *Quality Assurance Requirements for Cleaning of Fluid Systems and Associated Components for Nuclear Power Plants*
- Buyer specification 24590-WTP-3PS-AFPS-T0001, *Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and Equipment,* where applicable.

# 6 Tests and Inspections

## 6.1 General

6.1.1 Seller shall conduct and be responsible for all testing and inspections of the Preheaters per the requirements of this specification, ASME AG-1 Articles AA-5000 and CA-5400, and all applicable references in Section 2 of this specification.

6.1.2 Seller shall develop and submit detailed procedures for all tests and inspections for the Preheaters per the requirements of this specification, applicable codes, standards, reference documents, and Form G-321-E of the MR for Buyer review.

6.1.3 Seller shall complete and submit reports of all testing and inspections required by this specification and per Form G-321-V of the MR. Each report shall identify the component tested or inspected, date performed, applicable procedures, acceptance criteria, person performing the test or inspection, results, and conclusions.

6.1.4 Control and calibration of measuring and test equipment shall be in accordance with Article AA-5130 of ASME AG-1.

## 6.2 Personnel Qualifications

6.2.1 All inspections and tests shall be performed by personnel qualified per the requirements of this specification and all applicable references in Section 2 of this specification.

6.2.2 Seller shall submit personnel qualification documents of Seller's inspection and test personnel, for Buyer review.

## 6.3 Shop Tests

6.3.1 Seller shall provide all materials, labor, tools, equipment, appurtenances, and instrumentation to conduct all shop tests on the Preheaters.

6.3.2 Seller shall conduct tests and inspections specified in ASME AG-1 Articles AA-5000 and CA-5400 on each Preheater.

6.3.3 Seller shall conduct visual inspection on the Preheaters and provide an inspection checklist for Buyer review.

6.3.4 Seller shall conduct weld inspections for soundness using radiography and liquid penetrant examinations on each Preheater in accordance with ASME AG-1 Article AA-5300 and Buyer specification 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication*, where applicable.

6.3.5 Seller shall conduct pneumatic leak test on the plenum of each Preheater in accordance with ASME Boiler and Pressure Vessel Code, Section V and Buyer specification 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication*. Acceptance criterion: *No leaks observed.*

6.3.6 Deleted

6.3.7 Instrumentation and control systems shall be functionally tested, inspected, and calibrated in accordance with ASME AG-1 Article CA-5400 and Buyer specification 24590-WTP-3PS-JQ07-T0001, *Engineering Specification for Instrumentation for Package Systems, Section 6.*

6.3.8 Seller shall provide all equipment, instrumentation, labor, and materials to perform a lifting test in the shop, demonstrating that the lifting lugs or attachment points are adequate to support the Preheaters without any distortion. Seller shall provide a shop test report on lifting points provided on each Preheater.

6.3.9 A test report shall be prepared for each completed test. All test results shall be documented, certified (signed) by appropriate employee of the Seller, submitted to the Buyer, and included in the documentation package.

6.3.10 Seller shall perform fit-up test on one (1) of the fully assembled Preheaters and witnessed by the Buyer, to demonstrate:

- Mounting of the Preheater plenum to the in-cast liner
- Assembly and removal of the radiation shielding plates and shielding plugs
- Installation, removal, and replacement of the heating element and temperature sensor.

The Preheater used for the demonstration shall be chosen by the Buyer.

# 7 Preparation for Shipment

## 7.1 General

7.1.1 The Preheaters shall be prepared for shipment in accordance with:

- Buyer specification 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling and Storage Requirements*
- ASME AG-1 Article CA-7000

7.1.2 All results of shop tests and inspections for the Preheaters shall be reviewed by the Buyer prior to preparing and packaging the Preheaters for shipment.

7.1.3 Seller shall verify, by calculation, that the Preheaters and its internals will withstand loads occurring during shipping, handling, and installation.

## 7.2 Tagging

7.2.1 A stainless steel nameplate shall be permanently and rigidly affixed to each Preheater containing, as a minimum, the following information:

a. Seller's name and serial number
b. year of manufacture
c. Buyer's purchase order number
d. plant item number as furnished by the Buyer
e. capacity, kW
f. electrical characteristics, V/Phase/Hz

7.2.2 The information shall be stamped or etched on the nameplate using characters no less than 1/4 inch tall.

7.2.3 The attachment and location of nameplates shall be in accordance of Articles AA-9130 and AA-9140 of ASME AG-1.

7.2.4 All packages shall be clearly and suitably tagged to at least show the Seller's name, Buyer's name, plant item number, purchase order number, package contents, parts list, and handling instructions for each package.

### 7.3 Shipping, Handling and Storage Instructions

7.3.1 Seller shall submit shipping weights as well as detailed shipping, handling, and storage instructions for the Preheaters prior to its shipment per Form G-321-E of the MR.

7.3.2 Seller shall provide storage instructions for storage interval greater than one year. See Section 3.4.1 of this Specification for the environmental conditions for long term storage of the Preheaters.

# 8 Quality Assurance (QA)

### 8.1 General Requirements

8.1.1 Deleted.

8.1.2 Deleted.

8.1.3 Seller's Quality Assurance Program (QAP), as a minimum, shall contain the requirements detailed in the Supplier Quality Assurance Program Requirements data sheet listed in Section 2 of the MR.

### 8.2 Quality Related Components

8.2.1 Deleted.

8.2.2 The successful bidder must pass a pre-award survey by the Buyer. Seller shall demonstrate that its quality program is in compliance with the procurement quality requirements listed in the Supplier Quality Assurance Program Requirements Data Sheet. Seller shall allow the Buyer, its agents, and DOE access to their facility and records pertaining to this purchase order for the purpose of QA audits and surveillance at mutually agreed times.

8.2.3 All items shall be manufactured in accordance with Seller's QAP that meets the requirements of ASME NQA-1, and has been previously evaluated and accepted by the WTP Quality Assurance Organization.

8.2.4 Deleted

8.2.5 If Seller subcontracts any work (engineering, fabrication, testing etc.) on "Q" SSCs items, Seller is responsible to audit and approve Subcontractor's NQA-1 program.

8.2.6 As required, commercial grade items (CGI) for "Q" applications shall be dedicated in accordance with Buyer specification 24590-WTP-3PS-G000-T0019, *Acquisition of Commercial Items and Services for Use in Safety Application at WTP.*

# 9 Configuration Management

9.1 The equipment covered by this specification is identified with the plant item number shown in the MDSs. The equipment shall be identified in accordance with Section 7.2, Tagging, of this specification.

9.2 Substitutions and deviations must be in accordance with Section 2 of the MR.

# 10 Documentation and Submittals

## 10.1 General

10.1.1 Seller shall submit for Buyer review all detailed designs, documentation, procedures, instructions (including erection and installation instructions), calculations, analyses, models, manufacturer data, inspection reports, test reports, environmental and seismic qualification reports, certified material test reports, certifications, certificates, manuals (including operations and maintenance manuals), Material Safety Data Sheets, spare parts list, and drawings required per this specification, its addenda and attachments, the purchasing documents, and referenced codes, standards and Buyer documents.

10.1.2 Seller shall submit to Buyer the Engineering and Quality Verification documents in the forms, quantities, and timing shown in Form G-321-E, *Engineering Document Requirements*, and Form G-321-V, *Quality Verification Document Requirements*, in Section 3 of the MR.

10.1.3 Each documentation transmittal package shall have a documentation inventory sheet attached listing all documents and the number of pages in each package.

## 10.2 Calculations and Analyses

10.2.1 Deleted.

10.2.2 All calculations and analyses to be provided to the Buyer shall be done in accordance with 24590-WTP-3PS-G000-T0014 *Engineering Specification for Supplier Design Analyses.*

10.2.3 Calculations/analyses to be provided for Buyer's review shall include, but are not limited to:

a. Calculation/analysis to demonstrate that the Preheater is able to maintain the contamination and pressure boundaries in accordance with Section 3.2.6 of this specification.

b. Preheater design and performance calculations/analyses in accordance with Section 3.3 of this specification, including ASME Boiler and Pressure Vessel Code Section VIII analysis.

c. Environmental Qualification analyses in accordance with Section 3.4 of this specification.

d. Loading and seismic analysis and qualification in accordance with Section 3.5 of this specification.

e. Thermal analysis and calculations in accordance with Section 3.8 of this specification.

f. Lifting, handling and shipping load analyses in accordance with Sections 3.11 and 7.1 of this specification.

## 10.3 Schedules

10.3.1 A detailed schedule of engineering, document submittals, material purchases, fabrication, shop tests, and shipment shall be submitted using Form 15EX in Section 3 of the MR.

## 10.4 Drawings

10.4.1 Seller shall provide all drawings required per this specification and the applicable documents in Section 2 of this specification.

10.4.2 Seller shall produce all drawings per the drawing practices set forth in ASME Y14.100, *Engineering Drawing Practices.*

10.4.3 Seller shall submit drawings and diagrams for Buyer review prior to fabrication, and/or purchase of appurtenance equipment. Drawing and diagram submittals shall include as a minimum, but are not limited to, the following:

a. Outline drawings showing dimensions, services, insulation, and foundation and mounting details.

b. Outline drawings showing electrical and instrumentation tie-in points.

c. Outline drawings showing locations of piping connections with nozzle schedule, including sizes of piping connections, including required location and sizes of wiring connections.

d. Overall single line diagram (wiring diagram) showing all electrical equipment and wiring for the Preheaters and local control panels.

e. Control logic diagrams showing input signal paths required to accomplish a response.

f. Assembly drawings with sufficient information and detail to facilitate assembly of the component parts of an equipment item, including drawings illustrating the removal and reassembly of the radiation shielding plates and associated components.

g. Shop detail drawings that provide information and details to facilitate fabrication, manufacture, inspection, and installation.

# Appendix A

## Not Used

# Appendix B

# ANSI/AISC N690, Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities - *Tailored*

# 3.0 ANSI/AISC N690, "Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities"

Revision: 1994
Sponsoring Organization: American National Standards Institute/American Institute of Steel Construction

RPP-WTP Specific Tailoring

The following tailoring of ANSI/AISC N690 is required for use by the WTP contractor as an Implementing Standard for structural design.

## Page 22, Section Q1.5.7.1 Primary Stresses

Revise the stress limit coefficients for compression in Table Q1.5.7.1 as follows:

- 1.3 instead of 1.5 [stated in footnote (c)] in load combinations 2, 5, and 6
- 1.4 instead of 1.6 in load combinations 7, 8, and 9
- 1.6 instead of 1.7 in load combination 11

**Justification**: These changes are made for consistency with the NRC requirements of Appendix F of section 3.8.4 of NUREG-0800 (Draft Rev. 2).

## Page 22, Section Q1.5.7.1 Primary Stresses

Delete the following load combinations:

4. D + L + Eo
6. D + L + Ro + To + Eo

**Justification**: These load combinations are required for evaluation of an Operation Basis Earthquake (OBE). The WTP project has not identified an OBE event.

This section has been deleted.

# Appendix C

# ASME AG-1, Code on Nuclear Air and Gas Treatment - *Tailored*

# 35.0 ASME AG-1, Code on Nuclear Air and Gas Treatment

Revision: 1997 (R2000)
Sponsoring Organization: The American Society of Mechanical Engineers

WTP Specific Tailoring

The following tailoring of ASME AG-1 is required for use by the RPP-WTP project as an implementing standard for the use of safety radial HEPA filter systems and the use of safety axial flow HEPA filters as inbleed units in the Laboratory C5V Exhaust System. Where not specifically identified herein, the remainder of the code requirements are invoked.

Section FK is added as an addendum to ASME AG-1-1997 with the ASME AG-1a-2000 Addenda AG-1 edition invoked on the project.

In addition to the above tailoring for HEPA filter systems, ASME AG-1 is tailored to add ISO 1940-1:2003, Mechanical Vibration - Balance Quality Requirements For Rotors in A Constant (Rigid) State - Part 1: Specification And Verification Of Balance Tolerances, for balancing multi-stage blowers.

## Page 228.9; Article HA-2000 Reference Documents

Revise Article HA-2000 as follows:

Change the code edition of ASME N509 as applied as a referenced (daughter) standard to AG-1 from 1989, reaffirmed December 6, 1996 to 2002.

**Justification:** The version of the ASME N509 Standard currently referenced as a daughter by AG-1 was issued in 1989 and Reaffirmed in 1996. At the time the N509-1989 (R1996) code was selected to be a daughter of AG-1, the ASME AG-1 code did not include requirements for HEPA filter housings. These requirements were later added in the 2000 Addenda to the AG-1 code. The ASME N509-2002 edition does not provide component requirements for HEPA filter housings and HEPA filters but instead refers the user to AG-1 for this information. Therefore, by making this change it will reduce potential redundancies and conflicts.

## Page 228.16; Subsubarticle HA-4420 Access Doors and Panels

Revise Subsubarticle HA-4420 as follows for remote change housings:

Not applicable. The requirements of this article are not applicable to Remote Change Radial HEPA Filter Housings; the access doors and panels shall satisfy HA-4500, Pressure Boundary Leakage, and HA-5300, Pressure Boundary Leakage Testing.

**Justification:** Remote housings are not designed to "incorporate a means for adjusting compression forces, gasket compression..." There are not hinges or latches in the design and they are not designed for manual operation. Therefore, the requirements described in this code article are not applicable.

The remote housing design requires remote access, using a grapple to manipulate doors in a cave environment that may become subject to contamination and high radiation fields. The design incorporates low maintenance features not subject to failure (i.e., vertical housings and heavy doors). The housing doors seal by virtue of their weight alone. Door guides are included. A bar placed across the tops of the doors (and pinned in position) is used to ensure the doors remain in place during seismic events.

## Page 228.18; Paragraph HA-4443 Clamping Mechanism

Revise Paragraph HA-4443 as follows for remote change and safe change radial HEPA housings:

Replace the text with: The requirements of this article are not applicable to Safe Change and Remote Change Radial HEPA Filter Housings. For Safe Change and Remote Change Radial HEPA filter housings, the design shall ensure that the housing knife-edge is embedded into the pliable filter sealant and will provide a seal for the complete perimeter of each filter.

**Justification:** The remote change housings are not side access housings and are not designed for manual operation. There are no clamping mechanisms or filter indexing mechanisms. The weight of the remote filter and differential pressure across the filter is relied upon to ensure that the knife-edge is embedded into the fluid seal.

The safe change housings are front access and are not walk-in style. The filter is not accessed from its side. Therefore, filter retrieval features and filter indexing mechanisms do not apply. A clamping mechanism that is capable of moving the filter (e.g., for side access housings) is not required. The safe change housings are designed to allow a person to insert and remove each filter.

## Subarticle FK-4100 General Design

Revise second paragraph of Subarticle FK-4100 as follows for remote change and safe change radial HEPA filter designs:

Replace the text with: For Remote Change and Safe Change Radial HEPA Filters, the total media area provided within the filter pack shall be such that maximum media velocity is 6.5 ft/min (2.0 m/min) at the rated flow.

**Justification:** The RPP-WTP radial filter design is based upon a UK Atomic Energy Standard Specification AESS 30/95100. This Standard contains an equivalent requirement to that found in AG-1. It states: "The effective area of filter medium used for each insert shall be not less than 3.0 sq m for every 100 l/s rated airflow." The Project proposes to meet this criterion. Converting these metric units for a UK 950 l/s (~2,000 cfm) rated filter equates to approximately 6.5 ft/min media velocity or a minimum of 308 sq. ft of media.

The DOE Nuclear Air Cleaning Handbook (Reference DOE-HDBK-1169-2003 Chapter 2.3.7 and Figure 2.8(a)) illustrates the importance and intent behind this code requirement. AG-1 Subsubarticle FK-1130 states that a HEPA filter shall have *"a minimum efficiency of 99.97% (that is, a maximum particle penetration of 0.03%) for 0.3 micrometer diameter test aerosol particles."* This defines the minimum performance of a HEPA type filter. The curves depicted in Figure 2.8(a) of the Handbook show that at 10.5 ft/min air velocity, the 0.30-micron particle size can be expected to penetrate a HEPA filter such that the AG-1 FK-1130 performance requirement would not be met.

Numerous aerosol penetration tests have been performed on the proposed filter design both inside prototype housings and on individual prototype radial filters designed with a media area of 236 sq. ft., or approximately 8.5 ft/min media velocity. Each test demonstrated that a filter design with media velocities of this magnitude would meet the qualification performance requirements as stated in AG-1 (e.g., 99.97% efficiency or better for penetration of 0.3-micron particles).

The proposed RPP-WTP design uses a filter with approximately 325 sq. ft. of effective media area, or a media velocity of approximately 6.1 ft/min. This represents a small improvement on the UK design and therefore continues to meet the UK Standard requirement.

Further addition of filter media to meet the more restrictive AG-1 Section FK requirement would possibly result in other undesirable design and performance characteristics (e.g.; increased DP, reduced pleat spacing). The filter geometry is also limited by many other design restrictions including: available building space, personnel filter handling limitations, and waste disposal package limitations.

## Table FK-4000-1

Revise Table FK-4000-1 rating information for the 2,000 acfm filter as follows for remote change and safe change HEPA radial filter designs:

**TABLE FK-4000-1 (TAILORED)**
**TYPE 1 RADIAL FLOW HEPA FILTER – NOMINAL RATINGS**

| Maximum Rated Air Flow | | Maximum Resistance | |
|---|---|---|---|
| (acfm) | (m3/hr) | Inches WC | Pa |
| 40 | 68 | 1.3 | 325 |

| Maximum Rated Air Flow | | Maximum Resistance | |
|---|---|---|---|
| (acfm) | (m3/hr) | Inches WC | Pa |
| 100 | 170 | 1.3 | 325 |
| 250 | 425 | 1.3 | 325 |
| 500 | 850 | 1.3 | 325 |
| 1000 | 1700 | 1.3 | 325 |
| 1500 | 2550 | 1.3 | 325 |
| 2000 | 3400 | 1.6 | 400 |

**Justification:** A new filter design is being developed with the intent of qualifying it in accordance with the AG-1 code. The RPP-WTP radial flow HEPA filter design originated from UK Atomic Energy Standard Specification AESS 30/95100. The radial flow HEPA filters will be designed for a maximum initial pressure drop of approximately 1.55 inches WC at a rated flow of 2,000 cfm. This is just slightly greater than (~ delta of 0.15 inches WC) the acceptance criterion stated in UK Atomic Energy Standard Specification AESS 30/95100. This increase in observed pressure drop is primarily due to small design differences between the UK design and the design proposed for use in the RPP-WTP. These differences include increases in filter pack depth, increases in faceguard to media pack gaps (used to enhance protection of the media), and space to accommodate the filters gel seal channel. The UK filter pack depth is approximately 68mm or ~2.7 inches. The RPP-WTP filters are available in 1-inch increment pack depths with a 3-inch pack depth proposed for use on the RPP-WTP. The slightly deeper RPP-WTP media pack design will increase the filter media area and increase the removal efficiency for small particles. The benefits gained in the RPP-WTP radial filter design are viewed to outweigh the negligible increase in airflow resistance (~ 3 to 5% of typical filter loading at change-out of filter element).

## Paragraph FK-6211 Flatness and Squareness

Revise Paragraph FK-6211 (a) as follows for remote change and safe change radial HEPA filter designs:

Type 1 filter flange and end cap tolerances shall meet the following criteria: parallel within 1/8 in., flat within 1/16 in.

**Justification:** TAILORING OF PARALLELISM TOLERANCE: The tailoring presented above changes the code requirement for flange to end cap parallelism from 1/16 in. to 1/8 in. For the Remote Change Filter, the inlet flange, which includes the gel channel with a nominal width of 3/4 in., creates the seal and supports the filter inside the housing. The outlet end cap is fully suspended inside the housing by the opposite inlet flange (i.e., outlet end cap does not touch the housing and is not used to form the seal).

Parallelism to within 1/8 in. will ensure that an adequate housing-to-filter seal is created. For the Safe Change Filter, as with the remote filter, the seal is formed by insertion of a housing knife-edge into a filter gel filled channel with a nominal width of 3/4 in. The gel channel is located on the filter inlet flange. Parallelism to within 1/8 in. will ensure an adequate housing-to-filter seal is created.

TAILORING OF SQUARENESS TOLERANCE: The "squareness" tolerance from FK-6211 is being addressed with a tolerance for circular runout as stated in tailoring for FK-6212. Circular runout controls the cumulative variations that may be present in the positional relationship between the inlet flange and outlet end cap. Inspection for circular runout is equivalent to and meets the code requirement to maintain the squareness characteristic while taking into account the entire length of the filter. Maintaining radial filter circular runout to within the 3/32" tolerance will ensure the filter forms an adequate seal within the filter housing.

## Paragraph FK-6212 Overall Dimensions

**Replace Paragraph FK-6212 as follows for the remote change and safe change radial HEPA filter design:** Type 1 filter length shall be (+0 / -1/8 in.), circular runout of filter flange with respect to the filter end cap shall be within 3/32 in., all other dimensions ±1/16 in.

**Justification:** "Seal ring" and "seal face" are terms specific to Section FK radial filters with gaskets and therefore dimensions and tolerances associated with these terms are not applicable to the Type 1 gel seal radial filters to be used at the RPP-WTP.

TAILORING OF CONCENTRICITY: Concentricity is the condition in which the axes of all cross-sectional elements of a surface of revolution are common to the axis of a datum feature. Concentricity is being replaced with a tolerance for circular runout as a more practical method to verify roundness. Runout refers to the result of rotating a part about its central axis while measuring with a dial indicator its surface deviation from perfect roundness. With circular runout, the dial indicator is not moved along the direction of the axis of the part (as with "total runout"). Circular runout is therefore applied independently at each single circular element along the length of the part as the part is rotated through 360 degrees. The tolerance for circular runout provided in the tailored text controls the cumulative variations that may be present in the positional relationship between the inlet flange and outlet end cap. The 3/32 in. tolerance provided for circular runout will ensure the filter forms an adequate seal within the filter housing.

TAILORING OF GENERAL DESIGN TOLERANCE OF +/- 1/16 IN.: REPLACE: "all other dimensions +/- 1/16 in. " WITH: "all other dimensions +/- 1/16 in. with exception that design filter media to faceguard gap shall be +/- 1/8 in. (i.e., to maintain a minimum media to faceguard gap of 1/8").

**Justification:** The proposed design is verified to be safe through code required filter qualification testing as described in Section FK-5100.

## Section FG Mounting Frames

Not Applicable.

**Justification:** The ASME Committee on Nuclear Air and Gas Treatment (CONAGT) has stated that Section FG only applies to walk in housings. None of the filter housings (i.e., radial or axial filter designs) to be installed on the RPP-WTP Project is a "walk in" design. Reference ASME Technical Interpretation File # 05-990, RPP-WTP CCN # 107935).

## Page 607; Paragraph TA-4632 Airflow Distribution Test (AD)

Revise Paragraph TA-4632 as follows for remote change and safe change radial HEPA housings:

Replace "downstream" with "upstream". Add for clarity: "For Remote Change and Safe Change Radial HEPA filter banks, flow measurement location is upstream vs. code required downstream."

**Justification:** The requirement for flow measurements to be taken downstream of each HEPA filter in a bank is in order to verify equal flow distribution between filters in a bank. In traditional axial flow systems, a measurement location downstream is preferred due to the improvements in the flow conditions (i.e., flow straightening) inside the housing created by the filter itself. However, due to the difference in configuration created by the radial filter, the flow profile both entering and exiting the filter is extremely complex (i.e., not uniform over the filter face). Testing and analysis (computational fluid dynamic models) performed on prototype units to date have determined that taking the flow measurement upstream and inside the filter (inlet) using a hot wire anemometer provides the most repeatable measurement. Accuracy of the measurement is still hindered by flow conditions and anemometer placement; however, increased precision is obtained by taking an average of multiple measurements at multiple locations within each filter inlet. Predicted results from CFD modeling have agreed with actual field measurements using this technique. The project intends to design (based on the prototype tests) and use an anemometer instrument developed specifically for the radial filter design and place it at the inlet (i.e., upstream) side of the filter. Verification, in the field, of acceptable air distribution between filters in a bank can then be accomplished, as the code requires.

## Page 607; Paragraph TA-4633 Air-Aerosol Mixing Test (AA)

Revise Paragraph TA-4633 as follows for axial housings used as LAB C5V Inbleeds:

This article is not applicable to LAB C5V inbleed axial filter housings.

**Justification:** The intent of this test is to verify that the test aerosol is uniformly mixed in the air stream when it reaches the filter in order to verify that each filter in a filter bank is being challenged. This test is concerned primarily with designs and layouts where a single point injection of aerosol in close proximity to the filter bank may result in non-uniform distribution of the test agent.

The Laboratory Facility C5V Inbleed housing is designed such that each filter is assigned its own aerosol injection manifold. The manifold design and its proximity to the filters have been qualified to meet the aerosol mixing test criteria presented in AG-1. The housing is not designed to accommodate the air-aerosol mixing field-commissioning test per TA-4633. However, the housing design is not being

modified for RPP-WTP use and aerosol mixing, by virtue of the manufacturer test sections, will not be impacted by the installation in the RPP-WTP Laboratory Facility.

## Page 111; Section BA-4162 Vibration, Centrifugal Fans

Supplement Section BA-4162 as follows for balancing multi-stage blowers:

Since Section BA-4162 of ASME AG-1 is not applicable for multi-stage blowers used in ventilation/ offgas systems, multi-stage blowers shall be balanced to Quality Grade 2.5 of ISO 1940-1:2003, Mechanical Vibration - Balance Quality Requirements For Rotors in A Constant (Rigid) State - Part 1: Specification And Verification Of Balance Tolerances.

**Justification:** ASME AG-1 is not applicable for multi-stage blowers. ASME AG-1 Section GC is applicable to multi-stage blowers. However, Section GC is in the course of preparation and is not available for use at this time.

# Appendix D

# IEEE 384, IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits - *Tailored*

# 19.0 IEEE-384, IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits

Revision: 1992
Sponsoring Organization: The Institute of Electrical and Electronics Engineers, Inc.

RPP-WTP Specific Tailoring

The following tailoring of IEEE-384 is required for use by the RPP-WTP project as an implementing standard for SC or SS electrical equipment and circuit design.

**All Sections Clarification of Nuclear Power Generating Station Terminology**

The term "Standby Generator" in the Standard is synonymous with "Emergency Generator" in the RPP-WTP.

**Justification:** As determined by the ISM review process, the Standby Generators on the RPP-WTP are not classified as SC while the Emergency Generators are classified as SC.

**Section 2.0, Purpose**

Replace with the following:

This standard establishes the criteria for implementation of the independence requirements of IEEE 603-1998 (as tailored in C.33) and IEEE 308-1991 (as tailored in C.18).

**Justification:** This section was revised to clarify that SRD implementing standards IEEE 603-1998 and IEEE 308-1991 are tailored in Appendix C.

**Section 3.0, References**

The following reference standards, do not apply for the RPP-WTP.

- [1] ANSI/ANS-58.2-1988, Design Basis for Protection of Light Water Nuclear Power Plants Against the Effects of Postulated Pipe Rupture.

**Justification:** This document is applicable to the high pressure steam lines found in nuclear power generating stations and doesn't apply for the RPP-WTP.

- [4] ANSI/NFPA 803-1988, Fire Protection for Light Water Nuclear Power Plants.

**Justification:** This document specifically addresses nuclear power generating stations. Per Section 4.5 of volume II of the SRD, the RPP-WTP will use NFPA 801-2003 as an implementing standard for fire protection.

• [11] IEEE Std 494-1974 (Reaff 1990), IEEE Standard Method for Identification of Documents Related to Class 1E Equipment and Systems for Nuclear Power Generating Stations.

**Justification:** This standard has been withdrawn by the IEEE standards committee and no replacement standard has been recommended. This standard is not called out as an implementing standard in the SRD. Procedures for identification of documents related to SC or SS equipment will be developed internally for the RPP-WTP project.

Replace the 1991 version of IEEE 603 with the following version.

> IEEE Std 603-1998, *IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations.*

**Justification:** SRD Safety Criterion 4.4-4 lists the 1998 version of IEEE 603 as an implementing standard for SC electrical power systems. The 1998 revision of IEEE 603 shall be used in place of the 1991 revision called out as a reference in the body of IEEE 384-1992 for SC electrical power systems only.

The following reference Standards shall be included:

• [16] DOE/RL-96-0006, Revision 1, *Top-level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors.*

**Justification:** Called out as a regulatory basis in the SRD.

• [17] ANSI/ISA-S84.01-1996, *Application of Safety Instrumented Systems for the Process Industries.*

**Justification:** Replaces IEEE-603 for Control and Instrumentation Systems at the WTP, per 24590-WTP-ABCN-ESH-01-027.

• [18] NFPA 801-2003, *Standard for Fire Protection for Facilities Handling Radioactive Materials.*

**Justification:** Called out as an implementing standard under safety criteria 4.5-1 through 4.5-4.

**Section 4.0, Definitions**

• The definition of **design basis events** shall be replaced with the following:

"Postulated events providing bounding conditions for establishing the performance requirements of structures, systems, and components that are necessary to: 1) ensure the integrity of the safety boundaries protecting the worker; 2) place and maintain the facility in a safe state indefinitely; or 3) prevent or mitigate the event consequences so that the radiological exposures to the general public or the workers would not exceed appropriate limits. The Design-Basis Events also establish the performance requirements of the structures, systems and components whose failure under Design-Basis Event conditions could adversely affect any of the above functions."

**Justification:** This definition is from DOE/RL-96-0006.

**Section 5.3, Equipment and Circuits Requiring Independence**

Replace with the following sentence:

Equipment and circuits requiring independence shall be determined during the ISM review cycle and shall be identified on documents and drawings in a distinctive manner.

**Justification:** The reference to IEEE-494 is not applicable since this standard has been withdrawn by the IEEE standards committee and no replacement standard has been recommended. This standard is not called out as an implementing standard in the SRD. The ISM process will provide reliability requirements for each control strategy. These reliability requirements determine when control strategies require independence, redundancy, and seismic qualifications.

---

**Section 6.1.3.2, Area Boundaries**

Replace the reference to NFPA 803-1988[4] with NFPA 801-2003 [18].

**Justification:** Standard NFPA 803-1998 is not applicable for the RPP-WTP. Per Section 4.5 of the SRD, NFPA 801-2003 shall be used for the RPP-WTP.

