U.S. Department of Energy
Office of River Protection
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

0069627

MAY 04 2006

06-ED-039

Ms. Jane Hedges, Program Manager
Nuclear Waste Program
State of Washington
Department of Ecology
3100 Port of Benton Blvd.
Richland, Washington 99352

Dear Ms. Hedges:

SUBMITTAL OF FINAL DANGEROUS AND/OR MIXED WASTE RESEARCH, DEVELOPMENT, AND DEMONSTRATION PERMIT (RD&D Permit) FOR THE DEMONSTRATION BULK VITRIFICATION SYSTEM (DBVS) IN-CONTAINER VITRIFICATION SYSTEM

Reference: WA7890008967, "Permit for Dangerous and/or Mixed Waste Research, Development, and Demonstration," (RD&D Permit) for the Demonstration Bulk Vitrification System (DBVS)

This letter transmits the Final Dangerous and/or Mixed Waste RD&D Permit for the DBVS In-Container Vitrification System for review and approval. Included in the supporting information, as required by the RD&D Permit, is a report by an Independent Qualified Registered Professional Engineer (IQRPE). This is the sixth of seven design packages to be submitted for the State of Washington Department of Ecology (Ecology) approval for the RD&D Permit.

The following engineering design and support information for the In-Container Vitrification (ICV^{TM}) System are attached. The RD&D Permit conditions satisfied by these attachments are also identified.

1. Certification Statement (Attachment 1);

2. RPP-24544, "Demonstration Bulk Vitrification System IQRPE/RCRA Design Review Package for the In-Container Vitrification System" (RPP-24544, Revision 1C, dated April 20, 2006) (Attachment 2), Permit condition V.I.3;

3. IQRPE Design Assessment Report No. DR-013, Revision 1, "Review of Demonstration Bulk Vitrification System IQRPE/RCRA Design Review Package RPP-24544, Revision D," (Attachment 3), Permit Condition V.I.3; and

4. Permit Tables III.1, V.1, V.2, V.3, V.4, V.5, V.7, and V.8, (Attachment 4), Permit Conditions III.G.1 and V.I.3.

Ecology was provided the opportunity to review these permit packages and associated information.

If you have any questions, please contact me, or your staff may contact Gae M. Neath, Environmental Division, (509) 376-7828.

Sincerely,

Roy J. Schepens, Manager
Office of River Protection

ED:GMN

Attachments: (4)

cc w/attachs:
K. A. Conaway, Ecology (plus 1 CD)
S. L. Dahl, Ecology
T. Hill, Ecology (1 CD only)
Administrative Record
CH2M Correspondence Control
Environmental Portal, LMSI

cc w/o attachs:
P. K. Brockman, CH2M HILL
M. N. Jaraysi, CH2M HILL
F. R. Miera, CH2M HILL
D. H. Shuford, CH2M HILL
M. S. Spears, CH2M HILL
J. E. Van Beek, CH2M HILL
J. Cox, CTUIR
S. Harris, CTUIR
S. A. Thompson, FHI
G. Bohnee, NPT
J. B. Hebdon, RL
A. C. McKarns, RL
K. Niles, Oregon Energy
R. Jim, YN

Attachment 1
06-ED-039

Certification Statement

The following certification is required by WAC 173-303-810(13) for all applications and reports submitted to Ecology.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Roy J. Schepens 5/2/06

Owner/Operator
Roy J. Schepens, Manager
Office of River Protection
U.S. Department of Energy

Date

MS Spears 4/25/06

Co-operator
Mark S. Spears, President
and Chief Executive Officer
CH2M HILL Hanford Group, Inc.

Date

Attachment 3
06-ED-039

IQRPE Design Assessment Report No. DR-013, Revision 1, "Review of Demonstration Bulk Vitrification System IQRPE/RCRA Design Review Package," RPP-24544, Revision D

Independent Qualified Registered Professional Engineer Support to Demonstration Bulk Vitrification Project

CH2M Hill Requisition # 114648

IQRPE Design Assessment Report No. DR-013, Rev. 1

Review of

Demonstration Bulk Vitrification System IQRPE/RCRA Design Review Package, RPP-24544, Revision D

Section 2.6, In-Container Vitrification (ICV™) System (90 Percent Design)

Prepared by:

William P. Dana, PE
Dana Engineering, Inc. PSC
4000 S. Irby St.
Kennewick, WA 99337-2455
For
Techno General Services Company

Reviewed By:

Karl M. Walterskirchen, PE, Chief Engineer
TechnoGeneral Services Company
710 N. 4th Avenue
Pasco, Washington 99301

At the request of
CH2M Hill Hanford Group, Inc.
POB 1500
Richland, Washington 99352

April 20, 2006

Table of Contents

Tables

Figures

Attachments

A In-Container Vitrification (ICV™) System IQRPE Disposition of Calculations, Specifications, and Drawings

B In-Container Vitrification (ICV™) System Design Deliverables to be Reviewed with Construction Certification Package

C Codes, Standards, and Regulations Incorporated Into Technical Specification Packages

D In-Container Vitrification (ICV™) System Piping & Instrumentation Diagrams

E Engineering Corrosion Review

1.0 INTRODUCTION

The Washington State Department of Ecology (Ecology) has issued a permit for the Demonstration Bulk Vitrification System (DBVS) that mandates the use of an Independent Qualified Registered Professional Engineer (IQRPE) to perform a third-party independent review of the design of Washington Department of Ecology sensitive portions of the DBVS project. TechnoGeneral Services Company (TGS) has prepared this IQRPE Design Assessment Report in conjunction with Dana Engineering, Inc. (DEI), at the request of CH2M Hill Hanford Group, Inc. (CH2M HILL), the project co-operator. TGS is the IQRPE of record for this project.

1.1 Project Description

The DBVS is a demonstration waste treatment plant operated under a Research, Development and Demonstration (RD&D) Permit issued by Ecology. The RD&D Permit is issued to the U.S. Department of Energy, Office of River Protection (DOE-ORP) and CH2M HILL. The DBVS plant will be located at the 200 West Area of the Hanford Site. The DBVS is being designed, constructed, and operated by AMEC, an engineering/services company from Vancouver, British Columbia, under contract to CH2M HILL. AMEC is tasked to comply with the RD&D Permit. Figure 1 is a three-dimensional graphic view of the DBVS project.

The DBVS is designed to process a liquid salt solution of low-activity mixed waste (LAW) originating from Tank 241-S-109. Tank 241-S-109 is located adjacent to the DBVS facility. The LAW is to be converted into solid glass form by drying the LAW, mixing the LAW in dried form with soil, and melting it with an electric current. The project is intended to demonstrate the viability of immobilizing LAW from the tank farm utilizing a proprietary AMEC vitrification system. The demonstration is to involve treating up to 600,000 gal of waste (5M Na solution) in 24 months, producing up to 50 In-Container Vitrification (ICV™) melt boxes of stabilized vitrified waste.

About 13,000 gal of S-109 waste (5M Na solution) is to be processed in each melt box.. A detailed description of the process is provided in Attachments AA and BB of the RD&D Permit.

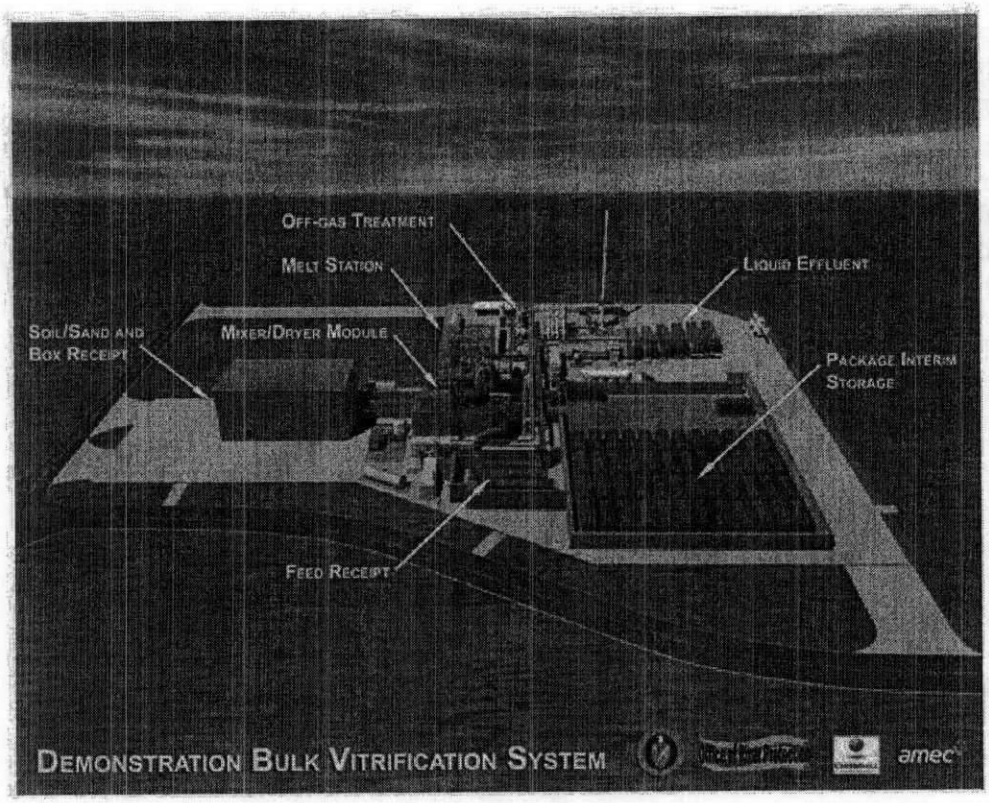


Figure 1. Demonstration Bulk Vitrification System Site Three-Dimensional View

1.2 Design Review Requirements

Many of the components of the DBVS will handle dangerous or mixed waste and are regulated by Washington Department of Ecology in the RD&D Permit. The RD&D Permit requires an IQRPE review of the design of these components prior to installation.

