0077592

RPP-RPT-33306, Rev. 0A

IQRPE Integrity Assessment Report for the 242-A Evaporator Tank System

Timothy J. Oliver, PE (Cooper Zietz Engineers, Inc.) for
CH2MHILL Hanford Group, Inc.
Richland, WA 99352
U.S. Department of Energy Contract DE-AC27-99RL14047

EDT/ECN:	DRF	UC:	NA
Cost Center:	7T600	Charge Code:	500806
B&R Code:	NA	Total Pages:	867

Key Words: 242-A Evaporator, waste, IQRPE, integrity assessment, WAC 173-303-640

Abstract: This document is the assessment by an Independent Qualified Registered Professional Engineer (IQRPE) of the 242-A Evaporator Unit. This assessment is required by RCRA Permit WA7890008967 and the Washington State Dangerous Waste Regulations (WAC 173-303-640(2)). The report recommends that the 242-A Evaporator unit be re-assessed by an IQRPE in 10 years.

Release Approval — 4.2.08 Date — Release Stamp

Approved For Public Release

attached to 0077590

Tank Farm Contractor (TFC) **RECORD OF REVISION**	(1) Document Number: **RPP-RPT-33306**	Page 1

(2) Title:

IQRPE Integrity Assessment Report for the 242-A Evaporator Tank System

Change Control Record

(3) Revision	(4) Description of Change – Replace, Add, and Delete Pages	Authorized for Release	
		(5) Resp. Engr. (print/sign/date)	(6) Resp. Mgr. (print/sign/date)
0A	Replace Tables 1.6 and 2.1.1 in their entirety with the attached pages in response to DOE-ORP comments.	AH Friberg AH Friberg 3/31/08	B Thacker Approved via telecon 4/2/08 AH Friberg

CH2M HILL DOCUMENT RELEASE FORM

(1) Document Number:	RPP-RPt-33306	(2) Revision Number:	0A	(3) Effective Date:	NA
(4) Document Type:	☐ Digital Image ☒ Hard copy ☐ PDF ☐ Video	(a) Number of pages (including the DRF) or number of digital images	867		
(5) Release Type	☐ New ☐ Cancel	☒ Page Change	☐ Complete Revision		
(6) Document Title:	IQRPE Integrity Assessment Report for the 242-A Evaporator Tank System				
(7) Change/Release Description:	Revised Table 1.6 to clarify operating and design pressures. Revise Table 2.1.1 to clarify the existing documentation that supports structural adequacy of critical equipment.				
(8) Change Justification:	Revised in response to DOE-ORP comments.				

(9) Associated Structure, System, and Component (SSC) and Building Number:	(a) Structure Location: 200E	(c) Building Number: 242-A	
	(b) System Designator: WT	(d) Equipment ID Number (EIN): N/A	

(10) Impacted Documents:	(a) Document Type	(b) Document Number	(c) Document Revision
	NA	NA	NA

(11) Approvals:

(a) Author (Print/Sign): AH Friberg	Date: 3/31/08
(b) Responsible Manager (Print/Sign): B Thacker for	Date: 04/1/2008
(c) Reviewer (Optional, Print/Sign): TL Faust	Date: 4/1/08
(d) Reviewer (Optional, Print/Sign):	Date:

(12) Distribution:

(a) Name	(b) MSIN	(a) Name	(b) MSIN
CA Burke	R3-26	PC Miller	R1-51
TL Faust	S5-07	VL Wagner	S5-14
RP Raven	S5-15	AH Friberg	R3-26
RN Dale	S5-25	SD Ringo	R3-25

Release Stamp

APR 02 2008
DATE:
STA: 4
HANFORD RELEASE
ID: 8

(13) Clearance	(a) Cleared for Public Release	(b) Restricted Information?	(c) Restriction Type:
	☑ Yes ☐ No	☐ Yes ☑ No	

(14) Clearance Review (Print/Sign): Ana B Garza Date: 4.2.08

Independent Qualified Registered Professional Engineer
IQRPE Report IAR-001, Rev.0A

CH2M HILL Requisition No. 144001

IQRPE Integrity Assessment Report

for the

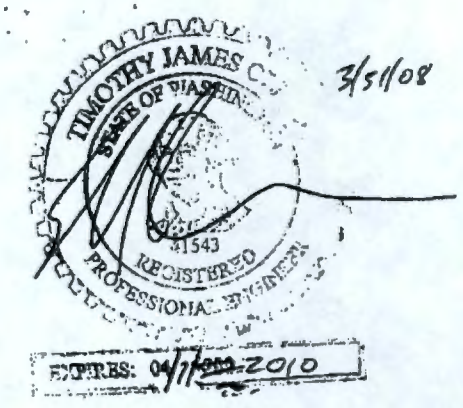
242-A Evaporator Tank System

Prepared:

Timothy J. Oliver, Environmental PE
Cooper Zietz Engineers, Inc.
421 SW Sixth Avenue, Suite 1210
Portland, Oregon 97204

for

TechnoGeneral Services Company



Approved:

TechnoGeneral Services Company
1840 Terminal Drive
Richland, WA 99353

for
CH2M HILL Hanford Group, Inc.
POB 1500
Richland, Washington 99352

March 31, 2008

Table 1.6 242-A Evaporator Unit System Operational Design Basis

Component	Design Pressure psia (kPa) (absolute)	Operating Pressure psia (kPa) (absolute)	Design Temperature °F (°C)	Operating Temperature °F (°C)	Length Inch (cm)	Width Inch (cm)	Height Inch (cm)	Construction Material
C-A-1	0 (0) (Full Vacuum)	0.97 (6.7)	Not Applicable	100.4-158 (38-70)	Not Applicable	168.5 (428) Diameter	493.7 (1254)	Stainless Steel
E-A-1	0 (0) (Process side); 115 (793) (Steam side)	0.97 (6.7)	350.6 (177)	100.4-158 (38-70)	Not Applicable	40.6 (103) Diameter	180 (457)	Stainless Steel
P-B-1	23.8 (164)	30 (205)	199.4 (93)	100.4-158 (38-70)	Not Applicable	48 (122)	125.2 (318)	Stainless Steel
P-B-2	0.34 (2.313)	51 (350)	179.6 (82)	158 (70)	116.9 (297)	35 (89)	37 (94)	Stainless Steel
E-C-1	0 (0) (Process side); 115 (793) (Tube side)	0.97 (6.7)	150.8 (66)	77 (25)	209.8 (533)	85 (216) Diameter	Not Applicable	Carbon Steel
E-C-2	0 (0) (Process side); 115 (793) (Tube side)	0.97 (6.7)	350.6 (177)	102.2 (39)	87 (221)	16.1 (41) Diameter	Not Applicable	Carbon Steel
E-C-3	0 (0) (Process side); 115 (793) (Tube side)	14.7 (101)	350.6 (177)	150.8 (66)	93.7 (238)	7.9 (20) Diameter	Not Applicable	Carbon Steel
TK-C-100	Not Applicable	14.7 (101)	Not Applicable	80.6 (27)	Not Applicable	168.5 (428) Diameter	252.8 (642)	Stainless Steel

NOTES:
The design and operating pressures are stated as absolute pressures (psia). A full vacuum is equivalent to 0 psia and atmospheric pressure equates to 14.7 psia. A design pressure of 0 psia (full vacuum) represents a higher stress level for design of equipment. An operating pressure above the design pressure results in a lower stress level for the equipment under vacuum conditions.

psia = pounds per square inch absolute 1 psia = 6.894 kilo Pascal (kPa) absolute

Table 2.1.1 Structural Analysis Performed for the 242-A Evaporator Unit

Component	Structural Analysis (SA) Performed	Comments/Recommendations	Reference
242-A Evaporator Facility	Review performed by Blume and Scott. Kaiser Engineers performed 242A Building piping support analysis to verify the structural adequacy of anchor and seismic restraint.	Meets or exceeds the current natural phenomena hazards criteria for a Safety Class 2 Moderate Hazard Facility. Anchor and seismic restraint are structurally adequate for intended application.	SD-WM-DP-019 (WHC 1993) Calc. # W-105-24 Calc. # 005 B-534
Evaporator, C-A-1	Performed by Struthers for 242-S Evaporator vessel; no separate analysis performed for 242-A Evaporator vessel since they are equivalent. Vessel and supports analyzed to 0.25g design basis earthquake (DBE) and operating basic earthquake (OBE) of one-half of the DBE accelerations.	Vitro performed a more comprehensive stress report and a dynamic seismic analysis to enhance confidence in the structural integrity of the evaporator during an earthquake event. The stress analysis demonstrates that the equipment does meet all design criteria for both the DBE and OBE acceleration conditions.	SD-WM-DP-019 (WHC 1993) SD-WM-TI-003 (WHC 1991)
Reboiler, E-A-1	Certified by code data report to be in accordance with the ASME code.	Testifies that appropriate design parameters were considered and that the authorized code inspector verified that applicable calculations were completed and on file at the manufacturer's plant at the time of Data Report signed.	SD-WM-DP-019 (WHC 1993)
E-C-1, Primary Condenser	Condenser was certified by ASME code data report; stress analysis conducted during a water hammer event in 1992 showed that condenser heads, flow dividers, and head bolts may have exceeded ASME Section VIII, Division I, code stress allowable.	Recommended additional inspections and tests to ensure system integrity.	SD-WM-DP-019 (WHC 1993)
E-C-2, Inter Condenser	Constructed in accordance with ASME VIII, Division I, criteria; certified by code data report.	Condenser was replaced in 2004 with an identical one supplied by Project B-534.	SD-WM-DP-019 (WHC 1993) RPP 21574, Rev.0 Vendor Information File No. 14739