---

**Section 6.5, Containment Electrical Penetrations**

Not applicable for the RPP-WTP.

**Justification:** Containment electrical penetration assemblies are unique to the containment structure of Nuclear Power Generating Stations and have no equivalent in the RPP-WTP project.

ISSUED BY
RPP-WTP POC

R10923205

# RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

## ENGINEERING SPECIFICATION

FOR

## HLW System HDH Canister Rinse bogie

Please note that source, special nuclear, and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA) are regulated at the U. S. Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts that pursuant to AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

**Content applicable to ALARA?** ☒ **Yes** ☐ **No**

**ADR No.**
24590-HLW-ADR-M-02-048

**Rev**
1

| Quality Level |
|---|
| Q |
| DOE Contract No. DE-AC27-01RV14136 |

NOTE: Contents of this document are Dangerous Waste Permit affecting.

| REV | DATE | BY | CHECK | REVIEW | E&NS | QA | DPEM |
|---|---|---|---|---|---|---|---|
| 4 | 6/3/08 | D. Lopez | A. Ceja | J. Hancock | N/A | N/A | D. J. Wilsey |
| 3 | 4-18-05 | J. Hancock | R. Wight | P. Snider | C. Meng | G. T. Warner | D. J. Wilsey |
| 2 | 2-3-04 | J. Hancock | E. Szavay | J. L. Weamer | N/A | G. T. Warner | D. J. Wilsey |
| 1 | 4-14-03 | J. Hancock | J. Roach | J. L. Weamer | N/A | G. T. Warner | D. J. Wilsey |
| 0 | 9-12-02 | S. Bradshaw | J. Hancock | N/A | N/A | G. Warner | G. Duncan |

**SPECIFICATION No.**
24590-HLW-3PS-MQR0-T0002

**Rev**
4

**Revision History**

| Revision | Reason for Revision |
|---|---|
| 0 | Issued for Procurement |
| 1 | Issued for Purchase.<br>Seismic requirements clarified. Appendix A updated. Appendix B & C added. Additional revisions indicated with revision bars. |
| 2 | Issued for Purchase.<br>SCN 24590-HLW-3PN-MQR0-00002 & 24590-HLW-3PN-MQR0-00002 incorporated. Additional revisions indicated with revision bars. |
| 3 | Issued for Purchase.<br>SCN's 24590-HLW-3PN-MQR0-00003, 24590-HLW-3PN-MQR0-00004, 24590-HLW-3PN-MQR0-00005, 24590-HLW-3PN-MQR0-00006, 24590-HLW-3PN-MQR0-00007 & 24590-HLW-3PN-MQR0-00008 incorporated.<br>SDDR's 24590-WTP-SDDR-PROC-04-00857, 24590-WTP-SDDR-PROC-05-00041, 24590-WTP-SDDR-PROC-05-00180, 24590-WTP-SDDR-PROC-05-00551, & 24590-WTP-SDDR-PROC-05-00552 incorporated.<br>Exclusions to general specifications identified in sections 5.1.6, 5.2.2.2, 5.2.2.17, 5.7.1, 5.7.8, 5.8.1.1, 6.1, 7.2, 8.2.3.1, and 8.5.1. |
| 4 | Issued for purchase<br><br>SCN's: 24590-HLW-3PN-MQR0-00009, 24590-HLW-3PN-MQR0-00010, and 24590-HLW-3PN-MQR0-00011 Incorporated.<br><br>SDDR'S: 24590-WTP-SDDR-M-05-00403, 24590-WTP-SDDR-MH-07-00115 incorporated.<br><br>SDDRs incorporated by Reference: 24590-WTP-SDDR-M-05-00117, 24590-WTP-SDDR-MH-07-00110, 24590-WTP-SDDR-MH-07-00111, 24590-WTP-SDDR-MH-07-00114, 24590-WTP-SDDR-MH-07-00117, and 24590-WTP-SDDR-MH-07-00118.<br><br>QA and E&NS signatures are not required on the sign off sheet because they have both previously reviewed and approved all the incorporated change documents for this revision. |

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# 1 Scope

## 1.1 Project Description and Location

1.1.1 The Office of River Protection (ORP) and its contractors manage 177 underground radioactive waste storage tanks at the Hanford Site in Washington. These tanks contain approximately 55.5 million US gallons of radioactive waste. Bechtel National, Inc. (BNI) has entered into a contract with the US Department of Energy (DOE) to design, construct, and commission a Hanford Tank Waste Treatment and Immobilization Plant (WTP) to process and vitrify the waste into a stable form that is suitable for permanent storage. The WTP will be constructed in the 200 East Area of the Hanford Site, near Richland, Washington. The main facilities within the WTP complex will be the Pretreatment (PTF), Low-Activity Waste (LAW) and High-Level Waste (HLW) Facilities.

## 1.2 Equipment, Material, and Services Required

1.2.1 This engineering specification covers the equipment, materials and services required for the design and supply of the HLW Canister Decontamination Handling (HDH) System, Canister Rinse Bogie and associated equipment.

1.2.2 A bogie is a four (4) wheeled trolley that travels on a pair of parallel rails.

1.2.3 The Canister Rinse Bogie is used to transport Immobilized High-Level Waste (IHLW) Canisters containing radioactive material from one location to another during process activities. A vessel located on the bogie holds the canister and performs a pre-wash of the canister at an intermediate station. The bogie travels in a process tunnel during normal operation, but has the ability to leave the tunnel and enter an adjoining room for maintenance purposes. A shield door separates the process and maintenance areas, and provides radiological shielding.

1.2.4 This specification supports Material Requisition (MR) No. 24590-QL-MRA-MQTS-00002

1.2.5 The Seller shall design, fabricate, inspect and functionally test equipment as specified in this specification. The equipment shall be fabricated and assembled in compliance with this specification, referenced codes and standards, and detail drawings reviewed by the Buyer. The Seller is responsible for:

- Design
- Procurement of materials
- Fabrication
- Assembly
- Tagging equipment with a component tag number (CTN)
- Functional Testing
- Examination/inspection
- Packaging and preparation for shipping
- Loading of equipment on Buyer arranged conveyance
- Umbilical electric cable located in Bogie Maintenance Area, see Section 3

- Submittals as identified in the submittal requirements found in the Purchase Order (PO) and this specification
- Installation, Operation, and Maintenance Manuals
- Lists of recommended spare parts
- Field support for installation and testing

1.2.6 The Seller shall provide the following equipment and any other equipment as necessary to perform the requirements identified in this specification:

| **Plant Item Number** 24590-HLW- | **Description** |
|---|---|
| MQ-HDH-TRLY-00003 | Canister Rinse Bogie |
| MV-HDH-VSL-00001 | Canister Rinse Bogie Decon Vessel |
| MH-HDH-RAIL-00002 | Canister Rinse Bogie Rails |
| MH-HDH-RAIL-00004 | Canister Rinse Bogie Seismic Rails |
| MH-HDH-MHAN-00016 | Canister Rinse Vessel Service Track |
| MH-HDH-MHAN-00017 | Canister Rinse Bogie Service Track |
| MH-HDH-RCVY-00009 | Canister Rinse Bogie Recovery System |
| MH-HDH-MHAN-00011 | Canister Rinse Bogie Spool Piece |
| MH-HDH-MHAN-00015 | Canister Rinse Vessel Lid |
| MP-HDH-PMP-00001 | Bogie Decon Canister Pump |
| JC-HDH-PNL-00001 | Canister Rinse Bogie ASD Control Cabinet |

1.2.7 The Seller shall provide any special lifting equipment and tools, for assembly (or disassembly), installation, or maintenance of the bogie and associated equipment.

1.2.8 The Buyer shall provide a "mock-up" canister for shop testing, see Section 8.2 of this specification.

1.2.9 The Seller shall verify the accuracy and applicability of design information to meet the requirements identified in this specification. The Seller is encouraged to propose design improvements, which could result in quality, performance, cost, or schedule benefits beyond those offered by the Design Proposal Drawings (DPDs), and Mechanical Data Sheets (MDSs) accompanying the Purchase Order.

1.2.10 All requests for substitutions, modifications, or relaxation of this specification or requirements specified in the referenced documents shall be identified in writing for the consideration of the Buyer. For DPDs and MDSs, the following shall be considered required elements: parameters indicated as bounding ("max", "min", "not-to-exceed", or similar qualifier); information present on the DPDs and MDSs that includes the term "required", "mandatory", "shall", or similar term; components or equipment identified as pre-selected or mandatory by the Buyer. The Seller shall document such changes in a Supplier Deviation Disposition Request (SDDR) in accordance with Section 2 of the Purchase Order.

1.2.11 The following items and services will be supplied by the Buyer and are not included in the Seller's scope of work:

- Embed plates embedded in structural concrete to which equipment is anchored
- Waste Neutralization Vessel (PI. No. 24590-HLW-MV-HDH-VSL-00003)

- Shipment from Seller's location to the Hanford receiving location
- Unloading at Hanford receiving location
- Field assembly, installation, erection and field testing of the bogie, vessel, and associated equipment
- Field startup, test, and run-in labor and materials
- Installation of conduit and wiring from the Seller provided control cabinets to the Buyer's Motor Control Center (MCC), Buyer's Controller, and Buyer's Remote I/O
- Mains electric power supply and connections
- Field touch-up painting
- Programming of the bogie control system
- Startup and commissioning
- Mock-up canister

## 1.3 Work by Others

1.3.1 The Seller may subcontract portions of the work, including any portion of the design, fabrication, manufacturing, or inspection, provided it meets the conditions of this specification and the Buyer's approval is obtained.

1.3.2 The Seller shall be ultimately responsible for the completeness and quality of all materials and services provided.

## 1.4 Definitions and Abbreviations

### 1.4.1 Definitions

1.4.1.1 Buyer: Bechtel National, Inc. (BNI)

1.4.1.2 Offeror: The party submitting a proposal for the equipment and/or services described in this specification.

1.4.1.3 Seller: The party selected to provide the equipment and/or services described in this specification.

1.4.1.4 Shall: Indicates a mandatory requirement in order to comply

1.4.1.5 Should: Indicates a recommendation for compliance

### 1.4.2 Abbreviations

| | |
|---|---|
| ANSI | American National Standards Institute |
| AISC | American Institute of Steel Construction |
| API | American Petroleum Institute |
| ASD | Adjustable Speed Drive |
| ASME | American Society of Mechanical Engineers |
| AWS | American Welding Society |
| BNI | Bechtel National, Inc. |
| CFR | Code of Federal Regulations |
| CM | Commercial Quality |

| | |
|---|---|
| CMAA | Crane Manufacturers Association of America |
| CTN | Component Tag Number |
| DOE | Department of Energy |
| DPD(s) | Design Proposal Drawing(s) |
| EMI | Electromagnetic Interface |
| HDH | HLW Canister Decontamination Handling |
| HLW | High-Level Waste |
| HMI | Human-Machine Interface |
| ICN | Integrated Control Network |
| ICS | Industrial Controls and Systems |
| IEEE | Institute of Electrical and Electronics Engineers |
| IHLW | Immobilized High-Level Waste |
| IJB | Instrument Junction Box |
| I/O | Input/Output |
| ISA | Instrumentation, Systems, and Automation Society |
| ITS | Important to Safety |
| LAW | Low-Activity Waste |
| LOI | Local Operator Interface |
| MCC | Motor Control Center |
| MDS(s) | Mechanical Data Sheet(s) |
| MHD(s) | Mechanical Handling Diagram(s) |
| MR | Material Requisition |
| MSDS | Material Safety Data Sheet |
| MTR(s) | Material Test Report(s) |
| NDE | Non-Destructive Examination |
| NEC | National Electric Code |
| NEMA | National Electrical Manufacturers Association |
| NFPA | National Fire Protection Agency |
| NQA | Nuclear Quality Assurance |
| ORP | Office of River Protection |
| OSHA | Occupational Safety and Health Administration |
| P&ID(s) | Piping and Instrumentation Diagram(s) |
| PO | Purchase Order |
| PTF | Pretreatment Facility |
| PTFE | Polytetrafluoroethylene |
| QAP | Quality Assurance Program |
| QL | Quality Level |
| RFI | Radio Frequency Interface |
| RIO | Remote I/O |
| SC | Seismic Category |
| SDC | Safety Design Class |
| SDDR | Supplier Deviation Disposition Request |
| SDS | Safety Design Significant |
| SSC(s) | Structures, Systems or Components |
| TEFC | Totally Enclosed Fan Cooled |
| TFE | Tetrafluoroethylene |
| UBC | Uniform Building Code |
| UL | Underwriters Laboratories |
| WNRF | Weld Neck Raised Face |
| WTP | Hanford Tank Waste Treatment and Immobilization Plant |

## 1.5 Safety/Quality Classifications

### 1.5.1 Important to Safety

1.5.1.1 Structures, Systems, and Components (SSCs) that serve to provide reasonable assurance that the facility can operate without undue risk to the health and safety of the workers and public are classified as Important to Safety (ITS). ITS encompasses the broad class of facility features addressed in the top-level radiological, nuclear, and process safety standards and principles that contribute to the safe operation and protection of workers and the public during all phases and aspects of facility operations (i.e., normal operation and accident mitigation).

1.5.1.2 SSCs designated as ITS are classified as either Safety Design Class (SDC) or Safety Design Significant (SDS).

- The classification Safety Design Class (QL-1) is assigned to SSCs that prevent or mitigate offsite public, worker, or co-located worker radiological exposures that could exceed the standards.

- The classification Safety Design Significant (QL-2) is assigned to SSCs that ensure the that radiological standards for normal operation are not exceeded.

1.5.1.3 For Quality Assurance requirements of ITS SSCs refer to Section 10 of this specification.

### 1.5.2 Non Important to Safety

1.5.2.1 SSCs designated as Non-ITS, or Commercial Quality (CM), are those SSCs not classified as SDS, SDC, or Immobilized High-Level Waste (IHLW) product-quality affecting. Non-ITS items are manufactured using standard commercial practices as required by applicable industry standards, with the quality requirements identified in the Seller's Quality Assurance Program (QAP).

1.5.2.2 For Quality Assurance requirements of Non-ITS SSCs refer to Section 10 of this specification.

### 1.5.3 Equipment Classifications

1.5.3.1 The table below identifies equipment that have components designated as ITS.

| Equipment | Components | Safety Classification (Quality Level) | Critical Characteristics |
|---|---|---|---|
| Canister Rinse Bogie | All components that maintain structural integrity (i.e. load path items) of the bogie and vessel support stand. These include but are not limited to, bogie chassis, vessel support stand, uplift restraints, bumpers, bogie rail end stops, and bolted/welded connections on the load path, including connections to bogie chassis. | SDS (QL-2) | Maintain vessel and canister on bogie and prevent bogie from derailing under normal operating conditions (following a wheel failure) or an SC-II design basis earthquake. |
| | All other components (including drive system and wheel modules) | Non-ITS | N/A |
| Canister Rinse Bogie Seismic Rails | All load path components that maintain the structural integrity, including bolted/welded connections. | SDS (QL-2) | Prevent bogie from derailing under normal operating conditions (following a wheel failure) or an SC-II design basis earthquake. |
| | All other components | Non-ITS | N/A |

1.5.3.2 All other equipment identified in this specification are designated as Non-ITS. SSCs, identified as Non-ITS can include, but are not limited to, non-load path items and proprietary items such as motors, gearboxes and winches.

1.5.3.3 For seismic loading requirements, refer to Section 5.6.4 of this specification.

# 2 Applicable Documents

## 2.1 General

2.1.1 Work shall be carried out in accordance with, but not limited to, the applicable codes and standards listed in the following subsections. The specific revision or effective date identified, as well as the specific revision or effective date of codes and standards that they incorporate by reference (daughter codes and standards) shall be followed. If a date or revision is not identified, the latest issue, including addenda, in effect at the date of contract award or later, shall be used. Deviation from the dated codes and standards shall only apply with the agreement of the Buyer, or when in accordance with Sections 6.5 and 6.6 of this specification.

2.1.2 The Seller shall refer to Section 2 of the Purchase Order for the appropriate revisions of the WTP project documents identified in Sections 2.3, 2.4 and 2.5 of this specification.

2.1.3 Any known or suspected conflicts between the specifications, drawings, and the applicable codes and standards, shall be brought to the attention of the Buyer, via a SDDR, for resolution prior to start of work.

2.1.4 Where requirements in this specification exceed code requirements, this specification shall govern.

2.1.5 Deleted

## 2.2 Codes and Standards

2.2.1 American Society of Mechanical Engineers (ASME)

ASME NQA-1-1989, *Quality Assurance Program Requirements for Nuclear Facility Applications*

ASME B&PV Section VIII Division 1, *Rules for Construction of Pressure Vessels DIVISION 1 Non-Interfiled (Boiler and Pressure Vessel Codes)*

ASME B31.3 -1996, *Process Piping*

ASME NOG-1-2002, *Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)*

ASME/ANSI B73.2M, *Specification for Vertical In-Line Centrifugal Pumps for Chemical Process*

ASME B46.1, *Surface Texture (Surface Roughness, Waviness & Lay)*

2.2.2 American Welding Society (AWS)

AWS D1.1 2002, *Structural Welding Code – Steel*

AWS D1.6, *Structural Welding Code – Stainless Steel*

2.2.3 American Institute of Steel Construction (AISC)

AISC MO16, *Manual of Steel Construction, Allowable Stress Design, 9th Edition*

2.2.4 Crane Manufacturers Association of America (CMAA)

CMAA 70-2000, *Specification for Top Running Electric Overhead Traveling Cranes*

2.2.5 Department of Energy (DOE) Orders and Directives

DOE O 414.1A, *Quality Assurance*

2.2.6 Instrumentation, Systems, and Automation Society (ISA)

ISA 5.1, *Instrument Symbols and Identification*

2.2.7 National Electrical Manufacturers Association (NEMA)

NEMA, MG-1-1998, *Motors and Generators*

2.2.8 Institute of Electrical and Electronics Engineers (IEEE)

IEEE Std 1023-1988, *IEEE Guide for the Application of Human Factors Engineering to Systems, Equipment, and Facilities of Nuclear Power Generating Stations*

IEEE Std 1205-2000, *IEEE Guide for Assessing, Monitoring, and Mitigating Aging Effects on Class 1E Equipment used in Nuclear Power Generating Stations, Annex D*

2.2.9 Code of Federal Regulations (CFR)

FED-STD 595B-1994, *Colors Used in Government Procurement*

10 CFR Part 830, *Quality Assurance Criteria*

2.2.10 Uniform Building Code (UBC)

UBC-1997, *Uniform Building Code*

2.2.11 Underwriters Laboratories (UL)

UL 508 -1999, *Standard for Safety Industrial Control Equipment*

2.2.12 National Fire Protection Association (NFPA)

NFPA Volume 70, 1999 National Electric Code (NEC)

2.2.13 Department of Defense and Energy Standards, Nuclear Regulations

MIL-STD-1472F Human Engineering

| | |
|---|---|
| DOE-HDBK-1140, 2001 of | Human Factors/Ergonomics Handbook for the Design for Ease Maintenance |
| NUREG-0700 | Human System Interface Design Review Guidelines |
| NUREG-0711 | Human Factors Engineering Program Review Model |

2.2.14 American Society of Testing Materials (ASTM)

ASTM A554 Standard Specification for Welded Stainless Steel Mechanical Tubing.

2.2.15 EN 292-1 Safety of Machinery - Basic Concepts, General Principles of Design - Part 1; Basic Terminology, Methodology.

2.2.16 EN 292-2 Safety of Machinery - Basic Concepts, General Principles of Design - Part 2; Technical Principle and Specifications.

2.2.17 ISO 281:1990 Roller bearings - Dynamic load ratings and rating life.

2.2.18 AGMA 908 Geometry Factors for Determining Pitting Resistance and Bending Strength of Spur, Helical, and Herringbone Gear Teeth.

2.2.19 AGMA 2001 Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gears.

## 2.3 WTP Project Specifications

2.3.1 24590-WTP-3PS-M000-T0002, Rev 0, *General Specification for Mechanical Handling Equipment Design and Manufacture,* Bechtel National, Inc., Richland, Washington. Sections which do not apply to this equipment: 3.5.8.1, 3.5.8.2, 3.5.8.5, 3.6, 3.7, 4.1.9, 4.1.10, 4.1.11, 4.1.12, 4.10.1, 4.10.4, 4.12, and 4.13.

2.3.2 24590-WTP-3PS-P000-T0001, Rev 4, *Engineering Specification for Piping Material Classes,* Bechtel National, Inc., Richland, Washington. Section which does not apply to this equipment: 16.

2.3.3 24590-WTP-3PS-EKP0-T0001, Rev 2, *Engineering Specification for Electrical Requirements for Packaged Equipment,* Bechtel National, Inc., Richland, Washington. Sections which do not apply to this equipment: 6.4.2.3, 6.4.3.1, 6.6.1, 6.6.3, and 6.8.

2.3.4 24590-WTP-3PS-JQ07-T0001, Rev 1, *Engineering Specification for Instrumentation for Package Systems,* Bechtel National, Inc., Richland, Washington. Sections which do not apply to this equipment: 3.4.5.1, 3.4.5.2.3, 3.4.5.4.4, 3.4.5.9, 3.4.5.10, 3.4.5.12, 3.4.5.13, 3.4.5.14, 3.4.5.15, 3.4.5.16, 3.4.5.17, 3.7.1, 3.8.3, 3.8.4, 3.8.6, 3.8.7, and 3.8.8.1.

2.3.5 24590-WTP-3PS-MUMI-T0002, Rev 2, *Engineering Specification for Low Voltage Induction Motors,* Bechtel National, Inc., Richland, Washington. Sections which do not apply to this equipment: 5.1.1, 5.3, and 5.4.1.

2.3.6 24590-WTP-3PS-JD02-T0001, *Engineering Specification for Intelligent Drives for Packaged Equipment,* Bechtel National, Inc., Richland, Washington

2.3.7 Deleted.

2.3.8 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling, and Storage Requirements*, Bechtel National, Inc., Richland, Washington

2.3.9 24590-WTP-3PS-AFPS-T0001, *Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and Equipment,* Bechtel National, Inc., Richland, Washington

2.3.10 24590-WTP-3PS-G000-T0001, *General Specification for Supplier Quality Assurance Program Requirements,* Bechtel National, Inc., Richland, Washington

2.3.11 24590-WTP-3PS-SS00-T0001, Rev 5, *Welding of Carbon Structural Steel*, Bechtel National, Inc., Richland, Washington. Section which does not apply to this equipment: 8.18.

2.3.12 24590-WTP-3PS-SS00-T0002, *Welding of Structural Stainless Steel and Welding of Structural Carbon Steel to Structural Stainless Steel*, Bechtel National, Inc., Richland, Washington

2.3.13 24590-WTP-3PS-JV15-T0001, *Engineering Specification for Actuators for On/Off Valves*, Bechtel National, Inc., Richland, Washington

2.3.14 24590-WTP-3PS-PV00-T0001, Rev 1, *Engineering Specification for Technical Supply Conditions for Valves*, Bechtel National, Inc., Richland, Washington. Section which does not apply to this equipment: 5.4.

## 2.4 WTP Design Documents

### 2.4.1 Design Proposal Drawings (DPDs)

| Document Number | Document Description |
|---|---|
| 24590-HLW-M0-HDH-00013 | Canister Rinse Bogie Arrangement |
| 24590-HLW-M0-HDH-00012001 | Canister Rinse Bogie |
| 24590-HLW-M0-HDH-00012002 | Canister Rinse Bogie |
| 24590-HLW-M0-HDH-00008 | Canister Rinse Bogie Rails |
| 24590-HLW-M0-HDH-00010 | Canister Rinse Bogie Seismic Rails |
| 24590-HLW-M0-HDH-00043 | Canister Rinse Bogie Service Tracks |
| 24590-HLW-M0-HDH-00029 | Canister Rinse Bogie Recovery System |

### 2.4.2 Mechanical Data Sheets (MDSs)

| Document Number | Document Description |
|---|---|
| 24590-HLW-M0D-HDH-00029 | Canister Rinse Bogie Spool Piece |

| Document Number | Document Description |
|---|---|
| 24590-HLW-M0D-HDH-00030 | Canister Rinse Vessel Lid |
| 24590-HLW-MPD-HDH-00001 | HDH-PMP-00001 Canister Rinse Bogie Pump |
| 24590-HLW-MVD-HDH-00009 | HDH-VSL-00001 Canister Rinse Bogie Vessel |

### 2.4.3 Reference Drawings and Data Sheets

| Document Number | Document Description |
|---|---|
| 24590-HLW-M6-HDH-00002 | P&ID – HLW Canister Decontamination Handling System |
| 24590-HLW-M0-HDH-00001001 | DPD, Canister Rinse Bogie Decon/Maint Shield Door Arrangement |
| 24590-HLW-M0-HDH-00001002 | DPD, Canister Rinse Bogie Decon/Maint Shield Door Arrangement & Details |
| 24590-HLW-M0-HDH-00002 | DPD, Canister Rinse Bogie Decon/Maint Shield Door Embed Plates |
| 24590-HLW-M0-30-00001001 | HLW Test Canister Assembly |
| 24590-HLW-M0D-HDH-00002 | MDS, Canister Rinse Bogie Maint Crane 1 |
| 24590-HLW-M0D-HDH-00003 | MDS, Canister Rinse Bogie Maint Crane 2 |

## 2.5 Other WTP Documents

2.5.1 24590-WTP-3PD-MQTS-00002, *Supplier Quality Assurance Program Requirements Data Sheet*, Bechtel National, Inc., Richland, Washington

2.5.2 24590-WTP-3PD-MQTS-00004, *Supplier Quality Assurance Program Requirements Data Sheet*, Bechtel National, Inc., Richland, Washington

2.5.3 24590-HLW-SOC-S15T-00009, Rev 0D, *HLW Vitrification Building Seismic Analysis - In-Structure Response Spectra (ISRS)*, Bechtel National, Inc., Richland, Washington.

2.5.4 24590-HLW-SOC-S15T-00039, Rev D, *HLW Vitrification Building Seismic Analysis - Enveloped In-Structure Response Spectra*, Bechtel National, Inc., Richland, Washington.

# 3 System Description

3.1 The Canister Rinse Bogie operates in the HLW Canister Decontamination Handling (HDH) System.

3.2 The Canister Rinse Bogie travels in the Canister Rinse Tunnel (Room H-B039B) during normal operations. The Canister Rinse Tunnel is classified as a C5/R5 and C3/R3 transition zone. Maintenance activities are performed in an adjoining Bogie Maintenance Area (Room H-B039A), separated by a shield door from the process area. The Bogie Maintenance Area is classified as C3/R3. For environmental conditions and definitions of the classification of areas refer to project specification 24590-WTP-3PS-M000-T0002, *General Specification for Mechanical Handling Equipment Design and Manufacture.*

3.3 Where dual classifications are identified on the DPDs, for example, C5/R5 and C3/R3, they indicate a transition zone where the room is designated as C5/R5 when a container is present and C3/R3 when a container is not present.

3.4 The Canister Rinse Bogie transfers glass filled IHLW Canisters from a position below the Canister Handling Cave (Room H-136) to a position below the Canister Decontamination, Swabbing and Monitoring Cave (Room H-133). A vessel located on the bogie holds the canister and performs a pre-wash of the canister at an intermediate station.

3.5 The purpose of the pre-wash is to perform a general rinse of the canister prior to transfer into the Canister Decontamination, Swabbing and Monitoring Cave.

3.6 The basic operations are as follows:

- Bogie and vessel positioned under the hatch located in the Canister Handling Cave
- Canister lowered into vessel, through hatch, by overhead crane located in the Canister Handling Cave
- Bogie, vessel and canister travel to the Canister Rinse Station
- Canister rinse cycle, see Section 4.2 of this specification
- Bogie, vessel and canister travel to a position under the hatch located in the Canister Decontamination, Swabbing, and Monitoring Cave
- Canister removed from bogie after 30 minute drying period, through hatch, by overhead crane located in the Canister Decontamination, Swabbing, and Monitoring Cave
- Bogie and vessel travel to a position under the hatch located in the Canister Handling Cave

3.7 Process and electrical services are provided to the bogie and vessel through service tracks (energy chains) located in the Canister Rinse Tunnel. When the bogie requires transferring from the process area to the maintenance area the service tracks and the service connections (process and electrical) are manually disconnected from the bogie at the shield door aperture and parked on a bracket located at the door aperture. A Seller provided umbilical electrical cable, located in the maintenance area, is manually connected to the bogie terminal box allowing the bogie to transfer into the maintenance area. The umbilical electrical cable provides the power and control to the bogie only. Once the bogie is located in the maintenance area the shield door is closed prior to any maintenance activities being performed.

3.8 The drain valve (YV0182) (Classified as Safety Significant and Seismic Category SC-1) for the Canister Rinse Bogie shall be designed to fail in the open position upon loss of normal power. This is to mitigate the possibility of the accumulation of Hydrogen (HPAV) if the system were to shut down with a canister on the rinse bogie for an extended period of time.

# 4 Equipment Description

## 4.1 Canister Rinse Bogie

4.1.1 The bogie is a motorized trolley used for transporting IHLW Canisters containing radioactive material from one location to another during process activities.

4.1.2 The bogie is driven by an on-board geared motor, and travels on a pair of floor-mounted rails.

4.1.3 Power and control are provided to the bogie through a service track.

4.1.4 The bogie control system uses bogie mounted proximity switches and the motor brake to control the process stopping positions of the bogie

4.1.5 The bogie control system uses a bogie mounted ultimate travel limit switch to prevent the bogie from impacting the rail end stops in the event of a proximity (positioning) switch failure.

4.1.6 A stand mounted to the bogie chassis supports the Canister Rinse Vessel.

4.1.7 Restraints mounted to the side of the vessel support stand, in conjunction with the seismic rails (see Section 4.4), prevent the bogie from overturning or derailing in the event of a wheel failure or a seismic event.

## 4.2 Canister Rinse Vessel

4.2.1 The vessel is mounted to a support frame located on the bogie chassis. The vessel locates the canister for transfer and provides the containment and associated services for canister washing.

4.2.2 An inflatable seal mounted to the top flange of the vessel provides the seal between the vessel and the spool piece (see Section 4.7) to provide containment of the water spray during the rinse cycle. Process air is supplied to the inflatable seal from the Buyer's plant utility system through a 1" pipe, and has a line pressure of 90 - 100 psig. The line pressure is reduced to 25 psig by a pressure regulator for the inflatable seal air supply.

