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STRUCTURAL INTEGRITY ASSESSMENT OF THE HIGH LEVEL WASTE (HLW) BELOW GRADE MELTER OFFGAS TREATMENT PROCESS (HOP) VESSELS

COGEMA-IA-013, Rev. 1

BECHTEL

Job No. 24590

Bechtel National, Inc.

SUPPLIER DOCUMENT STATUS

1. [X] **Work may proceed.**
2. [ ] **Revise and resubmit. Work may proceed subject to resolution of indicated comments.**
3. [ ] **Revise and resubmit. Work may not proceed.**
4. [ ] **Review not required. Work may proceed.**

Permission to proceed does not constitute acceptance or approval of design details, calculations, analyses, test methods, or materials developed or selected by the supplier and does not relieve supplier from full compliance with contractual obligations.

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G-321 Document Category N/A
[From Supplement A to G-321-E (E) or G-321-V (V), as applicable, or "N/A" if SSRS is used]

Supersedes BNI Document No. 24590-CM-HC4-HXYG-00138-01-12 Rev. 00A
[When applicable]

Accepted by DC Pfluger (Print Name) DC Pfluger (Signature) 10/14/03 (Date)

Released by (Print Name) (Signature) (Date)
[When applicable]

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(A) KJ 10/13/03
(C) el 10/13/03

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.

24590-CM-HC4-HXYG-00138-01-17 Rev. 00A

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Scope	Scope of this Integrity Assessment	This Integrity Assessment addresses the Submerged Bed Scrubber (SBS) Condensate Receiver Vessels (HOP-VSL-00903 & HOP-VSL-00904). These vessels are located in rooms H-B021 and H-B005 respectively at elevation (-) 21'-0" in the High Level Waste Vitrification Building.
References	Drawings, Mechanical Data Sheets, and System Description	24590-HLW-MV-HOP-P0001, Rev. 1, Equipment Assembly SBS Condensate Receiver Vessel HOP-VSL-00903; 24590-HLW-MV-HOP-P0003, Rev. 0, Equipment Assembly Melter 2 SBS Condensate Receiver Vessel HOP-VSL-00904 (Q); 24590-HLW-M5-V17T-P0003, Rev. 0, Process Flow Diagram HLW Vit Primary Offgas Treatment (System HOP); 24590-HLW-M5-V17T-P20003, Rev. 0, Process Flow Diagram HLW Vit Melter 2 Primary Offgas Treatment (System HOP); 24590-HLW-P1-P01T-P0001, Rev. 5 , HLW Vitrification Building General Arrangement Plan at EL. (-) 21'-0"; Mechanical Systems Data Sheet: Vessel, 24590-HLW-MVD-HOP-P0001, Rev. 1, SBS Condensate Receiver Vessel HOP-VSL-00903; Mechanical Data Sheet: Vessel, 24590-HLW-MVD-HOP-P0012, Rev. 0, Melter 2 SBS Condensate Receiver Vessel HOP-VSL-00904; 24590-HLW-3YD-HOP-00001, Rev. 0, Systems Description for HLW Melter Offgas Treatment Process and Process Vessel Vent Extraction (HOP and PVV Systems); System Description Change Notice (SDCN) SDCN No. 24590-HLW-3YN-HOP-00001, Rev. 0, for System Description No. 24590-HLW-3YD-HOP-00001, Rev. 0; SDCN No. 24590-HLW-3YN-HOP-00002, Rev. 0, for System Description No. 24590-HLW-3YD-HOP-00001, Rev. 0

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 controls and requirements to assure the design intent fully satisfies the WAC requirements.