Table 2.1.1 Structural Analysis Performed for the 242-A Evaporator Unit

Component	Structural Analysis (SA) Performed	Comments/Recommendations	Reference
E-C-3, Inter Condenser	Constructed in accordance with ASME VIII, Division I criteria; certified by ASME code data report.	Replaced in 2004 with a condenser identical to the existing one.	SD-WM-DP-019 RPP 21574, Rev.0
TK-C-100, Condensate Collection Tank	Fabricated, inspected and tested in accordance with ASME VIII, Division 1 criteria.	Not certified by code data report; wall thickness inspections meet or exceed the minimum wall thickness of 0.16 inch.	SD-WM-DP-019 (WHC 1993)
TK-C-103, Condensate Measurement Tank	Constructed in accordance with ASME VIII, Division 1 criteria.		SD-WM-DP-019 (WHC 1993)
Seal Pot Liquid Seal	Constructed in accordance with ASME VIII, Division 1 criteria.		SD-WM-DP-019 (WHC 1993)
Recirculation Pump (P-B-1)	Analyzed as a part of piping calculations done by Project B-534 (B-534-27-003 and Calculation # 004 B-534).	New pump installed by B-534 project; flow sizing, nozzle loading, and lifting yoke analysis performed; no documentation to qualify the pump in accordance with the seismic requirements of the UBC-85.	SD-WM-DP-019 (WHC 1993) Procurement Spec B534-P4 VI #21942 (KEH 1992)
Bottoms Pump (P-B-2)	Analyzed as a part of piping calculations done by Project B-534 (B-534-27-015, B-534-27-019, B-534-27-044)	New pump installed by B-534 project; flow sizing, lifting attachment loading analysis performed.	SD-WM-DP-019 (WHC 1993) Procurement Spec B534-P11 VI #22069 (KEH 1992)

Table 2.1.1 Structural Analysis Performed for the 242-A Evaporator Unit

Component	Structural Analysis (SA) Performed	Comments/Recommendations	Reference
Condensate Pump (P-C-100)	General service pump attached to Condenser Room floor.	New pump installed byB-534 project; flow sizing analysis performed.	SD-WM-DP-019 (WHC 1993) Vendor specification B-534/CR0449.(KEH 1992)
Recirculation Piping	Performed SA by Struthers, but no detailed analysis report located; Only summary report by RHO was located; summary report addresses the thermal flexibility of the recirculation system with various piping configurations; performed insulation sizing calculations; Recirculation pump piping stress analysis was conducted by Vitro Hanford Engineering Services.	Summary report recommended for support modifications and recirculation pump nozzle loading resulting from thermal loading conditions; no other loading conditions discussed. Stress analysis results were provided in SD-WM-TI-003 in pages 43 through 67.	SD-WM-DP-019 (WHC 1993) SD-WM-TI-003 (WHC 1991)

6.0 REFERENCES

American Society of Mechanical Engineers (ASME). 2007a. Boiler and Pressure Vessel Code, Section V Non-destructive Examination.

ASME. 2007b. Boiler and Pressure Vessel Code, Section XI Rules for In-Service Inspection of Nuclear Power Plant Components.

American Society for Testing and Materials (ASTM). 2004. ASTM G16-1995 (Reapproved 2004) Standard Guide for Applying Statistics to Analysis of Corrosion Data.

ASTM. 2005. ASTM G 46(2005) G46-94(2005). Standard Guide for Examination and Evaluation of Pitting Corrosion.

Banning D.L.. 2005. *242-A Evaporator Data Quality Objectives (DQO)*, SD-WM-DQO-014 (most current revision), CH2M HILL Hanford Group, Richland Washington.