The Compliance Schedules, Sections IV.A.8 and V.I of the RD&D Permit, define the design documents to include drawings, specifications, calculations, and other information as deemed necessary to support the design. The RD&D Permit identifies seven systems, including the foundations system that will have design packages prepared for IQRPE review. CH2M HILL is providing the IQRPE with design review packages as AMEC completes the design.

As a basis for the IQRPE certification, a review is performed on a final version of the document "Demonstration Bulk Vitrification System IQRPE/RCRA Design Review Package", RPP-24544 as prepared by AMEC and reviewed and approved by CH2M HILL. Each design review package includes a body of text that explains the purpose and scope of the DBVS and describes the overall process as well as the specific system addressed in the design package. Included as supporting

information (appendices) are calculations, site maps, drawings, sketches, piping and instrumentation drawings (P&ID), process flow diagrams (PFD), waste characteristics, technical specifications for materials and equipment, and miscellaneous supporting data. Each design review package will be a revision of the RPP-24544 specific to the system addressed in the package. CH2M HILL is not requiring AMEC to seal/stamp final design documents per WAC standards for any DBVS work, other than the Site Improvements work (foundations and site work). Documents such as drawings, calculations, and specifications included in the design review package that are marked as final and have signatures for the preparer, checker, and approver, will be reviewed by the IQRPE as a complete document. All other documents will be reviewed as preliminary or supportive information. Preliminary design data was submitted and reviewed by the IQRPE reviewer as part of this certification, but only in an effort to familiarize the reviewer with the design until receipt of the final version.

The sixth system identified for IQRPE design review is the In-Container Vitrification (ICV™) System, Section 2.6 of RPP-24544, Rev. D, hereafter known as Design Package 2.6. The primary functions of the ICV™ System are:

- Preparation of the ICV™ box in the ICV Box Assembly Building,
- Receipt of the dried waste feed from the Dried Waste Handling System,
- Vitrification of the mixture through joule heating,
- Receipt of top-off soil from the Process Additive Handling System,
- ICV Box Sealing, and
- ICV™ Box transport from the melt area to the storage and sampling area.

1.3 In-Container Vitrification (ICV™) System Design Overview

This certification of the In-Container Vitrification (ICV™) System is based on the information presented in Design Package 2.6. This design package includes multiple calculations, specifications, and drawings, as summarized in Attachment A. TGS is providing one IQRPE design review report for the ICV™ System.

Figure 2 is a three dimensional view of the ICV™ system. White arrows in Figure 2 show the ICV™ System process path boundary. Major components of the ICV™ System are as follows:

- ICV™ Box Preparation Building
- ICV™ Box (prepared and assembled)
- Air Pallets for movement of ICV™ boxes
- Box Cooling, Sampling and Storage Area
- ICV™ Core Sampling

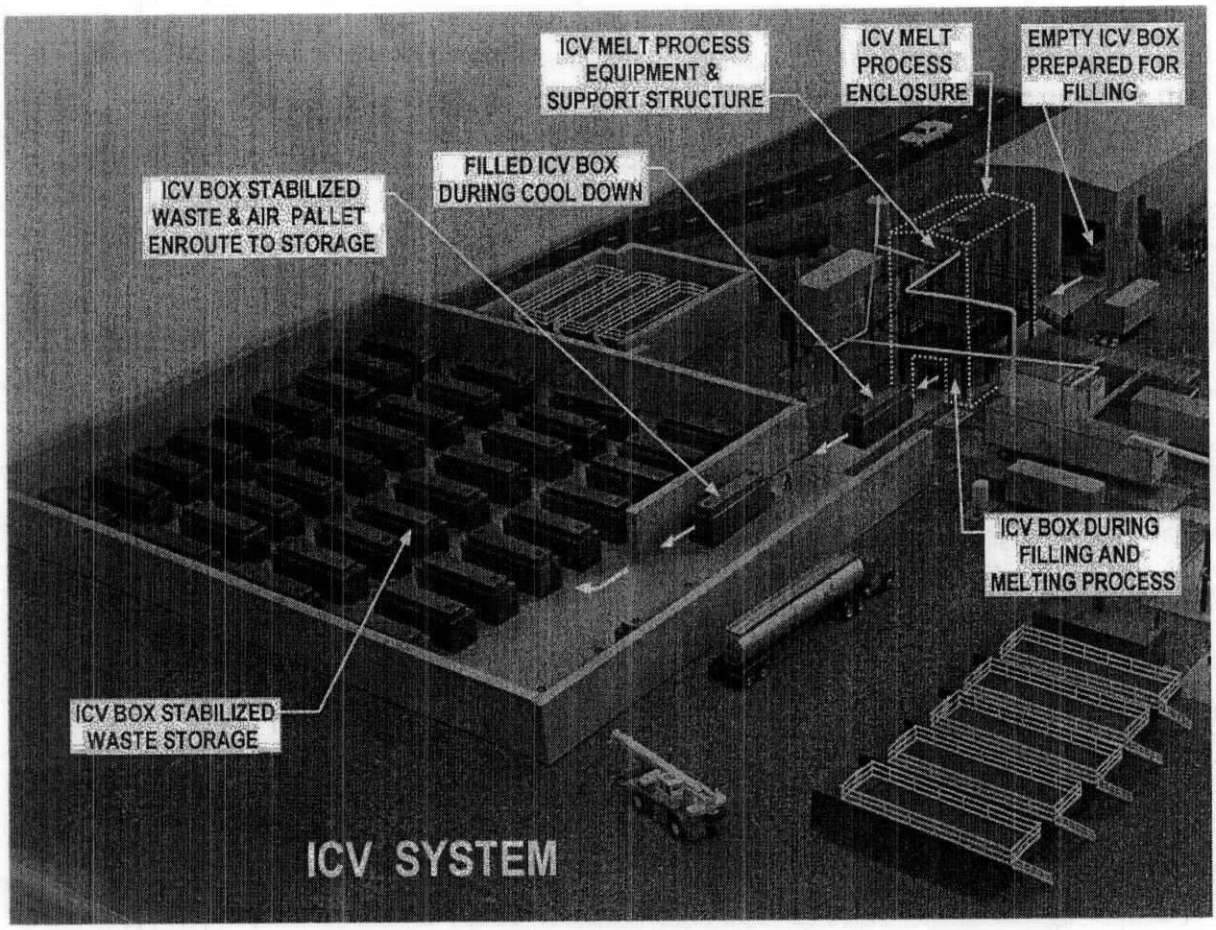


Figure 2. In-Container Vitrification (ICV™) Three Dimensional View

ICV™ boxes are prepared in the box assembly building (ICV™ Container Preparation and Assembly Enclosure). Backing bricks are added to the bottom ends and sides by positioning them on the inside of the ICV™ box, and mortared as required. Six rows of support ribs are spaced with sand fill between ribs as required, and run the length of the ICV™ box bottom. Box sand and refractory panels (container liners), mortar sealant between installed refractory panel half moon joints, seals, box instrumentation (thermocouples) and electrodes are added to each box. Starter path is then added. Plate glass is added to protect the starter path (conductive electrical path) from displacement during the initial loading process.

Once properly prepared, the ICV™ boxes are moved by the ICV™ Box Transporter (ICV-BT) to the melt area beneath the Ancillary Waste Transfer Enclosure (AWTE), with box position determined by box positioning pins. Power supply electrode stubs, designed to be reusable, are lowered and screwed at the ICV™ box lid to the top of the disposable electrodes. The ICV™ Box is also connected to the feed chutes and the Off-Gas Treatment System (OGTS) for venting. The instrumentation wiring harness is also connected to the ICV™ box.

The ICV™ System receives dried waste mixture in sequential batches from the Waste Dryer System via the Dried Waste handling System. The dried waste is then vitrified in an ICV™ box. Approximately two batches of dried waste are fed from the Dried Waste Handling System to the ICV™ box before starting the melt. The power supply to the ICV™ box is then turned on and melting of the soil/waste mixture starts from the bottom (at the starter path location) and progresses in an upward direction Once these initial batches are melted, approximately 6 batches of dried product are added sequentially. A total of approximately 8 batches of dried waste product are melted. Gases produced during the vitrification process are vented to the Offgas Treatment System. Loading of each batch of material from the dryer to the ICV™ box takes several hours. Once all required dryer loads have been placed in the ICV™ box, the melt is allowed to continue to complete the vitrification process.