4.2.3 A series of spray nozzles located in the vessel directs demineralized water to spray the entire surface of the canister. The proposal drawings provided with this specification show an upper and lower spray ring. This allows the canister to be sprayed in stages due to the limiting flow rate. Demineralized water is supplied to the vessel from the Buyer's plant utility system through a 2" pipe, and has a maximum flow rate of 90 gpm and pressure 60 psig.

4.2.4 The maximum batch transfer to the vessel is 360 gallons. Maximum batch transfer is defined as the maximum water volume transferred to the vessel during the rinse cycle.

4.2.5 Two (2) solenoid operated on/off control valves divert the water flow between the upper and lower spray rings while a centrifugal pump continually discharges the water from the vessel during the rinse cycle. Water is discharged from the vessel to the Buyer's Waste Neutralization Vessel through a 2" pipe.

4.2.6 A high-high level switch and continuous level instrument monitor the water levels in the vessel during the rinse cycle.

4.2.7 The following rinse cycle is based on the proposal drawings provided with this specification:

- Pressurize the inflatable seal to make the seal between the vessel and the spool piece.

- Open the upper demineralized water line for the upper spray ring to begin the water wash.
- After the vessel has filled to 10 gallons, confirm that the vessel discharge pump has begun discharging the water at 80 gpm.
- After washing with 180 gallons of water in 2 minutes, close upper demineralized water line. After 2.5 minutes the vessel should be fully drained (check the level indicator on the vessel).
- Open the lower demineralized water line for the lower spray ring to finish the water wash.
- After the vessel has filled to 10 gallons, check that the vessel discharge pump has begun discharging the water at 80 gpm.
- After washing with 180 gallons of water in 2 minutes, close lower demineralized water line. After the vessel is emptied (2.5 minutes), ensure the vessel discharge pump is shut off.
- Depressurize the inflatable seal.

4.2.8 The pressurized demineralized water and plant process air are provided to, and removed from, the vessel through a dedicated process service track. Power and control are provided to the vessel equipment through the same service track that provides the electrical services to the bogie.

## 4.3 Canister Rinse Bogie Rails

4.3.1 The bogie rails run between the Canister Rinse Tunnel and the Bogie Maintenance Area. The rail supports are mounted on embeds located in the floor.

4.3.2 The rails guide the bogie between the process stations maintaining the relative position of the bogie to the process stations.

4.3.3 End-stops are located at the end of the rails to prevent bogie over-travel.

## 4.4 Canister Rinse Bogie Seismic Rails

4.4.1 The seismic rails are mounted on embeds located in the North and South walls of the Canister Rinse Tunnel.

4.4.2 The seismic rails, in conjunction with the bogie restraints, prevent the bogie from overturning or derailing in the event of a wheel failure or a seismic event.

## 4.5 Canister Rinse Bogie Service Tracks

4.5.1 Two (2) service tracks (energy chains) are located in the Canister Rinse Tunnel. One service track provides the routing for the electrical services to the bogie and the vessel, the other provides the routing for process services (water and air) to the vessel. The service tracks are dynamic tracks that allow movement of the bogie while maintaining fixed connections at the entry to and exit from the track for connection and routing of services.

4.5.2 The proposed design includes 4 cable systems: (1) mechanical handling power - bogie motor, (2) mechanical handling instrumentation - position sensors/limit switches, (3) process power - pumps and valves, (4) process instrumentation - level switches and transmitters.

4.5.3 The proposed design includes 3 process hoses: (1) water supply, (2) water discharge, and (3) air supply.

4.5.4 A Seller supplied bracket, at the shield door aperture, allows the service tracks to be parked in position prior to transferring the bogie into the maintenance area.

### 4.6 Canister Rinse Bogie Recovery System

4.6.1 The recovery system provides a means of recovering the bogie in the event of a component failure that would cause the bogie to become immobile.

4.6.2 In a recovery event the bogie is towed by a recovery block located at the West end of the bogie rail. The recovery block is connected, via a static cable, to a wall-mounted electric winch located in the maintenance area.

4.6.3 In a recovery event the canister is either removed from a position directly under the Canister Handling Cave (if the bogie has not moved from its park position), or the bogie is recovered to a position under the Canister Decontamination, Swabbing and Monitoring Cave where the canister is removed. The bogie is then recovered into the Bogie Maintenance Area where hands-on maintenance can be performed.

### 4.7 Canister Rinse Bogie Spool Piece

4.7.1 The spool piece is mounted to an embed located on the ceiling of the Canister Rinse Tunnel at the Canister Rinse Station. The spool piece provides the sealing surface for the vessel mounted inflatable seal.

### 4.8 Canister Rinse Vessel Lid

4.8.1 The vessel lid is placed over the top of the vessel while the bogie and vessel are located in the maintenance area. The vessel lid minimizes the potential for transfer of radioactive particulate (contamination) from inside the vessel while it is located in the maintenance area. The vessel lid is stored in the maintenance area.

# 5 Design Requirements

### 5.1 General

5.1.1 System components and equipment provided in accordance with this specification shall not exceed the bounding equipment envelope dimensions implied or explicitly indicated on the DPDs and MDSs referenced in Section 2.4 of this specification.

5.1.2 Equipment weights shall not exceed the bounding weights indicated on the DPDs and MDSs without Buyer authorization. The Seller shall be responsible for any analysis required to determine embed loadings for equipment weights exceeding the bounding weights indicated on the DPDs and MDS, and are subject to Buyer review.

5.1.3 System components and equipment provided in accordance with this specification shall utilize the facility concrete embedments as depicted in the DPDs and MDSs referenced in Section 2.4 of this specification. Equipment mountings shall be capable of accommodating embed plate placement and orientation tolerances specified in sections 5.1.3.1 and 5.1.3.2 of this specification.

5.1.3.1 Tolerances for concrete placement shall be in accordance with the Table for Concrete Placement Tolerances, unless noted otherwise on the project drawings.

Table for Concrete Placement Tolerances

| Component | Category | Tolerance |
|---|---|---|
| Footings | Lateral Alignment – As cast to center of individual footing. | 0.02 times width of footing in direction of misplacement but not more than 2 in. |
| | Horizontal dimension for unformed members cast against soil.<br>2 feet or less<br>Over 2 feet, but less than 6 feet<br>Over 6 feet | <br>+3 in. or –1/2 in<br>+6 in. or –1/2 in.<br>+12 in. or –1/2 in. |
| | Level Alignment – Top of footings | +1/2 in. and –2 in. |
| | Cross-Sectional Dimensions – Horizontal dimension of formed members. | +2 in. and –1/2 in. |
| | Cross-Sectional Dimensions – Vertical dimension (thickness) | +5% |
| | Relative Alignment – Single footing side and top surface slope with respect to specified plane. | +1 in. within 10 feet |
| Cast-In-Place Concrete for Buildings | Vertical Alignment/Plumbness – (Lines, surfaces, and rises):<br>Outside corner of exposed corner columns and control joint grooves in concrete exposed to view. | ±1 in.<br>±1/2 in. |
| | Lateral Alignment: (Horizontal Location)<br>Members<br>Centerline location of openings 12 in. or smaller in slabs and edge location of larger openings.<br>Sawcuts, joints, and weakened plane embeds | <br>±1 in.<br>±1/2 in.<br>±3/4 in. |

| | | |
|---|---|---|
| | Level Alignment: | |
| | Elevation of top of slabs and other formed surfaces before removal of shoring | ±3/4 in. |
| | Elevation of lintels, sills, parapets, horizontal grooves, and other lines exposed to view | ±1/2 in. |
| | Elevation of slabs on grade | ±3/4 in. |
| | Cross-Sectional Dimensions: Members such as columns, beams, piers, or walls with thickness: | |
| | 12 in. dimension or less | + 3/8 in. or –1/4 in. |
| | More than 12 in. dimension but not over 3 ft dimension | + 1/2 in. of –3/8 in. |
| | Over 3 ft dimension | + 1 in. or –3/4 in. |
| | Relative Alignment: | |
| | Vertical alignment of outside corner of exposed corner columns and control joint grooves in concrete exposed to view | ±1/4 in. in 10 ft. |
| | All other formed surfaces may slope in 10 ft with respect to the specified plane | ±3/8 in. in 10 ft. |
| | Offset between adjacent pieces of formwork facing material shall not exceed: | |
| | Surfaces that receive special protective coatings-Class B See Section 3.1.4 for further clarifications. | ± 1/4 in. |
| | For a Class C surface | ±1/2 in. |
| | Openings Through Members: | |
| | Cross-sectional size of openings | –1/4 in. or +1 in. |
| | Location of centerline of opening | ±1/2 in. |

5.1.3.2 Placement tolerances for embedded items shall be in accordance with the Table for Embedded Item Placement Tolerances, unless noted otherwise on the project drawings:

Table for Embedded Item Placement Tolerances

| Conditions | Embed Type | Tolerance |
|---|---|---|
| Lateral alignment in both directions in the plane of the slab or wall. Level alignment through the slab or wall. | Standard Embeds per drawing 24590-WTP-DD-S13T-00002 | ±2 in. |

5.1.4 Equipment standardization shall be employed throughout equipment designs where safety requirements and cost requirements can be satisfied. Items performing similar duties should,

as far as possible, be standardized so that one particular make, model and size can be used in all similar applications.

5.1.5 The design shall consider human factors engineering and ergonomic requirements to ensure good human factor principles, guidelines, and methods are integrated into equipment design in accordance with IEEE Std 1023-1988 *IEEE Guide for the Application of Human Factors Engineering to Systems, Equipment, and Facilities of Nuclear Power Generating Stations*. The codes and standards identified in Appendix H, or buyer approved equal, shall be used to implement IEEE Std 1023. The specific human factor attributes applying to the equipment shall be invoked.

5.1.6 For general design requirements of mechanical handling equipment refer to project specification 24590-WTP-3PS-M000-T0002, *General Specification for Mechanical Handling Equipment Design & Manufacture,* excluding sections 3.5.8.1, 3.5.8.2, 3.5.8.5, 3.6, 3.7, 4.1.9, 4.1.10, 4.1.11, 4.1.12, 4.10.1, 4.10.4, 4.12, and 4.13.

5.1.7 Equipment that is not painted (or otherwise coated) and exposed to radiation that can cause surface contamination shall have decontaminable surface finishes of 63 microinches (or better) roughness average in accordance with ASME B46.1. Except when the equipment is infrequently handled or decontaminated, in which case it can have decontaminable surface finishes of 125 microinches (or better) roughness average in accordance with ASME B46.1.

## 5.2 Mechanical Requirements

### 5.2.1 Canister Rinse Bogie

5.2.1.1 The bogie shall be designed to travel on stainless steel fabricated rails with rail centers of 82 inches, see Section 5.2.3.

5.2.1.2 The bogie shall be capable of transporting a glass filled IHLW Canister, weighing 9260 lbs (max), and the Canister Rinse Vessel including rinse water.

5.2.1.3 Special attention shall be paid to the bogie chassis, to ensure plain surfaces can be cleaned easily, and potential contamination traps are minimized. Tube sections should be used in preference to structural 'I' beams and channels. All tubing shall be sealed to prevent the ingress of contamination. Drain holes shall be provided wherever water may collect during wash down, except in sealed tubing.

5.2.1.4 The bogie chassis shall accommodate a support frame for the Canister Rinse Vessel. The support frame shall be capable of supporting the vessel while located on the bogie.

5.2.1.5 The bogie chassis and vessel support frame shall be fitted with appropriate lifting features to assist with maintenance activities, using an overhead crane, while the bogie is located in the maintenance area. The combined weight of the bogie chassis and the vessel support frame shall not exceed 10,000 lbs. The Seller shall provide any special lifting equipment required. The Buyer will provide to the Seller details of the crane hook prior to final design.

5.2.1.6 The bogie chassis and vessel support frame should be fabricated from ASTM A36 steel. Proprietary items shall be "as supplied" providing they are suitable for the operating conditions.

5.2.1.7 The bogie chassis shall accommodate equipment associated with the Canister Rinse Vessel.

5.2.1.8 The vessel support frame shall have location features to aid in the alignment and set down of the Canister Rinse Vessel.

5.2.1.9 The bogie shall have two driven wheels.

5.2.1.10 The bogie shall be guided by two (2) double flanged wheels on one side of the bogie. The opposite two wheels shall be plain. The flanged wheels shall be located on the same rail as the recovery winch. The wheel flanges shall be of adequate size to withstand skew forces from track misalignment and forces imposed due to recovering the bogie with a seized drive system.

5.2.1.11 Clearances between wheel flanges and rail, accounting for manufacturing tolerances, shall be sufficient to allow free running of the bogie while achieving the required positional tolerances in accordance with Section 5.3.4 of this specification.

5.2.1.12 Seismic restraints shall be mounted to the vessel support frame, to prevent the bogie from derailing in the event of a flanged wheel failure under normal operation, or an SC-II design basis earthquake, in accordance with Sections 1.5.3 and 5.6 of this specification.

5.2.1.13 The drive system and wheel modules shall be designed for ease of maintenance and replacement.

5.2.1.14 The bogie shall have four (4) bumpers, one at each corner of the bogie; to prevent damage to the bogie, shield door, or rail end-stops. The bumpers shall be designed to absorb the impact of a fully laden bogie, traveling at full operating speed, with a closed shield door, such that the resulting force imparted on the shield door does not exceed 1500 lbf.

5.2.1.15 There shall be two (2) proximity switches mounted on the bogie chassis for operational positioning of the bogie.

5.2.1.16 There shall be one (1) ultimate-travel limit switch mounted on the bogie chassis to prevent over travel of the bogie in the event of a proximity switch failure. The limit switch shall be capable of operating with the bogie traveling in both directions.

5.2.1.17 Adjustable proximity switch targets and limit switch strikers shall be supplied with the bogie as required per the system drawings. The targets and strikers shall be designed to be adjustable for on-site installation.

5.2.1.18 A means of detecting a canister is present in the vessel shall be provided.

5.2.1.19 The bogie shall be designed to limit individual wheel loads during normal operation to less than 1/3 of the total laden bogie weight while traveling on rails installed per paragraph 5.2.3.5. This requirement can be demonstrated by analysis or test.

5.2.1.20 Gears and gearboxes, shall comply with AGMA Standards, or, EC Machinery Directive 98/37/EC, EN 292-1 & 292-2 *Safety of Machinery*, and ISO 281 - 1990 *Roller bearings, Dynamic load ratings and rating life*.

5.2.1.21 In addition to the requirement defined in 24590-WTP-3PS-M000-T0002, Rev 0, Section 4.10.6, gear cases can be split vertically provided that, in the event of a fluid leak, the fluid is contained in a driptray. The driptray shall have a minimum fluid capacity of 1.5 times greater than the fluid capacity of the gearbox.

### 5.2.2 Canister Rinse Vessel

5.2.2.1 The vessel shall be designed in accordance with ASME B&PV Section VIII, Division 1, except that code stamping is not required.

5.2.2.2 Process piping shall be designed in accordance with the applicable requirements identified in ASME B31.3 and project specification 24590-WTP-3PS-P000-T0001, *Engineering Specification for Piping Material Classes,* excluding section 16. The piping material class for interfacing to the Buyer provided piping shall be S11B.

5.2.2.3 The centrifugal discharge pump shall be in accordance with the requirements identified in ASME/ANSI B73.2M *Specification for Vertical In-Line Centrifugal Pumps for Chemical Process*.

5.2.2.4 The vessel shall have lifting features to allow the vertical removal of the vessel from the bogie, using an overhead crane, while located in the maintenance area. Pipe connections shall be configured such that vessel can be removed easily. The weight of the vessel and internal components shall not exceed 10,000 lbs. The Seller shall provide any special lifting equipment required. The Buyer will provide to the Seller details of the crane hook prior to final design.

5.2.2.5 The design of the spray system shall ensure that the spray pattern is generally in a downward direction, minimizing "back spray" within the vessel, and providing full coverage of the canister surface. The canister can be sprayed in stages due to the limit on flow rate. If the canister is sprayed in stages it shall be sprayed from top to bottom.

5.2.2.6 The Seller shall make every effort to minimize the volume of water used during the rinse cycle while achieving the full coverage of the canister.

5.2.2.7 The vessel shall contain guides and a pedestal for locating and seating the canister. The guides internal diameter shall be 27 inches ± 1/4 inch. This diameter takes into account misalignment, due to tolerance build-up, between the bogie and the overhead crane during loading and unloading of the canister. The guides shall be designed such that the potential for scratching of the canister surface is minimized during loading and unloading.

5.2.2.8 The container guides shall be configured such that spray coverage is not affected. Lifting features shall be located at the top of the guides to allow removal from the vessel, using an overhead crane, while the bogie is located in the maintenance area. The Seller shall provide any special lifting equipment required. The Buyer will provide to the Seller details of the crane hook prior to final design.

5.2.2.9 The spray system shall be removable from the vessel without the requirement for hands on access to the internals of the vessel. Pipe connections shall be located at the top of the vessel and shall be arranged to allow manual disconnection and removal of the spray system, using an overhead crane, while the bogie is located in the maintenance area. The Seller shall provide any special lifting equipment required. The Buyer will provide to the Seller details of the crane hook prior to final design.

5.2.2.10 The vessel piping and internal components shall be designed to minimize contamination traps and maximize contamination removal through rinsing.

5.2.2.11 The inflatable seal shall be mounted to the top flange of the vessel. The seal shall be capable of containing the water spray in the vessel during the rinse cycle.

5.2.2.12 The centrifugal discharge pump shall be capable of discharging water from the vessel such that the static head of water does not contact the canister or compromise the spray nozzles.

5.2.2.13 The vessel shall have a high-high penetration point for a level switch to detect the maximum static head of water. The penetration shall be a 2" Weld Neck Raised Face (WNRF) flange. Initiation of the high-high level switch shall terminate the spray sequence.

5.2.2.14 The vessel shall have an external chamber located on the side of the vessel for a continuous level instrument. The external chamber shall have a minimum internal diameter of 2". The top of the chamber shall be flanged for device mounting. The bottom leg of the chamber shall interconnect to the vessel drain pipe at the bottom of the vessel. The top leg of the chamber shall penetrate the vessel at a point above the maximum static head of water such that the operating range of the level instrument places the maximum static head of water at the 50% - 75% point of the level instruments range. The continuous level instrument shall initiate the discharge of the rinse water at a set level.

5.2.2.15 Transmitters for both the level switch, and the continuous level instrument, will be mounted in the corridor adjacent to the transfer tunnel.

5.2.2.16 The vessel shall have a vent pipe located within the vessel for venting during the normal rinse cycle. The design of the vent pipe should address the unlikely event of slight pressurization of the vessel during normal spraying operations that would cause a water column to be pushed through the vent pipe. An air in-bleed near the top of the vent pipe will allow air to escape the vessel if the bottom of the vent pipe becomes submerged. An in-bleed is defined as a hole in the pipe that either has a small bent tube, plating, or other method for baffling mist from entering the hole, while allowing air to escape through it. The vent pipe shall run from a point just below the top of the vessel to a point just above the canister bottom, creating an arduous path to prevent the release of mist carryover from the vessel. The Seller shall determine during shop tests the levels of mist carryover released from the vent pipe, see Section 8.2.3 of this specification.

5.2.2.17 The control valves shall be of the pneumatic operated actuator type. The control valves shall meet the applicable requirements identified in 24590-WTP-3PS-JV15-T0001, *Engineering Specification for Actuators for On/Off Valves*, and 24590-WTP-3PS-PV00-T0001, *Engineering Specification for Technical Supply Conditions for Valves,* excluding section 5.4.

5.2.2.18 The operating position of the control valves shall be monitored by position switches on the actuator. The actuator shall operate the valve to a "failed closed" condition in the event of power failure.

5.2.2.19 The vessel, and associated rigid piping supplying demineralized water to the vessel, shall be constructed from 316L stainless steel.

5.2.2.20 The canister shall not come into contact with any material other than stainless steel.

5.2.2.21 The vessel shall accommodate all static, dynamic, and seismic loads in accordance with Section 5.6 of this specification.

### 5.2.3 Canister Rinse Bogie Rails

5.2.3.1 The rail assembly shall be fabricated from a suitable grade stainless steel, with the running rail made from an age-hardened martensitic stainless steel.

5.2.3.2 The rail hardness shall be suitable for the intended application, but as a minimum shall be greater than that of the wheel. The rail and wheels should both be of similar high hardness to avoid unnecessary wear, and shall be of a dissimilar material such that galling does not take place.

5.2.3.3 End-stops shall be provided at the ends of each rail. The end-stops shall be capable of withstanding the impact of a fully laden bogie traveling at full operating speed, without exceeding allowable stresses.

5.2.3.4 The Seller shall provide shim packs for site adjustment to achieve the required installation tolerances. Refer to Section 3.5.3 of project specification 24590-WTP-3PS-M000-T0002, *General Specification for Mechanical Handling Equipment Design & Manufacture*, for details of installation features.

5.2.3.5 The bogie rails shall be fabricated to achieve the following installation tolerances:

| | |
|---|---|
| Rail Span | ± 1/8 inch |
| Rail straightness | ± 1/8 inch |
| Rail elevation | ± 1/8 inch |
| Difference in rail heights | ± 1/16 inch |

### 5.2.4 Canister Rinse Bogie Seismic Rails

5.2.4.1 The seismic rails shall prevent the bogie from derailing in the event of a flanged wheel failure under normal operation, or an SC-II design basis earthquake, in accordance with Sections 1.5.3 and 5.6 of this specification.

5.2.4.2 The seismic rails shall be constructed from a suitable grade stainless steel.

5.2.4.3 The seismic rails shall accommodate the full process travel of the bogie.

5.2.4.4 The seismic rails shall be adjustable in both the vertical and the North-South directions for on-site setting. Refer to Section 3.5.3 of project specification 24590-WTP-3PS-M000-

T0002, *General Specification for Mechanical Handling Equipment Design & Manufacture*, for details of installation features.

### 5.2.5 Canister Rinse Bogie Service Tracks

5.2.5.1 One (1) each service track shall be provided for electrical cables and process hoses associated with the operation of the Canister Rinse Bogie and Canister Rinse Vessel.

5.2.5.2 The service track for the process hoses shall be located on the South side of the bogie. The service track for the electrical cables shall be located on the North side of the bogie.

5.2.5.3 The service tracks shall be capable of operating over the full process movement of the bogie and have sufficient additional capacity to transfer the bogie to the shield door aperture.

5.2.5.4 The process service track shall be capable of accommodating the loads exerted when the process hoses (water and air) are pressurized.

5.2.5.5 The service tracks shall contain sufficient lengths of electrical cable and process hoses to allow for remaking of connections at the Buyer's facility to the Buyer provided cables and piping. The Buyer will provide to the Seller interface details prior to final design.

5.2.5.6 The service tracks, electrical cables and process hoses shall be capable of being manually disconnected and reconnected to the bogie at the shield door aperture.

5.2.5.7 The electrical cables and process hoses shall be capable of being easily disconnected and reconnected to the bogie using quick disconnect type connectors. The process hose connectors shall be of the non spill double shutoff type. The Seller shall consider the use of manifolds or multi-pin connectors to simplify the operation with the aim to minimize operator time while the shield door is in the open position.

5.2.5.8 The service tracks shall provide protection for the cable and hoses as the bogie moves to prevent them from becoming entangled or damaged.

5.2.5.9 The service tracks shall be constructed from a suitable grade stainless steel.

5.2.5.10 The tracks shall be of an open construction to allow for ease of decontamination and access to electrical cables and process hoses for inspection.

### 5.2.6 Canister Rinse Bogie Recovery System

5.2.6.1 The bogie recovery system shall be capable of recovering a fully laden bogie with a seized drive system, as a minimum.

5.2.6.2 The wire rope shall be polyethylene sheathed for ease of decontamination.

5.2.6.3 The design shall ensure that proper fleet angles are maintained between the winch and the pulley to ensure correct cable winding during recovery.

5.2.6.4 The Seller shall provide all support structures required for mounting of the recovery winches to the embeds identified on the DPDs.

5.2.6.5 The gearbox shall be capable of being decoupled from the winch drum to allow periodic maintenance. The decoupling process shall be a simple procedure with minimal effort by maintenance personnel.

5.2.6.6 The recovery block shall be capable of being pushed along the rails by the bogie to its park position.

### 5.2.7 Canister Rinse Bogie Spool Piece

5.2.7.1 The spool piece shall provide the sealing surface for the vessel mounted inflatable seal.

5.2.7.2 The spool piece shall include features to allow on-site adjustment of the sealing face to accommodate the inflatable seal operating parameters and installation tolerances. Refer to Section 3.5.3 of project specification 24590-WTP-3PS-M000-T0002, *General Specification for Mechanical Handling Equipment Design & Manufacture*, for details of installation features.

5.2.7.3 The spool piece shall be constructed from a suitable grade stainless steel.

### 5.2.8 Canister Rinse Vessel Lid

5.2.8.1 The vessel lid shall be fitted with appropriate lifting features to assist with handling, using an overhead crane located in the maintenance area. The Seller shall provide any special lifting equipment. The Buyer will provide to the Seller details of the crane hook prior to final design.

5.2.8.2 The lid shall contain guide features to assist with the location of the lid over the vessel.

5.2.8.3 The lid shall not interfere with the inflatable seal.

5.2.8.4 The lid shall be constructed from a suitable grade stainless steel.

## 5.3 Performance

### 5.3.1 Design Life

5.3.1.1 All equipment shall be designed to operate over a plant life of 40 years and in accordance with the duty cycles identified in Section 5.3.2 of this specification.

5.3.1.2 It is recognized that some commercially available components may not have a design life of 40 years. These components shall be configured and incorporate features to allow hands-on maintenance and replacement.

### 5.3.2 Duty Cycles

5.3.2.1 A cycle consists of the complete movement of a bogie from its starting position to its final destination and back to its starting position, including all process activities between.

5.3.2.2 The Canister Rinse Bogie is subject to the following duty cycles:

| Duty Cycles (per year) | | Duty Cycles (per day) |
|---|---|---|
| **Min** | **Max** | **Max** |
| 180 | 730 | 2 |

### 5.3.3 Speeds

5.3.3.1 The Canister Rinse Bogie shall travel between process stations at a nominal speed of 10 ft per minute (normal) and shall ramp down when approaching a station to a suitable creep speed which maintains throughput and positional accuracy. The Seller shall determine and document the creep speed during testing.

5.3.3.2 After each process stop, the bogie shall ramp up to the normal operating speed. The Seller shall confirm the suitability of the acceleration and deceleration rates during the shop tests, to ensure smooth starting and stopping of the bogie.

5.3.3.3 The Canister Rinse Bogie shall be recovered at an appropriate speed to ensure smooth movement of the bogie during the full recovery travel. The proposal drawings show the recovery speed at 1 ft per minute. However, the Seller shall determine the most appropriate speed whether identical to the proposal or otherwise.

### 5.3.4 Positional Accuracy

5.3.4.1 The Canister Rinse Bogie shall be capable of repeatable positioning to within ±1/8 inch in all directions. The accuracy is required to minimize misalignment, due to tolerance build-up, between the bogie and the overhead crane used to load/unload the canister.

## 5.4 Design Conditions

5.4.1 For general design conditions refer to Section 3.3 of project specification 24590-WTP-3PS-M000-T0002, *General Specification for Mechanical Handling Equipment Design & Manufacture.*

## 5.5 Environmental Conditions

5.5.1 For Hanford Site Climatological Data refer to Section 1 of the Purchase Order, *Information and Instructions to Bidders.*

5.5.2 For general facility internal conditions refer to Section 3.4 of project specification 24590-WTP-3PS-M000-T0002, *General Specification for Mechanical Handling Equipment Design & Manufacture.*

5.5.3 The bogie, vessel, and associated equipment may be subject to decontamination prior to hands-on maintenance being performed. This could include wiping equipment with wet rags and washing with water or dilute nitric acid.

5.5.4 The Canister Rinse Tunnel will be subject to periodic washdown with demineralized water, from a fixed spray system, to maintain general cleanliness of the tunnel.

## 5.6 Design Loads

### 5.6.1 General

5.6.1.1 The equipment identified in this specification shall accommodate all static, dynamic, and seismic loads, in accordance with this section and the requirements identified in Sections 1.5.3 and 5.2.

5.6.1.2 For normal service conditions a bogie shall be treated as a crane trolley and shall be evaluated in accordance with the applicable requirements identified in CMAA 70.

5.6.1.3 The bogie and bogie components, SC-I and SC-II SSCs, shall be seismically qualified to not fail during all operating conditions, including the design basis earthquake, and shall be in accordance with the requirements of ASME NOG-1-2002, *Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder),* Sections 4150 and 5481. Extraordinary loadings, in addition to the loadings identified in CMAA 70, Section 3.3.2, shall include seismic acceleration loads identified in Section 5.6.4, and test loads (125%) applied during load test. The permissible stresses for seismic conditions shall be in accordance with CMAA 70, Section 3.4.3. Stress Level and Case 3.

5.6.1.4 Design of SC-III and SC-IV SSCs shall be governed by the provisions of AISC MO16, *Manual of Steel Construction, Allowable Stress Design, 9th Edition.*

5.6.1.5 ITS (load path) items shall be designed in accordance with ASME NOG-1-2002, Sections 4130, 4200, 4300, 4400, 5100, 5300, 5456 and 5458, as applicable.

5.6.1.6 For SC-II SSCs, loads shall be combined in accordance with ASME NOG-1-2002. For SC-III and SC-IV SSCs, loads shall be combined in accordance with the Uniform Building Code (UBC) Section 1612.3.2.

### 5.6.2 Static Loads

5.6.2.1 The bogie shall be capable of transporting a glass filled IHLW Canister, weighing 9260-lbs (max), and the canister rinse vessel during normal operation under the duty cycles identified in Section 5.3.2 of this specification.

5.6.2.2 Canister dimensions:

Diameter: 24.12 inches (maximum)
24 inches (nominal)

Height: 177.165 inches (maximum)
176.75 inches (nominal)

### 5.6.3 Dynamic loads

5.6.3.1 The bogie, vessel, and bogie rails shall be capable of withstanding impact loads from the canister under normal service conditions. Under normal service conditions the crane hoist operating speed at point of impact will be 5 feet per minute maximum.