Campbell, T. A., 2003, *242-A Evaporator Technical Safety Requirements*, HNF-15279, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

Campbell, T. A., 2004, *242-A Evaporator Documented Safety Analysis*, HNF-14755, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

Department of Energy (DOE)-Richland Operations Office (RL), 1975, *Hanford Plant Standard Design Criteria (SDC) 4.1*, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1989, *Hanford Plant Standard Design Criteria: Design Loads for Facilities (SDC) 4.1, Revision 11,* U.S. Department of Energy-Richland Operations Office, Richland, Washington.

DOE-RL, 1990, *242-A Evaporator Dangerous Waste Permit Application, DOE/RL-90-42,*Rev. 0, Appendix 3E, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1991, *Hanford Facility Dangerous Waste Permit Application Double Shelled Tank Systems*, DOE/RL-90-39, Vol 1B, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Washington State Department of Ecology (Ecology), US Environmental Protection Agency (EPA), and DOE, 1990, *Hanford Federal Facility Agreement and Consent Order,* Washington Department of Ecology, U.S. Environmental Protection Agency, U.S. Department of Energy, Olympia, Washington.

Ecology, 1994, Guidance for Assessing and Certifying Tank Systems that Store and Treat Dangerous Waste. Publication 94-114. June.

Ecology, 1995, Guidance for Assessing Dangerous Waste Secondary Containment Systems. Publication 95-420. September.

Ecology, EPA, and DOE, 1996, *Hanford Federal Facility Agreement and Consent Order,* as amended, Washington State Department of Ecology, Olympia, Washington, U.S. Environmental Protection Agency Region 10, Seattle, Washington, and U.S. Department of Energy Richland Operations Office, Richland, Washington.

Ecology, 1998, *Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste,* WA7890008967, as amended, State of Washington, Department of Ecology, Kennewick, Washington.

Ecology, 2003, "Dangerous Waste Permit for 242-A Evaporator," Attachment 35, Resource Conservation and Recovery Act Permit for the Treatment, Storage and Disposal of Dangerous Waste, WA7890008967, as amended, Washington State Department of Ecology, Kennewick, Washington.

Ecology. 2004a. Hanford Facility Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste, Permit Number WA7890008967, Washington State Department of Ecology, Olympia, Washington and U.S. Environmental Protection Agency Region 10, Seattle Washington.

Ecology. 2004b. Hanford Facility Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste, Permit Number WA7890008967, Part III, Liquid Effluent Retention Facility and 200 Area Effluent Treatment Facility. Washington State Department of Ecology, Olympia, Washington and U.S. Environmental Protection.

Ecology, 2005, "Waste Analysis Plan for 242-A Evaporator," Chapter 3.0 of Attachment 35, Resource Conservation and Recovery Act Permit for the Treatment, Storage and Disposal of Dangerous Waste, WA7890008967, as amended, Washington State Department of Ecology, Kennewick, WA.

EPA, 2004, Approval of the Toxic Substance Control Act (TSCA) Risk-based Disposal Approval (RBDA) Application for Management of Polychlorinated Biphenyl (PCB) Remediation Waste at the 200 Area Liquid Waste Processing Facilities, (letter from L. J. Iami (EPA) to J. B. Hebron and J. E. Rasmussen, June 8), U.S. Environmental Protection Agency Region 10, Seattle, Washington.

Fowler, K. D., 2005, *Waste Compatibility Assessment of 242-A Evaporator Slurry (EVAP 05-01) with Tank 241-AP-108 and Tank 241-AW-102 Waste*, RPP-23820, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

Fowler, K.D., 2007, *Tank Farm waste Compatibility Program*, HNF-SD-WM-OCD-015 (most current revision) CH2M HILL Hanford Group, Richland Washington.

Hanford Facility (HNF)-3327, 1998, *242-A Evaporator Life Extension Study,* Rev. 0, Waste Management Federal Services, Inc., Richland, Washington.

HNF-3327, 2001, *Engineering Study for the 242-A Life Extension Upgrades for Fiscal Years 2002 Thru 2005,* Rev. 1, Waste Management Hanford, Richland, Washington.

HNF-14755, Rev 1, Documented Safety Analysis for the 242-A Evaporator, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-3172, Rev.1, 2001. Liquid Waste Processing Facilities Waste Acceptance Criteria. ECN 658598. Fluor Hanford, Richland, Washington.

HNF-SD-WM-DQO-014, *242-A Evaporator Data Quality Objectives.*

HNF-SD-WM-SAD-040, Rev.2, 2001. Liquid Effluent Retention Facilities (LERF) Final Hazard Category Determination. Fluor Hanford, Richland, Washington.