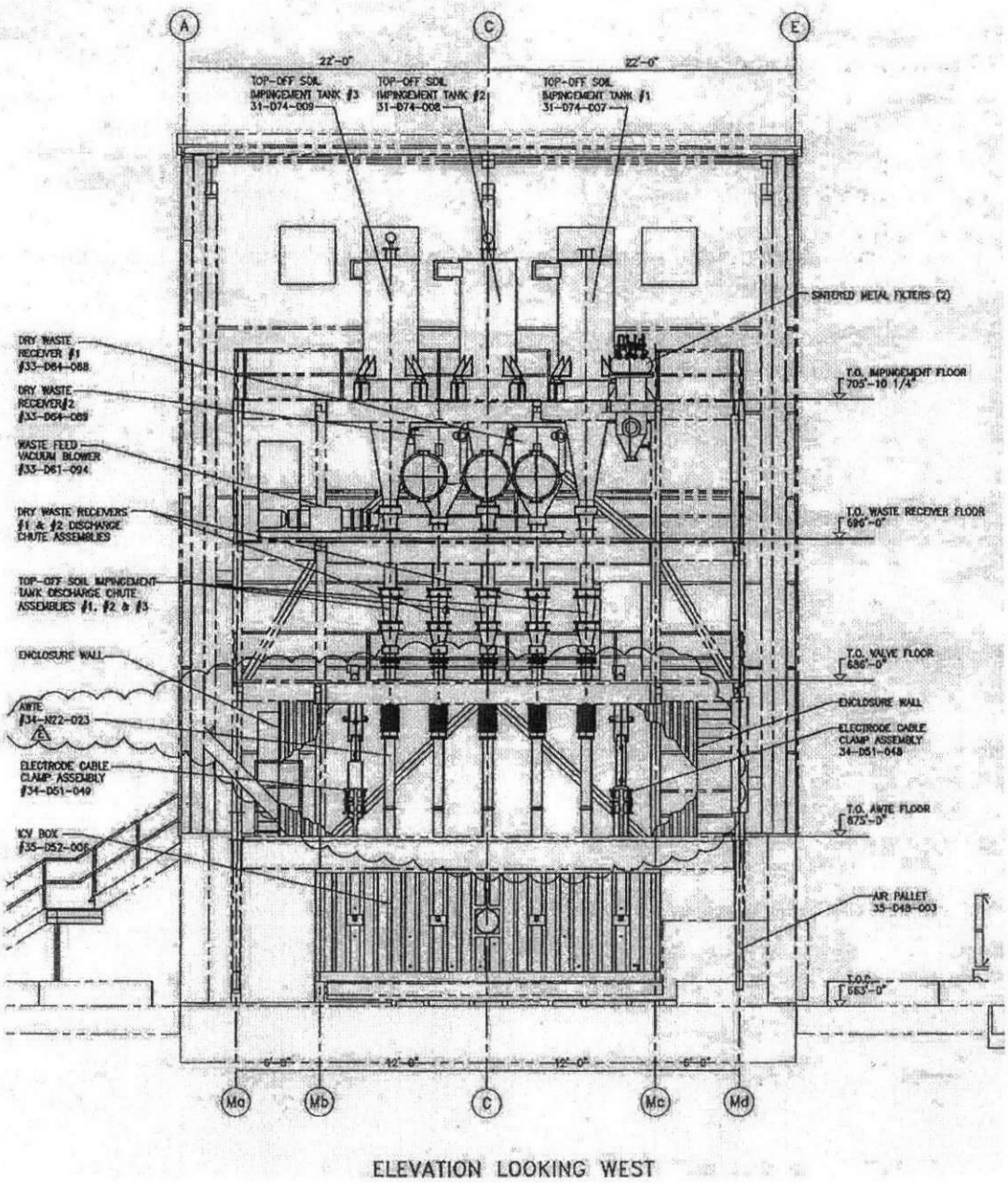
After all batches of material have been processed, top-off soil is added through the 2 blended dried waste and 3 top-off soil feed chutes. Soil added through the top-off soil feed chutes is fed by gravity from the 3 top-off soil impingement tanks and is controlled by using the airlock assemblies (34-D88-035,036,and 037 on Drawing F-145579-34-A-0101). Soil added through the dried waste feed chutes is added via the mixer/dryer and is controlled by the Dried Waste Handling Equipment. Shielding in the form of top off soil is added through the top-off soil chutes and controlled using the top-off soil feed chute airlock assemblies (34-D88-035, 036, 037 on Drawing F-145579-34-A-0101). Sufficient top-off soil is added such that the interior of the box is approximately 90 percent full and dose rates at the top of the box are as low as reasonably achievable. The chute airlock assemblies allow material to be metered into a given chute. The material feed ports will be capped, which seal to the ICV box lid.

Following initial cool-down, the ICV™ box is manually disconnected from the AWTE, caps are placed onto the open ports and electrode wells for storage/burial after all the chutes and electrode extensions have been disconnected and are clear of the ports and wells. The ICV™ box is then transferred to the Storage and Sampling Area to continue cooling. Following initial cooling, the filled ICV™ box is moved again by the ICV-BT to the designated storage location.

Figure 3 is the ICV™ system elevation arrangement diagrams, depicting the Dried Waste Handling System (above the ICV™) which feeds blended dried waste and top-off soil to the ICV™ box. The ICV Box ICV™ Box Transporter (ICV-BT) floats heavy loads on a film of compressed air. The ICV-BT is positioned below the ICV™ and used to transfer the ICV™ box from the box preparation building to the melting station and then to the cooling/sampling station after addition and vitrification of the waste product batch is completed.

Figure 4 shows an extract from the ICV™ system P&ID, depicting interfaces with other systems for the following process steps:

- Addition of blended waste;
- Melting blended waste
- Addition of clean top off soil added after melting.



ELEVATION LOOKING WEST

Figure 3. In-Container Vitrification (ICV™) System Elevation Arrangement Diagram

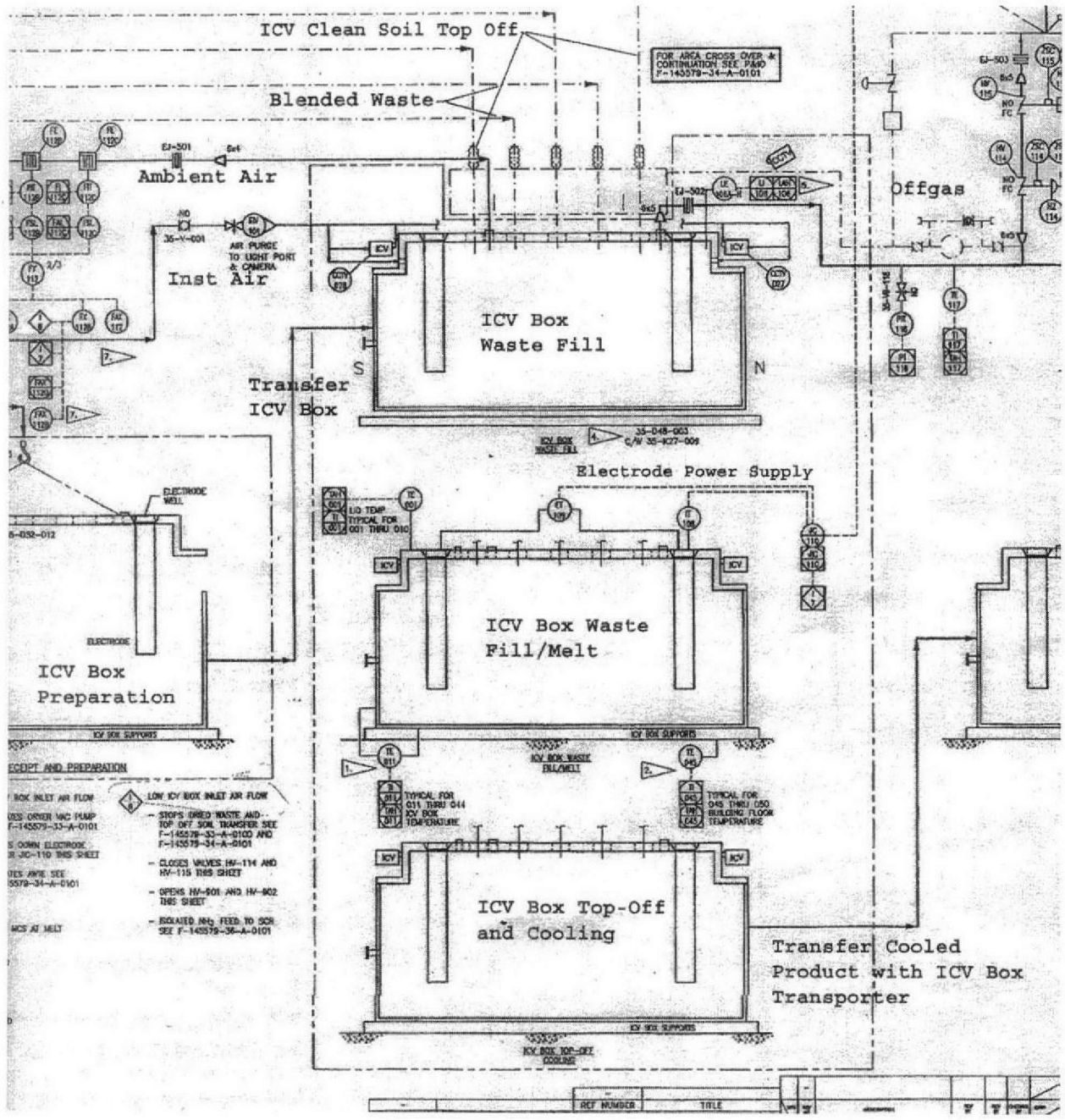


Figure 4. In-Container Vitrification (ICV™) System Interfaces

Figure 5 below, shows the layers contained in the welded steel ICV™ box, sand and castable refractory panels. Silica sand acts as a melt barrier for any liquid glass leaks if the refractory fails. Kaowool M board acts as a cushion for the refractory panels to allow for differential thermal movement between the lining and the metal box. Refractory panels are the primary containment of the melt, but also prevent fumes from escaping into the outer box area. They also provide shielding against the radioactive materials inside the box.