5.6.3.2 The bogie and bogie rails shall be capable of withstanding all loads associated with impacts to the rail end-stops by the bogie (with load) traveling at full operating speed.

### 5.6.4 Seismic Loads

5.6.4.1 The following table identifies equipment requiring seismic protection and their associated Seismic Category (SC). Definitions of the seismic categories:

Seismic Category I (SC-I):
SSC important to safety and which has a seismic safety function.

Seismic Category II (SC-II):
SSC important to safety, whose failure during a seismic event could prevent a Seismic Category I SSC from performing its seismic safety function.

Seismic Category III (SC-III):
(a) SSC important to safety, but without seismic safety function.
(b) SSC not important to safety, but which has an inventory of radioactive or hazardous material in an amount less than that which would lead to an "important to safety" designation.

Seismic Category IV (SC-IV):
SSC not important to safety and without an inventory of radioactive or hazardous material, but requiring seismic protection.

| **Plant Item Number** 24590-HLW- | **Description** | **Seismic Category** |
|---|---|---|
| MQ-HDH-TRLY-00003 | Canister Rinse Bogie | SC-II |
| MV-HDH-VSL-00001 | Canister Rinse Bogie Decon Vessel | SC-III |
| MH-HDH-RAIL-00002 | Canister Rinse Bogie Rails | SC-III |
| MH-HDH-RAIL-00004 | Canister Rinse Bogie Seismic Rails | SC-II |
| MH-HDH-MHAN-00016 | Canister Rinse Vessel Service Track | SC-III |
| MH-HDH-MHAN-00017 | Canister Rinse Bogie Service Track | SC-IV |
| MH-HDH-RCVY-00009 | Canister Rinse Bogie Recovery System | SC-IV |
| MH-HDH-MHAN-00011 | Canister Rinse Bogie Spool Piece | SC-IV |
| MP-HDH-PMP-00001 | Bogie Decon Canister Pump | SC-III |

5.6.4.2 Where specific seismic requirements are identified in Section 1.5.3, for the Canister Rinse Bogie and the Canister Rinse Bogie Seismic Rails, the applicable components shall be designed to SC-II. All other components shall be designed to SC-III.

5.6.4.3 SSCs designated SC-II, see Section 1.5.3 of this specification, the seismic loads imparted on the equipment shall be evaluated in accordance with the response spectra identified in the table below. A damping value of 7% shall be used.

| Equipment | Seismic Response Spectra Reference |
|---|---|
| Canister Rinse Bogie<br><br>(24590-HLW-MQ-HDH-TRLY-00003, and associated equipment) | See 24590-HLW-S0C-S15T-00009 Rev 0D<br>Fig. 10 Seismic Response at -31 ft and -21 ft Elevation, East-West (attached)<br>Fig. 11 Seismic Response at -31 ft and -21 ft Elevation, North-South (attached)<br>Fig. 12 Seismic Response at -31 ft and -21 ft Elevation, Vertical (attached) |
| Canister Rinse Bogie Seismic Rails<br><br>(24590-HLW-MH-HDH-RAIL-00004, and associated equipment) | See 24590-HLW-S0C-S15T-00039 Rev D<br>Sheet No. B-9, Fig. B-7 Seismic Response, East-West (attached)<br>Sheet No. B-10, Fig. B-8 Seismic Response, North-South (attached)<br>Sheet No. B-11, Fig. B-9 Seismic Response, Vertical (attached) |

5.6.4.4 For SSCs designated as SC-III, the seismic loads shall be evaluated in accordance with the Uniform Building Code (UBC), Section 1632, using the following parameters:

Ip = 1.5

Ca = 0.24

hr = 91

hx = rail elevation

5.6.4.5 For all other SSCs, the seismic loads imparted on the equipment shall be evaluated in accordance with the Uniform Building Code (UBC), Section 1632, using the parameters above with an Ip of 1.0.

5.6.4.6 The 200 East Area of the Hanford Site is located in Seismic Zone 2B.

## 5.7 Electrical Requirements

5.7.1 The requirements in 24590-WTP-3PS-EKP0-T0001, *Engineering Specification for Electrical Requirements for Packaged Equipment*, excluding sections 6.4.2.3, 6.4.3.1, 6.6.1, 6.6.3, and 6.8, shall apply to this specification. Where there is a conflict between this specification and 24590-WTP-3PS-EKP0-T0001, the Seller shall report all conflicts to the Buyer. At such time, all conflicts shall be resolved.

5.7.2 All electrical equipment and material, including industrial control panels and cabinets that are assemblies of industrial control devices, shall be suitable for installation and use in conformity with the provisions of NFPA 70. Suitability of equipment shall be evidenced by listing or labeling as a completed assembly by Underwriters Laboratories (UL). Equipment and assemblies not listed or labeled shall be required to bear a UL "Field Evaluated Product" mark. Equipment and materials listed, labeled or field evaluated by other nationally recognized testing laboratories (NRTLs) as recognized by OSHA, may be accepted only after receipt of prior written approval from the Buyer.

5.7.3 The Seller shall provide all cables and multi-conductor cable systems from the bogie and associated equipment to the Buyer's designated interface point, see Section 5.8.2. The Seller shall recommend connector types at the Buyer's interface for connection to the Buyer-provided cabling.

5.7.4 All cables shall be evaluated for radiation tolerance by addressing IEEE Std 1205-2000, *IEEE Guide for Assessing, Monitoring, and Mitigating Aging Effects on Class 1E Equipment used in Nuclear Power Generating Stations, Annex D* for acceptable insulation for radiation environments. Generally Tetrafluoroethylene (TFE) and Polytetrafluoroethylene (PTFE) should be avoided in radiation areas.

5.7.5 The Seller shall provide details of the electrical cable end connections (at bogie terminal box) to the Buyer for interfacing of the Seller provided umbilical electrical cable, located in the maintenance area. Unique pin arrangements and/or color coding shall be provided for the electrical connectors to prevent incorrect engagement.

5.7.6 The Seller shall specify within the proposal the full load amp and voltage rating for the bogie and associated electrically powered equipment.

5.7.7 When more than one motor is powered from a single control cabinet the Seller shall specify the ampere rating for the main over current device serving the cabinet.

5.7.8 Induction motors shall meet the requirements of 24590-WTP-3PS-MUMI-T0002, *Engineering Specification for Low Voltage Induction Motors*, excluding sections 5.1.1, 5.3, and 5.4.1, and shall be of a Totally Enclosed Fan Cooled (TEFC) type. Deviation from the specifications shall be submitted, on an SDDR form, to the Buyer and may be accepted based on the application and technical requirements. When deviating from the specifications, the motors shall comply with the equivalent International Electrotechnical Commission standard (IEC). The Seller shall provide certification that the manufacturer satisfactorily performed standard and routine tests on electric motors.

5.7.9 Flux Vector or Servo Drives shall meet the requirements of 24590-WTP-3PS-JD02-T0001, *Engineering Specification for Intelligent Drives for Packaged Equipment.*

5.7.10 All electrical equipment and electrical cables shall be suitable for the environment in which they will operate.

5.7.11 Separate disconnects shall be provided from the control cabinet for each major component. Seller shall provide all necessary schematics, wiring diagrams and details necessary to facilitate installation and connection to Buyer's system.

5.7.12 All conductors shall be numbered on both ends for ease of identification.

5.7.13 Cable design and construction shall take account of Electromagnetic Interface (EMI) and Radio Frequency Interface (RFI).

5.7.14 Individual and overall shields shall be provided, as appropriate, to ensure that circuits are not subjected to or affected by interference. The shields shall be terminated at individual slip rings/brush gears. The Buyer will then make arrangements to terminate them at a suitable ground point. All special grounding design requirements are the responsibility of the Seller.

5.7.15 The Seller shall be responsible for assuring operability of the cable system under all design conditions.

5.7.16 In addition to tagging requirements defined in Engineering Specification for Instrumentation for Packaged Systems, 24590-WTP-3PS-JQ07-T0001 Rev 1, and Engineering Specification for Electrical Requirements for Packaged Equipment, 24590-WTP-3PS-EKP0-T0001 Rev 2. Tags subject to high radiation environments, stainless steel is preferred.

## 5.8 Instrumentation and Control Requirements

### 5.8.1 General

5.8.1.1 The requirements in project specification 24590-WTP-3PS-JQ07-T0001, *Engineering Specification for Instrumentation for Package Systems,* excluding sections 3.4.5.1, 3.4.5.2.3, 3.4.5.4.4, 3.4.5.9, 3.4.5.10, 3.4.5.12, 3.4.5.13, 3.4.5.14, 3.4.5.15, 3.4.5.16, 3.4.5.17, 3.7.1, 3.8.3, 3.8.4, 3.8.6, 3.8.7, and 3.8.8.1, shall apply to this specification. Where there is a conflict between this specification and 24590-WTP-3PS-JQ07-T0001, the Seller shall report all conflicts to the Buyer. At such time, all conflicts shall be resolved.

5.8.1.2 Control panels, including Supplier Packaged Equipment panels, shall be provided with an Alarm Test function such as a "push to test" button that verifies that alarm indicating functions operate satisfactorily. In order to maintain consistent operation between equipment items, this requirement shall apply to all alarm indicating lights, including LED's. This requirement is limited to alarm indications and is not applicable to other indications.

5.8.1.3 The Seller shall be responsible for the final determination of the required level and type of controls and instrumentation necessary for the proper operation and monitoring of the Seller's proposed system. Any changes to the required control and monitoring features shall be reflected in the Seller's submittals for control and instrumentation (as required by this specification and the G321-E form) and shall be subject to Buyer authorization. The Seller's submittals that necessitate changes to the control and instrumentation shall not generally require that an SDDR be submitted. An SDDR shall be submitted if the Seller's control and instrumentation submittals fail to reflect incorporation of any functional requirement of the supplied equipment (as described in this specification, DPDs, or Arrangement).

5.8.1.4 The Seller shall provide, as early as practicable in the design process (but no later than as required by the submittal schedule), required control and instrumentation submittals necessary to support the Buyer's revisions to their Mechanical Handling Diagrams (MHDs). These submittals are required in order to finalize the relevant facility interfaces (e.g., wall penetrations, conduit, and Integrated Control Network interfacing) to suit the Buyer's construction schedules.

5.8.1.5 To ensure commonality across project equipment, 24590-WTP-3PS-JQ07-T0001 identifies preferred instrument vendors for some components. Components not included in the specification are selected at the Seller's discretion with review and permission to proceed from the Buyer unless otherwise specifically stated within this specification.

5.8.1.6 The Seller shall provide all limit switches and proximity switches as required in the design of the bogie system, and shall meet the requirements of sections 3.4.5.7 and 3.4.5.8 of 24590-WTP-3PS-JQ07-T0001.

5.8.1.7 The bogie control systems shall utilize the Integrated Control Network (ICN) platform described in 24590-WTP-3PS-JQ07-T0001.

5.8.1.8 Instrumentation for control and positioning is defined on the DPDs. The instrument tag numbers on the DPDs shall be used to tag instruments. Additional instruments provided by the Seller shall be tagged using ISA 5.1, and sequence numbers provided by the Buyer.

5.8.1.9 The Seller shall provide to the Buyer control logic diagrams and a structured description of the control requirements, procedures, interlocks, and sequences of operation necessary to perform the basic functions of the bogie, vessel, and associated equipment. Documentation of the control requirements shall conform to the requirements of 24590-WTP-3PS-JQ07-T0001, Section 3.5, *Control Software*.

5.8.1.10 The Buyer will develop the application software that controls the bogie, vessel, and associated equipment identified in this specification. All Human Machine Interfaces (HMI), including facility control room HMI, Local Operator Interfaces (LOI), and Bogie Maintenance Areas, will be interfaced to and controlled by the Buyer-developed Intergrated Control Network (ICN). The Buyer's software shall be tested during the Seller's Factory Acceptance Tests (FAT).

5.8.1.11 Motor drives and other 'intelligent' devices as applicable shall have Profibus DP® capability where feasible.

5.8.1.12 Where integral brake motors are used on adjustable speed drives the brake shall be wired independently from the motor winding. All brakes shall be "fail-on" in the event of loss of power.

5.8.1.13 All instrumentation and instrument cables shall be suitable for the environment in which they will operate.

5.8.1.14 The Seller shall provide a phase monitor relay to provide protection against phase loss, phase reversal, phase unbalance, undervoltage and overvoltage of the 3Ph 480 voltage feed to Seller's equipment.

### 5.8.2 Interfaces Between Buyer and Seller

#### 5.8.2.1 General

5.8.2.1.1 This specification identifies equipment that is classified as a "Type B-Option 1" package. A "Type B" package is one in which the Seller provides the starters/drives and shall have the equipment located near the Seller's equipment in a Seller provided control cabinet.

#### 5.8.2.2 Type B Package

5.8.2.2.1 Appendix A, Figure 1, shows a pictorial representation of a "Type B-Option 1" package definition that the Seller shall comply with. This Type B package shall include Seller

provided equipment control cabinets that include Seller provided starters/drives, control transformers, Profibus DP® interface(s), Fiber Optic cable interfaces, control wiring interface, etc. The Buyer will be responsible for the Profibus DP® cable from the Buyer Controller, the control signal wiring from the Remote I/O (RIO), a single 480 VAC, 3 phase power supply from the Buyer's MCC to the Seller's equipment control cabinets. The Buyer will also be responsible for all cabling between the Seller's equipment control cabinet and the Seller's equipment "skid" with the exception of specialty cable. Specialty cable is defined as cable assemblies normally part of the equipment package such as drag chains and festoon or cable that is not included in the Buyer's standard cable list. For the purpose of this specification, a "skid" is defined as the part of a Seller's package which is shipped pre-assembled and pre-wired.

### 5.8.3 Bogie Positioning Control

5.8.3.1 Bogie shall have a minimum of two proximity switches mounted to the bogie chassis used for operational positioning of the bogie. Both switches shall provide a signal under normal operating conditions.

5.8.3.2 The bogie utilizes two (2) or three (3) targets for each stopping position as required per the system drawings. The first target, approached from a specific direction (two targets required if approaching stopping position from two directions), is used to slow the bogie to creep speed; the second target stops the bogie. To achieve positional accuracy, the bogie may require to be stopped by approaching the target from one direction only. In this case the bogie will proceed past the stopping point then reverse to approach the position target from the designated stopping direction.

5.8.3.3 Under a recovery event the bogie mounted proximity switches are also used to position the bogie, in conjunction with the proximity switch targets, at the appropriate process station for canister removal.

5.8.3.4 The recovery winch drive shall include a Profibus DP® interface to enable operation from the Buyer's LOI.

### 5.8.4 Communication Network Interface

The Buyer has selected the Industrial$^{IT}$ platform from ABB, Inc. as the primary control system for the WTP Facility. A Profibus DP® communication network will be used to communicate to drives and intelligent positioning instruments. The Seller shall provide the following components for a fiber optic cable interface:

#### 5.8.4.1 Profibus DP Communication Interface

5.8.4.1.1 The Seller shall provide a native Profibus DP® slave interface for the control panel or instrument and the associated drivers (GSD files) for communication with the Buyer's control system. The interface should support communication speeds up to 12 Mbit/sec over the Profibus DP® network.

### 5.8.4.2 Fiber Optic Connections

5.8.4.2.1 The Seller shall provide a fiber optic connection external to the control panel or instrument per the following requirements:

a) The Seller shall install a Hirschmann OZD Profi 12M G12 fiber optic converter within the control panel or near the instrument for each communication network.
b) The Seller shall patch the Hirschmann fiber optic converter(s) to a fiber optic patch plate where the Buyer will terminate the Buyer's fiber optic cable(s). The patch plate shall utilize MT-RJ multimode fiber optic connectors.
c) The Seller shall use multimode 62.5/125 glass fiber in the patch cable with appropriate connectors on each end of the patch cable to connect between the fiber optic converter and the patch plate. Any unused fiber optic connections shall be fitted with protective caps to guard against extraneous light and dirt.
d) The Seller shall derive the appropriate power for the fiber optic converter(s) from the control panel. A separate power supply shall be provided for each communication network.

### 5.8.4.3 Alternate Communication Interface

5.8.4.3.1 If a native Profibus DP® interface is not available, then the Seller may propose an alternate communication interface or network that is compatible with the Buyer's control system for Buyer review.

If an alternate communication interface is proposed:

a) The Seller shall provide all necessary interfaces or converters required to provide the Buyer's control system with the appropriate communications.
b) The Seller shall provide any required drivers, software, and protocol conversion information to the Buyer for design, development, testing, and maintenance of the supplied networks and interfaces for the period of performance of the contract, including software or firmware upgrades or revisions.

# 6 Materials

6.1 For general material requirements refer to Section 4 of 24590-WTP-3PS-M000-T0002, *General Specification for Mechanical Handling Equipment Design & Manufacture*, and applicable requirements identified in the project specifications referenced in this document. Sections 4.1.9, 4.1.10, 4.1.11, 4.1.12, 4.10.1, 4.10.4, 4.12, and 4.13 of 24590-WTP-3PS-M000-T0002 do not apply.

6.2 The Seller may use cast iron for the bogie wheels and wheel housings provided they meet the design requirements identified in Section 5 of this specification.

6.3 For specific material requirements refer to Section 5 of this specification.

6.4 Welded stainless steel mechanical tubing, conforming to ASTM A554, is acceptable for use, in the manufacture of structural members and support brackets.

6.5 All material supplied to ASTM standards, pertaining to QL or ITS equipment, shall be in accordance with the codes and standards identified in Section 2 of this specification, otherwise an SDDR shall be submitted to the Buyer, to obtain a material equivalency. Equivalency of materials shall, as a minimum, consider physical and chemical properties.

6.6 All material supplied to ASTM standards, pertaining to CM, Non-ITS equipment, shall be in accordance with any year of the standard.

# 7 Fabrication

7.1 For general fabrication requirements refer to Section 5 of 24590-WTP-3PS-M000-T0002, *General Specification for Mechanical Handling Equipment Design & Manufacture*, and applicable requirements identified in the project specifications referenced in this document.

7.2 Welding shall be in accordance with the applicable requirements identified in project specification 24590-WTP-3PS-SS00-T0001, *Specification for Welding of Carbon Structural Steel*, excluding section 8.18, and in accordance with 24590-WTP-3PS-SS00-T0002, *Specification for Welding of Structural Stainless Steel and Welding of Structural Carbon Steel to Structural Stainless Steel.*

7.3 The vessel shall be fabricated in accordance with ASME B&PV Section VIII, Division 1, except that code stamping is not required.

7.4 Process piping shall be fabricated in accordance with the applicable requirements identified in ASME B31.3, Category D Fluid Service.

# 8 Tests and Inspections

## 8.1 General

8.1.1 Test and inspections shall be performed in accordance with the requirements identified in this section and the project specifications referenced in this document.

8.1.2 The Seller shall be responsible for performing and documenting all inspections and testing necessary to demonstrate compliance with all relevant specifications, drawings, and related standards.

8.1.3 Shop tests identified in section 8.2 are defined as Factory Acceptance Tests (FAT). A FAT procedure shall be submitted to the Buyer along with the Inspection and Test Plan. FAT reports shall also be submitted to the Buyer.

## 8.2 Shop Tests

### 8.2.1 General

8.2.1.1 The Seller shall perform, in-house, full-scale, Buyer-witnessed, functional testing of the bogie, vessel, and associated equipment, to demonstrate, as a minimum, the requirements identified in this section.

8.2.1.2 The Seller may combine some of the tests providing each requirement can be verified.

8.2.1.3 The tests and demonstrations identified in this specification are not limiting, and shall not relieve the Seller of their responsibilities to fully test and demonstrate the performance of the bogie, vessel, and associated equipment, to the satisfaction of Buyer, in accordance with the Buyer-reviewed Inspection and Test Plan.

8.2.1.4 Where maintenance tests are identified they shall be performed wearing appropriate personnel protective clothing (e.g. gloves, coveralls) to simulate in-cell maintenance conditions. The Buyer will provide, to the Seller, the appropriate personnel protective clothing prior to performing the maintenance tests. The tests shall be video taped, timed, and recorded in the maintenance procedures.

8.2.1.5 The bogie control and instrumentation shall be tested in accordance with a defined schedule. All steps shall be taken to ensure that tests are realistic and representative of the bogie operating sequences. Operation of switches and contacts shall be via movement of the bogie and not by the shorting or open circuit action of terminals.

8.2.1.6 The Seller shall provide all wiring, electrical feeds, power supplies, transformers, operator panels, test equipment, and connections for shop testing of the bogie and associated equipment.

8.2.1.7 The Seller shall be responsible for any alterations to the Seller's facility that may be required to perform the tests, and any additional equipment and materials required.

8.2.1.8 The Buyer shall provide a "mock-up" canister, fabricated from a cylindrical tube, replicating the canister envelope dimensions, key features, and weight, for performing the shop tests.

8.2.1.9 The Seller shall notify the Buyer of any failed tests or defective components following testing. All corrective actions suggested by the Seller shall be reviewed by the Buyer prior to implementation and subsequent re-testing.

### 8.2.2 Canister Rinse Bogie

8.2.2.1 The Seller shall replicate normal service design load conditions (with and without canister), and operating speeds, as required, to represent the normal operating conditions of the bogie.

8.2.2.2 The Seller shall ensure that, as a minimum, the following requirements are demonstrated and verified in accordance with the requirements identified in Section 5.2.1 of this specification:

- Smooth and free running of the drive shaft, gearbox, and wheels, through the full operating travel of the bogie.
- Running clearances between interfacing equipment through the full operating travel of the bogie.
- Bogie operating speeds in accordance with Sections 5.3.3 and 5.8.3 of this specification.
- Positional accuracy of the bogie in accordance with Sections 5.3.4 and 5.8.3 of this specification.
- Operation of the ultimate-travel limit switch.
- Maximum buffer impact load.
- Proof load test the bogie and rails to 1.25 times rated load capacity.
- Lubrication points are accessible without major disassembly.
- Removal and replacement of maintainable and modular components.

### 8.2.3 Canister Rinse Vessel

8.2.3.1 The Seller shall ensure that, as a minimum, the following requirements are demonstrated and verified in accordance with the requirements identified in Section 5.2.2 of this specification:

- Perform a hydrostatic leak test of the vessel, pump and associated piping by filling the vessel with water to the top flange and holding for a minimum of one (1) hour, after which, run the pump until all water is discharged from the vessel.
- Inspection and testing of the vessel, pump and associated piping as required by the applicable requirements identified in ASME B&PV Section VIII Division 1, ANSI B73.2M, and ASME B31.3.
- Functional testing of the spray system using the "mock-up" canister. The spray test shall be performed such that full visual observation of the spray coverage and "back spray" can be achieved by eye and with a video camera. Part of the test should be performed using food coloring or dye to aid in visualization.
- Level of mist carryover released from the vent tube during the rinse cycle.
- Operation of the inflatable seal and the sealing interface with the spool piece.
- Inspect and test the control valves in accordance with the applicable requirements identified in 24590-WTP-3PS-JV15-T0001, *Engineering Specification for Actuators for On/Off Valves*, and 24590-WTP-3PS-PV00-T0001, *Engineering Specification for Technical Supply Conditions for Valves,* excluding section 5.4.
- Performance of the level switch and continuous level instrument.
- Canister set-down at nominal handling speed of 5 feet per minute.
- Disconnection of the vessel services and removal of the vessel from the bogie.
- Mounting of vessel on the bogie and reconnection of the vessel services.
- Removal and installation of the canister guides and spray rings.

### 8.2.4 Canister Rinse Bogie Rails

8.2.4.1 During performance and maintenance testing, the Seller shall ensure that, as a minimum, the following requirements are demonstrated and verified in accordance with the requirements identified in Section 5.2.3 of this specification.

- Assemble rail sections and verify rail alignment to drawing tolerances and CMAA 70.

### 8.2.5 Canister Rinse Bogie Service Tracks

8.2.5.1 The Seller shall ensure that, as a minimum, the following requirements are demonstrated and verified in accordance with the requirements identified in Section 5.2.5 of this specification:

- Service tracks are moved freely by the bogie through the full operating travel.
- Replicate on-site shield door aperture interfaces and demonstrate the disconnection and reconnection of the electrical and process services and service tracks.

### 8.2.6 Canister Rinse Bogie Recovery System

8.2.6.1 The Seller shall ensure that, as a minimum, the following requirements are demonstrated and verified in accordance with the requirements identified in Section 5.2.6 of this specification:

- Proof load test the cable connection to the recovery block to 1.25 times the winch rating.
- Recovery of the bogie (with load), with a seized drive system, over the full operating travel of the bogie.
- Monitor and record the bogie recovery forces at incremental positions as the bogie moves along the rails. The recovery block, rails and cable shall be inspected following the test. The results shall be documented in the Inspection and Test Report.
- During the recovery test stop the bogie at a proximity switch target to demonstrate the stopping accuracy.
- Repositioning of the recovery block at the end of the rail using the bogie to push the recovery block into position.
- Decoupling of the recovery winch gearbox from the winch drum.

## 8.3 Temporary Structures

8.3.1 The Seller shall supply a test rig, as required, in the form of temporary structures that simulate the site conditions for the bogie and associated equipment. This shall include replicating key facility interfaces to verify equipment clearances.

8.3.2 The plant installation relationship between the bogie and associated equipment shall be maintained for the shop tests.

8.3.3 The structures provided shall be designed to allow safe access for viewing at equipment levels.

8.3.4 For in-cell equipment, which may lack conventional guarding, the Seller shall apply, as a minimum, the OSHA requirements to protect personnel from the danger of moving equipment during shop tests.

## 8.4 Cyclic Tests

8.4.1 Following satisfactory completion in all specific shop tests, cyclic testing shall be conducted on the bogie over the full operating travel. As a minimum requirement, 5 consecutive full

cycles shall be completed within a period that shall not exceed 120% of the predicted nominal duration for such a program, subject to all duty restrictions.

8.4.2 The cyclic tests shall follow the on-site sequence of operations, with exception of the rinse cycle, as defined in Section 3 of this specification. For the rinse cycle the Seller shall demonstrate the operation of the inflatable seal and incorporate an appropriate time delay to replicate the rinse cycle. The "mock-up" canister shall be used to replicate normal service design load conditions.

8.4.3 Following completion of the cyclic tests a general visual inspection shall be performed on the equipment with results from the inspection being documented in the Inspection and Test Report.

### 8.5 Weld Inspections

8.5.1 Weld inspections and Non-Destructive Examinations (NDE) shall be performed in accordance with project specification 24590-WTP-3PS-SS00-T0001, excluding section 8.18, and in accordance with 24590-WTP-3PS-SS00-T0002, and welding standards AWS D1.1 and AWS D1.6, unless specified otherwise.

8.5.2 All welds shall be visually inspected.

8.5.3 As a minimum, all load-bearing welds shall be non-destructively examined by either liquid penetrant or magnetic particle examination as appropriate to the material and configuration.

8.5.4 All welds that maintain the structural integrity of the bogie in accordance with the Important to Safety (ITS) requirements identified in section 1.5.3 of this specification shall be non-destructively examined. Full penetration welds shall be examined by either radiographic or ultrasonic examination as appropriate to the material and configuration. Partial penetration and fillet welds shall be examined by magnetic particle or liquid penetrant examination, as appropriate to the material and configuration.

8.5.5 The Seller shall perform 100% radiographic examination of the vessel and associated piping in accordance with the applicable requirements identified in ASME B&PV Section VIII, Division 1 and ASME B31.3.

## 9 Preparation for Shipment

### 9.1 General

9.1.1 Packaging, shipping, handling, and storage shall be performed in accordance with Project Specification 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling and Storage Requirements*, and Section 7 of the Purchase Order.

### 9.2 Cleaning and Coating

9.2.1 Surfaces shall be cleaned and coated in accordance with 24590-WTP-3PS-AFPS-T0001, *Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and*

*Equipment.* The paint system to be used for the bogie and associated equipment shall be in accordance with System Code T as identified in 24590-WTP-3PS-AFPS-T0001.

9.2.2 The final paint color for all equipment as applicable shall be in accordance with Appendix E of 24590-WTP-3PS-AFPS-T0001.

9.2.3 All Manufacturers Standard Coating (Mfg. Std) must be identified on Appendix H of 24590-WTP-3PS-AFPS-T0001, and be submitted to the Buyer, along with technical data sheets and Material Safety Data Sheets (MSDS).

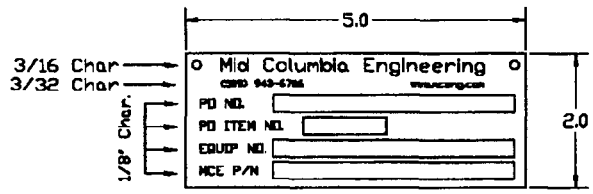
9.2.4 Stainless Steel shall not be coated.

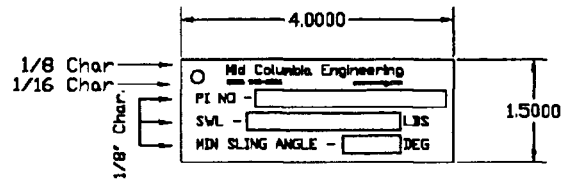
## 9.3 Tagging

9.3.1 The equipment shall be tagged in accordance with the following:

- A separate stainless steel nameplate shall be provided to include the Buyer's plant item number (identification number) and purchase order number.
- The separate stainless steel nameplate shall have the information impressed, stamped, or etched directly on the stainless steel surface with characters at least 1/8" inch high. The nameplate, where physically possible, shall be secured to the body of the equipment by corrosion resistant screws tapped into a low stress area of the assembly, or welded, so the structural integrity and functional capability of the assembly are not impaired. If it is not physically possible to secure the nameplate to the body of the equipment, then the nameplate shall be attached using a stainless steel wire.
- Instruments shall be tagged according to *Specification for Instrumentation for Package Systems*, 24590-WTP-3PS-JQ07-T0001, Rev 1, Section 8.

(Example)



# 10 Quality Assurance

## 10.1 QA requirements specific to item(s) or service

10.1.1 The Seller's Quality Assurance Program (QAP) requirements are specified in 24590-WTP-3PS-G000-T0001, *General Specification for Supplier Quality Assurance Program Requirements*, and in the Supplier Quality Assurance Program Requirements Data Sheet(s) included in the procurement documents.