Hanford Plant Standards (HPS) Architectural/Civil Committee, 1994. Hanford Plant Standards, Architectural/Civil Manual. KH-SD-GN-DGS-30012, Rev.0.

Health and Safety Executive. 2002. Guidelines for Use of Statistics for Analysis of Sample Inspection of Corrosion.

JABE-VITRO-03, 1972, *Earthquake Analysis of Evaporator Facility Building 242-S. Hanford Atomic Energy Reservation,* John A. Blume and Associates, San Francisco, California.

Kaiser Engineers Hanford (KEH), 1992. Construction Specifications for 242-A Building Evaporator/Crystallizer Upgrade (Process Upgrade). B-534-C1, Rev.2. V-B534c1-026. Kaiser Engineers Hanford Co.

Knight, M.A., 2003. Engineering Specialty Assessment of Tank Waste Compatibility Reporting. RPP-16760, Rev.0.

LMHC. 1998. HNF-2905. 1998 Interim 242-A Evaporator Tank System Integrity Assessment Report. Revision 0. July 2.

McCallum, G. J., 1990a, "Project B-534, Seismic Qualification of the 242-A Evaporator Building and Pump Room Sump and Drain Line," (Letter number *B-534-26* dated June 8,

1990, from G.J. McCallum, Kaiser engineers Hanford, to J.C. Lavender), Westinghouse Hanford Company; see WHC-SD-WM-TI-490.

McCallum, G. J., 1990b, "Project B-534, Overview Level Review of the Seismic Design of Building 242-A," (Letter number B-534-45 dated July 18, 1990 from G.J. McCallum to J.C. Lavender, Westinghouse Hanford Company); see WHC-SD-WM-TI-490.

Mulkey, C. H., 1999, *Data* Quality *Objectives for Tank Farms Waste Compatibility Program*, HNF-SDWM-DQO-001, Rev. *C-3*, Lockheed Martin Hanford Corp., Richland, Washington.

RPP 21574, 2004. Specification for Replacement Intercondensor E-C-3 for 242-A Evaporator, Rev. 0. CH2M HILL Hanford Group, Richland, Washington.

RPP-8949, 2002, Project *Execution Plan for 242-A Evaporator Life Extension Upgrades*, Rev. 0 CH2M HILL Hanford Group, Inc. Richland Washington.

RPP-RPT-25891-2006, Rev. 1, *System Health Report for the 242-A Evaporator Facility for Cold Run – CY.2006*

Project Hanford Management System, 2006. Engineering Design and Evaluation (Natural Phenomena Hazard). HNF-PRO-097, Rev.4.

Szelmeczka, R. W., 2002, *Application for Risk-Based Disposal Approval for Polychlorinated Biphenyls Hanford 200 Area Liquid Waste Processing Facilities*, DOE/RL-2002-02, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

TF-OR-A-02. 2007. 242-A Evaporator Backside Rounds. August 27 through September 2.

TGS 2007a. IQRPE Integrity Assessment Plan for the 242-A Evaporator System and PC-5000 Process Condensate Transfer Line. RPP-PLAN-32530, Rev.1. July.

TGS 2007b. IQRPE Integrity Assessment Report for the PC-5000 Process Condensate Transfer Line. RPP-RPT-33307, Rev.0. December.

UBC, 1988, *Uniform Building Code*, International Conference of Building Officials, Whinier, California.

VonBargen, B.H., 1998. 242-A Evaporator/Liquid Effluent Retention Facility Data Quality Objectives, WHC-SD-WM-DQO-014, Rev.2. Waste Management Federal Services of Hanford, Richland, Washington.

Vitro, 1974, *Construction Specification for 242-A Evaporator-Crystallizer Facilities, Project B-100,* B-100-C1, Automation Industries, Inc., for Vitro Engineering Division, Richland, Washington.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, Washington State Department of Ecology, Kennewick, Washington.

WHC-1993. WHC-SD-WM-ER-124. 242-A Evaporator-Crystallizer Tank System Integrity Assessment Report. Revision 1.

WHC-SD-WM-PSE-008, 1990, *Hazard Classification for the 242-A Evaporator Facility,* Westinghouse Hanford Company, Richland, Washington.

WHC-SD-WM-ER-102, 1992, *242-A Evaporator Seismic Design Basis Evaluation,* Westinghouse Hanford Company, Richland, Washington.

WHC-SD-TWR-RPT-002, 1998, *Structural Integrity and Potential Failure Modes of the Hanford High-Level Waste Tanks,* Rev. 0A, Westinghouse Hanford Company, Richland, Washington.