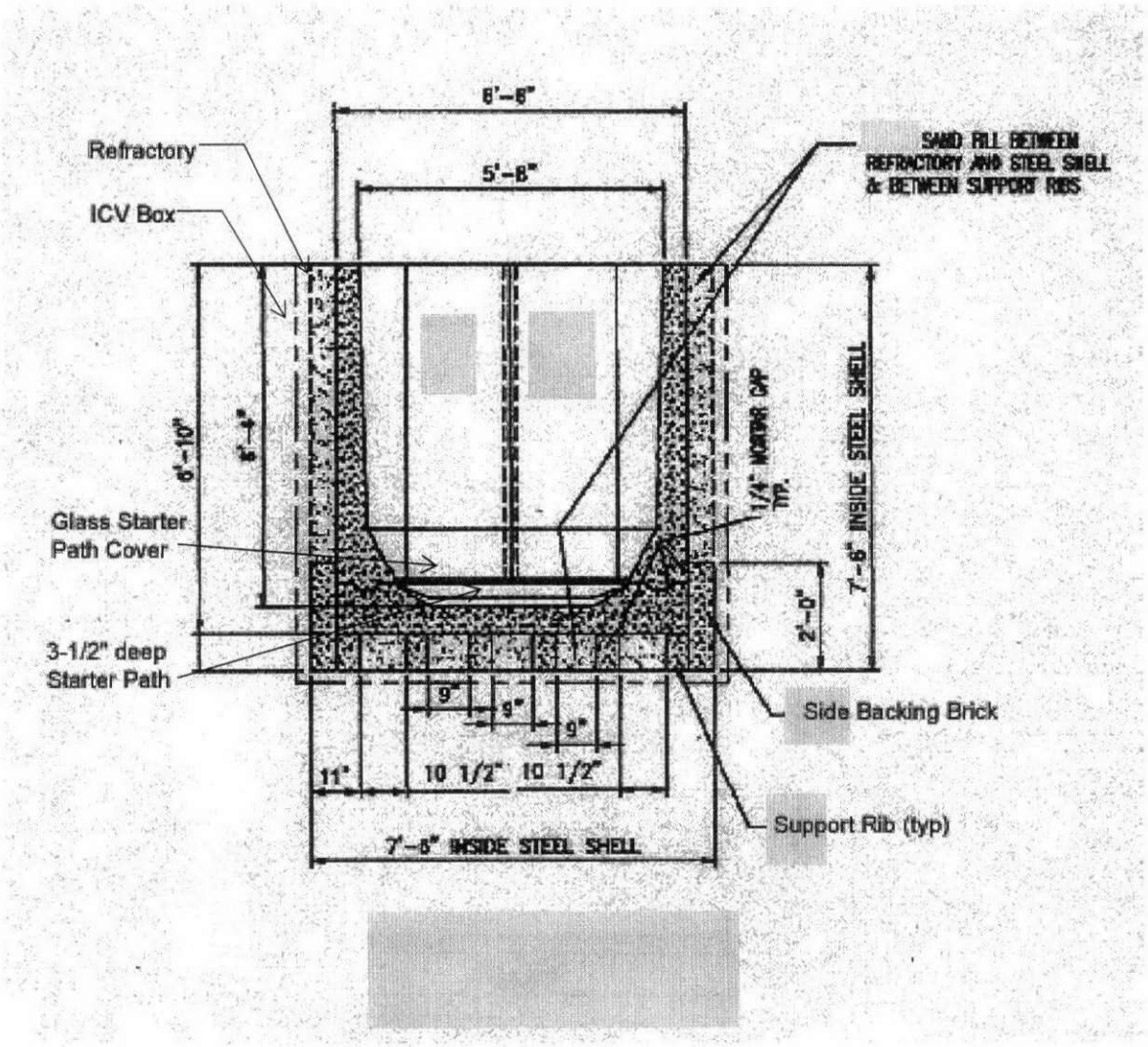


Figure 5. In-Container Vitrification (ICV™) Cross-Section

Finally, the following drawings further help to describe the ICV™ process and arrangement:

- F-145579-35-A-0100 Bulk Vitrification ICV™ Box P&ID
- F-145579-35-D-0004 ICV™ Box Data Sheet
- F-145579-35-D-0005 ICV™ Box Lid Assembly
- F-145579-00-A-0021 Full DBVS Feed Preparation & Melt Process Flow Diagram
- F-145579-00-D-0051 Bulk Vitrification Melt Area G.A. Plan Views
- F-145579-00-D-0041 Bulk Vitrification Melt Area G.A. Sections
- F-145579-35-D-0014 Bulk Vitrification ICV™ Shell Starter Path Details
- F-145579-35-D-0016 Bulk Vitrification ICV™ Box Refractory Assembly
- F-145579-35-D-0020 Bulk Vitrification ICV™ Box Electrode Details
- F-145579-00-F-0014 Bulk Vitrification ICV™ Box Instrument Locations

Note that Design Package 2.6 of the ICV™ System package also includes the "Bulk Vitrification Waste Feed Dryer to Box" P&ID (Drawing F-145579-33-A-0106) which interfaces with, but is not a part of the ICV™ System.

1.4 Scope of IQRPE Design Assessment

This IQRPE design report number is DR-013. This IQRPE design assessment includes a comprehensive review of Design Package 2.6, in accordance with the requirements of the DBVS RD&D Permit IV.A.8.b.i through IV.A.8.b.viii, IV.A.8.c.i, and V.I.2.a through V.I.2.f, and V.I.3.a through V.I.3.e, and WAC 173-303-630(4), (7). For this IQRPE review, the ICV™ system is treated with the same rigor and general format of review as a tank system, since the ICV™ box does contain liquid glass during the melting process; however, since the glass quickly turns to a solid during cooling, the ICV™ box is treated as a "container". A "container" is described in WAC 173-303-040 as any portable device in which a material is stored, transported, treated, disposed of, or otherwise handled. Much of the ICV™ system as provided in Design Package 2.6 was determined to be "Out of Scope" to the WAC requirements for IQRPE review and certification. Further discussion of the scope of the IQRPE design assessment is provided below. Any exceptions taken by the IQRPE to incomplete or unavailable items in Design Package 2.6 are listed in Section 2.2 at the end of each subsection. The documents included in this review and the level of each document review is summarized in Attachment A.

1.4.1 Portions of the ICV™ System Included "In Scope" for IQRPE Certification

ICV™ System processes which were determined to be in-scope for IQRPE review, include the following:

- Receipt of the dried waste feed from the Dried Waste Handling System
- Receipt of top off soil from the Process Additive Handling System
- Vitrification of the mixture through joule heating
- ICV™ Box Sealing
- ICV™ Box transport from the melt area to the storage and sampling area.

In-scope IQRPE reviews include structural assessments of the ICV™ Box and lid design, and melt area steel curbs, to confirm that required strength ICV™ box and strength supporting a fully loaded ICV™ box, especially during elevated temperatures or during full ICV™ box movement, is adequate. IQRPE scope includes review of the fully assembled and loaded ICV™ box design against specified waste stream properties at elevated temperatures, for overall configuration, materials, refractory, sand and insulation. Pressure controls of the ICV™ box during processing are also to be reviewed.

Although the ICV™ Box Transporter (ICV-BT) does not specifically fall under definitions of Tank or Container, as referenced in applicable RD&D Permit and WAC regulations, failure of the ICV-BT during hazardous waste transport of the ICV™ box could challenge structural aspects of the ICV™ box. IQRPE design certification of the ICV-BT which may otherwise affect unsafe drop or ICV™ box structural integrity is recommended when design details of the ICV-BT become available.

The IQRPE scope includes review of the fully assembled and loaded ICV™ box design against specified waste stream properties at elevated temperatures to consider overall configuration, materials, refractory, sand and insulation. Waste compatibility aspects in-scope to be reviewed by the IQRPE include ICV™ box and equipment material selection, melting points, structural strength at temperature, corrosion allowance.

IQRPE Ancillary Equipment considered in-scope includes any equipment which affects pressure control, overfill control, containment, piping, fittings, flanges, valves, instrumentation, valves, Ancillary Waste Transfer Enclosure design which may affect safe containment of hazardous waste in the ICV™ box.