10.1.2 The Seller's QAP Manual shall be submitted to Buyer for review in accordance with 24590-WTP-3PS-G000-T0001.

10.1.3 For SSCs indicated in this specification as ITS, the Seller shall have and maintain a Buyer approved Quality Assurance Program meeting the applicable sections of ASME NQA-1-1989, as per 24590-WTP-3PS-G000-T0001, and the Supplier Quality Assurance Program Requirements Data Sheet, 24590-WTP-3PD-MQTS-00002.

10.1.4 For SSCs indicated in this specification as Non-ITS, or Commercial Quality, the Seller shall have and maintain a Buyer approved Quality Assurance Program meeting the applicable sections of DOE Order O 414.1A, as per 24590-WTP-3PS-G000-T0001, and the Supplier Quality Assurance Program Requirements Data Sheet, 24590-WTP-3PD-MQTS-00004.

10.1.5 The Seller, including all sub-tier suppliers providing items or services, that affect, or may affect, nuclear safety of DOE nuclear facilities shall, as a minimum, have a quality assurance program in place that complies with the requirements of 10 CFR Part 830.122.

10.1.6 Should any portion of the work defined within this specification be subcontracted, these requirements shall be passed on to the sub-contractor as applicable to the work being performed.

## 10.2 Program QA Elements

10.2.1 The Seller's QAP as a minimum, shall contain the requirements detailed in the Supplier Quality Assurance Program Requirements Data Sheets listed in Section 2 of the Purchase Order.

# 11 Documentation and Submittals

## 11.1 General

11.1.1 Documentation shall be submitted to the Buyer in accordance with this specification, and as summarized on the G321-E and G321-V forms in section 3 of the Purchase Order. The G321-V form lists all the documents required for quality verification and the G321-E form lists those engineering documents required.

11.1.2 General requirements and submittal procedures are also covered in Section 3 of the Purchase Order. Each document to be submitted must be listed on the "Seller's Index/Schedule" (Form 15EX). This form tracks the scheduled and actual delivery of each submittal.

## 11.2 Quality Assurance Manual

11.2.1 The Offeror's Quality Assurance Manual shall be submitted to the Buyer with the Offeror's proposal in accordance with the G321-E form.

## 11.3 Design Compliance Matrix

11.3.1 The Seller shall develop a matrix that tabulates the design requirements of this specification and the applicable requirements in the referenced project specifications, identifying the method of compliance. The matrix shall describe how each requirement is met including narrative as well as references to drawings, calculations, and/or other specific documentation that demonstrates compliance.

11.3.2 The matrix shall be included as a preliminary document in the 50% design review package. The preliminary document shall form the template for the final document.

11.3.3 The matrix shall be included as a final document in the 90% design review package.

## 11.4 Safety Equipment List

11.4.1 The Safety Equipment List shall identify which components of the supplied equipment are to be provided as Important to Safety (ITS) or Commercial Quality (CM).

11.4.2 The Safety Equipment List shall be based on the requirements identified in Sections 1.5.3 and 10.1 of this specification.

11.4.3 The Offeror shall provide a Safety Equipment List with the Offeror's proposal that communicates the Offeror's understanding of which components of the equipment identified in this specification are to be provided as ITS and which components are to be provided as CM. The list shall be a detailed listing of components for the supplied equipment along with the designation of each item in the list as either CM or ITS.

11.4.4 The Safety Equipment List, or specific components of the Safety Equipment List, shall be submitted to the Buyer for review and permission to proceed prior to procurement of materials. The document shall be submitted with the 50% design review package as a preliminary document and at the 90% design review as a final document.

## 11.5 Software Requirements Document

11.5.1 The Seller shall develop a Software Requirements Document that describes the protocols and requirements for programming the bogie control system. The document shall be submitted with the 50% and 90% design review package as a preliminary document and as a final document following shop tests.

## 11.6 Drawings

### 11.6.1 General

11.6.1.1 The Seller shall prepare and submit drawings per Section 3 of the MR, Drawings and Data Requirements.

11.6.1.2 The Seller shall prepare drawings in accordance with American Society of Mechanical Engineers (ASME) Y14 series, Engineering Drawing and Related Document Practice. The drawings shall be assigned a unique number in accordance with Section 3 of the MR, Drawings and Data Requirements.

11.6.1.3 SELLER shall specify all dimensions, tolerances, materials, surface finishes, weld symbols, special filler material used, torque values, set points and special fabrication instructions on drawings supplied to BUYER.

11.6.1.4 SELLER drawings shall show critical interface dimensions and their tolerances as specified by BUYER on DPDs or MDSs. This information shall be identified by using an asterisk or another method and note shall be included that explains how to distinguish these dimensions.

11.6.1.5 Seller drawings shall include as a minimum, but not be limited to, the following:

- Descriptive title blocks that are relevant to the information on the drawing
- Notes that will clarify all vague or obscure details that would not otherwise be understandable without a note
- A drawing cross-reference section that will cross-reference other drawings/documents that are relevant to make drawings more complete or more understandable
- A bill of material that will list all items shown on an assembly drawing
- Legend of symbols. Symbols shall be used consistently throughout all drawings related to weld systems

11.6.1.6 Sufficient information shall be included on these drawings to permit manufacture of any replacement parts in the event that the original Seller is not able to supply parts at the time future needs may arise. All drawings shall be specific to the system addressed in this specification and shall be exact up to the time of delivery. The final set of drawings are to be "as-built" drawings. Drawings that are "typical" shall not be provided.

11.6.1.7 Where required, the Seller shall prepare MDSs on data sheets furnished by the Buyer.

### 11.6.2 Arrangement Drawings:

11.6.2.1 An arrangement drawing shall be submitted at all the design reviews for each piece of equipment. These drawings shall show all major dimensions, supports, arrangements, interfaces, and component identification numbers where appropriate. These drawings shall also show weight(s) and center of gravity (CG) location(s) for installation.

### 11.6.3 Assembly Drawings:

11.6.3.1 An assembly drawing shall be submitted at the formal, final design closeout meeting for each piece of equipment. These drawings shall show the arrangement of the equipment's

components, junction boxes, and interfaces with existing systems/structures. These drawings shall identify utilities required to be supplied by the facility.

11.6.3.2 General assembly drawings shall identify sub-assemblies and drawings.

11.6.3.3 Bill of Materials shall contain the minimum following information:

- an item number for each individual part or material,
- quantity of an item or part,
- description of an item or part,
- reference code (ASTM, ANSI) of an item or part,
- material callout or SELLER part number.

11.6.3.4 Component identification numbers shall be included on drawings where appropriate.

### 11.6.4 Shop Fabrication/Detail Drawings:

11.6.4.1 Shop Fabrication/Detail drawings of all designed components shall be submitted for the formal, final design closeout meeting. Component identification numbers shall be included on drawings where appropriate.

11.6.4.2 All nameplates and labels shall be shown.

### 11.6.5 Installation Drawings:

11.6.5.1 An installation drawing shall be submitted for the formal, final design closeout meeting for each piece of equipment. These drawings shall detail modifications required to accommodate equipment installation. Component identification numbers shall be included on drawings where appropriate.

11.6.5.2 The installation drawings shall clearly indicate lifting and rigging points and safe lifting load at each for initial installation and any other lifting evolutions.

11.6.6 Any proposed changes to required elements identified on the Buyer's DPDs, as defined in Section 1.2 of this specification, shall be submitted to the Buyer via SDDR in accordance with Section 2 of the Purchase Order.

## 11.7 Calculations

11.7.1 Calculations shall be submitted to the Buyer to document engineering analysis performed to verify the adequacy of the supplied equipment designs, including calculations for stress, deflection, and fatigue, for seismic and normal service conditions, electrical loads and machine component selection (e.g., motors, bearings, gears, and drive shafts).

11.7.2 The Seller shall submit, as early as practical in the design process (but no later than as required by the Buyer approved schedule), an analysis of the reaction loads at all embeds and other support locations.

11.7.3 Stress reports and additional calculations affecting ITS components (including calculations for Non-ITS components that may affect ability of the ITS related component to perform the associated ITS function) shall be subject to the requirements of the applicable sections of ASME NQA-1-1989.

11.7.4 If commercial off the shelf computer software is used in performing calculations, it shall be validated before use in the documents it supports. The validation test report shall be provided to the Buyer and shall meet, as a minimum, the following requirements:

- Validation testing shall be performed to a Seller approved procedure
- The testing shall validate the functions and requirements relevant to calculations that it supports
- The test environment conditions shall be described
- Testing shall be performed on the same computer platform that the calculations will be performed.

11.7.5 Spreadsheet and mathematical program calculations shall be treated like hand calculations. Each equation used in the spreadsheet or program shall be presented in the calculation so the result can be reproduced by hand calculations. The title and version of the program shall also be provided. Evidence of hand calculation reproduction at all key steps in the spreadsheet or program shall be presented in the calculation.

11.7.6 English system units of measure shall be used.

11.7.7 Calculations and analyses shall be validated, checked, and approved by qualified personnel independent of the preparer. All calculations shall be provided as part of the design report. Independent reviewers shall be qualified in the subject area and shall not have participated in the calculations and analysis under review. Check review comments are subject to audit.

11.7.8 Seismic calculations and analyses shall be validated, checked, and approved by qualified personnel independent of the preparer. Evidence shall be provided that both the preparer, the checker, and the independent reviewer are fully qualified including a minimum of 10 years experience in structural seismic analysis. Preliminary seismic calculations shall be provided at the 50 % design review. Final seismic calculations shall be provided at the 90 % design review.

11.7.9 The Seller shall ensure that independent checking of critical calculations that bear on long-term performance and reliability are performed.

11.7.10 References shall be provided for all physical properties and/or derived physical quantity data and used as input to calculations or analysis.

11.7.11 References shall be provided for all formulas or references extracted from applicable codes and standards.

11.7.12 Checking shall be performed to confirm the accuracy of the calculations. The checker shall be capable of originating the document. The checker shall not be the originator. Calculations shall be checked and approved prior to use for design or other calculation input.

11.7.13 All calculations shall include headers (on all pages) with the following information:

- Calculation number
- Project name
- Revision
- Author
- Date Subject
- Pagination

11.7.14 All calculations shall include the following sections:

- Objective
- Inputs
- Background
- Applicable codes and standards
- Methodology
- Assumptions
- Calculations
- Results and discussions
- References
- Attachments

11.7.15 Attachments to calculations shall include the following information (on every page):

- Calculation number
- Revision
- Page numbering

## 11.8 Design Reviews

### 11.8.1 Contract Award Kick-Off Meeting

11.8.1.1 The contract award kick-off meeting will be an informal discussion conducted at the Seller's facility to ensure the newly awarded contract is clear and concise, and that the Seller has a clear understanding of the scope of the contract.

11.8.1.2 The Seller shall provide to the Buyer, a minimum of five (5) working days prior to the scheduled meeting, copies of documentation or information that is expected to be discussed and/or presented in the meeting. Documentation may be provided as either hard copies or as electronic files via email.

### 11.8.2 20% Design Review

11.8.2.1 The first interim review will be an informal review conducted at the Buyer's facility after approximately 20% of the design is completed. Preliminary design media, including

arrangement and assembly drawings, calculations and analyses will be reviewed by the Buyer. The Seller shall be prepared to discuss any Seller recommended changes to the approaches indicated on the Buyer's proposal drawings and identify any conflicts with equipment envelope dimensions. The Seller shall participate in the design review and shall be prepared to discuss any comments.

11.8.2.2 The Seller shall be responsible for producing and submitting meeting minutes, as a formal document of record.

### 11.8.3 50% Design Review

11.8.3.1 The second interim review will be an informal review conducted at the Buyer's facility after approximately 50% of the design is completed. Preliminary design media, including arrangement and assembly drawings, calculations and analyses, Design Compliance Matrix, Software Requirements Document, and Safety Equipment List shall be provided to the Buyer for review. The preliminary design media shall be provided to the Buyer at a mutually agreed time prior to the scheduled meeting. The Seller shall participate in the design review and shall be prepared to discuss any comments.

11.8.3.2 Upon buyer's approval, Seller may be authorized to procure (at Buyer's risk) "specific long-lead items", upon satisfactory completion of 50% design review of these items. The Seller shall transmit a detailed list of the "specific long-lead items" that require procurement prior to obtaining code [1] status on the formal drawing submittal. The Seller shall provide sufficient reference documentation for the Buyer to review and authorize the early procurement of these "specific long-lead items".

11.8.3.3 The Seller shall be responsible for producing and submitting meeting minutes, as a formal document of record.

### 11.8.4 90% Design Review

11.8.4.1 At the conclusion of definitive design, a formal 90% design review will be conducted at the Buyer's facility in accordance with WTP procedures. The (draft) final design report, including all design media, supporting calculations and analyses, Design Compliance Matrix, Software Requirements Document, Safety Equipment List, and other required submittals that document the design, shall be provided to the Buyer.

11.8.4.2 The Seller is encouraged to provide to the Buyer copies of documentation or information that is expected to be discussed and presented at the design review approximately 5 working days prior to the scheduled meeting (if not previously submitted in accordance with the submittal schedule).

11.8.4.3 The Seller shall participate in the design review and present the design, including discussion of the provided submittals.

11.8.4.4 Following the design review meeting, the Buyer will formally transmit comments or other requests on the design submittals. The Seller is required to provide response/resolution to the Buyer's comments in accordance with the submittal schedule, or request deviation from the Buyer's requirements through use of the Buyer's SDDR form.

11.8.4.5 The resolved/corrected submittals shall be provided in the final design report in accordance with the submittal schedule.

11.8.4.6 The Seller shall be responsible for producing and submitting meeting minutes, as a formal document of record.

## 11.9 Deleted

11.9.1 Deleted.

11.9.2 Deleted.

## 11.10 Material Test Reports

11.10.1 The Seller shall submit to the Buyer, a complete package of Material Test Reports (MTRs) for all stock steel used for components designated as ITS in Section 1.5.3 of this specification, and as required per the applicable codes and standards referenced in this specification, validating critical parameters as applicable.

## 11.11 Spare Parts List

11.11.1 The Seller shall provide to the Buyer a recommended spare parts list for all equipment within the Seller's scope of supply for the preventive maintenance of three distinct classifications of spare parts. The Seller's recommendations are to address a startup and warranty period, operational spare parts, and capital spare parts. The recommendations shall also include intervals of replacement based on the operating life of the equipment subject to the duty cycles identified in this specification.

- Startup and warranty spare parts are those parts that may be required at any time during equipment installation, startup, testing, and unit operation through the warranty period.
- The operational spare parts are those parts that require replacement at regular intervals to maintain continuous operation of the supplied equipment and/or system.
- Capital spare parts are major parts or equipment that provide reliable equipment operation throughout the plant life and having a significant lead time for manufacture and delivery.

11.11.2 The spare parts list shall include names of manufacturers with appropriate model numbers and special ordering instructions (if applicable) for replaceable parts. The spare parts list shall also include pricing and delivery information valid for one year after delivery of the equipment.

## 11.12 Inspection and Test Plan

11.12.1 The Seller shall prepare a detailed Inspection and Test Plan including insertion of Buyer-designated source inspection/witness notification points in accordance with Section 5 of the Purchase Order.

11.12.2 Prior to starting work, the plan shall be submitted to the Buyer for review.

11.12.3 The plan shall include, but not be limited to, the following:

- Equipment to be inspected and tested
- Description of inspection and tests to be performed
- Sequential points for inspection and tests to be performed
- Each characteristic or attribute to be evaluated
- The inspection and test report form to be used
- Other requirements as required by Codes, Standards, or Purchase Order

11.12.4 The plan shall include provisions for increased hold and notification points as the project progresses.

11.12.5 The results of the inspections and tests shall be documented in the Inspection and Test Report.

11.12.6 The Seller shall provide an inspection and test procedure documenting the process followed for determining that specified requirements (dimensions, properties, performance results, etc.) are met.

## 11.13 Manuals

11.13.1 The Seller shall provide a clearly written instruction manual(s). The manual(s) shall include:

- Storage maintenance instructions
- Rigging instructions
- Installation instructions
- Spare parts list
- General description of the equipment identifying as applicable, significant technical characteristics, test and adjustment information, and safety and warning notices
- Instructions for equipment operation (start-up, shut down, normal, and abnormal), referencing drawings and diagrams as appropriate
- General maintenance instructions
- Recommended inspection points if any, with procedures and period for inspection
- Maintenance instructions for any required lubrication

## 11.14 Design Changes Incorporated by Reference

| | |
|---|---|
| 24590-WTP-SDDR-PROC-05-00180 | Material Equivalency |
| 24590-WTP-SDDR-M-05-00117 | Material Equivalency of QL materials for the Canister Rinse Bogie equipment. |
| 24590-WTP-SDDR-MH-07-00110 | MR25 Canister Rinse Bogie Control Panel HDH-PNL-00001 -Wire Insulation Colors |
| 24590-WTP-SDDR-MH-07-00111 | MR25 Canister Rinse Bogie Control Panel HDH-PNL-00001 - Wire Splicing |
| 24590-WTP-SDDR-MH-07-00114 | MR25 Canister Rinse Bogie Control Panel HDH-PNL-00001 - Nameplates |
| 24590-WTP-SDDR-MH-07-00117 | MR25 Canister Rinse Bogie -Shim Packs |

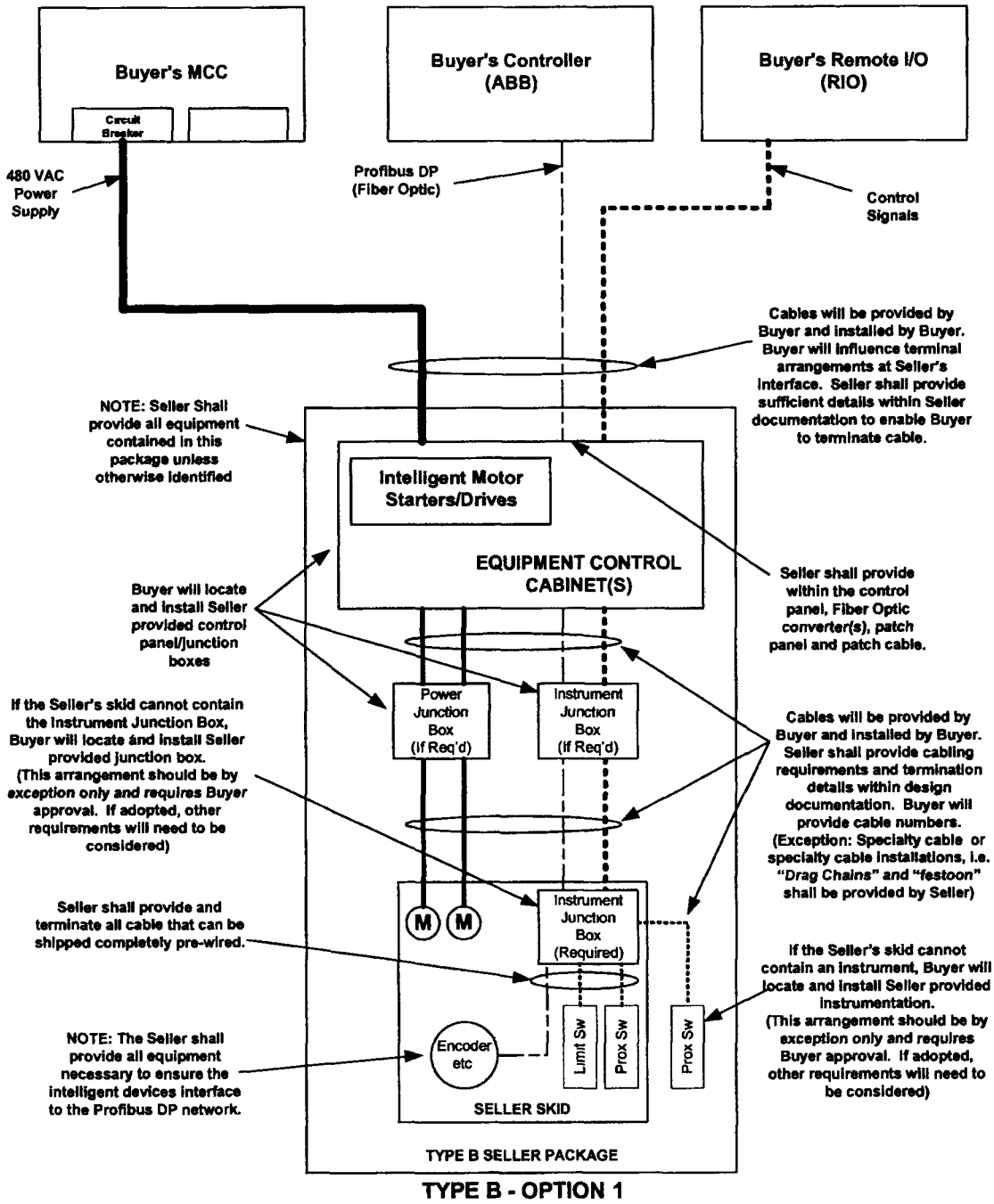
| | |
|---|---|
| 24590-WTP-SDDR-MH-07-00118 | MR25 Canister Rinse Bogie - Factory Acceptance Cycle Testing & Recovery Positional Accuracy |

# Appendix A

# Instrumentation and Control Interfaces

# Appendix A
# Instrumentation and Control Interfaces

**Figure 1 "Type B" Package**




**TYPE B - OPTION 1**

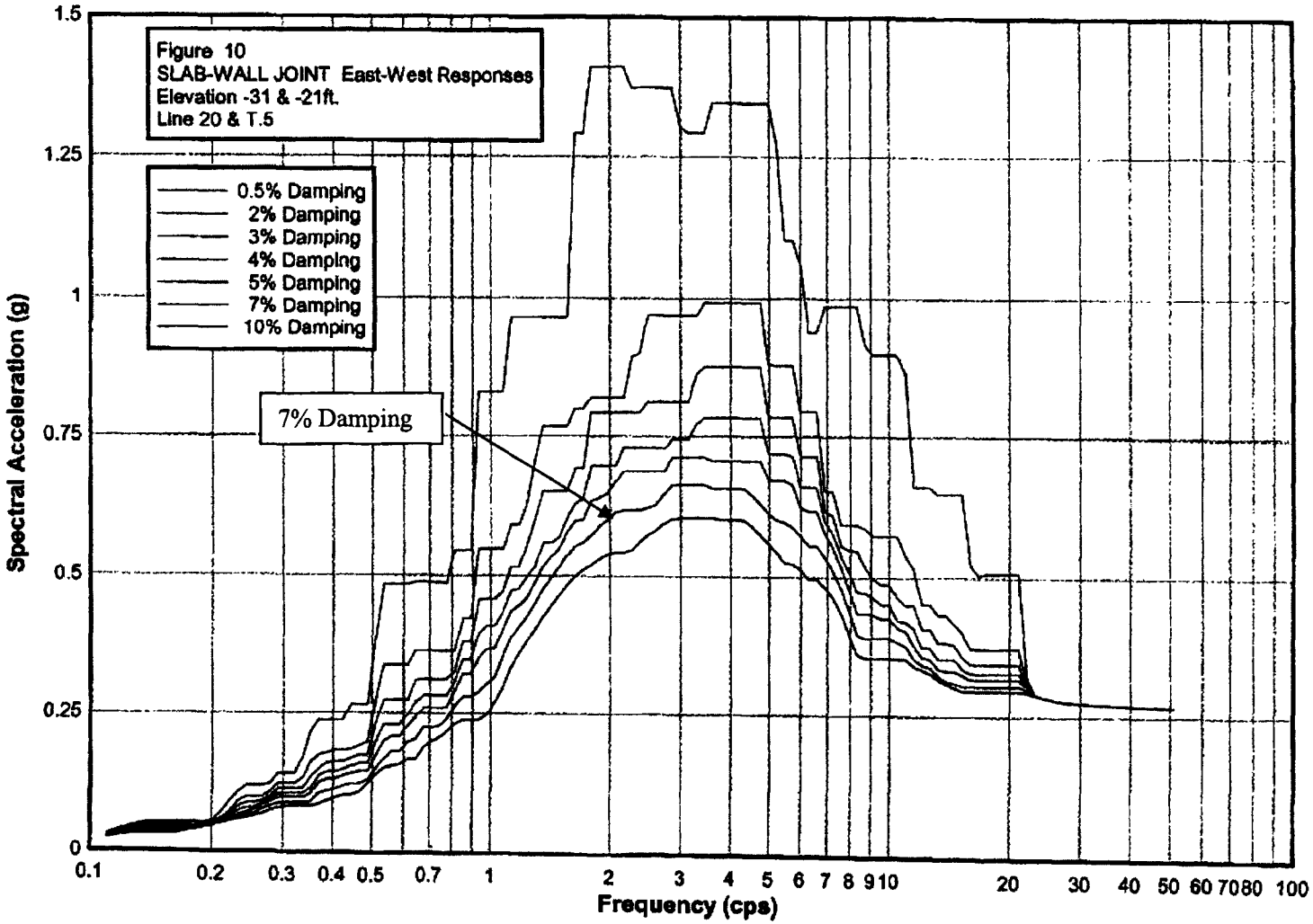
| DATE | REV. |
|---|---|
| 05/06/03 | D |

# Appendix B

# Seismic Response Spectra

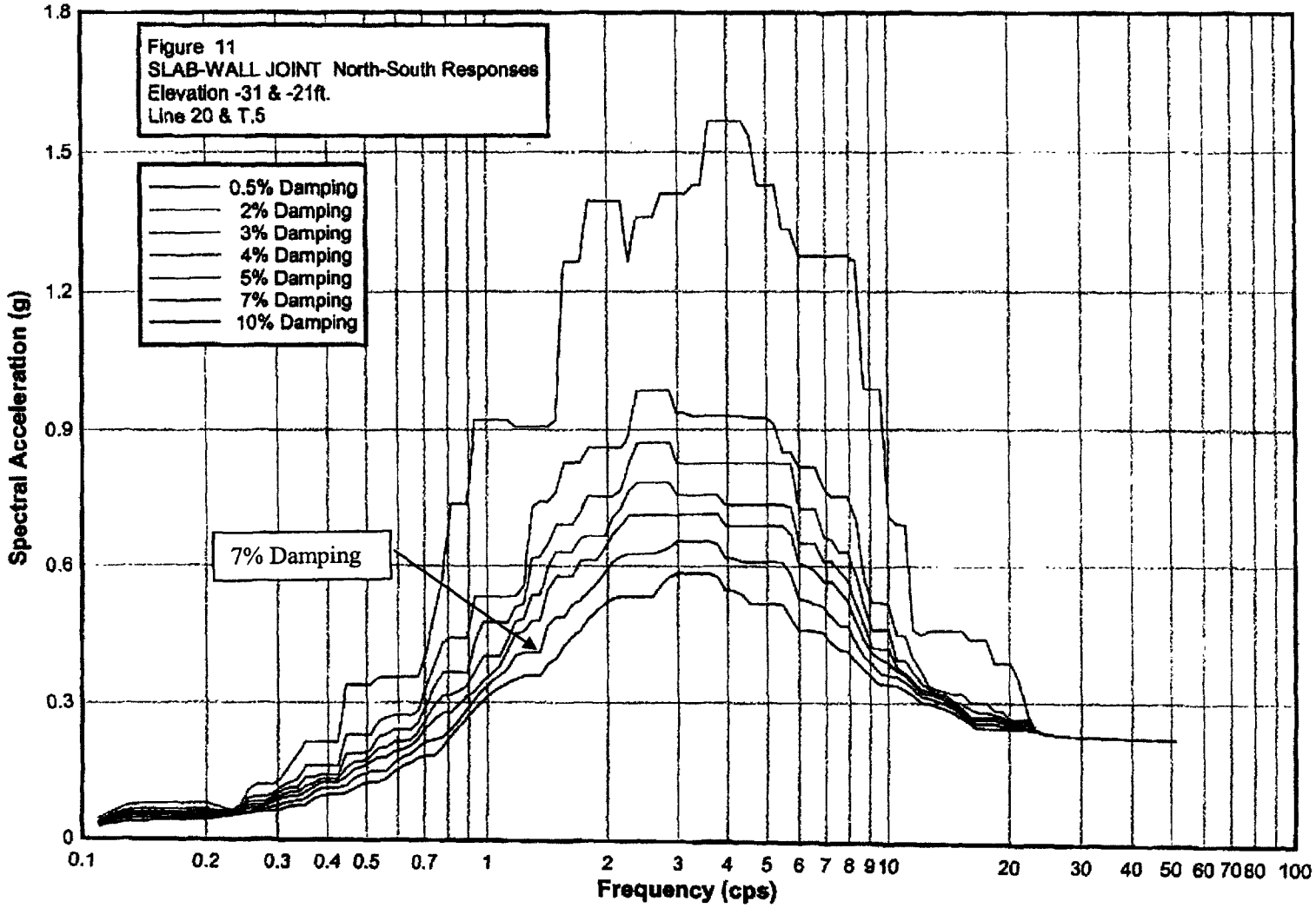
# RPP-WTP HLW Vitrification Facility ISRS

