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AREVA-06-045

Ms. Anne Weldon
Subcontracts
Bechtel National, Inc.
2435 Stevens Center Place
Richland, Washington 99352

May 9, 2006

Dear Ms. Weldon:

BECHTEL NATIONAL, INC. CONTRACT NO. 24590-CM-HC4-HXYG-00211 - STRUCTURAL INTEGRITY ASSESSMENT OF HIGH LEVEL WASTE (HLW) MELTER PROCESS SYSTEM (HMP) MISCELLANEOUS TREATMENT UNITS (MTUs) (AREVA-IA-084, REV. 0)

The integrity assessment of the subject Miscellaneous Treatment Units (MTUs) 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 MTUs 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 feel free to contact me at (509) 376-8020

Sincerely,

M. D. Rickenbach, Director
Engineering & Services
AREVA NC Inc.
Richland

llm

Enclosure

cc: D. C. Pfluger M.1.I104 w/enclosure (2)

COGEMA, INC.
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IQRPE REVIEW
OF
THE HIGH LEVEL WASTE (HLW) MELTER PROCESS SYSTEM (HMP) MISCELLANEOUS TREATMENT UNITS (MTUs)

"I, Fred Porter, 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) Melter Process System (HMP) Miscellaneous Treatment Units (MTUs) 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 ten (10) pages numbered one (1) through ten (10).

FRED E. PORTER
STATE OF WASHINGTON
11689
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES: 12-08-2007

Signature

5-09-2006
Date

STRUCTURAL INTEGRITY ASSESSMENT OF THE HIGH LEVEL WASTE (HLW) MELTER PROCESS SYSTEM (HMP) MISCELLANEOUS TREATMENT UNITS (MTUs)

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.

Scope	Scope of this Integrity Assessment.	The HLW Melter Process System (HMP) is comprised of two HLW melters, each with the same design. Also included in the HMP are the pour spouts that are attached to the discharge chambers (2) of each melter. Melter 1 is located in HLW building cave H-0117 and Melter 2 is in cave H-0106, as shown on HLW Vitrification Building General Arrangement Plan at EL. 0'-0". This Integrity Assessment reviews the HLW Melter Process System (HMP) melter design and compatibility with ancillary process systems interfacing with the melters as shown on: Process Flow Diagram Drawings 24590-HLW-M5-V17T-P0002, -P20002; P&ID drawings 24590-HLW-M6-HMP-P0001, -P0002, -P0003, -P0004, -P0006, -P0007, -P0008, -P0013, -P0014, -P20001, -P20002, -P20003, -P20004, -P20006, -P20007, -P20008, -P20013, -P20014; and as defined in the System Description for HLW Melter Process System (HMP).
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 ensure the design fully satisfies the requirements of Washington Administrative Code, WAC-173-303-640, *Dangerous Waste Regulations* for Tank Systems.

References	Drawings and System Description.	Drawings: 24590-HLW-P1-P01T-00002, Rev. 5, HLW Vitrification Building General Arrangement Plan at EL. 0'-0"; 24590-HLW-M5-VI7T-P0002, Rev. 1, Process Flow Diagram HLW Vitrification Melter 1 (Systems HMP and HOP); 24590-HLW-M5-V17T-P20002, Rev.1, Process Flow Diagram HLW Vitrificatiion Melter 2 (Systems HMP and HOP); 24590-HLW-M6-HMP-P0001, Rev. 1, P&ID - HLW Melter 1 System Feed and Agitation; 24590-HLW-M6-HMP-P0002, Rev. 1, P&ID - HLW Melter 1 System Film Cooler and Offgas Connection; 24590-HLW-M6-HMP-P0003, Rev. 0, P&ID - HLW Melter Process System HLW Melter 1 Cooling System; 24590-HLW-M6-HMP-P0004, Rev. 0, P&ID - HLW Melter 1 Electrode Air Cooling and Joule Heating; 24590-HLW-M6-HMP-P0006, Rev. 1, P&ID - HLW Melter 1 System East Discharge Heaters and Airlift; 24590-HLW-M6-HMP-P0007, Rev. 1, P&ID - HLW Melter 1 System West Discharge Heaters and Airlift; 24590-HLW-M6-HMP-P0008, Rev. 1, P&ID - HLW Melter Process System Melter 1 Glass Pour & Monitoring Instrumentation; 24590-HLW-M6-HMP-P0013, Rev. 1, P&ID - HLW Melter 1 System Pressure, Density and Level Detection; 24590-HLW-M6-HMP-P0014, Rev. 0, P&ID - HLW Melter Process System HLW Melter 1 Cooling System; 24590-HLW-M6-HMP-P20001, Rev. 1, P&ID - HLW Melter 2 System Feed and Agitation; 24590-HLW-M6-HMP-P20002, Rev. 1, P&ID - HLW Melter 2 System Film Cooler and Offgas Connection; 24590-HLW-M6-HMP-P20003, Rev. 0, P&ID - HLW Melter Process System HLW Melter 2 Cooling System; 24590-HLW-M6-HMP-P20004, Rev. 0, P&ID - HLW Melter 2 Electrode Air Cooling and Joule Heating; 24590-HLW-M6-HMP-P20006, Rev. 1, P&ID - HLW Melter 2 System East Discharge Heaters and Airlift; 24590-HLW-M6-HMP-P20007, Rev. 1, P&ID - HLW Melter 2 System West Discharge Heaters and Airlift; 24590-HLW-M6-HMP-P20008, Rev. 1, P&ID - HLW Melter Process System Melter 2 Glass Pour & Monitoring Instrumentation; 24590-HLW-M6-HMP-P20013, Rev. 1, P&ID - HLW Melter 2 System Pressure, Density and Level Detection; 24590-HLW-M6-HMP-P20014, Rev. 0, P&ID - HLW Melter Process System HLW Melter 2 Cooling System. System Description: 24590-HLW-3YD-HMP-00001, Rev. 1, System Description for HLW Melter Process System (HMP).