Recommended factory and construction inspections (prior to operation) are considered in-scope for IQRPE review.

Assembly procedures for sand, refractory, and electrode installation inside the ICV™ box, as performed in the ICV™ Box Assembly Building, are considered "In-Scope" where the sand and

refractory shall form the containment barrier during melting of solids forming hazardous waste radioactive liquid glass.

1.4.2 Portions of the ICV™ System "Not-In-Scope" for IQRPE Certification

The following systems interface with the ICV™ System but are outside the scope of this IQRPE review:

- ICV™ box and lid positioning, hoisting and rigging in Preparation Building prior to ICV™ box assembly of sand and refractory,
- Dried Waste Handling system,
- Process Additive Handling system,
- Electrical Power Supply,
- Main Off-Gas Treatment system,
- Waste Sampling, and
- Waste Dryer system.

The following items are not covered by the WAC dangerous waste regulations or the RD&D Permit for the facility, and are therefore outside of the scope of this certification:

- Plant utilities, including instrument and plant air supply lines and electrical power beyond the first upstream valve or uninterruptible power supply systems.
- Structural features not related to hazardous waste secondary containment.
- Architectural features not related to hazardous waste containment.
- Lighting systems.
- System design features related to protection of the system due to vehicular traffic.
- Electrical or signal lines beyond the first upstream field termination box (FTB), motor control center (MCC), or instrument control panel (ICS).
- Radiation monitoring or detection components that may be mounted at various locations throughout the system.
- Verification of functional logic for operation and control of the In-Container Vitrification (ICV™) System.

This certification also excludes the review of the Design Package 2.6 to the following design standards included in RPP-17403 because the Design Review Package does not address these issues:

- Section 3.1.2.1.1.3 and Table 3-3 requirements regarding waste feed radionuclide properties, including all radioactive and radionuclide property considerations.

  Section 3.1 requirements for the DBVS that the design:

  - Ensure that all process byproducts are safe for long-term storage or release into the environment.

- Section 3.3.1.6 requirements for the DBVS that the design include the capability for flushing components for decontamination.

- Section 3.3.6 requirements for the DBVS that the design related to the following:

  - Personnel Safety

  - Fire Protection

  - Non-Radioactive Airborne Emissions (Section 3.3.6.3.4)

  - Radioactive Airborne Emissions (Section 3.3.6.3.6)

- Section 3.3.8 (Decontamination and Deactivation) or Section 3.3.9 (Nuclear Safety) requirements for the DBVS.

Because portions of the 90 percent design of the ICV™ Box Transporter has been developed as purchase specifications, some of the 'design' activities have been designated as the responsibility of the equipment vendor or Seller. Therefore, this information will not be available until fabrication of the equipment is underway and will require further IQRPE review as part of the construction certification package. Documentation to be reviewed by the IQRPE for inclusion with the installation certification package includes the deliverables listed in Attachment B.

2.0 ASSESSMENT

Section 1.4.1 of this report identifies portions of the ICV™ System included "In-Scope" for IQRPE review and certification. The following subsections identify the basis and methods used to complete this IQRPE design certification.

2.1 Codes, Standards and Regulations

The codes, standards, and regulations specifically used during the preparation of this certification are referenced as necessary throughout this report. A complete list of codes, standards, and regulations that have been incorporated into the Technical Specification packages is included as Attachment C.

The IQRPE concurs with the use of the codes, standards, and regulations that have been designated in the Technical Specifications.

2.2 Basis of Design

The ICV™ System is anticipated to operate for a minimum service life of 24 months while handling LAW from Tank S-109. Equipment has been specified with a design life of 5 years to handle the physical properties of low level radioactive hazardous waste identified below. ICVS tank waste feed dangerous waste constituents mean chemical composition of analytes are listed in Table 1. Physical property requirements of treated glass waste product are outside the scope of this certification.

ARES calculated for the box sidewall, in the extremely off-normal condition of a melt interface temperature of 1700° C, the maximum box sidewall skin temperature increases to 421 deg C and the leading edge of the leaking glass approaches to within 5/8" of the ICV box steel skin. Even under these extremely severe assumptions, the molten material is still contained within the refractory and sand layer. Even if the heat transfer coefficients are reduced by a factor of two, the ICV box sidewall temperature increases to 557° C and the "leaking glass" front approaches to within ½" of the ICV box steel skin. These conditions are still within the design limits of the box (Design package 2.6, Calculation CA-001 Rev. 2).

Similarly in this calculation, with the same conditions for the box bottom, even if the heat transfer coefficients are reduced by a factor of two, the ICV box bottom temperature increases to 391° C and the "leaking glass" front approaches to within 1-5/8" of the ICV box steel skin. Even under these extremely severe assumptions, the molten material is still contained within the refractory and sand layer. Even if the heat transfer coefficients are reduced by a factor of two, the ICV box bottom temperature increases to 517° C and the "leaking glass" front approaches to within 1-1/8" of the ICV box steel skin. These conditions are still within the design limits of the box.

The final vitrified waste will be sampled to provide data for waste form qualification, risk assessment, performance assessment and regulatory compliance. The vitrified waste will be analyzed for the dangerous waste constituents that were detected in the tank waste feed to determine compliance with Land Disposal Restrictions (LDR) requirements.

Ecology Publication 94-114, June 1994, "Guidance for Assessing and Certifying Tank Systems that Store and Treat Dangerous Waste" provides the format to assess and certify the In-Container Vitrification (ICV™) System. The ICV™ box is classified as a "container" and not a "tank" (section 1.4 of this report); therefore, this report format is adjusted as appropriate to the certification of hazardous waste ICV™ box containers. The IQRPE assessment focuses on the "process" of adding and vitrifying hazardous waste in the ICV™ box, followed by transport of the loaded ICV™ Boxes to the Storage and Sampling Area.

The following sections highlight the recommendations for the ICV™ System IQRPE assessment:

- Structural design assessment
- Waste compatibility
- Pressure control system
- Secondary containment system
- Ancillary equipment design
- Corrosion assessment
- Inspection schedule

Table 1. ICVS Tank Waste Feed Dangerous Waste Constituents Mean Chemical Composition of Analytes *

Analyte	Average Analyte to Na Mole Ratio
Waste Al^{+3}	9.32E-03
Waste CA^{+2}	2.43E-04
Waste Cl^{-1}	1.5E-03
Waste Cr (total)	2.96E-03
Waste F^{-1}	1.13E-03
Waste Fe^{+3}	9.57E-04
Waste K+	8.73E-04
Waste Mn^{+4}	2.85E-05
Waste Ni^{+2}	2.13E-05
Waste $NO2^{-1}$	1.31E-02
Waste $NO3^{-1}$	9.29E-01
Waste Pb^{+2}	2.78E-05
Waste $PO4^{-3}$	1.16E02
Waste Si^{+4}	1.13E-03
Waste $SO4^{-2}$	7.79E-03
Waste Sr^{+2}	6.53E-06
Waste TIC as $CO3^{-2}$	3.58E-02
Total Organic Carbon (TOC)	5.26E-03
U (Total)	2.34E-05
* RPP-17403, Rev 2 "Functional and System Design Requirements to DBVS, Table 3-2	

2.2.1 Structural Design Standards

Structural assessment of the ICV™ Box was performed to confirm that the required strength of all members in the ICV™ Box and lid are adequate. The plate thickness and stiffeners are sized using an allowable stress at an elevated temperature of 1058° F (570°C). The assessment included a review of each section of the box (i.e. sides, ends and floor) and a review of the calculated lifting requirements. Attachment A provides a summary of calculations, specifications, drawings and comments applicable to structural related matters relevant to the IQRPE scope of review.

Other structures in the ICV™ System are not designated to store or treat dangerous waste, and therefore did not receive an IQRPE review in compliance with WAC standards. For example, the ICV™ Box Assembly Building structure did not receive IQRPE structural reviews.

Where possible, the IQRPE reviewed the ICV™ System report to ensure that the following activities were incorporated into the Technical Specifications as part of the design basis:

- Design parameters used in structural calculations are clearly indicated and labeled on clarifying sketches.

- Seismic considerations, which are appropriate to the seismic risk zone (UBC 1997, Seismic Zone 2B) are accounted for in the structural calculations.

- The foundation underlying the ICV™ System will support the load of a full In-Container Vitrification (ICV™) Box. The foundation underlying the ICV™ system was certified by the IQRPE as part of IQRPE Design Assessment Report No DR-002 (see Section 4.0 References).

- The foundation underlying the ICV™ System has been designed to prevent failure due to settlement, compression, and uplift per the requirements of WAC 173-303-640(4)(c)(II). This was certified by the IQRPE as part of DR-002.

- The foundation supporting the ICV™ System has been designed to withstand the effects of frost heave per the requirements of WAC 173-303-640(3)(a)(v)(C). This was certified by the IQRPE as part of DR-002. This requirement is conservative, since the ICV™ box is classified as a "container", whereby requirements of WAC 173-303-630(4),(7) are applicable.

2.2.1.1 ICV™ Box and Lid Specification (SP-023, Rev 0)

The ICV™ Box and Lid Specification 145579-D-SP-023, Rev 0 was reviewed to ensure that provisions for the proper loads, supports, and design basis had been specified. The appropriate structural considerations have been made in this specification.