	Information Assessed	Source of Information	Assessment
Design	Vessel design standards are appropriate and adequate for the vessel's intended use.	Drawings and Mechanical Data Sheets listed above under references; 24590-WTP-3PS-MV00-TP001, Rev. 1, Engineering Specification for Pressure Vessel Design and Fabrication; 24590-WTP-3PS-MV00-TP003, Rev. 1, Engineering Specification for Pressure Vessel Fatigue Analysis; 24590-WTP-3PS-MVB2-T0001, Rev. 1, Engineering Specification for Welding of Pressure Vessels, Heat Exchangers and Boilers; 24590-WTP-3PS-G000-TP002, Rev. 1, Positive Material Identification (PMI); 24590-WTP-3PS-G000-T0001, Rev. 0, General Specification for Supplier Quality Assurance Program Requirements	The SBS Condensate Receiver Vessels (HOP-VSL-00903 and HOP-VSL-00904) and all tank appurtenances are to be designed to the ASME Section VIII, Division 1 rules which are appropriate for unfired pressure vessels operating with mixed waste solutions over the pressure and temperature range specified for these vessels. Supplementary requirements are specified in the Engineering Specification for Pressure Vessel Design and Fabrication. Supplementary requirements address pressure vessel fatigue analysis, positive material identification, fabrication tolerances, acceptable welding procedures for the vessel and appurtenances, welder qualifications and testing records, NDE inspections and records, and packaging, shipping, handling and storage requirements. Some of the vessel internal equipment is subject to cyclic loading. The pulse jet mixer fatigue design analysis is adequate. The fatigue design standards, ASME Section VIII, Division 2, are appropriate for components with a high number of load cycles. These are adequate and acceptable design standards. The SBS Condensate Receiver Vessels are vertical vessels with a 144" ID and a vertical length of 93" tangent line to tangent line supported on a cylindrical skirt. Top and bottom heads are 2:1 elliptical shells. The shell and skirt are specified to have a minimum thickness of 5/8 inch. The heads have a minimum thickness of 11/16 inch. Materials for the shell, heads and vessel internal equipment are a nickel chromium alloy Hastelloy C-22, or equal. The external appurtenances such as the vessel skirt and the cooling jackets on the shell and the lower head are to be SA-240 304L and 316L stainless steel respectively. The operating volume is to be about 8134 gallons and the total internal volume is to be about 9891 gallons.

	Information Assessed	Source of Information	Assessment
Design	If a non-standard vessel is to be used, the design calculations demonstrate sound engineering principles of construction.	Drawings and Mechanical Data Sheets listed above under References	The SBS Condensate Receiver Vessels (HOP-VSL-00903 and HOP-VSL-00904) are standard vessels that are shop fabricated. The Mechanical Data Sheets require that the ASME Section VIII, Division 1 vessels be delivered after design, fabrication, inspection and testing with ASME code stamps and that the vessels be nationally registered. They are shop fabricated vessels for liquid acidic condensate mixed waste service in the High Level Waste Building. The vessels' design standards are appropriate and adequate for the intended service.
	Vessel has adequate strength, after consideration of the corrosion allowance, to withstand the operating pressure, operating temperature, and seismic loads.	Drawings and Mechanical Data Sheets listed above under references; 24590-WTP-3PS-MV00-TP001, Rev. 1, Engineering Specification for Pressure Vessel Design and Fabrication; 24590-WTP-3PS-MV00-TP002, Rev. 1, Engineering Specification for Seismic Qualification Criteria for Pressure Vessels; 24590-WTP-3PS-SS90-T0001, Rev. 0, Engineering Specification for Seismic Qualification of Seismic Category I/II Equipment and Tanks	The Mechanical Data Sheets identify each vessel's operating pressure and temperature ranges, the materials selected for each vessel, the corrosion allowance(s), and the vessel quality levels which determine the requirements for seismic design. The design specifications for the vessels require specific consideration of the operating pressures and temperatures and seismic loads in the design process. ASME Section VIII, Div. 1 requires that corrosion allowance material not be considered when evaluating the adequacy of vessel components for these loads at end of life. The Engineering Specification for Seismic Qualification Criteria for Pressure Vessels adopts ASME Section VIII, Div. 2 design rules to address seismic design and analysis of the vessel and vessel supports. Detailed requirements for seismic design of Seismic Category (SC-I/II) vessels are furnished in the specification for Seismic Qualification of Seismic Category I/II Equipment and Tanks. These codes and standards are adequate and appropriate for design of the Condensate Receiver Vessels to withstand operating pressure and temperature loads and seismic loads for the specified design life while considering corrosion allowance.