Design	Melter design standards are appropriate and adequate for the equipment's intended use.	24590-HLW-3PS-AE00-T0001, Rev. 3, Engineering Specification for High Level Waste Melters; 24590-WTP-DC-ST-01-001, Rev. 11, Structural Design Criteria; 24590-WTP-SED-ENS-03-002-04, Rev 0H, Safety Envelope Document; HLW Facility Specific Information (SED); ASME B31.3, Chemical Plant and Petroleum Refinery Piping (1996); ASME Boiler and Pressure Vessel Code, Section III, Division 1, Subsection NC, Appendices N and F, Rules for Construction of Nuclear Power Plant Components (2001); ASME Boiler and Pressure Vessel Code, Section VIII, (2001). .	Melters 1 and 2 are vendor supplied equipment. The melters are designed to meet performance requirements specified in the Engineering Specification for High Level Waste Melters for all phases of melter life, including assembly, transport, startup, commissioning and maintenance. Structural design of the melters is in accordance with the Structural Design Criteria Document for seismic category SC-II structures, systems and components (SSCs) referenced in the Engineering Specification Document. The melters are not required to operate after a seismic event. However, the category SC-II shell and restraints containing the molten glass pool will maintain structural integrity and remain in place to preclude potential impacts to SC-I items referenced in the Safety Envelope Document. Provisions to avoid stress problems associated with thermal growth of the melter as it expands in relation to ancillary equipment has been considered in the design. Melter cooling water piping, feed piping, offgas piping and pour flanges are designed in accordance with ASME B31.3. Piping seismic design is in accordance with ASME B&PV Code Section III, appendices N and F. Melter cooling water system panels located on the external surface of the ceramic refractory containing the glass pool are designed in accordance with ASME B&PV Code Section VIII.

Design	Melter design compatibility with ancillary systems.	Drawings and System Description listed above under References; ASME B31.3, Chemical Plant and Petroleum Refinery Piping (1966); ASME Boiler and Pressure Vessel Code, Section III, Division 1, Subsection NC, Appendices N and F, Rules for Construction of Nuclear Power Plant Components (2001); 24590-WTP-3PS-J000-T0001, Rev. 1, Melter Systems C&I Work Specification; 24590-HLW-3YD-HOP-00001, Rev. 1, System Description for HLW Melter Offgas Treatment Process and Process Vessel Vent Extraction (HOP and PVV Systems).	Melters are supplied as packaged units with provisions for interface connections with ancillary systems listed in the System Description Document and shown on the P&ID drawings. Ancillary process systems interfacing with melters include: HLW Melter Feed Process System (HFP), HLW Melter Offgas Treatment Process System (HOP), and HLW Canister Pour Handling System (HPH). The melter design provides nozzles for jumpers from connecting ancillary piping systems. Melter piping and nozzle design is compatible with ASME B31.3 and ASME B&PV Code Section III design requirements of ancillary piping systems. Melter offgas is routed to the HLW Melter Offgas Treatment Process System (HOP) as defined in the System Description for HLW Melter Offgas Treatment Document. The ancillary HOP system scrubbers and coolers reduce melter offgas temperature and minimize solids disposition in the downstream offgas system. Controls and Instrumentation for specific melter-related functional requirements are specified in the Melter Systems C&I Work Specification. Purge air is supplied to the melter for continuous bubbler and air lift lance operation in the glass pool and for intermittent uses in the plenum.