The ICV™ Box is based on a standard 50 yd^3 roll-off box with modifications and designed to be water tight; withstand the hydraulic and thermal loads of the molten glass and the weight of the total contents of sand, refractory, glass and top-off soil.

The ICV™ Box Lid is an integral lid and vent hood that is installed on the ICV™ box at assembly and remains on the box through processing and ultimately goes to the disposal site. It will be fastened to the top flange of the ICV™ box and is sealed to it with bolts, nuts, and a refractory gasket. The ICV™ Box Lid is specified to have ports in wells for electrodes that will be hung in electrical insulating bushings that seal to the lid as well as to the electrodes. The design includes 5 ports for material charge into the ICV™ box (three for top-off soil and two for waste feed). The material feed ports have caps which seal to the ICV™ box with refractory seals. These caps will be removed to allow the material feed chutes to extend into the box during filling.

2.2.1.2 ICV™ Box Transporter Data Sheet (D-DS-012.1 Rev 2)

ICV™ Box Transporter (ICV-BT) mechanical, electrical and controls details were not reviewed by the IQRPE, since D-DS-012.1 is a procurement data sheet, and actual equipment has not been designed at the time of this report. Although the ICV-BT does not specifically fall under definitions of Tank or Container, as referenced in applicable RD&D Permit and WAC regulations, failure of the ICV-BT during hazardous waste transport of the ICV™ box could

challenge structural aspects of the ICV™ Box. The ICV™ box design receives IQRPE certification and the ICV-BT supporting the ICV™ box is also critical to the ICV™ Box maintaining structural shape and containment of radioactive hazardous waste during transport from the vitrification station to the storage and sampling station. The Seller must account for temperature increases and weight, when selecting and sizing the ICV-BT per the data sheet. IQRPE design certification of the ICV-BT is recommended as it relates to "safe drop", when structural design aspects of the ICV-BT become available.

Effects of heat transferred to the ICV-BT from the loaded hot ICV™ box should also receive IQRPE evaluation when the ICV-BT design becomes available, to ensure that heat from the box may not detrimentally affect structural aspects of the design to safely transport the loaded ICV™ box.

2.2.1.3 Structural Data Sheets Applicable to Structural Review

The ICV™ Electrodes, Ceramic Sleeve and Collar form part of the pressure boundary of the operating ICV™ box. This pressure boundary is considered structural in nature and intended to be confirmed during pressure testing or during preoperational air flow testing of the ICV™ Box. The following specification sections are required to receive follow-up IQRPE review during or following ICV™ box pressure leak testing or air flow testing:

Specification No.	Specification Structural Sections Applicable to Future IQRPE Review
145579-D-DS-029.1, Rev 0 & TECN-D-DS-029.1.R00.1	ICV™ Electrodes and Accessories
145579-D-DS-047.1, Rev 0 & TECN-D-DS-047.1.R00.1	Ceramic Sleeve and Collar

2.2.1.4 Structural Design Exceptions

The IQRPE reviewed the structural design aspects of the applicable ICV™ System specifications, drawings and calculations as indicated. Structural review certification concurrence and exceptions to the AMEC design package calculations are as follows:

1. Calculation 145579-D-CA-010 Rev 0, ICV™ Box Weight Calculations, Final DBVS Design. IQRPE reviewed and concurs with the calculations.

2. Calculation 145579-D-CA-011 Rev 4, ICV™ Box Structural Analysis, Final DBVS Design. IQRPE reviewed and concurs with the analysis.

3. Calculation 145579-D-CA-028 Rev 0, ICV™ Box Center of Gravity Calculation, Final DBVS Design. IQRPE reviewed and concurs with the calculations.

4. Calculation 145579-D-CA-004 Rev 3, ICV™ Box Support Curbs Type 'C' and 'D' and 'E', Final DBVS Design. IQRPE reviewed and concurs with the calculations.

Heat transfer calculations have been included in the structural review section since high temperatures associated with vitrification may affect structural strength:

5. Calculation 145579-D-CA-001 Rev 2, Area 35- Transient Heat Transfer Calculations of ICV™ Box (includes calculation 0509206.01-M-001 Rev 1, "DBVS ICV™ Box Thermal Analysis"). IQRPE reviewed and concurs with the calculations.

6. Calculation 145579-D-CA-060 Rev A, "Heat Transfer Analysis- ICV Lid" (includes calculation 0509206.01-M-002 Rev 1, "DBVS ICV™ Off-Gas Hood Thermal Analysis"). IQRPE reviewed and concurs with the calculations.

7. IQRPE design certification of the ICV-BT is recommended as it relates to "safe drop", when structural design aspects of the ICV-BT become available.

8. Effects of heat transferred to the ICV-BT from the loaded hot ICV™ box should also receive IQRPE evaluation when the ICV-BT design becomes available, to ensure that heat from the box may not detrimentally affect structural aspects of the design to safely transport the loaded ICV™ box.

2.2.2 Waste Compatibility

RD& D Permit, Table V.1 classifies the ICV™ Boxes as "Containers". WAC 173-303-630 (4) "Use and Management of Containers" states that the owner or operator must use a container made of or lined with materials which will not react with, and are otherwise compatible with, the dangerous waste to be stored, so that the ability of the container to contain the waste is not impaired. Ecology Publication 95-420 provides guidance for assessing dangerous waste secondary containment systems. WAC 173-303-810 General Permit Conditions is applicable to all permits, requiring IQRPE certification of system design.

The IQRPE has reviewed waste characteristics compatibility with refractory and sand enclosed in the steel constructed ICV™ box, for temperature, chemical and corrosion affects. Chemical and corrosion effects are discussed in more detail in Section 2.2.6, Corrosion Assessment.

The following subsections highlight the IQRPE Waste Compatibility review for each of the major ICV™ System subsystems and specific exceptions to this IQRPE certification report as they relate to the Waste Compatibility review.

2.2.2.1 ICV™ Box and Lid Specification (SP-023, Rev 0)

Full scale testing with non-regulated material have been performed with a representative ICV™ box; observations for waste compatibility have been noted from the full-scale tests, and corrective actions have been taken on box design, as warranted. Testing of materials conducted by the melt vendor has confirmed the final selected material characteristics of the ICV™ box and lid.

The IQRPE reviewed the fully assembled and loaded ICV™ box design against specified waste stream properties at elevated temperatures, for overall configuration, materials, refractory and sand (see Table 1, Section 2.2 of this report). Waste compatibility aspects reviewed by the

IQRPE include ICV™ box and equipment material selection, melting points, structural strength at temperature, and HEPA filtration of potentially contaminated airborne particles. Structural strength at temperature is discussed in more detail in Section 2.2.1 of this report.

The IQRPE concurs that this 90 % design basis meets the requirements of the DBVS RD&D Permit and WAC 173-303-630(4),(7), subject to final IQRPE review of results from the melt Vendor ICV™ box vitrification testing.

2.2.2.2 ICV™ Box Transporter System Specification (SP-012, Rev C)

The ICV™ Box Transporter (ICV-BT) has no contact with the waste. Therefore, waste compatibility review on the ICV-BT is not applicable.

2.2.2.3 Waste Compatibility Exceptions

Prior to final acceptance of the proposed construction materials and design configuration, results of ICV™ box vitrification testing are required to be reviewed by the IQRPE for independent review of product compatibility with materials and configuration of construction.

2.2.3 Pressure Control System

During processing in the ICV™ box, ambient air passes through an inlet HEPA filter, feeds the upper ICV™ box internal cavity, and exhausts dust and air to the Off-Gas Treatment System (OGTS). The ICV™ box is intended to be maintained by the OGTS at a negative pressure with respect to atmospheric conditions as indicated by 35-PIT-118 during the melt and during dried waste or top-off soil feed. Pressure is also is remotely indicated on the main control panel. Pressure is manually controlled through adjustment of the flow through the ICV™ lid by remote actuation of valve 35-HV-114. Flows into and out of the ICV™ box are monitored by 35-FE-112A, B, and C .

Low ICV box inlet air flow activates the following pressure control interlocks:

- Stops dried waste and top off soil transfer;
- Isolates OGTS ICV box exhaust processing valves HV-114, HV-115;
- Opens OGTS bypass valves HV-901, HV-902;
- Isolates ammonia feed to SCR;
- Isolates offgas treatment system inlet air bleed valves;
- Stops the dried waste vacuum blower;
- Isolates the AWTE.

Pressure control of the ICV™ Box is maintained at ambient pressures during cooling and storage through installation of an ICV™ box HEPA breather filter. The ICV™ box HEPA breather filter is installed after top-off soil is introduced into the ICV™ box and just before disconnection from the AWTE. Melted liquid head pressure is accounted for in the design of the ICV™ Box, and no other pressure control system is required.

2.2.3.1 Pressure Control System Exceptions

The IQRPE has reviewed the Pressure Control system for the ICV™ box and has no exceptions. The ICV box is designed to prevent excess pressure buildup through the use of continuous venting to the Off Gas Treatment System while connected to the AWTE, or through atmospheric venting through the breather filter after melt is completed. During processing when ICV box is connected to the OGTS, pressures are intended to be maintained negative relative to atmosphere and the AWTE. ICV™ box negative pressure design values (Ref: F-145579-00-A-0021, Rev 0J), may be difficult to attain unless controllable system resistance is added to the ICV™ box inlet air supply piping. This may be verified during preoperational testing . Gases generated, and any particulate suspended, during the process are directed to the OGTS for treatment.