**Calc No.: 24590-HLW-S0C-S15T-00009, Rev. 0D**



# RPP-WTP HLW Vitrification Facility ISRS

**Calc No.: 24590-HLW-S0C-S15T-00009, Rev. 0D**



# RPP-WTP HLW Vitrification Facility ISRS

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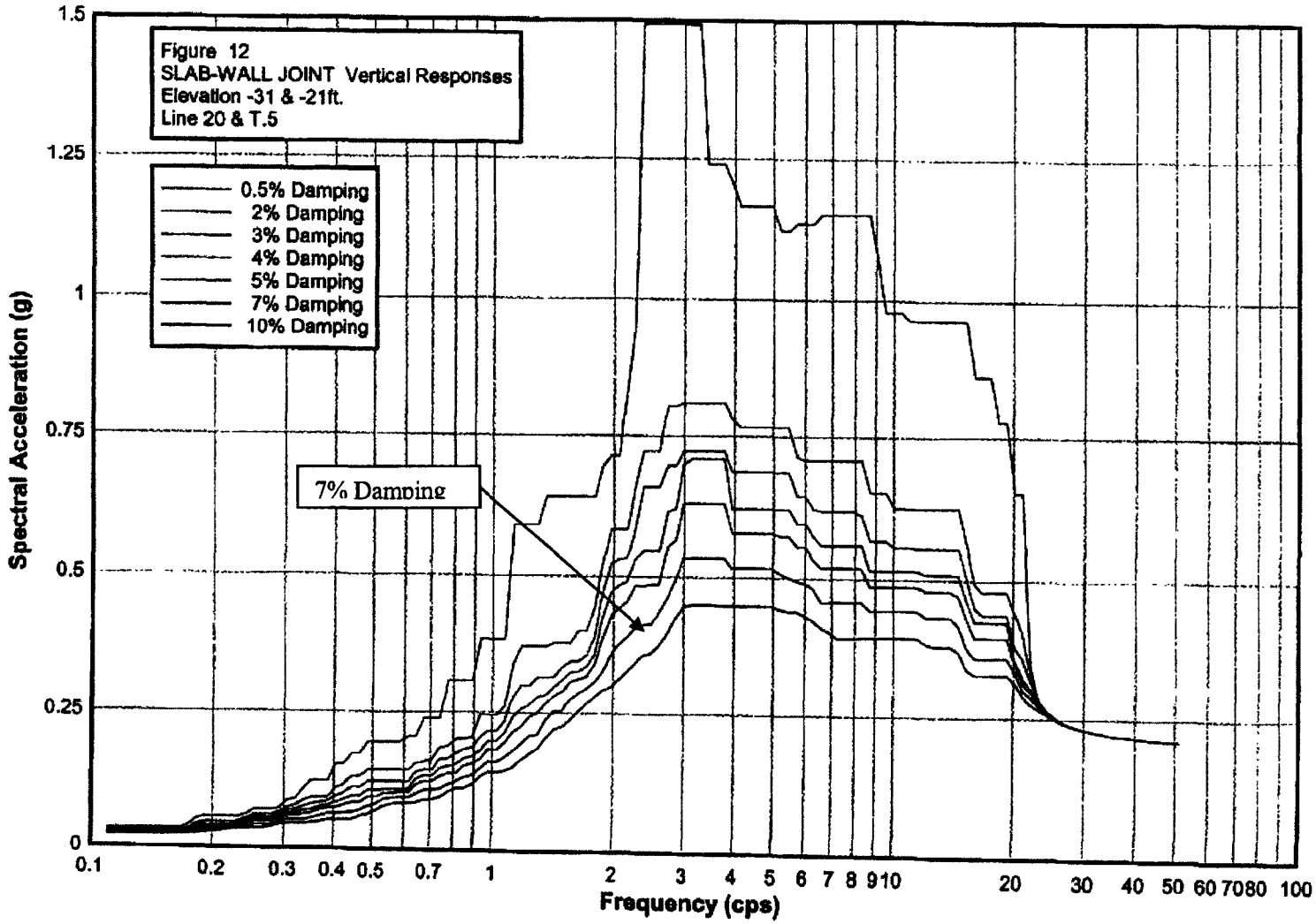
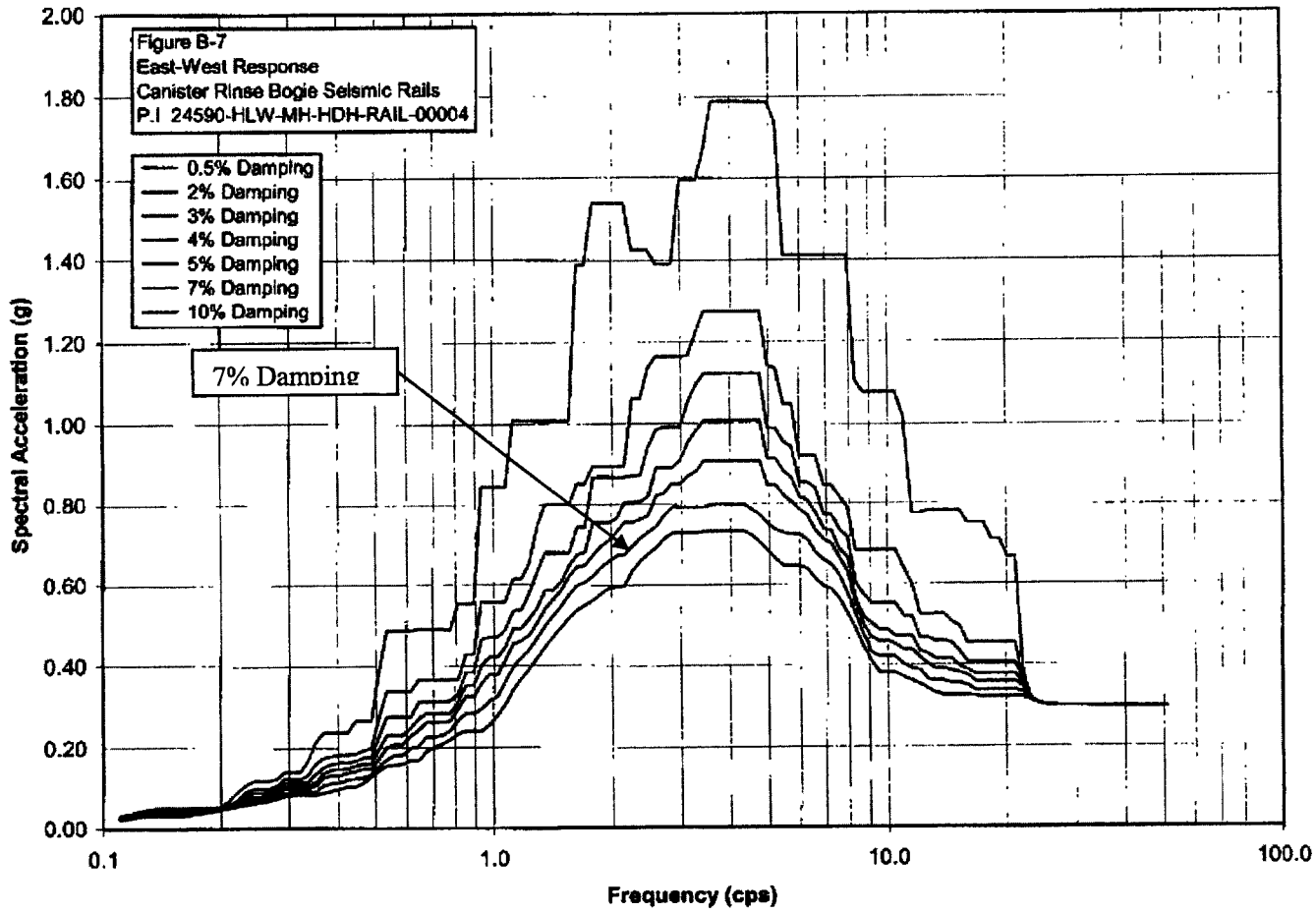


# CALCULATION SHEET

PROJECT: RPP-WTP
JOB NO.: 24590
CALC NO.: 24590-HLW-S0C-S15T-00039
SHEET REV: D
SHEET NO.: B-9

BY: Ed Ulle
DATE: 8/19/05

SUBJECT: HLW Vitrification Building Seismic Analysis – Enveloped In-Structure Response Spectra

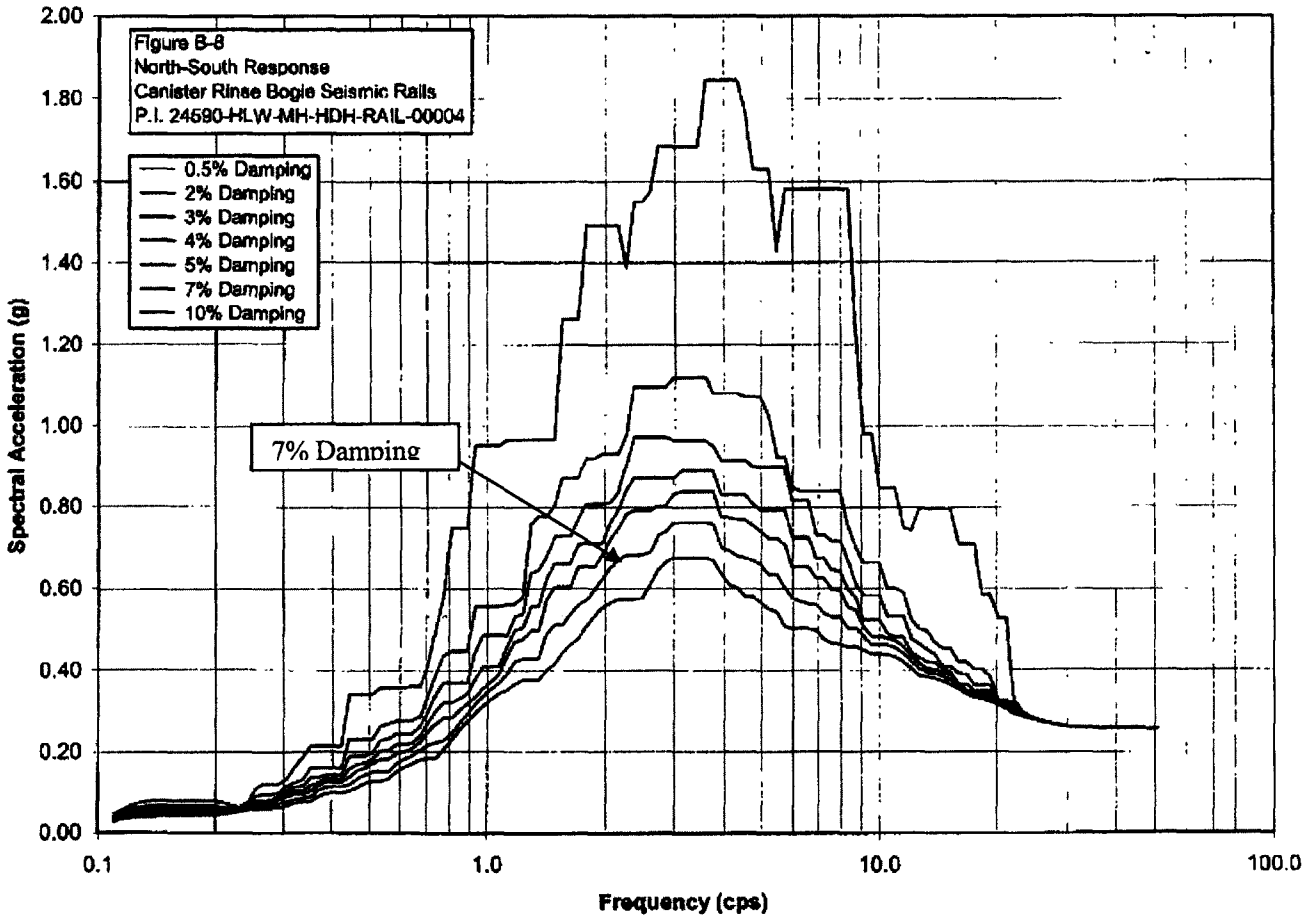


# CALCULATION SHEET

PROJECT: RPP-WTP
JOB NO.: 24590
CALC NO.: 24590-HLW-S0C-S15T-00039
SHEET REV: D
SHEET NO.: B-10

BY: Ed Ulle
DATE: 8/19/05

SUBJECT: HLW Vitrification Building Seismic Analysis – Enveloped In-Structure Response Spectra

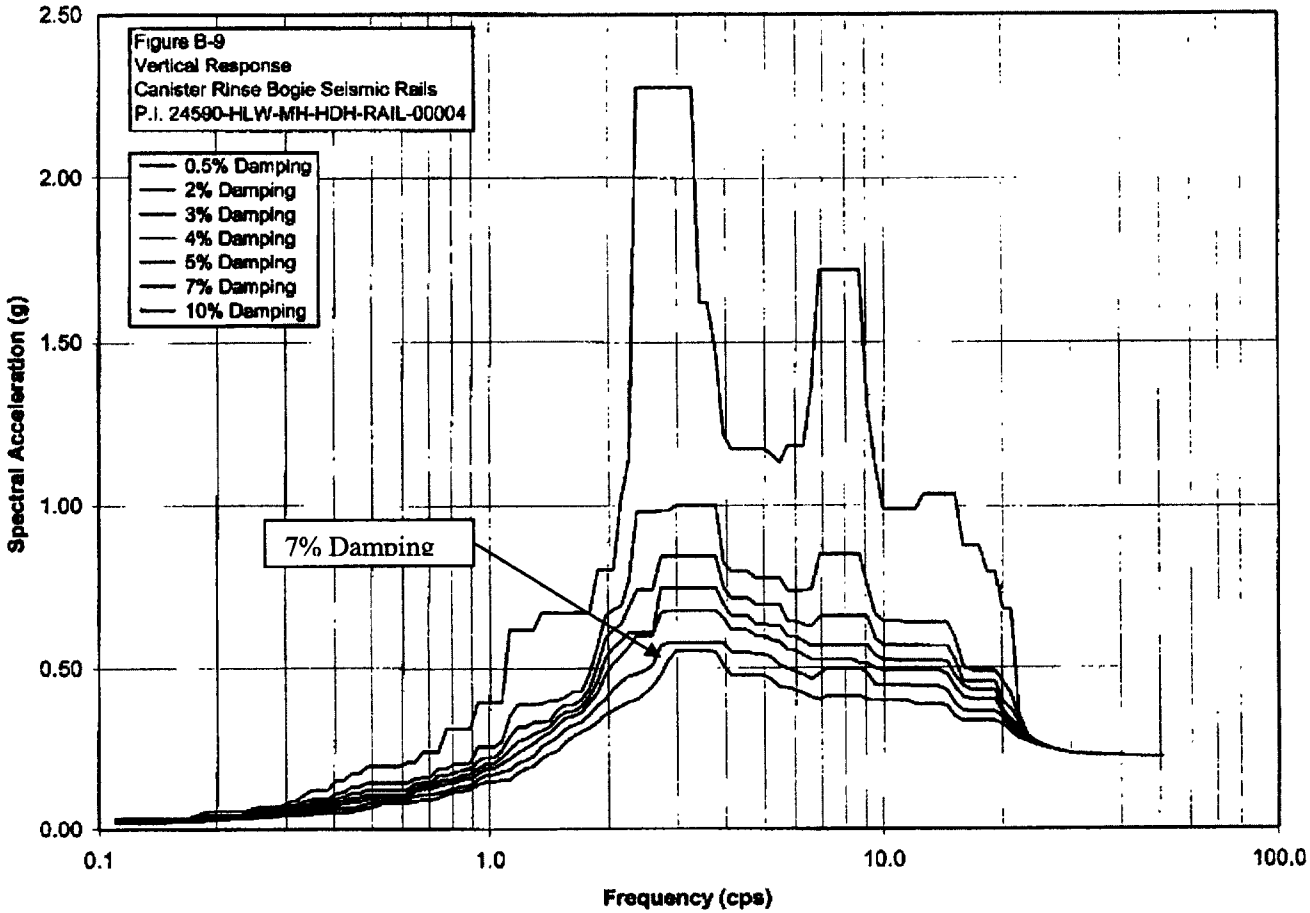


# CALCULATION SHEET

PROJECT: RPP-WTP
JOB NO.: 24590
CALC NO.: 24590-HLW-S0C-S15T-00039
SHEET REV: D
SHEET NO.: B-11

BY: Ed Ulle
DATE: 8/19/05

SUBJECT: HLW Vitrification Building Seismic Analysis – Enveloped In-Structure Response Spectra



# Appendix C

# ALARA Design Review (ADRs)

| | |
|---|---|
| 24590-HLW-ADR-M-02-005 | HLW Canister Rinse Bogie Services Design Evaluation, Rev. 1 |
| 24590-HLW-ADR-M-02-006 | HLW Bogie Recovery Systems, Rev 1 |
| 24590-HLW-ADR-M-02-007 | Rinse Bogie Energy Chain, Rev 1 |
| 24590-HLW-ADR-M-02-013 | Power and Control Supplies for the Canister Rinse Bogie (System HDH), Drum Transfer Bogie (RWH) and Cask Transfer Bogie (RWH), Rev. 1 |
| 24590-HLW-ADR-M-02-048 | ALARA Review of HLW System Bogies, Rev. 1 |
| 24590-HLW-ADR-M-02-050 | ALARA Design Review for HLW System HDH & RWH Bogie Rails, Rev. 0 |

# Appendix D

# Deleted

# Appendix E

# Deleted

# Appendix F

# Deleted

# Appendix G

# Deleted

# Appendix H

# Human Factor Codes and Standards

# Appendix H
# Human Factor Codes and Standards

| IEEE 1023-1988 Application Areas for Mechanical Handling | Applicable Human Factor Attributes | Applicable Code, Standard, or Requirement |
|---|---|---|
| 3.0 Planning for Human Factors Engineering | | |
| | HFE Program Management | NUREG-0711, Section 2 |
| | Human Reliability Analysis | NUREG-0711, Sec. 7 |
| | | |
| | Functional Requirements Analysis and Function Allocation | NUREG-0711, Section 4 |
| | Human Factors Engineering Program Review | NUREG-0711 |
| | Human Engineering Information Display | Part 1 of NUREG-0700, Rev 1 |
| 4.1 Task considerations | Task Analysis | NUREG-0711, Section 5 |
| 4.2 Environmental considerations: | | |
| | Environment, Internal Design Conditions | See Section 5.5 of this specification |
| | Acoustical Noise | MIL-STD-1472F, sec. 5.8.3 |
| | Anthropometric Data | MIL-STD-1472F, sec. 5.6.3 |
| | Illuminance & Illumination | MIL-STD-1472F, Sections 5.8.2, 5.10.5 |
| 4.3 Equipment considerations | | |
| | Cranes, Material Handling and construction | MIL-STD-1472F, section 5.12.8 |
| | Vibration | MIL-STD-1472F, Section 5.8.4 |
| | Remote Handling Equipment | |
| | • Controls: General | DOE-STD-1140-2001 Section 2.5 |
| | • Handle and Grasp Area Design | DOE-STD-1140-2001 Section 2.13 |
| | • Remote Handling | MIL-STD-1472F Section 5.10 |
| | • Self-Alignment | MIL-STD-1472F Section 5.10.1.1 |
| | • Quick-Disconnect | MIL-STD-1472F Section 5.10.1.2 |
| | • Fasteners | MIL-STD-1472F Section 5.10.1.3 |
| | • Lock or Latching | MIL-STD-1472F Section 5.10.1.4 |
| | • Feedback | MIL-STD-1472F Section 5.10.2 |
| | • Manipulators | MIL-STD-1472F Section 5.10.3 |
| | • Position Control | MIL-STD-1472F Section 5.10.3.2 |

| IEEE 1023-1988 Application Areas for Mechanical Handling | Applicable Human Factor Attributes | Applicable Code, Standard, or Requirement |
|---|---|---|
| | • Mutual Force Reflection | MIL-STD-1472F Section 5.10.3.2 |
| | • Degrees of Freedom | MIL-STD-1472F Section 5.10.3.2 |
| | • Power Assist | MIL-STD-1472F Section 5.10.3.3 |
| | • Viewing Equipment | MIL-STD-1472F Section 5.10.4 |
| | • Direct Viewing | MIL-STD-1472F Section 5.10.4.2 |
| | • Viewing Angle | MIL-STD-1472F Section 5.10.4.3 |
| | • Indirect Viewing | MIL-STD-1472F Section 5.10.4.4 |
| | Viewing Equipment - Coding | MIL-STD-1472F Section 5.10.4.5 |
| | Viewing Equipment - Lettering | MIL-STD-1472F Section 5.10.4.6 |
| | • Illumination - Reflected Light | MIL-STD-1472F Section 5.10.5.1 |
| | • Threshold Viewing | MIL-STD-1472F Section 5.10.5.2 |
| 4.4 Personnel Considerations | | |
| | Hand Tools | DOE-HDBK-1140-2001 Section 4.7 |
| | Interface Design Evaluation,(Human Machine Interface) | NUREG-0711, Section 8 |
| | Labeling | MIL-STD-1472F, section 5.5 |
| 4.5 Nuclear Operations Considerations | | |
| | Remote Handling ( Power Manipulators) | MIL-STD-1472F, section 5.10.3 |
| | Workplace Design | Part III of NUREG-0700, Rev 2, Section 12 |
| | Workstation Design | Part III of NUREG-0700, Rev 2, Section 11.1 |
| | Radiological Hot Workshops | DOE-HDBK-1140-2001, Section3.4 |
| 4.6 Documentation Considerations | No attribute identified | |
| 5. Methodology | No attribute identified | |
| 5.1 None observational methods | No attribute identified | |
| 5.2 Observational methods | No attribute identified | |
| 5.3 Expert Opinion Techniques | No attribute identified | |
| | Procedure Development | NUREG-0711, Section 9 |
| | Task Analysis | NUREG-0711, Section 5, |
| 6: Implementation in Design, Operations, Testing and Maintenance process | | |
| | Maintenance/Maintainability | DOE-HDBK-1140-2001, Section 5.2 & Section 6.6 |

| IEEE 1023-1988 Application Areas for Mechanical Handling | Applicable Human Factor Attributes | Applicable Code, Standard, or Requirement |
|---|---|---|
| 6.1 Program Plan | | |
| | Training Program Development | NUREG-0711, Section 10 |
| 6.2 Documenting HFE in the Design, Operations, Testing and Maintenance Process | | |
| | Verification and Validation | NUREG-0711, Section 11 |
| | Maintenance/Maintainability | DOE-HDBK-1140-2001, Section 5.2 & Section 6.6 |
| 6.3 Operational Experience Review: | | |
| | Operating Experience Review | NUREG-0711, Section 3 |
| | Staffing & Qualifications | NUREG-0711, Section 6 |

# *Drawings and Documents*

## Operating Unit Group 10 – Appendix 10.8
## High Level Waste Building
## Engineering Calculations

The documents listed in the following table are incorporated by reference into this permit and are subject to the requirements set forth in Part I Standard Conditions, Part II General Facility Conditions, and Part III Operating Unit Group 10 Conditions. Upon request, copies of the documents can be viewed at the Nuclear Waste Program Resource Center located at 3100 Port of Benton Blvd. Richland, WA. Appointments for viewing can be scheduled by calling (509) 372-7950.

| ***Drawing/Document*** | ***Description*** |
|---|---|
| 24590-HLW-PER-M-02-003, Rev 3 | Flooding Volume Calculation for the HLW Facility |
| RESERVED | RESERVED |

Source documents (which do not include a "P" in the last set of numbers, e.g. "-P0001," or "-TP001") should be used in conjunction with any document change notices issued against them.

We are currently transitioning from permit documents (which do include a "P" in the last set of numbers) to source documents. At the end of the transition period, permit submittals will contain source documents and will be incorporated into the permit as described in Ecology Publication # 07-05-006 (www.ecy.wa.gov/biblio/nwp.html).

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# *Drawings and Documents*

## Operating Unit Group 10 – Appendix 10.9
## High Level Waste Building
## Material Selection and Corrosion Evaluation Documentation

The documents listed in the following table are incorporated by reference into this permit and are subject to the requirements set forth in Part I Standard Conditions, Part II General Facility Conditions, and Part III Operating Unit Group 10 Conditions. Upon request, copies of the documents can be viewed at the Nuclear Waste Program Resource Center located at 3100 Port of Benton Blvd. Richland, WA. Appointments for viewing can be scheduled by calling (509) 372-7950.

See Appendix 7.9 for material selection documentation common to the Pretreatment, LAW, HLW, and Laboratory buildings.

| ***Drawing/Document*** | ***Description*** |
|---|---|
| 24590-HLW-N1D-HDH-P0003, Rev 1 | Material Selection Data Sheet for HDH-VSL-00002/4 |
| 24590-HLW-N1D-HDH-P0005, Rev 1 | Material Selection Data Sheet for HDH-VSL-00003 |
| 24590-HLW-N1D-HDH-P0007, Rev 1 | Material Selection Data Sheet for HDH-VSL-00001 |
| 24590-HLW-N1D-HMP-P0001, Rev 0 | Material Selection Data Sheet for HLW HMP-MLTR-00001 & 2 |
| 24590-HLW-N1D-HOP-P0001, Rev 0 | Material Selection Data Sheet for HOP-HEME-00001A/1B/2A/2B |
| 24590-HLW-N1D-HOP-P0002, Rev 0 | Selection Data Sheet for HOP-WESP-00001/2 |
| 24590-HLW-N1D-HOP-00003, Rev 1 | Corrosion Evaluation for HOP-ADBR-00001A/B & 2A/B |
| 24590-HLW-N1D-HOP-P0004, Rev 1 | Material Selection Data Sheet for HOP-SCO-00001/4 |
| 24590-HLW-N1D-HOP-P0005, Rev 1 | Material Selection Data Sheet for HOP-SCR-00001/2 |
| 24590-HLW-N1D-HOP-P0006, Rev 1 | Material Selection Data Sheet for HOP-ABS-00002/3 |
| 24590-HLW-N1D-HOP-P0007, Rev 0 | Material Data Sheet for HOP-HX-00002/4 |

| | |
|---|---|
| 24590-HLW-N1D-HOP-P0009, Rev 2 | Material Selection Data Sheet for HOP-VSL-00903/4 |
| 24590-HLW-N1D-HOP-P0010, Rev 0 | Material Selection Data Sheet for HOP-SCB-00001/2 |
| 24590-HLW-N1D-HSH-P0001, Rev 0 | Material Selection Data Sheet for HSH-TK-00001/2 |
| 24590-HLW-N1D-RLD-P0001, Rev 0 | Material Selection Data Sheet for RLD-VSL-00007 |
| 24590-HLW-N1D-RLD-P0002, Rev 0 | Material Selection Data Sheet for RLD-BRKPT-00007/9 |
| 24590-HLW-N1D-RLD-P0006, Rev 0 | Material Selection Data Sheet for RLD-VSL-00008 |
| 24590-HLW-N1D-RLD-P0009, Rev 0 | Material Selection Data Sheet for RLD-BRKPT-00004 |
| 24590-HLW-N1D-RLD-P0013, Rev 0 | Material Selection Data Sheet for RLD-VSL-00002 |
| RESERVED | RESERVED |

Source documents (which do not include a "P" in the last set of numbers, e.g. "-P0001," or "-TP001") should be used in conjunction with any document change notices issued against them.

We are currently transitioning from permit documents (which do include a "P" in the last set of numbers) to source documents. At the end of the transition period, permit submittals will contain source documents and will be incorporated into the permit as described in Ecology Publication # 07-05-006 (www.ecy.wa.gov/biblio/nwp.html).

# CORROSION EVALUATION

R11387010

## HOP-ADBR-00001A/B & 2A/B (HLW)
## Activated Carbon Adsorber

- Design Temperature (°F): 250
- Design Pressure (in-WG): -82
- Location: Room H-A123; outcell

ISSUED BY
RPP-WTP PDC

**Contents of this document are Dangerous Waste Permit affecting**

**Operating conditions are as stated on attached Process Corrosion Data Sheet**

## Operating Modes Considered:

- Equipment is maintainable.
- The moisture during operation is 15% by volume.
- Design to include a cool down mode that will prevent condensation of acid gasses
- A preheater will be used to prevent condensation from forming in the activated carbon media during start-up or after replacement.

## Materials Considered:

| Material (UNS No.) | Acceptable Material | Unacceptable Material |
|---|---|---|
| Type 304L (S30403) | | X |
| Type 316L (S31603) | X | |
| 6% Mo (N08367/N08926) | X | |
| Hastelloy® C-22® (N06022) | X | |

**Recommended Material: Type 316 (max 0.030% C; dual certified)**

**Recommended Corrosion Allowance: 0.010 inch (includes 0.00 inch erosion allowance)**

## Process & Operations Limitations:

- None

**Concurrence** NA
Operations

| REV | DATE | REASON FOR REVISION | PREPARER | CHECKER | MET | APPROVER |
|---|---|---|---|---|---|---|
| 1 | 7/18/11 | Incorporate revised PCDS<br>Incorporate revised design temp<br>Revise corrosion allowance<br>Add "AEA" notice<br>Format and editorial changes | DLAdler | RBDavis | NA | SWVail |
| 0 | 6/24/04 | Initial Issue | DLAdler | JRDivine | APR | APRangus |

# CORROSION EVALUATION

Please note that source, special nuclear and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the U.S. Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

This bound document contains a total of 7 sheets.

# CORROSION EVALUATION

## Corrosion Considerations:

The sulfur-impregnated activated carbon column removes volatile mercury compounds from the offgas at a mildly elevated temperature, 197 to 239 °F. During normal operation air atomized demineralized water is injected into the inlet piping to cool the offgas to operating temperature. Temperatures are not high enough to have concern for oxidation.

**a General Corrosion**
The anticipated dry-air conditions are not conductive to general corrosion and none is expected.

*Conclusion*
Either Type 304L or 316L would be satisfactory.

**b Pitting Corrosion**
Pitting corrosion will only be a concern if moisture is present. It is assumed that there will be no condensation in the unit. For safety, Type 316L is recommended.

*Conclusion*
At the stated operating conditions, pitting corrosion is not a significant concern. Type 316L is recommended.

**c End Grain Corrosion**
End grain corrosion only occurs in high acid conditions and is not a concern.

*Conclusion:*
Not a concern

**d Stress Corrosion Cracking**
At operations at the stated temperatures, stress corrosion cracking will only be a concern in the presence of moisture. It is assumed that there will be no condensation in the unit. Also see Pitting.

*Conclusion*
At the stated operating conditions, stress corrosion cracking is not a concern.

**e Crevice Corrosion**
Crevice corrosion will only be a concern if moisture is present. The offgas humidity is controlled so that there will be no condensation.

*Conclusion*
At the stated operating conditions, crevice corrosion is not a concern.

**f Corrosion at Welds**
Assuming dry air and proper welding procedures, corrosion at welds is not anticipated.

*Conclusion*
At the stated operating conditions, weld corrosion is not a concern.

**g Microbiologically Induced Corrosion (MIC)**
The stated operating conditions are not suitable for microbial growth.

*Conclusion*
At the stated operating conditions, MIC is not a concern.

**h Fatigue/Corrosion Fatigue**
Extreme temperature cycling or fluctuations are not expected.

*Conclusion*
At the expected operating conditions, corrosion fatigue is not a concern.

# CORROSION EVALUATION

**i Vapor Phase Corrosion**
Components essential consist entirely of vapor space so general corrosion comments apply.

*Conclusion:*
See comments under general corrosion.

**j Erosion**
The velocity and solids content are sufficiently low that erosion is not a concern.

*Conclusion*
Erosion is not a concern.

**k Galling of Moving Surfaces**
There are no unlubricated moving surfaces present.

*Conclusion*:
Galling is not a concern.