Design	Melter design is adequate to maintain operating requirements during design life.	24590-HLW-3PS-AE00-T0001, Rev 3, Engineering Specification for High Level Waste Melters; 24590-WTP-DB-ENG-01-001, Rev. 1F, Basis of Design; 24590-WTP-SRD-ESH-01-001-02, Rev.31, Safety Requirements Document, Volume II.	The Basis of Design Document for the HLW facility specifies the facility is expected to operate for 40 years. The Engineering Specification for High Level Waste Melters specifies the melter, excluding consumable SSCs, shall have a minimum 5 year design life. The melter design life is applicable to all non-maintainable melter components, which includes refractory, electrodes, discharge dam and trough, cooling panels, and all structural and containment steelwork. Melter consumable components are designed to be removed and replaced remotely. Components requiring replacement during the design life of the melter are designed for ease of remote replacement and disposal. Where required, installed spare capacity is provided. Melters are designed and installed to allow for replacement after end-of-life or failure. The melter design and installation permits appropriate periodic inspection and testing in accordance with Safety Requirements Document, Volume II (SRD).
Design	Melter is adequately designed. For structural and seismic loads.	24590-HLW-3PS-AE00-T0001, Rev. 3, Engineering Specification for High Level Waste Melters; 24590-WTP-DC-ST-01-001, Rev. 11, Structural Design Criteria; 24590-WTP-RPT-ST-01-002, Rev. 3, Seismic Analysis and Design Approach.	Seismic design for the melters is in accordance with the Seismic Analysis and Design Approach document for SC-II structures, systems, and components as referenced in the Engineering Specification for High Level Waste Melters. Melter structural design is in accordance with Structural Design Criteria Document for seismic category II structures.

Connections	Melter Seams and connections are adequately designed.	24590-HLW-3PS-AE00-T0001, Rev. 3, Engineering Specification for High Level Waste Melters; ASME B31.3, Chemical Plant and Petroleum Refinery Piping (1996); ASME Boiler and Pressure Vessel Code, Section III, Division 1, Subsection NC, Appendices N and F, Rules for Construction of Nuclear Facility Components (2001). .	The Engineering Specification for High Level Waste Melters requires in-cell piping that is non-maintainable to be fully welded. The melter nozzle connections at the interface with ancillary piping system Jumpers are maintainable and are not welded connections. Melter piping and nozzle interface connections are compatible with ancillary piping design codes ASME B31.3 and ASME B&PV, Section III. The melter design provides in-leakage through engineered openings in some lid components. There is also incidental air in-leakage into the melter plenum. Air in-leakage to the melter plenum comes directly from the HLW cave. Each melter is connected to a dedicated offgas system that maintains a slight vacuum in the melter plenum.
Frost Heave	The Melter Process System will withstand the effects of frost heave.	24590-WTP-DC-ST-01-001, Rev.11, Structural Design Criteria.	The Structural Design Criteria requires that all structural foundations shall extend into the surrounding soil below the frost line to preclude frost heave. The frost depth line is 30 in. below grade. The HLW building foundation is at elevation -21"-0"and is not subject to frost heave. The HLW Melter Process System is located in caves within the HLW building at elevation 0'-0".

Waste Characteristics	Characteristics of the waste to be stored or treated have been identified.	Drawings and System Description listed above under References; 24590-HLW-3PS-AE00-T0001, Rev. 3, Engineering Specification for High Level Waste Melters; 24590-WTP-DB-ENG-01-001, Rev. 1F, Basis of Design.	The Basis of Design describes the characteristics of the waste to be treated and waste product to be stored. The HMP System Description provides a melter process overview listing the range of physical properties of HLW molten glass which is further defined in the Engineering Specification for High Level Waste Melters. The System Description Document describes facility interfaces, waste characteristics and production flow rates. Process systems that interface with the HLW Melter Process System (HMP) are shown on the P&ID drawings. The constituents of the HLW concentrate undergo chemical reactions, convert to their respective oxides, and dissolve in the molten glass.