	Information Assessed	Source of Information	Assessment
Foundation	Vessel foundation will maintain the load of a full vessel.	Drawings listed above under references; 24590-WTP-DB-ENG-01-001, Rev. 0, Basis of Design; 24590-WTP-3PS-MV00-TP001, Rev. 1, Engineering Specification for Pressure Vessel Design and Fabrication	The Engineering Specification for Pressure Vessel Design and Fabrication requires the use of ASME B&PV code, Section VIII, Division I for design of each vessels skirt. This code assures an adequate design for the vessel skirts. Chapter 14 of the Basis of Design document requires that vessel foundations design must be adequate to support the loads from full vessels.
	If in an area subject to flooding, the vessel is anchored.	24590-WTP-3PS-MV00-TP001, Rev. 1, Engineering Specification for Pressure Vessel Design and Fabrication	Buoyant forces of an empty vessel in a flooded room are a mandatory standard design load case in this specification for Pressure Vessel Design and Fabrication.
	Vessel system will withstand the effects of frost heave.	24590-WTP-DC-ST-01-001, Rev. 1, Structural Design Criteria	The Structural Design Criteria document requires that all structural foundations extend a distance below grade that exceeds the depth of the frost line in order to preclude frost heave. The frost line is 30 in. below grade. Therefore, the vessels are not subject to frost heave.
Waste Characteristics	Characteristics of the waste to be stored or treated have been identified (ignitable, reactive, toxic, specific gravity, vapor pressure, flash point, storage temperature)	Mechanical Data Sheets listed above under References; Vessel/ Tank Material Selection Data Sheet, 24590-HLW-N1D-HOP-P0009, Rev. 2, SBS Condensate Receiver Vessel, HOP-VSL-00903 & HOP-VSL-00904 (HLW); 24590-WTP-PSAR-ESH-01-002-04, Rev. 1, Preliminary Safety Analysis Report (PSAR) to Support Construction Authorization; HLW Facility Specific Information	The Mechanical Data Sheets present the waste specific gravity, storage temperatures and pressures. The Vessel/ Material Selection Data Sheets address the pH range and chemical composition of the waste to select appropriate vessel materials and specify the corrosion allowance. Other waste characteristics that are hazardous, such as ignitability, flash point, and toxicity are addressed by the Preliminary Safety Analysis Report for the HLW Facility as an integral part of the design process. The HOP vessels provide primary confinement of the waste during normal operations, abnormal operations and during and after a Design Basis Earthquake. The main safety function is confinement of the vessel waste contents during these conditions. The PSAR identifies that the HOP vessels are not a concern for hydrogen control. The vessels are grounded to control ignition sources.

	Information Assessed	Source of Information	Assessment
Waste Characteristics	Vessel is designed to store or treat the wastes with the characteristics defined above and any treatment reagents.	Vessel/ Tank Material Selection Data Sheet, 24590-HLW-N1D-HOP-P0009, Rev. 2, SBS Condensate Receiver Vessel, HOP-VSL-00903 & HOP-VSL-00904 (HLW); System Description and System Description Change Notices listed above under References	The Vessel/Tank Material Selection Data Sheet demonstrates that the vessel is designed to store the wastes discussed above. The System Description discusses normal and abnormal operations for the HOP vessels (HOP-VSL-00903 and HOP-VSL-00904). Reagents will not routinely be added to these vessels during normal operations.
	The waste types are compatible with each other.	System Description and System Description Change Notices listed above under References; Process Flow Diagrams listed above under References	The System Description for the HLW Melter Offgas Treatment Process (HOP) System does not describe any operations where incompatible wastes are mixed in these vessels for processing. The HOP vessels function primarily to collect acidic condensate generated by the Submerged Bed Scrubber, the Wet Electrostatic Precipitators, and the High Efficiency Mist Eliminators as shown on the Process Flow Diagrams.

	Information Assessed	Source of Information	Assessment
Corrosion Protection	Vessel material and protective coatings ensure the vessel structure is adequately protected form the corrosive effects of the waste stream and external environments (expected to not leak or fail for the design life of the system)	Drawings, System Description and System Description Change Notices listed above under References; Vessel/ Tank Material Selection Data Sheet, 24590-HLW-N1D-HOP-P0009, Rev. 2, SBS Condensate Receiver Vessel, HOP-VSL-00903 & HOP-VSL-00904 (HLW)	The Vessel/Tank Material Selection Data Sheet for HOP-VSL-00903 and HOP-VSL00904 selected the nickel chromium alloy Hastelloy C-22, or equal, to provide resistance to potential process upset conditions. Accident related steam ejector use might produce higher temperatures above the normal operating temperature of 122 °F, perhaps up to the boiling point of the waste. The higher temperatures in combination with the normal operations chemistry of the acidic melter offgas (pH = 1.3) preclude the use of less resistant materials. Continuous agitation is recommended under normal operations to help control pitting and stress corrosion cracking. The material recommendations from the Vessel/Tank Material Selection Data Sheet have been adequately and appropriately incorporated into the Mechanical Data Sheets for the HOP vessels. The vessels are equipped with internal wash rings for decontamination as shown on the drawings. The HOP vessels are not equipped with overflow lines; therefore, the inaccessible process cells in which they are located should remain dry during normal operations which will limit external corrosion of the vessels over the facility design life.
Corrosion Allowance	Corrosion allowance is adequate for the intended service life of the vessel.	Mechanical Data Sheets listed above under references; Vessel/ Tank Material Selection Data Sheet, 24590-HLW-N1D-HOP-P0009, Rev. 2, SBS Condensate Receiver Vessel, HOP-VSL-00903 & HOP-VSL-00904 (HLW)	The bases for the HOP vessels material selection and corrosion allowance is furnished in the Vessel/Tank Material Selection Data Sheet. Selection of the nickel chromium alloy Hastelloy C-22, or equal, with a corrosion/erosion allowance of 0.08 in. for a service life of 40 years is adequate and appropriate. The material selections and corrosion allowances are carried forward to the Mechanical Data Sheets consistently and correctly.