2.2.4 Secondary Containment System

RD& D Permit, Table V.1 classifies the ICV™ Boxes as "Containers". Ecology Publication 95-420, "Guidance for Assessing Dangerous Waste Secondary Containment Systems" includes guidance for assessing the adequacy of secondary containment, for containers secondary containment. Secondary containment for container systems that store, accumulate, or treat dangerous waste must be designed and installed to meet the requirements of WAC 173-303-630(7). A review of the secondary containment system is normally part of the IQRPE review.

During processing, the ICV box is connected to the OGTS and maintained at a negative pressure relative to atmosphere and the AWTE. Gases generated, and any particulate suspended, during the process are directed to and retreated by the OGTS. The ICV box provides primary containment for the dried, molten and gaseous waste form. WAC-173-303-630(7) section (7)(c) states: *"Storage areas that store containers holding only wastes that do not contain free liquids, do not exhibit either the characteristic of ignitability or reactivity as prescribed in WAC 173-303-090, and are not designated as F020, F021, F022, F023, F026, or F027, need not have a containment system as described in this subsection, provided that: (ii) The containers are elevated or are otherwise protected from contact with accumulated liquids."*

Processed ICV™ boxes hold only waste which does not contain free liquids, do not exhibit characteristics of ignitability nor reactivity and are not designated under F numbers listed above. The ICV™ boxes are elevated at all times and are placed on curbs above the super flat floor, except when being transported by the ICV™ Box Transporter System in an elevated manner. Precipitation will be allowed to run-off the flat surfaces to nearby gravel for natural drainage over ground surfaces.

Based on the above, secondary containment does not apply to ICV™ boxes containing hazardous waste. Nevertheless, attention is directed to thermocouple indications during the melting process as well as visual inspections. A spill or release during the vitrification process is detected by thermocouples in the melt area, directly beneath the ICV box . Visual inspection of the ICV™ box is used in other locations to identify a spill or release of solids, consistent with accessibility limitations.

2.2.5 Ancillary Equipment Design

A review of the ancillary equipment design is normally part of the IQRPE review. Because the Technical Specifications prepared for the ICV™ System IQRPE/RCRA Design Review Package are purchase specifications that place responsibility for the final ancillary configurations and the purchase of all piping, fittings, flanges, valves, instrumentation, valves, and electronics on the Seller, a complete review of the ancillary equipment design cannot be completed until final 100% design information is available for IQRPE review.

The following subsections highlight the IQRPE Ancillary Equipment Design review as applied to the specifications, P&ID's, and data sheets; and also identifies specific exceptions to this IQRPE certification report as they relate to the ancillary equipment design review. Ancillary equipment design information to be submitted by the SELLER and reviewed by the IQRPE at a later date is listed in Attachment B.

2.2.5.1 P&ID Review

P&ID F-145579-35-A-0100 was reviewed for the following basic considerations:

- Appropriate location of pressure, temperature, and flow sensing equipment.
- Necessary piping, valve, and instrumentation labeling.
- Proper positioning of instrumentation to prevent undue influence from upstream equipment.
- Necessary isolation valves to allow instrumentation maintenance.
- Identification of preliminary interlocks.
- Designation of valves as fail-open or fail-close.
- Location of check valves or back-flow preventers, if applicable.
- General designation of appropriate alarms and recorded information.
- Overpressure protection.

2.2.5.2 Data Sheet Review

Data sheets are generally incomplete and are required for the 100% IQRPE design review. This review of the existing data sheets included:

- Appropriate materials of construction.
- Appropriate functionality.
- Hazard classification requirements.

The following miscellaneous ancillary equipment were included as part of package 2.6 and were evaluated by the IQRPE as follows:

- Ceramic Sleeve and Collar (DS-047.1)

  The IQRPE reviewed the Ceramic Sleeve and Collar data sheet and had no comments. See further comments in Section 2.2.2.3 of this report.

- Seals (DS-050.1)

  The IQRPE reviewed the Seals data sheet and had no comments.

- ICV™ Box HEPA Breather Filter

  The ICV™ Box Breather HEPA filter is a filter which is installed after top-off soil is introduced into the ICV™ box, just before the AWTE disconnect, to ensure that pressurization/de-pressurization during cooling and storage is avoided. The IQRPE reviewed the ICV™ Box HEPA Breather Filter data sheet and had no comments.

- ICV™ Box Transporter (Data Sheet D-DS-012.1, Rev 2)

  The ICV™ Transporter Data Sheet D-DS-012.1, Rev 2 received IQRPE review. The ICV-BT uses a variety of "casters" to float heavy loads on a film of air. The air pallet is specified to have a low profile to fit under the ICV™ box when mounted on curbs. The ICV-BT is a self contained unit with an on-board, diesel-driven compressor power unit supplying air for lift and drive/steerage. IQRPE reviews are required after 100% design information is available, in order to examine heat transfer into the air pallet affecting pallet process operability. The 100% review should also include the pallet's overall ability to support the load of the full vitrified waste container to ensure safe processing and transfer.

2.2.5.3 Ancillary Equipment Exceptions

IQRPE Certification exceptions to the ancillary equipment review are as follows:

Technical Specifications prepared for the ICV™ System IQRPE/RCRA Design Review Package are purchase specifications that place the responsibility for the final design of the system components on the Seller; thus a complete review of the ancillary equipment systems has not been completed.

The following have been considered by the IQRPE:

1. Secondary containment does not apply to ICV™ system ancillary equipment supporting vitrification processing. Nevertheless, attention is directed to thermocouple indications during the melting process as well as visual inspections. A spill or release during the vitrification process is detected by thermocouples. Visual inspection of the ICV™ box is used in other locations to identify a spill or release of solids, consistent with accessibility limitations.

2. ICV™ System ancillary equipment is required to be designed to be supported and protected against damage and excessive stress due to excessive settlement, vibration, expansion or contraction. (Note that equipment to be supplied by the Seller is not yet available for IQRPE review).

3. Final design of ICV™ System ancillary equipment is not available at the time of this report, therefore the IQRPE review is required at a later date to verify that equipment is supported and protected against damage and excessive stress due to excessive settlement, vibration, expansion or contraction.

4. IQRPE review is required at a later date to verify ICV™ System overfill prevention equipment (includes high ICV™ box process level sensing with remote indication) has been has been provided, to indicate to operator when ICV™ box design processing levels are reached.

5. For the ICV™ Box Transporter System, IQRPE reviews are required after 100% design information is available, to ensure that the pallet's overall ability to support the load of the full vitrified waste container and to ensure safe processing and transfer.

6. Implement a fully integrated pre-operational acceptance test, conducted by representatives of the Buyer, to verify correct operability of all interlocks, wiring, electrical components, instruments, logic and equipment, for both "normal" and "off-normal" conditions, prior to the start of simulant testing.

Revise P&ID F-145579-35-A-0100 in accordance with P&ID review comments below:

P&ID F-145579-35-A-0100 Rev N has been reviewed by the IQRPE with no comments. Previous P&ID comments provided by the IQRPE have been addressed.

2.2.6 Corrosion Assessment

RD& D Permit, Table V.1 classifies the ICV™ Boxes as "Containers". WAC 173-303-630 (4) "Use and Management of Containers" states that the owner or operator must use a container made of or lined with materials which will not react with, and are otherwise compatible with, the dangerous waste to be stored, so that the ability of the container to contain the waste is not impaired. Ecology Publication 95-420 provides guidance for assessing dangerous waste secondary containment systems. WAC 173-303-810 General Permit Conditions is applicable to all permits, requiring IQRPE certification of system design.

The IQRPE has performed an independent engineering corrosion review of the ICV™ Box. The IQRPE reviewed waste characteristics compatibility with refractory, sand, and insulation enclosed in the steel constructed ICV™ box for temperature, chemical, and corrosion affects. Temperature effects not related to the corrosion assessment are discussed in more detail in Section 2.2.2, Waste Compatibility.

The following sections highlight the IQRPE Corrosion Assessment review for the ICV™ System components, and also identify specific exceptions to this IQRPE certification report as they relate to the corrosion assessment review.

- ICV™ Box and Lid Specification (SP-023, Rev. 0, and DS-023.1, Rev. 0)

  NOTE: *Since the independent corrosion engineer's design review, full scale testing with non-regulated simulant material has been performed with a representative ICV box. The customer stated that "no significant scaling of the ICV container was observed." The independent corrosion engineer has recommended that testing of materials, as conducted by the melt vendor, should be conducted to confirm the final selected material characteristics of the ICV™ box and lid. Alternative vendor recommendations should also be evaluated.*

  An independent review was conducted for corrosion review (Appendix H6). An independent corrosion expert has reviewed the specification and associated data sheet and indicated a concern for scaling of the carbon steel in air at the processing temperatures. Since scaling temperature of carbon steel in air is about 900 deg F and increases rapidly above this temperature, it was suggested that use of carbon steel with chromium and molybdenum would raise the scaling temperature and be more compatible with service conditions. One suggested possible material is A387 (UNS 41545) with about 5% Cr and 0.5% Mo, which has a scaling temperature of approximately 1150 deg F (Appendix H6).