Waste Handling Functions	Melters are designed to handle wastes with the characteristics defined above.	Drawings and System Description listed above under References; 24590-HLW-3YD-HOP-00001, Rev. 1, System Description for HLW Melter Offgas Treatment Process and Process Vessel Vent Extraction (HOP and PVV Systems).	The System Description Document defines the functions of the HMP system as the following; receive HLW concentrate and additives, vitrify HLW concentrate and additives, contain glass pool, deliver glass, confine hazardous emissions and report system conditions. The melters are designed to produce molten glass formed from HLW concentrate and glass former additives with the characteristics defined above. The glass pool is contained using heat-resisting ceramic bricks called refractory, backed up with an exterior metal structure with cooling panels. The panels provide cooling to freeze the glass within the refractory brick seams. The melters deliver molten glass to stainless steel canisters. The molten material is then allowed to cool, forming a borosilicate glass waste form. Immobilized High Level Waste (IHLW) is the resulting product (glass plus canister). The system works with the HLW Melter Offgas Treatment System (HOP) to direct melter emissions to offgas treatment processes. The functions of the ancillary systems servicing the HMP System are defined in the System Description Document and shown on the P&ID drawings.
Compatibility	The selection of materials adequately addresses the operating environment.	24590-HLW-3PS-AE00-T0001, Rev. 3, Engineering Specification for High Level Waste Melters; 24590-HLW-N1D-HMP-P0001, Rev. 0, Plant Item Material Selection Data Sheet.	The Engineering Specification for High Level Waste Melters specifies each melter, excluding consumable components, shall have a minimum 5 year design life. Materials of construction provided in accordance with the Engineering Specification Document and Plant Item Material Selection Data Sheets are able to withstand the radioactive, thermal, and corrosive environment caused by the melter feed, molten glass, and offgasses. The selection of materials and structural design of melters fabricated in accordance with the Engineering Specification Document are compatible with the melter operating environment for the required design life.

Corrosion Allowance	Corrosion allowance is adequate for the intended service life of the miscellaneous treatment units.	24590-HLW-3PS-AE00-T0001, Rev. 3, Engineering Specification for High Level Waste Melters.	The Engineering Specification for High Level Waste Melters specifies materials selected to withstand the corrosive melter operating environment for the service life of melter SSC's. Corrosion monitoring capability during operations is not required. The Engineering Specification for High Level Waste Melters considers environmental, durability, corrosion and erosion factors during materials selection. Factors evaluated include: surface finish, chemical resistance, radiation resistance, pressure effects (cyclical), temperature effects, hardness and fatigue.
Strength	Pressure controls are designed to ensure pressure relief if normal operating pressures in the melters are exceeded.	Drawings and System Description listed above under References; 24590-WTP-SED-ENS-03-002-04, Rev. 0H, Safety Envelope Document; HLW Facility Specific In formation (SED).	The System Description Document states the system shall provide instrumentation to detect rises in pressure in the melter plenum and provide an actuating signal to the associated interlocks that follow when the melter plenum pressure reaches a predetermined value. The melter plenum pressure interlocks will stop feed to the melter and film cooler injection air on receiving an actuation signal from the melter pressure instrumentation. Redundant pressure measurement shown on the P&ID drawings is provided for the melter plenum in accordance with requirements of the Safety Envelope Document.
Strength	Maximum flows and any unusual operating stresses are identified	Drawings and System Description listed above under References; 24590-101-TSA-W000-0010-407-577, Rev, NA, HLW Melter FMEA Report.	The System Description Document section, Action on Faults and Mal-Operation, discusses selected failure modes and recovery responses for the HLW Melter Process System. A component- by- component detailed analysis can be found in the HLW Melter Failure Modes and Effects Analysis (FMEA) Document.

Secondary Containment	Containment and confinement requirements for high level wastes.	Drawings and System Description listed above under References; ASME Boiler and Pressure Vessel Code, Section VIII, (2001); 24590-WTP-SRD-ESH-01-001-02, Rev.31, Safety Requirements Document, Volume II.	High level wastes containment and confinement requirements in terms of configuration, interfaces, instrumentation, control and reliability is provided as defined in the HMP System Description Document. Confinement reliability factors for HMP structures, systems and components are in accordance with Safety Requirements Document, Volume II, for QL-2 requirements. The HMP melters use a refractory package to contain the molten glass. The refractory package consists of glass pool refractory and plenum refractory. The refractory package is designed to serve as a mechanical, thermal, and electrical barrier between the molten glass inside the shell and the external metal shell. The refractory package is contained within a metal structure with cooling panel assemblies on three sides and the bottom of the melter, which provide bulk containment and melter cooling. The metal containment shell / cooling water panels are designed and fabricated in accordance with ASME B&PV Section VIII. The caves that house the melter installations have protective liners and provide secondary containment for the HMP melter process system. Ventilation systems and offgas systems are provided to control radiological and chemical material releases and the generation of flammable and explosive gases during normal and accident conditions. Each melter is connected to a dedicated offgas system through to the stack, as shown on the P&ID drawings. Instrumentation is provided to detect and control rises in offgas pressure in the melter plenum.

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Subcontract Number:	24590-CM-HC4-HXYG-00211
Subcontract Title:	Tank Integrity Design Assessments by IQRPE
Subcontractor Name:	AREVA NC, Inc.
Subcontract Administrator:	Anne Weldon

PDC Document Number	Rev	Document Title	Rev
139504	0	AREVA -AI-084, Rev. 0	

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