	Information Assessed	Source of Information	Assessment
Pressure Relief	Pressure controls (vents and relief valves) are adequately designed to ensure pressure relief if normal operating pressures in the vessel are exceeded.	Process Flow Diagrams listed above under references; 24590-WTP-PSAR-ESH-01-002-04, Rev. 1, Preliminary Safety Analysis Report to Support Construction Authorization; HLW Facility Specific Information	The Condensate Receiver Vessels each operate in a series loop with the associated Submerged Bed Scrubber (SBS) for each melter train. The SBSs operated at a constant head continuously overflowing to the Condensate Receiver Vessels. The contents of the Condensate Receiver Vessels are continuously recycled back to the SBSs to provide agitation to mix the solids that tend to accumulate in the bottoms of the SBSs. When the Condensate Receiver Vessels become full, the bottoms liquid in the associated SBS is pumped off to the Acidic Waste Vessel (RLD-VSL-00007). The recycle stream from the Condensate Receiver Vessel empties the vessel as the SBS contents are transferred. The Process Flow Diagrams show that the HOP vessels are not equipped with overflow lines. They are, however, provided with redundant level indication and an interlock system that shuts off the melter feed on a high-high signal from either the SBS and/or the HOP vessel to stop the addition of more condensate to these vessels.

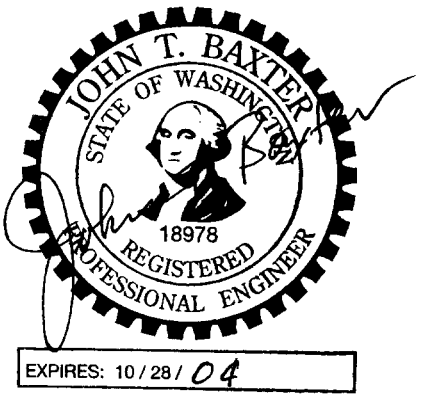
STRUCTURAL INTEGRITY ASSESSMENT OF THE HIGH LEVEL WASTE (HLW) BELOW GRADE MELTER OFFGAS TREATMENT PROCESS (HOP) VESSELS, REV. 1

"I, John T. Baxter 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 High Level Waste (HLW) Below Grade Melter Offgas Treatment Process (HOP) Vessels as required by The Dangerous Waste Regulations, namely, WAC 173-303-640(3), applicable paragraphs, i.e., (a) through (g)."

"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 indicate that the design intent fully satisfies the requirements of the WAC.

The attached review is 7 sheets numbered 1 through 7.



Signature: John T. Baxter Date: 10/13/2003

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BNI-Subcontracts

October 13, 2003

COGEMA-03-0317

Daisy J. Whiting
Bechtel National, Inc.
Waste Treatment Plant
2435 Stevens Center
Richland, Washington 99352

Dear Ms. Whiting:

STRUCTURAL INTEGRITY ASSESSMENT OF THE HIGH LEVEL WASTE (HLW) BELOW GRADE MELTER OFFGAS TREATMENT PROCESS (HOP) VESSELS, REVISION 1

The integrity assessment has been completed per the contract requirements and is enclosed for your use. The assessment found the design intent is sufficient to ensure the vessels will be adequately designed and will have sufficient structural strength, compatibility with the waste(s) to be stored or treated, and corrosion protection to ensure that they will not collapse, rupture, or fail.

If you have any questions, please contact me at (509) 376-5445, or via facsimile at (509) 372-0504.

Sincerely,

K V Scott

K. V. Scott, Manager
Facilities, Structures & Components

kld

Enclosure

cc: D. C. Pfluger w/ attachment

2003

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COGEMA Engineering Corporation