**l Fretting/Wear**
No metal/metal contacting surfaces are expected.

*Conclusion*:
Fretting is not a concern.

**m Galvanic Corrosion**
No significantly dissimilar metals are present, and it is assumed that condensation is controlled by design.

*Conclusion*:
Galvanic corrosion is not a concern because no fluids are present.

**n Cavitation**
Cavitation is not expected in an off-gas system

*Conclusion*:
Cavitation is not a concern.

**o Creep**
Stated operating temperatures are too low for creep to occur.

*Conclusion*
Creep is not a concern.

**p. Inadvertent Addition of Nitric Acid**
Addition of nitric acid to the offgas lines is not a plausible scenario.

*Conclusion*
Not applicable

# CORROSION EVALUATION

**References:**

1. 24590-WTP-RPT-PR-04-0001, Rev. 0CD, *WTP Process Corrosion Data*

**Bibliography**

1. 24590-HLW-MVD-HOP-00015, *Mechanical Data Sheet for 24590-HLW-MV-HOP-ADBR-00001A, 24590-HLW-MV-HOP-ADBR-00001B - Activated Carbon Adsorber For Mercury Abatement*

# CORROSION EVALUATION



## PROCESS CORROSION DATA SHEET

**Component(s) (Name/ID #)** Activated carbon adsorber (HOP-ADBR-00001A/B, HOP-ADBR-00002A/B)

**Facility** HLW

**In Black Cell?** No

| Chemicals | Unit[1] | Contract Maximum[2] | | Non-Routine | | Notes |
|---|---|---|---|---|---|---|
| | | Leach | No leach | Leach | No Leach | |
| Aluminum | g/m³ | 5.16E-15 | 9.07E-15 | | | |
| HCl | g/m³ | 1.7E-03 | 1.7E-03 | | | Note 4 |
| HF | g/m³ | 1.1E-03 | 1.1E-03 | | | Note 4 |
| Iron | g/m³ | 3.21E-14 | 2.20E-14 | | | |
| NO | g/m³ | 6.28E-01 | 6.52E-01 | | | |
| $NO_2$ | g/m³ | 1.71E-01 | 1.84E-01 | | | |
| Phosphate | g/m³ | 6.92E-16 | 2.20E-15 | | | |
| $SO_2$ | g/m³ | 1.8E-03 | 1.8E-03 | | | Note 4 |
| Mercury | g/m³ | 3.3E-02 | 3.3E-02 | | | Note 4 |
| Carbonate | g/m³ | 6.41E-16 | 8.34E-16 | | | |
| Particulate | g/m³ | 0 | 0 | | | |
| Pb | g/m³ | 1.19E-15 | 8.27E-16 | | | |
| $HNO_3$ | g/m³ | 5.0E-03 | 5.0E-03 | | | Assumption 1 |
| $HNO_2$ | g/m³ | 9.1E-03 | 9.1E-03 | | | Assumption 1 |
| Humidity | % | 41% | 41% | | | |
| Temperature | °F | | | | | Note 3 |
| | | | | | | |
| | | | | | | |
| | | | | | | |

**List of Organic Species:**

**References**

System Description: 24590-HLW-3YD-HOP-00001
Mass Balance Document: 24590-WTP-M4C-V11T-00005, Rev A
Normally Associated Streams: HOP22, HOP33
Off Normal Streams (e.g., overflow from other vessels): N/A
P&ID: N/A
PFD: 24590-HLW-M5-V17T-00004; 24590-HLW-M5-V17T-20004
Technical Reports: N/A

**Notes:**

1. Deleted
2. Data developed from a mass balance model which has constituents in the plant feed which are important to corrosion, adjusted to contract maximum values, except as noted.
3. The normal operating temperature is 197 °F at the inlet, and 197 °F at the outlet (page A-6, 24590-HLW-M4C-HOP-00011, Rev 1)
   The maximum operating temperature is 230 °F at the inlet, and 239 °F at the outlet (page A-10, 24590-HLW-M4C-HOP-00011, Rev 1)
4. Source: 24590-HLW-M4C-HOP-00011, Rev 1, pages A-10 through A-13

**Assumptions**

1. Based on empirical data from testing per Attachment 28 of 24590-HLW-M4E-HOP-00005, pages 3 and 4.

### 5.3.2 Activated Carbon Adsorber (HOP-ADBR-00001A/B, HOP-ADBR-00002A/B)

**Routine Operations**

The activated carbon (AC) adsorber removes volatile mercury from the offgas at a mildly elevated temperature. The AC column consists of two sulfur-impregnated activated charcoal beds. Each bed is contained inside a vessel that is insulated. The piping and valving are arranged to operate the beds in series (normal), in parallel, or individually. Connections are provided on each vessel to load the AC through isolation valves from multiple lines using a manual gravity feed chute supplied from a feed hopper located above the vessel(s). Spent AC is removed from a bed by gravity draining through multiple line isolation valves and using a screw conveyor system to route the AC to a vessel for packaging. The second bed can continue operation during bed changeout. A manual water deluge (by manual hose connection) of the vessel containing carbon filtration material is activated by operators based on vessel temperature and CO indications. CO monitors before and after the pressure vessel containing carbon filtration material, actuate an interlock to close the isolation valves and open the offgas bypass valve on high CO differential. The vessel inlet isolation valve provides a seal intended to be adequate to starve the fire of oxygen and limits the amount of offgas that can enter the pressure vessel. The system is activated based on differential inlet to exit CO concentration. The offgas inlet isolation valve is automatically closed on system activation. A water overflow valve is automatically activated in each vessel in case of fire to prevent overfilling with water. A water drain system is also provided.

**Non-Routine Operations that Could Affect** Corrosion or Erosion

None identified.

# *Drawings and Documents*

## Operating Unit Group 10 – Appendix 10.10
## High Level Waste Building
## Critical Systems Equipment/Instrument List

The documents listed in the following table are incorporated by reference into this permit and are subject to the requirements set forth in Part I Standard Conditions, Part II General Facility Conditions, and Part III Operating Unit Group 10 Conditions. Upon request, copies of the documents can be viewed at the Nuclear Waste Program Resource Center located at 3100 Port of Benton Blvd. Richland, WA. Appointments for viewing can be scheduled by calling (509) 372-7950.

| ***Drawing/Documents*** | ***Description*** |
|---|---|
| Rev 01-17-2007 | Room and Equipment List for EL.-21 |
| Rev 01-17-2007 | Room and Equipment List for EL. 0 |
| Rev 01-17-2007 | Room and Equipment List for EL. 37 |
| Rev 01-17-2007 | Room and Equipment List for EL. 58 |
| RESERVED | RESERVED |

Source documents (which do not include a "P" in the last set of numbers, e.g. "-P0001," or "-TP001") should be used in conjunction with any document change notices issued against them.

We are currently transitioning from permit documents (which do include a "P" in the last set of numbers) to source documents. At the end of the transition period, permit submittals will contain source documents and will be incorporated into the permit as described in Ecology Publication # 07-05-006 (www.ecy.wa.gov/biblio/nwp.html).

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# *Drawings and Documents*

## Operating Unit Group 10 – Appendix 10.11
## High Level Waste Building
## IQRPE Reports

The documents listed in the following table are incorporated by reference into this permit and are subject to the requirements set forth in Part I Standard Conditions, Part II General Facility Conditions, and Part III Operating Unit Group 10 Conditions. Upon request, copies of the documents can be viewed at the Nuclear Waste Program Resource Center located at 3100 Port of Benton Blvd. Richland, WA. Appointments for viewing can be scheduled by calling (509) 372-7950.

| ***Drawing/Document*** | ***Description*** |
|---|---|
| CCN 159562, IA-3002325-000, Rev 0 | IQRPE Integrity Assessment Report for HSH-TK-00001 and HSH-TK-00002 |
| CCN 169563, IA-3002378-000, Rev 0 | IQRPE Integrity Assessment Report for HOP-ABS-00002/3 |
| CCN 208821,IA-3005092-000 | IQRPE Structural Integrity Assessment Report for HLW Secondary Containment |
| 24590-CM-HC4-HXYG-00138-01-00021, Rev 00B | IQRPE Integrity Assessment Report for HOP Miscellaneous Unit Sub-systems |
| 24590-CM-HC4-HXYG-00138-01-15, Rev 00B | IQRPE Integrity Assessment Report for HLW Portion of Below Grade Transfer Lines, Secondary Containment, Ancillary Equipment, and Corrosion Assessment, Rev. 1 |
| 24590-CM-HC4-HXYG-00138-01-17, Rev 00A | IQRPE Integrity Assessment Report for HOP-VSL-00903/4 |
| 24590-CM-HC4-HXYG-00138-02-08, Rev 00B | IQRPE Integrity Assessment Report for El. -21 HOP Ancillary Equipment |

| | |
|---|---|
| 24590-CM-HC4-HXYG-00138-02-00010, Rev 00A | IQRPE Integrity Assessment Reports PVV System Ancillary Equipment |
| 24590-CM-HC4-HXYG-00138-02-00024, Rev 00A | IQRPE Integrity Assessment Report for HDH-VSL-00001/2/3/4 |
| 24590-CM-HC4-HXYG-00138-02-00025, Rev 00B | IQRPE Integrity Assessment Report for El. 0 to 58 HOP Ancillary Equipment |
| 24590-CM-HC4-HXYG-00138-02-00026, Rev 00A | IQRPE Integrity Assessment Report for El. 0 HOP Miscellaneous Unit Subsystems |
| 24590-CM-HC4-HXYG-00138-02-00030, Rev 00A | IQRPE Integrity Assessment Report for El. 0 HFP Ancillary Equipment |
| 24590-CM-HC4-HXYG-00138-02-00043, Rev. 00A | IQRPE Integrity Assessment Report for RLD-VSL-00002/7/8 |
| 24590-CM-HC4-HXYG-00138-02-00044, Rev 00A | IQRPE Integrity Assessment Report for El. 21 RLD Ancillary Equipment |
| 24590-CM-HC4-HXYG-00138-02-00048, Rev 00A | IQRPE Integrity Assessment Report for PJV Ancillary Equipment |
| 24590-CM-HC4-HXYG-00138-02-00049, Rev 00A | IQRPE Integrity Assessment Report for PJV-HEPA-00004A/4B/5A/5B and PJV-HTR-00002 |
| 24590-CM-HC4-HXYG-00138-02-00055 Rev. 00A | IQRPE Integrity Assessment Report for HDH Ancillary Equipment |
| AREVA-IA-084, Rev. 0 | IQRPE Integrity Assessment Report for Melter Process HMP System Miscellaneous Treatment Unit |
| AREVA-IA-082, Rev. 1 | IQRPE Integrity Assessment Report for Melter Process HMP System Miscellaneous Treatment Unit Subsystem Equipment Ancillary Equipment |
| RESERVED | RESERVED |

Source documents (which do not include a "P" in the last set of numbers, e.g. "-P0001," or "-TP001") should be used in conjunction with any document change notices issued against them.

We are currently transitioning from permit documents (which do include a "P" in the last set of numbers) to source documents. At the end of the transition period, permit submittals will contain source documents and will be incorporated into the permit as described in Ecology Publication # 07-05-006 (www.ecy.wa.gov/biblio/nwp.html).

CCN: 208821

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BY PDC

AREVA

AFS-11-0240

April 28, 2011

Ms. Trina Howard
Subcontract Administrator
Bechtel National, Inc.
2435 Stevens Center Place
Richland, Washington 99354

Dear Ms. Howard:

**BECHTEL NATIONAL, INC. CONTRACT NO. 24590-CM-HC4-HXYG-00211 IQRPE STRUCTURAL INTEGRITY ASSESSMENT REPORT FOR HLW SECONDARY CONTAINMENT (IA-3005092-000)**

The integrity assessment of the HLW building secondary containment has been completed per the contract requirements and is enclosed for your use. The assessment found that the design is sufficient to ensure that the secondary containment rooms are adequately designed and have sufficient structural strength, compatibility with the waste(s) to be processed/stored/treated, and corrosion protection to ensure that they will not collapse, rupture, or fail.

If you have any questions, please contact Tarlok Hundal at (509) 371-1975, or via email at tarlok.hundal@areva.com.

Sincerely,

Fred R. Renz
Contracts Administration
AREVA Federal Services LLC
Richland Office

Enclosure (1)

llm

cc: D. C. Pfluger, MS 5-L w/enclosure (2)

**AREVA Federal Services LLC**

2101 Horn Rapids Road, RC-19, Richland, WA 99354, P.O. Box 840, Richland, WA 99352
Tel.: 509-375-8096 - Fax: 509-375-8495 - www.areva.com

IA-3005092-000

# IQRPE STRUCTURAL INTEGRITY ASSESSMENT REPORT FOR HLW SECONDARY CONTAINMENT

**Please note that source, special nuclear and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the U.S. Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.**

IA-3005092-000

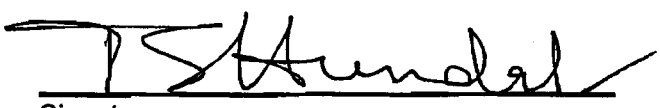
# IQRPE STRUCTURAL INTEGRITY ASSESSMENT REPORT FOR HLW SECONDARY CONTAINMENT

"I, Tarlok Singh Hundal have reviewed and certified a portion of the design of a new tank system or component located at the Hanford Waste Treatment Plant, owned/operated by Department of Energy, Office of River Protection, Richland, Washington. My duties were independent review of the current design for the HLW Secondary Containment, as required by the Washington Administrative Code, *Dangerous Waste Regulations*, Section WAC-173-303-640(3) (a) through (g) applicable components."

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

The documentation reviewed indicates that the design fully satisfies the requirements of the WAC.

The attached review is sixteen (16) pages numbered one (1) through sixteen (16).



Signature

4/28/11

Date

| | | |
|---|---|---|
| **Scope** | Scope of this Integrity Assessment | This Integrity Assessment addresses the dangerous waste permit (DWP) affecting Secondary Containment rooms in HLW building from floor Elevation (-) 21'-0" to Elevation 37'-0". These rooms are listed in 24590-HLW-RPT-ENV-09-001 document and are shown on the General Arrangement Plan drawings listed in the References below. The aforementioned document identifies each room and the plant items and/or ancillary equipment it houses at various floor elevations of the HLW building. The DWP affecting rooms considered in this assessment report are:<br><br>**Rooms at Elevation (-) 21'-0":** H-B005, H-B014, H-B021, H-B032, H-B035, H-B039A, and H-B039B.<br><br>**Rooms at Elevation 0'-0" and other Elevations between 0'-0" and (-) 21'-0':** H-0106, H-0115, H-0117, H-0121, H-0136, H-0137 (including H-0304A, H-0310A, and pipe chase HCH15).<br><br>**Rooms at Elevation 37'-0":** H-0302, H-0308 (including pipe chase HCH14). |
| **Summary of Assessment** | | For each item of "Information Assessed" (i.e., Criteria) on the following pages, the items listed under "Source of Information" were reviewed and found to furnish adequate design requirements and controls to ensure that the design fully satisfies the requirements of Washington Administrative Code (WAC), Chapter 173-303 WAC, *Dangerous Waste Regulations,* WAC-173-303-640, *Tank Systems.* |

| | | |
|---|---|---|
| References | Drawings | 24590-HLW- P1- P01T- 00001, Rev. 9, HLW Vitrification Building General Arrangement Plan at El. (-) 21'-0";<br>24590-HLW- P1- P01T- 00002, Rev. 7, HLW Vitrification Building General Arrangement Plan at El. 0'-0";<br>24590-HLW- P1- P01T- 00004, Rev. 7, HLW Vitrification Building General Arrangement Plan at El. 37'-0";<br>24590-HLW- P1- P01T- 00008, Rev. 11, HLW Vitrification Building General Sections A-A, B-B & C-C;<br>24590-HLW- P1- P01T- 00009, Rev. 11, HLW Vitrification Building General Sections D-D, E-E & F-F;<br>24590-HLW- P1- P01T- 00010, Rev. 11, HLW Vitrification Building General Section G-G & H-H;<br>24590-HLW- P1- P01T- 00011, Rev. 11, HLW Vitrification Building General Section J-J & K-K;<br>24590-HLW-DD-S13T-00013, Rev. 5, HLW Vitrification Building Structural Melter Cave #2 Liner Plate Plan, Section and Details;<br>24590-HLW-DD-S13T-00014, Rev. 4, HLW Vitrification Building Structural Melter Cave #2 Liner Plate Plan and Section;<br>24590-HLW-DD-S13T-00015, Rev. 4, HLW Vit Bldg Struct Canister Handling Cave Flr. Grillage, Insulation & SS Liner Plate Plan and Sections;<br>24590-HLW-DD-S13T-00021, Rev. 3, HLW Vitrification Building Structural Canister Handling Cave SS Wall Liner Partial Plan and Details;<br>24590-HLW-DD-S13T-00033, Rev. 3, HLW Vitrification Building Structural Concrete Embedment Details;<br>24590-HLW-DD-S13T-00041, Rev. 1, HLW Vitrification Building Structural Active Services Cell Melters I and II Liner Plate Plan;<br>24590-HLW-DD-S13T-00150, Rev. 5, HLW Vitrification Building Conc. SS Liner Plate & Insulation Pour Tunnels 1 and 2 Plan at El. (-) 21'-0";<br>24590-HLW-DD-S13T-00002001, Rev. 20, HLW Vitrification Building Concrete Stainless Steel Liners Plan at El. (-) 21'-0", Sheet 1;<br>24590-HLW-DD-S13T-00002002, Rev. 5, HLW Vitrification Building Concrete Stainless Steel Liners Plan at El. (-) 21'-0", Sheet 2;<br>24590-HLW-DD-S13T-00002003, Rev. 5, HLW Vitrification Building Concrete Stainless Steel Liners Sections and Details El. (-) 21'-0";<br>24590-HLW-D0-S13T-00002, Rev. 3, HLW Vitrification Building Concrete General Notes Abbreviation & Legend;<br>24590-HLW-D0-S13T-00003, Rev. 9, HLW Vitrification Building Notes on Concrete and Reinforcing Steel;<br>24590-HLW-DB-S13T-00001, Rev. 13, HLW Vitrification Building Concrete General Arrangement Plan at El. (-) 21'-0";<br>24590-HLW-DB-S13T-00002, Rev. 5, HLW Vitrification Building Concrete Overall Plan at El. 0'-0";<br>24590-HLW-DB-S13T-00004, Rev. 3, HLW Vitrification Building Concrete Overall Plan at El. 37'-0";<br>24590-HLW-DB-S13T-00007, Rev. 15, HLW Vitrification Building Structural Concrete Placement Plan at El. (-) 21'-0";<br>24590-HLW-DB-S13T-00015, Rev. 12, HLW Vitrification Building Structural Concrete Wall Placement Plan at El. 0'-0";<br>24590-HLW-DB-S13T-00021, Rev. 2, HLW Vitrification Building Structural Concrete Forming Partial Plan El. 0'-0";<br>24590-HLW-DB-S13T-00022, Rev. 2, HLW Vitrification Building Structural Concrete Forming Partial Plan El. 0'-0";<br>24590-HLW-DB-S13T-00026, Rev. 4, HLW Vitrification Building Structural Concrete Forming Partial Plan El. 0'-0";<br>24590-HLW-DB-S13T-00071, Rev. 3, HLW Vitrification Building Structural Concrete Forming Partial Plan El. 37'-0" Area 1;<br>24590-HLW-DB-S13T-00072, Rev. 2, HLW Vitrification Building Structural Concrete Forming Partial Plan El. 37'-0" Area 2;<br>24590-HLW-DB-S13T-00079, Rev. 2, HLW Vitrification Building Structural Concrete Forming Partial Plan El. 37'-0" Area 9;<br>24590-HLW-DB-S13T-00105, Rev. 7, HLW Vitrification Building Structural Concrete Wall Reinforcement Sections and Details;<br>24590-HLW-DB-S13T-00151, Rev. 3, HLW Vitrification Building Structural Concrete Forming Plan at El. (-) 21'-0";<br>24590-HLW-DB-S13T-00156, Rev. 6, HLW Vitrification Building Structural Concrete Forming Plan at El. (-) 21'-0";<br>24590-HLW-DB-S13T-00166, Rev. 3, HLW Vitrification Building Structural Concrete Forming Partial Section NE;<br>24590-HLW-DB-S13T-00263, Rev. 6, HLW Vitrification Building Structural Concrete Forming Elevations @ Col Line N and South Face;<br>24590-HLW-DB-S13T-00324, Rev. 2, HLW Vitrification Building Structural Concrete Forming Elevation @ Col Line 13.1 East and West Face;<br>24590-HLW-DB-S13T-00651, Rev. 6, HLW Vitrification Building Structural Concrete Wall Reinforcement Sections and Details; |

| | | |
|---|---|---|
| References (cont'd) | Drawings | 24590-HLW-DG-S13T-00001001, Rev. 7, HLW Vitrification Building Structural Concrete Base Mat Reinf. Plan El. (-) 21'-0" Top Reinf.;<br>24590-HLW-DG-S13T-00001002, Rev. 7, HLW Vitrification Building Structural Concrete Base Mat Reinf. Plan El. (-) 21'-0" Bottom Reinf.;<br>24590-HLW-DG-S13T-00002, Rev. 8, HLW Vitrification Building Structural Concrete Reinf. Plan (Top) at El. 0'-0";<br>24590-HLW-DG-S13T-00003, Rev. 6, HLW Vitrification Building Structural Concrete Reinf. Plan (Bottom) at El. 0'-0";<br>24590-HLW-DG-S13T-00033, Rev. 3, HLW Vitrification Building Structural Concrete Reinf. Partial Plan at El. 37'-0";<br>24590-HLW-DG-S13T-00034, Rev. 2, HLW Vitrification Building Structural Concrete Reinf. Partial Plan at El. 37'-0";<br>24590-HLW-DG-S13T-00090, Rev. 12, HLW Vitrification Building Structural Concrete Wall Reinforcement Partial Section NN;<br>24590-HLW-DG-S13T-00148, Rev. 3, HLW Vitrification Building Structural Wall & Floor Reinforcement Sections and Details;<br>24590-HLW-SS-S15T-00002, Rev. 6, HLW Vitrification Building Structural Steel Framing Overall Plan El. 0'-0";<br>24590-HLW-SS-S15T-00004, Rev. 2, HLW Vitrification Building Structural Steel Framing Overall Plan El. 37'-0";<br>24590-HLW-SS-S15T-00022, Rev. 7, HLW Vitrification Building Structural Steel Framing Partial Plan at El. 0'-0" in (Area 2);<br>24590-HLW-SS-S15T-00023, Rev. 10, HLW Vitrification Building Structural Steel Framing Partial Plan at El. 0'-0" (Area 3);<br>24590-HLW-SS-S15T-00042, Rev. 4, HLW Vitrification Building Structural Steel Framing Partial Plan El. 37'-0" in (Area 2);<br>24590-HLW-SS-S15T-00043, Rev. 6, HLW Vitrification Building Structural Steel Framing Partial Plan El. 37'-0" (Area 3);<br>24590-HLW-SS-S15T-00102, Rev. 3, HLW Vitrification Building Structural Steel Framing Elevation Col Line A;<br>24590-HLW-SS-S15T-00103, Rev. 3, HLW Vitrification Building Structural Steel Framing Elevation Col Line A;<br>24590-HLW-SS-S15T-00149, Rev. 1, HLW Vitrification Building Structural Steel Framing Elevation Col Line T Sheet 1;<br>24590-HLW-SS-S15T-00150, Rev. 0, HLW Vitrification Building Structural Steel Framing Elevation Col Line T Sheet 2;<br>24590-HLW-SS-S15T-00153, Rev. 1, HLW Vitrification Building Structural Steel Framing Elevation Col Line 1;<br>24590-HLW-SS-S15T-00157, Rev. 3, HLW Vitrification Building Structural Steel Framing Elevation Col Line 5 Sheet 1;<br>24590-HLW-SS-S15T-00168, Rev. 0, HLW Vitrification Building Structural Steel Framing Elevation Col Line 10 Sheet 2;<br>24590-HLW-SS-S15T-00190, Rev. 3, HLW Vitrification Building Structural Steel Framing Elevation Col Line 21;<br>24590-HLW-SS-S15T-00260, Rev. 11, HLW Vitrification Building Structural Steel Details;<br>24590-HLW-SS-S15T-00265, Rev. 5, HLW Vitrification Building Structural Steel Typical Connection Details;<br>24590-HLW-SS-S15T-00332, Rev. 5, HLW Vitrification Building Structural Steel Column Base Plate Details. |

| Information Assessed | | Source of Information | Assessment |
|---|---|---|---|
| Foundation Design | Description of subsurface conditions and soil bearing capacity are adequate. | 24590-HLW-RPT-ENV-09-001, Rev. 0, Dangerous Waste Permit Secondary Containment Requirements for HLW Facility;<br>24590-WTP-DC-ST-01-001, Rev. 12D, Structural Design Criteria;<br>24590-BOF-3PS-CE01-T0001, Rev. 6, Engineering Specification for Excavation and Backfill;<br>24590-BOF-3PS-C000-T0001, Rev. 6, Engineering Specification for Material Testing Services;<br>24590-HLW-DGC-S13T-00001, Rev. 0, Verification of HLW Basemat Thickness in Support of LCAR;<br>24590-HLW-DGC-S13T-00002, Rev. 3, Foundation Slab Rebar Below Grade;<br>24590-HLW-S0C-S15T-00006, Rev. E, HLW Vitrification Building Seismic Analysis- Structural Model;<br>WTSC99-1036-42-17B, RPP-WTP Final Report Geotechnical Investigation, Shannon & Wilson Inc. (H-1616-51), July 2000;<br>24590-BOF-3PS-CE00-T0001, Rev. 0, Technical Specification for Site Work. | The Dangerous Waste Permit document lists the rooms at various elevations in HLW building requiring the secondary containment. Details of the secondary containment requirements in each room are identified in the above document. The Structural Design Criteria adequately presents design guidance for both mat and spread footings based on the Geotechnical Investigation report for the site. This report concluded that the liquefaction of the subsurface soil is unlikely during an earthquake event because the ground water table is about 275 ft below the ground surface. Bearing capacity and settlement design parameters are furnished for the dense Hanford Upper and Lower Sand Units and Structural Fill. Use of the loose wind blown (dune) sands for foundations is precluded. The Verification of HLW Basemat Thickness calculations reviewed indicates that the allowable bearing of subsurface soil below the foundation mat is more than the maximum computed value. The Excavation and Backfill Specification provides structural backfill requirements based on the Geotechnical Investigation report and adequate current codes and standards for selection, placing, and compacting structural backfill including testing of candidate fill materials and completed backfills. The Specification for Material Testing Services provides current adequate codes and standards for testing of candidate structural fill materials and in-situ testing of structural fills as they are constructed. The codes and standards are consistent with those called out in the Excavation and Backfill Specification. Review of the sample calculations shows that appropriate values of the soil parameters including allowable bearing capacity, were used for the secondary containment structures' design. |

| Information Assessed | | Source of Information | Assessment |
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| Foundation Design (cont'd) | Foundation design loads (including full tanks) and estimated settlement are adequately considered. | 24590-WTP-DC-ST-01-001, Rev. 12D, Structural Design Criteria;<br>ASCE 7-98, Minimum Design Loads for Buildings and Other Structures;<br>ACI 349-01, Code Requirements for Nuclear Safety-Related Concrete Structures;<br>ACI 318-99, Building Code Requirements for Structural Concrete;<br>24590-HLW-DGC-S13T-00001, Rev. 0, Verification of HLW Basemat Thickness in Support of LCAR;<br>24590-HLW-DGC-S13T-00002, Rev. 3, Foundation Slab Rebar Below Grade;<br>24590-HLW-DGC-S13T-00010, Rev. B, HLW Concrete Subsidence Evaluation;<br>24590-HLW-DGC-S13T-00044, Rev. A, EL.+ 0 ft Slab Rebar Design –Area 2;<br>24590-HLW-DGC-S13T-00046, Rev. B, EL.+ 0 ft Slab Rebar Design –Area 4;<br>24590-HLW-DGC-S13T-00073, Rev. A, EL.+ 0 ft Slab –Wall Dowel Design;<br>24590-HLW-DGC-S13T-00100, Rev. 0, Construction Equipment on Elev. 0'-0";<br>24590-HLW-DGC-S13T-00115, Rev. A, HLW-Validation of Conc. for Slab at EL.(-) 21' and Walls from EL.(-) 21' to 0' for RGM;<br>24590-HLW-DGC-S13T-00130, Rev. A, HLW Slab Reinforcing @ Floor Elevation +37'-0" Bounded by Col. Lines 1-11 and B-M;<br>24590-HLW-DGC-S13T-00131, Rev. A, HLW Slab Reinforcing @ Floor Elevation +37'-0" Bounded by Col. Lines 11-20 and B-M. | The Structural Design Criteria uses current adequate standards to define design loads and load combinations (ASCE 7-98, ACI 349-01 and ACI 318-99). Dead and fluid loads are included in these loads and load combinations. Settlement design parameters are included in the Structural Design Criteria subsection on "geotechnical design parameters and foundation design." Review of the sample calculations for various floor elevation slabs shows that the full loads of the tanks and other applicable equipment including the in-structural seismic response and displacement's induced forces from other components and soil loads have been appropriately considered in the foundation design. |

| Information Assessed | | Source of Information | Assessment |
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| Foundation Design (cont'd) | Design calculation approach and design basis of footings with design standard references (e.g., ACI) are adequate. | 24590-WTP-DC-ST-01-001, Rev. 12D, Structural Design Criteria;<br>ACI 349-01, Code Requirements for Nuclear Safety-Related Concrete Structures;<br>ACI 318-99, Building Code Requirements for Structural Concrete;<br>24590-WTP-PER-CSA-02-001, Rev. 9, Secondary Containment Design;<br>24590-HLW-DGC-S13T-00001, Rev. 0, Verification of HLW Basemat Thickness in Support of LCAR;<br>24590-HLW-DGC-S13T-00002, Rev. 3, HLW Foundation Slab Rebar Below Grade;<br>24590-HLW-DGC-S13T-00044, Rev. A, El. 0'-0" Slab Rebar Design Area 2;<br>24590-HLW-SSC-S15T-00030, Rev. E, HLW Elevation 0'-0" Primary Steel - Release 4;<br>24590-HLW-SSC-S15T-00076, Rev. B, HLW Elevation 37'-0" Forming and Primary Steel – Supporting Concrete;<br>24590-HLW-SSC-S15T-00305, Rev. A, HLW Design of Connections for Steel Framing Elevation 15'-30', and 37' and Melter Roof for HLW Building;<br>24590-WTP-VV-ST-01-001, Rev. 5A, Verification and Validation Test Plan and Test Report for GTSTRUDL;<br>24590-HLW-DVR-ST-02-102, Rev. 0, HLW Building Vitrification Structural Drop Analysis. | The Structural Design Criteria references current adequate design criteria for the design of concrete foundations and footings. ACI 349-01 is referenced for design of "safety" grade structures and ACI 318-99 is referenced for the strength design of "commercial grade" structures. The Secondary Containment Design document provides the design approach, basis, and methodology used for the design of the secondary containment foundations/footings. The input parameters used in the GTSTRUDL computer code utilized for this secondary containment design are appropriate and the output results have been appropriately validated via the Verification and Validation Test Plan and Test Report document. Review of the requirement documents and sample calculations shows that the design basis and approach, methodology, and the codes and standards used are appropriate for the foundation design to adequately withstand the applicable loads including the seismic and soil loads. |

| | Information Assessed | Source of Information | Assessment |
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| Foundation Design (cont'd) | Foundation material is compatible with the soil. | 24590-WTP-3PS-D000-T0001, Rev. 7, Engineering Specification for Concrete Work;<br>24590-WTP-3PS-DB01-T0001, Rev. 8, Engineering Specification for Furnishing and Delivering Ready-Mix Concrete;<br>24590-BOF-3PS-C000-T0001, Rev. 6, Engineering Specification for Material Testing Services;<br>24590-WTP-DB-ENG-01-001, Rev. 1P, Basis of Design.<br>24590-WTP-3PS-DG00-T0001, Rev. 4, Engineering Specification for Furnishing of Reinforcing Steel. | The specification documents for Concrete Work and Furnishing and Delivering Ready-Mix Concrete provide adequate current requirements for design, testing, and the selection of coarse and fine aggregates and the procurement of cementitious materials. Adequate test procedures are provided in the Material Testing Services specification for testing candidate aggregates for chemical reactivity. Instructions for mixing and delivering Ready-Mix Concrete are adequate and current. As noted in Section 4.7 of the Basis of Design document, the water table lies about 250 feet below the ground surface elevation of the HLW Facility Site, so there is little reason to expect compatibility problems between the concrete foundations and the site soils. |
| | Foundation will withstand the effects of frost heave | Drawings listed above under References;<br><br>24590-WTP-DC-ST-01-001, Rev. 12D, Structural Design Criteria. | The Structural Design Criteria includes adequate provisions to preclude frost heave in the section addressing lateral earth pressure loads. All structural foundations are required to extend into the soil below the frost line to preclude frost heave. The frost line is 30 inches below the finished grade (El. 0'-0"), however, the drawings show that majority of the top of HLW foundation mat is at (-) 21'-0" and some sections are even lower than this. Therefore, the secondary containment foundations will not be subjected to frost heave effects. |

| Information Assessed | | Source of Information | Assessment |
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| Seismic Design | Seismic considerations have been adequately addressed. | 24590-WTP-PER-CSA-02-001, Rev. 9, Secondary Containment Design;<br>24590-WTP-DC-ST-01-001, Rev. 12D, Structural Design Criteria;<br>ACI 349-01, Code Requirements for Nuclear Safety-Related Concrete Structures;<br>ACI 318-99, Building Code Requirements for Structural Concrete;<br>ANSI/AISC N690, Specification for the Design, Fabrication and Erection of Steel Safety-Related Structures for Nuclear Facilities;<br>AISC MO16-89, Manual of Steel Construction - Allowable Stress Design;<br>ASCE 4-98, Seismic Analysis of Safety Related Nuclear Structures and Commentary;<br>24590-HLW-S0C-S15T-00006, Rev. E, HLW Virtification Building Structural Analysis- Structural Model;<br>24590-HLW-S0C-S15T-00011, Rev. 0, Structural Analysis of HLW Building – In Support of LCAR;<br>24590-HLW-S0C-S15T-00013, Rev. 0, HLW Virtification Building Structural Drop Analysis –for PCAR;<br>24590-HLW-DGC-S13T-00002, Rev. 3, Found. Slab Rebar Below Grade;<br>24590-HLW-DGC-S13T-00044, Rev. A, El. +0 ft Slab Rebar Design Area 2;<br>24590-HLW-DGC-S13T-00046, Rev. B, El. +0 ft Slab Rebar Design Area 4;<br>24590-HLW-DGC-S13T-00100, Rev. 0, Construction Equip. on Elev. 0'-0".<br>24590-HLW-DGC-S13T-00073, Rev. A, El. +0 ft Slab-Wall Dowell Design;<br>24590-HLW-DGC-S13T-00115, Rev. A, HLW-Validation of Conc. for Slab at EL.(-) 21' and Walls from EL.(-) 21' to 0' for RGM;<br>24590-HLW-DGC-S13T-00130, Rev. A, HLW Slab Reinforcing @ Floor Elevation +37'-0" Bounded by Col. Lines 1-11 and B-M;<br>24590-HLW-DGC-S13T-00131, Rev. A, HLW Slab Reinforcing @ Floor Elevation +37'-0" Bounded by Col. Lines 11-20 and B-M;<br>24590-HLW-SSC-S15T-00030, Rev. E, Elev. 0' Primary Steel-Release 4;<br>24590-HLW-SSC-S15T-00076, Rev. B, Elev. 37' Forming and Primary Steel Supporting Concrete;<br>24590-HLW-SSC-S15T-00305, Design of Connections for Steel Framing at Elevation 15'-30', 37' and Melter Roof for HLW Building;<br>24590-WTP-VV-ST-01-001, Rev. 5A, Verification and Validation Test Plan and Test Report for GTSTRUDL;<br>24590-WTP-VV-ST-05-004, Rev. 3B, SAP 2000 Verification and Validation Test Report. | The Secondary Containment Design document describes and provides references for the design methodology, materials, loads, and load combinations (including seismic loads) for the HLW Building secondary containment. The Structural Design Criteria provides detailed discipline specific codes and standards for the design of Seismic Category (SC-I/II) HLW secondary containment foundations and structures by the design engineers. ACI-349-01 and ACI 318-99 provide the design codes and load combinations for design of the secondary containment reinforced concrete foundations and structures. Structural steel components of the secondary containment structures and stainless steel liners are designed using ANSI/AISC N690 and the AISC Allowable Stress Design code. ASCE 4-98 is used for guidance on seismic analysis of safety-related nuclear structures. The GTSTRUDL and SAP 2000 structural software codes were used for concrete and steel members design. The codes and standards listed above are adequate and acceptable for addressing seismic considerations. Review of the sample calculations shows that the requirements of the applicable codes and standards are appropriately incorporated in these documents and output results were verified per V & V Test Reports. The review also concluded that the secondary containment components including the liner materials are adequately designed to withstand seismic forces and displacements. |

| | Information Assessed | Source of Information | Assessment |
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| Compatibility | The stored waste is compatible with its Secondary Containment and leak detection hardware based on a detailed chemical and physical analysis of the wastes used and other information sources. | 24590-WTP-DB-ENG-01-001, Rev. 1P, Basis of Design;<br>24590-WTP-PER-M-02-001, Rev. 3, Material Selections for Building Secondary Containment/Leak Detection;<br>24590-WTP-PER-CSA-02-001, Rev. 9, Secondary Containment Design;<br>24590-WTP-3PS-AFPS-T0006, Rev. 2, Engineering Specification for Field Applied Special Protective Coatings for Secondary Containment Areas;<br>24590-HLW-PER-M-02-001, Rev. 3, HLW Facility Sump Data;<br>24590-HLW-PER-M-02-003, Rev. 3, Flooding Volume for HLW Facility;<br>24590-WTP-3PS-NLLR-T0002, Rev. 1, Engineering Specification for Furnishing, Detailing, Fabrication, Delivery and Installation of Stainless Steel Liner Plates. | The Basis of Design document states that cells and sumps are appropriately lined and any spills are removed and flushed within 24-hrs or as timely as possible. The Secondary Containment Design document requires the use of stainless steel liner or special protective coatings (SPC) liner for various process cells and rooms at different elevations of HLW building. Flood Volume documents provide required specific liner height in various rooms. Based on detailed analysis of the corrosive properties of expected waste process operations and evaluation of potential leak scenarios, the Material Selection report identifies appropriate and adequate corrosion resistant materials requirements for Secondary Containment liners, sumps and leak detection equipment. The Engineering Specification for Field Applied Special Protective Coatings (SPCs) provides the selection test criteria used to determine acceptable approved coating systems. These test criteria include chemical resistance endurance requirements and wear abrasion resistance criteria which provides liners compatibility with the wastes considered. The Secondary Containment Design document provides adequate typical construction details for liners including tank anchorage details, stainless steel liner installation details and SPC installation details to be used for Secondary Containment. Rooms at various elevations are provided with floor drains as itemized in the Sump Data document for the HLW. All sumps are equipped with leak detection; however, individual floor drains are not equipped with leak detection. |

| Information Assessed | | Source of Information | Assessment |
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| Strength | The design shows that the Secondary Containment has sufficient strength and thickness to prevent failure owing to pressure gradients, static head during a release, physical contact with the waste, climatic conditions, and the stress of daily operations (e.g., vehicular traffic). | Drawings listed above under References;<br><br>24590-WTP-DC-ST-01-001, Rev. 12D, Structural Design Criteria;<br>24590-WTP-PER-CSA-02-001, Rev. 9, Secondary Containment Design;<br>24590-WTP-3PS-NLLR-T0002, Rev. 1, Engineering Specification for Furnishing, Detailing, Fabrication, Delivery and Installation of Stainless Steel Liner Plates;<br>24590-WTP-PER-M-02-001, Rev. 3, Material Selections for Building Secondary Containment/Leak Detection;<br>24590-HLW-DGC-S13T-00001, Rev. 0, Verification of HLW Basemat Thickness in Support of LCAR;<br>24590-HLW-DGC-S13T-00002, Rev. 3, Foundation Slab Rebar Below Grade.<br>24590-HLW-DGC-S13T-00044, Rev. A, El. +0 ft Slab Rebar Design Area 2;<br>24590-HLW-DGC-S13T-00046, Rev. B, El. +0 ft Slab Rebar Design Area 4;<br>24590-HLW-DGC-S13T-00100, Rev. 0, Construction Equip. on Elev. 0'-0";<br>24590-HLW-DGC-S13T-00073, Rev. A, El. +0 ft Slab-Wall Dowell Design;<br>24590-HLW-DGC-S13T-00115, Rev. A, HLW-Validation of Conc. for Slab at EL.(-) 21' and Walls from EL.(-) 21' to 0' for RGM;<br>24590-HLW-DGC-S13T-00130, Rev. A, HLW Slab Reinforcing @ Floor Elevation +37'-0" Bounded by Col. Lines 1-11 and B-M;<br>24590-HLW-DGC-S13T-00131, Rev. A, HLW Slab Reinforcing @ Floor Elevation +37'-0" Bounded by Col. Lines 11-20 and B-M. | Because the Secondary Containment structures being considered are installed inside the HLW Vitrification Building as shown on the general arrangement drawings, climatic conditions and vehicular traffic are not applicable load cases. The Secondary Containment Design requirements document identifies adequate and appropriate design codes and standards and all applicable load cases (operational stresses) from site specific conditions that must be considered in the design. The Engineering Specification for Furnishing Stainless Steel Liner Plates includes specific provisions for protection of and repair of completed liners during the construction process. Review of the sample calculations shows that the secondary containment structures are designed appropriately with sufficient strength to sustain the applicable loads. Factors that were considered during stainless steel liner material selection and special protective coating (SPC) material selection are adequately discussed in the Material Selections for Building Secondary Containment/Leak Detection document. |

| Information Assessed | | Source of Information | Assessment |
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| Strength (cont'd) | The Secondary Containment system has sufficient strength in the presence of operational stresses from site-specific conditions (i.e., traffic, heavy equipment, precipitation, frost). | Drawings listed above under References;<br><br>24590-WTP-DC-ST-01-001, Rev. 12D, Structural Design Criteria;<br>24590-WTP-PER-CSA-02-001, Rev. 9, Secondary Containment Design;<br>24590-WTP-3PS-NLLR-T0002, Rev. 1, Engineering Specification for Furnishing, Detailing, Fabrication, Delivery and Installation of Stainless Steel Liner Plates;<br>24590-WTP-PER-M-02-001, Rev. 3, Material Selections for Building Secondary Containment/Leak Detection;<br>24590-HLW-DGC-S13T-00002, Rev. 3, Foundation Slab Rebar Below Grade.<br>24590-HLW-DGC-S13T-00044, Rev. A, El. +0 ft Slab Rebar Design Area 2;<br>24590-HLW-DGC-S13T-00046, Rev. B, El. +0 ft Slab Rebar Design Area 4;<br>24590-HLW-DGC-S13T-00100, Rev. 0, Construction Equip. on Elev. 0'-0";<br>24590-HLW-DGC-S13T-00073, Rev. A, El. +0 ft Slab-Wall Dowell Design;<br>24590-HLW-DGC-S13T-00115, Rev. A, HLW-Validation of Conc. for Slab at EL.(-) 21' and Walls from EL.(-) 21' to 0' for RGM;<br>24590-HLW-DGC-S13T-00130, Rev. A, HLW Slab Reinforcing @ Floor Elevation +37'-0" Bounded by Col. Lines 1-11 and B-M;<br>24590-HLW-DGC-S13T-00131, Rev. A, HLW Slab Reinforcing @ Floor Elevation +37'-0" Bounded by Col. Lines 11-20 and B-M. | The Secondary Containment Design requirements document identifies adequate and appropriate design codes and standards and all applicable load cases (operational stresses) from site specific conditions that must be considered in the design. Because the Secondary Containment structures being considered are installed inside the HLW Vitrification Building as shown on the drawings, therefore, traffic, heavy equipment, precipitation, and frost are not applicable load cases. The Engineering Specification for Furnishing Stainless Steel Liner Plates includes specific provisions for protection of and repair of completed liners during the construction process. Review of the sample calculations shows that the secondary containment structures are designed appropriately with sufficient strength to sustain the applicable loads from the specific conditions. Factors that were considered during stainless steel liner material selection and SPC material selection are adequately discussed in the Material Selections for Building Secondary Containment/Leak Detection document. |

| Information Assessed | | Source of Information | Assessment |
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| **Foundation Integrity** | The Secondary Containment is properly supported by a foundation or base in order to prevent failure from settlement, compression, or uplift, including the residual effects of installation. | Drawings listed above under References;<br><br>24590-WTP-DC-ST-01-001, Rev. 12D, Structural Design Criteria;<br>24590-BOF-3PS-CE00-T0001, Rev. 0, Technical Specification for Site Work.<br>24590-WTP-3PS-D000-T0001, Rev. 7, Engineering Specification for Concrete Work;<br>24590-BOF-3PS-CE01-T0001, Rev. 6, Engineering Specification for Excavation and Backfill;<br>24590-BOF-3PS-C000-T0001, Rev. 6, Engineering Specification for Material Testing Services;<br>24590-WTP-PER-CSA-02-001, Rev. 9, Secondary Containment Design.<br>24590-HLW-DGC-S13T-00001, Rev. 0, Verification of HLW Basemat Thickness in Support of LCAR;<br>24590-HLW-DGC-S13T-00002, Rev. 3, Foundation Slab Rebar Below Grade.<br>24590-HLW-S0C-S15T-00006, Rev. E, HLW Vitrification Building Seismic Analysis- Structural Model;<br>24590-HLW-DGC-S13T-00044, Rev. A, El. +0 ft Slab Rebar Design Area 2;<br>24590-HLW-DGC-S13T-00046, Rev. B, El. +0 ft Slab Rebar Design Area 4;<br>24590-HLW-DGC-S13T-00100, Rev. 0, Construction Equip. on Elev. 0'-0".<br>24590-HLW-DGC-S13T-00073, Rev. A, El. +0 ft Slab-Wall Dowell Design;<br>24590-HLW-DGC-S13T-00115, Rev. A, HLW-Validation of Conc. for Slab at EL.(-) 21' and Walls from EL.(-) 21' to 0' for RGM;<br>24590-HLW-DGC-S13T-00130, Rev. A, HLW Slab Reinforcing @ Floor Elevation +37'-0" Bounded by Col. Lines 1-11 and B-M;<br>24590-HLW-DGC-S13T-00131, Rev. A, HLW Slab Reinforcing @ Floor Elevation +37'-0" Bounded by Col. Lines 11-20 and B-M. | These conditions are fully addressed in the Structural Design Criteria and the Secondary Containment Design requirements documents. The design requirements and codes and standards specified are adequate to satisfy the performance goals. The procurement and construction specifications adequately provide for proper foundation construction and installation of the Secondary Containment. The general arrangement plans and the associated design drawings show the secondary containment boundaries. The sample calculations reviewed show that the foundation slabs are appropriately designed and will not fail when subjected loads such as uplift, installation, settlement or residual effects. |

| Information Assessed | | Source of Information | Assessment |
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| Foundation Integrity (cont'd) | The placement, structural support, and type of material used for backfill around and below the Secondary Containment are appropriate. | Drawings listed above under References;<br><br>24590-BOF-3PS-CE01-T0001, Rev. 6, Engineering Specification for Excavation and Backfill;<br>24590-BOF-3PS-C000-T0001, Rev. 6, Engineering Specification for Material Testing Services.<br>24590-HLW-DGC-S13T-00001, Rev. 0, Verification of HLW Basemat Thickness in Support of LCAR;<br>24590-HLW-DGC-S13T-00002, Rev. 3, Foundation Slab Rebar Below Grade. | The Excavation and Backfill and Material Testing specifications contain current adequate industry standards for selecting and testing fill materials, placing and compacting backfills, and testing not less than once each lift to assure adequate compaction. Requirements for testing and record keeping are current and adequate for both "safety grade" fills and "commercial grade" fills. Drawings show that backfill requirements are properly applied, tested, documented, and accepted and approved by BNI. Review of sample calculations shows that appropriate parameters for backfill are used in design. |
| Infiltration | The design or operation (e.g., diking & curbing) prevents run-on or infiltration of precipitation into the Secondary Containment system unless the collection system has sufficient excess capacity (25 yr rainfall) to contain the run-on precipitation. | Drawings listed above under References;<br><br>24590-WTP-DB-ENG-01-001, Rev. 1P, Basis of Design. | This requirement is specified in the Basis of Design document. All secondary containment structure rooms being reviewed in this integrity assessment are located at various levels inside the HLW Vitrification Building where they are protected from precipitation as shown in the general arrangement plans and other associated drawings. Therefore, this requirement is not applicable to these rooms. The Basis of Design document also describes that the ground water table under the WTP site is more than 250 ft below the ground surface which makes it unlikely event for water infiltration or intrusion into the building. |

| | Information Assessed | Source of Information | Assessment |
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| Infiltration (cont'd) | The design includes an external moisture barrier or other means to prevent moisture from entering the cell. | Drawings listed above under References;<br><br>24590-WTP-DB-ENG-01-001, Rev. 1P, Basis of Design.<br>24590-WTP-3PS-NLLR-T0002, Rev. 1, Engineering Specification for Furnishing, Detailing, Fabrication, Delivery and Installation of Stainless Steel Liner Plates;<br>24590-WTP-3PS-AFPS-T0006, Rev. 2, Engineering Specification for Field Applied Special Protective Coatings for Secondary Containment Areas;<br>24590-WTP-PER-J-02-002, Rev. 4, Leak Detection in Secondary Containment Systems. | The secondary containment rooms listed in the Scope section above are shown on the general arrangement plan drawings at floor elevations from (-) 21'-0" up to 37'-0" are located inside the HLW Vitrification Building which protects them from the precipitation and surface water percolation. The Basis of Design document states that the ground water table at WTP site is located more than 250 feet below the ground surface; therefore, infiltration of external moisture into the interior of the building is not a credible event. And furthermore, the subject Secondary Containment rooms as shown on the drawings are lined with stainless steel plates or special protective coating (SPC) material. The sumps in these rooms are equipped with leak detection monitoring instrumentation as an added insurance against moisture infiltration and/or presence. |

| Information Assessed | | Source of Information | Assessment |
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| Liner System | The containment area is free of cracks or gaps and the design discusses methods of their minimization. | 24590-WTP-PER-CSA-02-001, Rev. 9, Secondary Containment Design;<br>24590-WTP-3PS-NLLR-T0002, Rev. 1, Engineering Specification for Furnishing, Detailing, Fabrication, Delivery and Installation of Stainless Steel Liner Plates;<br>24590-WTP-3PS-AFPS-T0006, Rev. 2, Engineering Specification for Field Applied Special Protective Coatings for Secondary Containment Areas. | The Secondary Containment Design requirements document provides adequate and appropriate codes and standards for design of leak-tight liners. This report includes appropriate details for design and installation of stainless steel and special protective coating liners and sumps free of cracks and gaps. The Engineering Specification for Furnishing, Detailing, Fabrication, Delivery and Installation of Stainless Steel Liner Plates provides detailed information on design, fabrication, installation, and inspection of stainless steel liners and sumps. The Engineering Specification for Field Applied Special Protective Coatings provides detailed information on the tested and approved coating systems. This information includes directions for surface preparation, patching materials and application methods, and specific directions for application of multi-layer coatings. From the review of the documents listed in the Sources of Information column, it is concluded that the liner materials applied are adequate. |

| | Information Assessed | Source of Information | Assessment |
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| Liner System (cont'd) | The design has considered the compatibility of the concrete liner or coatings and waste and presents information on coatings planning to be used from the manufacturer addressing compatibility with the stored waste. The lining or coating must prevent the waste from migrating into the concrete. | 24590-WTP-PER-M-02-001, Rev. 3, Material Selections for Building Secondary Containment/Leak Detection;<br>24590-WTP-PER-CSA-02-001, Rev. 9, Secondary Containment Design;<br>24590-WTP-3PS-NLLR-T0002, Rev. 1, Engineering Specification for Furnishing, Detailing, Fabrication, Delivery and Installation of Stainless Steel Liner Plates;<br>24590-WTP-3PS-AFPS-T0006, Rev. 2, Engineering Specification for Field Applied Special Protective Coatings for Secondary Containment Areas. | The Material Selections document contains adequate and appropriate general information on the compatibility of planned Secondary Containment stainless steel and special protective coating liners with the waste. The Secondary Containment Design document provides adequate and appropriate standard details for design and installation of stainless steel and special protective coating liners that will prevent migration of the waste into the concrete. The Engineering Specification for Furnishing, Detailing, Fabrication, Delivery and Installation of Stainless Steel Liner Plates provides detailed information on design, fabrication, installation, and inspection of stainless steel liners and sumps. The Engineering Specification for Field Applied Special Protective Coatings (SPC) provides detailed information on the tested and approved coating systems. This information includes directions for surface preparation, patching materials and application methods, and specific directions for application of multi-layer coatings. |

# *Drawings and Documents*

## Operating Unit Group 10 – Appendix 10.13
## High Level Waste Building
## Instrument Control Logic and Narrative Descriptions

The documents listed in the following table are incorporated by reference into this permit and are subject to the requirements set forth in Part I Standard Conditions, Part II General Facility Conditions, and Part III Operating Unit Group 10 Conditions. Upon request, copies of the documents can be viewed at the Nuclear Waste Program Resource Center located at 3100 Port of Benton Blvd. Richland, WA. Appointments for viewing can be scheduled by calling (509) 372-7950.

| ***Drawing/Document Number*** | ***Description*** |
|---|---|
| 24590-HLW-PER-J-02-001, Rev 2 | System Logic Description for HOP and PVV Systems |
| 24590-HLW-PER-J-02-002, Rev 1 | System Logic Description for HDH System |
| 24590-HLW-PER-J-02-003, Rev 0 | System Logic Description for RLD System |
| 24590-HLW-PER-J-04-0001, Rev 0 | System Logic Description for HFP System |
| 24590-HLW-PER-J-04-0002, Rev 0 | System Logic Description for PJV System |
| 24590-HLW-PER-J-04-0003, Rev 0 | System Logic Description for HSH System |
| 24590-HLW-PER-J-04-0004, Rev 1 | System Logic Description for HMP System |
| RESERVED | RESERVED |

Source documents (which do not include a "P" in the last set of numbers, e.g. "-P0001," or "-TP001") should be used in conjunction with any document change notices issued against them.

We are currently transitioning from permit documents (which do include a "P" in the last set of numbers) to source documents. At the end of the transition period, permit submittals will contain source documents and will be incorporated into the permit as described in Ecology Publication # 07-05-006 (www.ecy.wa.gov/biblio/nwp.html).

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# *Drawings and Documents*

## Operating Unit Group 10 – Appendix 10.18
## High Level Waste Building
## Operating Documents

The documents listed in the following table are incorporated by reference into this permit and are subject to the requirements set forth in Part I Standard Conditions, Part II General Facility Conditions, and Part III Operating Unit Group 10 Conditions. Upon request, copies of the documents can be viewed at the Nuclear Waste Program Resource Center located at 3100 Port of Benton Blvd. Richland, WA. Appointments for viewing can be scheduled by calling (509) 372-7950.

See Appendix 7.18 for operating documents common to the Pretreatment, LAW, HLW, and Laboratory buildings.

| ***Drawing/Document Number*** | ***Description*** |
|---|---|
| 24590-HLW-PER-PR-03-001, Rev 0 | Description of HLW Vitrification System Bypass Events |
| 24590-HLW-PER-M-04-002, Rev 3 | Leak Detection Capability in the HLW Facility |
| 24590-HLW-PER-M-04-0001, Rev 0 | HLW Facility Waste Removal Capability |
| RESERVED | RESERVED |

Source documents (which do not include a "P" in the last set of numbers, e.g. "-P0001," or "-TP001") should be used in conjunction with any document change notices issued against them.

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## *Operating Unit Group 10 – Appendix 11.0*

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954, as amended) has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit and chapter 70.105 RCW. In the event of any conflict between Permit Condition III.10.A and any statement relating to the regulation of source, special nuclear, and byproduct material contained in portions of the permit application that are incorporated into this permit, Permit Condition III.10.A will prevail.

# *Operating Unit Group 10 – Appendix 11.0*

## Laboratory Building
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# *Drawings and Documents*

Operating Unit Group 10 – Appendix 11.1
Laboratory Building
Process Flow Diagrams

The documents listed in the following table are incorporated by reference into this permit and are subject to the requirements set forth in Part I Standard Conditions, Part II General Facility Conditions, and Part III Operating Unit Group 10 Conditions. Upon request, copies of the documents can be viewed at the Nuclear Waste Program Resource Center located at 3100 Port of Benton Blvd., Richland, WA. Appointments for viewing can be scheduled by calling (509) 372-7950.

| ***Drawing/Document*** | ***Description*** |
|---|---|
| 24590-LAB-M5-V17T-P0029, Rev 1 | Process Flow Diagram (RLD System) |
| RESERVED | RESERVED |

Source documents (which do not include a "P" in the last set of numbers, e.g. "-P0001," or "-TP001") should be used in conjunction with any document change notices issued against them.

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# *Drawings and Documents*

Operating Unit Group 10 – Appendix 11.2
Laboratory Building
Piping and Instrumentation Diagrams

The documents listed in the following table are incorporated by reference into this permit and are subject to the requirements set forth in Part I Standard Conditions, Part II General Facility Conditions, and Part III Operating Unit Group 10 Conditions. Upon request, copies of the documents can be viewed at the Nuclear Waste Program Resource Center located at 3100 Port of Benton Blvd., Richland, WA. Appointments for viewing can be scheduled by calling (509) 372-7950.

| ***Drawing/Document*** | ***Description*** |
|---|---|
| 24590-LAB-M6-RLD-00001001, Rev. 1 | Piping & Instrument Diagram – LAB Radioactive Liquid Waste Disposal System - C5 Collection and Transfer RLD VSL-00165 |
| 24590-LAB-M6-RLD-00001002, Rev. 0 | Piping & Instrument Diagram – LAB Radioactive Liquid Waste Disposal System C5 Collection and Transfer RLD-PMP-00183A |
| 24590-LAB-M6-RLD-00001003, Rev. 0 | Piping & Instrument Diagram – LAB Radioactive Liquid Waste Disposal System C5 Collection and Transfer RLD-PMP-00183B |
| 24590-LAB-M6-RLD-00001004, Rev. 0 | Piping & Instrument Diagram – LAB Radioactive Liquid Waste Disposal System C5 Collection and Transfer Valve Pit |
| 24590-LAB-M6-RLD-00002001, Rev. 1 | Piping & Instrument Diagram – LAB Radioactive Liquid Waste Disposal System C3 Collection & Transfer RLD-VSL-00164 |
| 24590-LAB-M6-RLD-00002003, Rev. 0 | Piping & Instrument Diagram – LAB Radioactive Liquid Waste Disposal System C3 Collection & Transfer RLD-PMP-00182A/B |
| 24590-LAB-M6-RLD-00006001, Rev. 0 | Piping & Instrument Diagram – LAB Radioactive Liquid Waste Disposal System C3 Rad Lab Collection |

| | |
|---|---|
| 24590-LAB-M6-RLD-00006002, Rev. 0 | Piping & Instrument Diagram – LAB Radioactive Liquid Waste Disposal System C3 RAD LAB Collection |
| 24590-LAB-M6-RLD-00006003, Rev. 0 | Piping & Instrument Diagram – LAB Radioactive Liquid Waste Disposal System C3 RAD LAB Collection |
| 24590-LAB-M6-RLD-00007001, Rev. 0 | Piping & Instrument Diagram – LAB Radioactive Liquid Waste Disposal System C3 Leak Detection Boxes |
| 24590-LAB-M6-RLD-00007002, Rev. 0 | Piping & Instrument Diagram – LAB Radioactive Liquid Waste Disposal System C3 Collection Drain Header |
| 24590-LAB-M6-RLD-00008001, Rev. 0 | Piping & Instrument Diagram – LAB Radioactive Liquid Waste Disposal System – C5 Leak Detection Boxes |
| 24590-LAB-M6-RLD-00008002, Rev. 0 | Piping & Instrument Diagram – LAB Radioactive Liquid Waste Disposal System C5 Drain Collection Headers |
| RESERVED | RESERVED |

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