  The specification SP-023 requires the use of Carboline – Thermaline 4700 protective coating to be applied. The data sheet requires that the surface be prepared to an SSPC-SP 10 and that a Silicone Zinc Primer be applied to the blasted surface (dry film thickness is not specified). Care must be taken to ensure that the surface profile does not exceed the coating manufacturer's recommended 0.5 – 1.0 mil range. Provisions should be made to perform 3rd party coating inspection at the application location.

- ICV™ Box Transporter System Specification (SP-012, Rev. C)

  The ICV™ Box Transporter (ICV-BT) has no contact with the waste. Therefore, corrosion assessment for the ICV-BT is not applicable.

2.2.6.3 Corrosion Assessment Exceptions

IQRPE Certification exceptions to the corrosion assessment are as follows:

1. Prior to final acceptance of the proposed construction materials and design configuration, results of ICV™ box vitrification testing are required to be reviewed by the Buyer for corrosion effects with materials and configuration of construction. High temperature scaling of the carbon steel ICV™ box should be evaluated. Lined materials must be observed to be compatible with vitrified product and not to react with the product.

2. All Seller recommended protective coatings, surface preparation procedures, application methods, and environmental constraints should be reviewed and approved prior to fabrication.

2.2.7 Recommended Inspection Schedule

In-Container Vitrification (ICV™) System inspections are recommended during four phases:

1. Factory construction of ICV™ boxes/lids.
2. Factory construction of applicable portions of ICV™ Box Transporter System (see Section 1.4.1).
3. Inspections during assembly of ICV™ boxes and lids in the ICV™ Container Preparation and Assembly Enclosure.
4. Site construction Inspection of ICV™ Ancillary Equipment.

2.2.7.1 Factory Construction of ICV™ Boxes and Lids (SP-023, Rev 0)

As part of the procurement process, the ICV™ box Supplier is required to provide a process to plan and execute inspections to verify conformance of the ICV™ box and lid design and construction requirements (SP-023, 4.1.6). Inspections during fabrication shall be independently conducted, documented, and executed in accordance with an approved inspection or test procedure by a qualified inspector in accordance with the NQA-1 quality assurance program. Data from inspections and tests shall be documented in reports for further evaluation, including references to follow-up actions taken for non-conformances. Items inspected are required to be traceable by number, inspector name and date.

The qualified independent inspector or IQRPE should also review the factory ICV™ boxes/lids inspection and testing reports, as they become available, to include but not limited to the following:

- Evaluation of welding work packages and reports to verify no cracking or lack of fusion.
- Confirmation that no punctures, cracks, corrosion, or other structure damage are present.
- Review of "tightness testing" (hydrostatic or pneumatic leak tests, and results) to verify no leaks are present, and that leak test acceptance criteria specified over the test period has been met.
- Verification of critical dimension through physical inspections within specified tolerances;
- Review of Factory Acceptance Test procedures and test results prior to shipment;
- Verification of proper application of coatings, especially verification of ICV™ box high temperature coatings.

2.2.7.2 Factory Construction of the ICV™ Box Transporter (D-DS-012.1 Rev 2)

IQRPE inspection applies to the ICV-BT only as it relates to prevention of an unsafe drop Sections 2.2.1 and 2.2.2. Specification SP-012 requires that the ICV-BT supplier provide a process to plan and execute inspections to verify conformance of the ICV-BT design and construction requirements (SP-012, 4.1.7). Inspections during fabrication shall be independently conducted and documented in accordance with an approved inspection or test procedure by a

qualified inspector in accordance with the NQA-1 quality assurance program. Data from inspections and tests shall be documented in reports for further evaluation, including reference to follow-up actions taken for non-conformances. Items inspected are required to be traceable by number, inspector name and date.

2.2.7.3 Assembly of ICV™ boxes and lids in the ICV™ Container Preparation & Assembly Enclosure

Proper field assembly of the ICV™ boxes insulation, refractory, sand, starter path, lid and gaskets is critical to maintaining ICV™ box integrity (and thus adequately containing hazardous waste) during vitrification operations. ICV™ box assembly inspections are recommended to be conducted by a qualified inspector in accordance with the NQA-1 quality assurance program, and IQRPE spot checked (approximately 5 spot checks, especially during first assemblies) to ensure that assembly acceptance criteria is being met. IQRPE independent review of assembly of ICV™ boxes/lids is not a substitute for a thorough execution of the Quality Assurance/ Quality Control program.

2.2.7.4 Installation Inspection of ICV™ Ancillary Equipment

Accurate records must be kept and recorded in an IQRPE inspectors' database to properly track Inspections, Findings, Resolutions and Acceptance by the IQRPE and Buyer. The IQRPE is recommended to perform inspection walkdowns and coordinate with IQRPE inspectors to inspect and document ongoing and completed construction. Written statements by the IQRPE should be provided, attesting that the In-Container Vitrification(ICV™) System and interconnecting ancillary systems and components have been constructed in accordance with specified requirements, as per WAC 173-303-810 (13)(a).

Inspections shall be conducted by a qualified inspector in accordance with the NQA-1 quality assurance program. IQRPE construction inspections of ICV™ Ancillary Equipment are recommended to include the following:

- Before placing ICV™ Ancillary equipment into service, the associated equipment should be inspected by an IQRPE for structural damage and proper installation.
- IQRPE review of Construction Acceptance Tests, including equipment functional checkout tests, valve actuation tests, electrical continuity tests, valve limit switch tests, instrumentation functionality tests, interlock and control circuit loop tests.
- Verification of the protection of ancillary equipment against physical damage and stress.
- Installation inspection that conforms to consensus-recognized standards including the documentation of findings and corrective actions documented in a post-inspection report;
- Review of non-destructive testing results, including: visual weld examinations, radiography, liquid dye penetrant tests, ultrasonic inspections.
- Review of pre-operational acceptance test results, for testing conducted by representatives of the Buyer. This is an independent review to verify correct operability

of all interlocks, wiring, electrical components, instruments, logic, valves and equipment, for both "normal" and "off-normal" conditions, prior to the start of simulant.

2.2.7.5 Recommended Inspection Schedule Exceptions

The majority of recommended inspections in this report are provided by the IQRPE based on interpretation of requirements referenced in equipment and system procurement specifications, operations and maintenance manuals, equipment data sheets, WAC 173-303-810, WAC 173-303-630 (4),(7); and the RD&D Permit.

IQRPE Certification exceptions to the recommended inspection schedule assessment review are as follows:

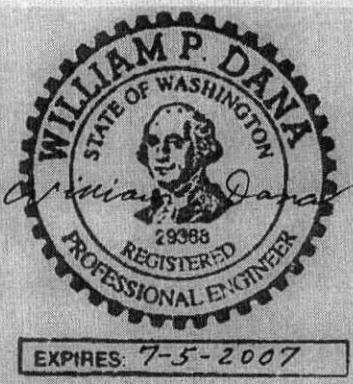
- The recommended inspection activities described in this section are based on the design basis operating life, operating conditions, and waste characteristics outlined in the Design Basis Report. Should any of these parameters change (for example: extended operating life, increased operating temperatures, etc.), the inspection schedule must be re-evaluated by the IQRPE.

3.0 DESIGN REVIEW ASSESSMENT CERTIFICATIONS

The In-Container Vitrification (ICV™) System IQRPE/RCRA Design Review Package, RPP-24544, Revision C for System 2.6 has been reviewed by the IQRPE, and, with the exceptions listed herein, was assessed to be in compliance with the applicable sections of WAC 173-303-630, and the RD&D Permit for the DBVS as stated in Section 1.4 of this report. These results are based on a review of the applicable codes, standards, and documents. The certifications below are in accordance with the requirements of WAC 173-303-630 (4),(7)and WAC 173-303-810(13)(a).

Report Lead IQRPE:

I certify under penalty of the law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment for knowing violations.



William Dana 4-21-07

Report Reviewed by:

Robert L. Goodman, P.E. 20 Apr 06.

Karl M. Walterskirchen, P.E. Date

Chief Engineer, TGS

4.0 REFERENCES

WAC 173-303-630, Use and Management of Containers, April, 2005

WAC 173-303-640, Tank Systems, Washington Administrative Code, as amended

WAC 173-303-810 General Permit Conditions, February, 2005

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

WA Dept of Ecology Publication 95-420 Guidance for Assessing Dangerous Waste Secondary Containment Systems, June 1994

RD&D Permit WA7890008967 Permit for Dangerous and or Mixed Waste Research, Development, and Demonstration

CH2M Hill Hanford Group, Inc. Statement of Work, Requisition 114648, "Independent Qualified Registered Professional Engineer support to Demonstration Bulk Vitrification System Project"

RPP-24544, DRAFT Demonstration Bulk Vitrification System IQRPE/RCRA Design Review Package, Revision E. March 21, 2006

WA Dept of Ecology Permit No. WA 7890008967, Permit for Dangerous and/or Mixed Waste Research, development and Demonstration

RPP-17403, Rev 2 "Function and System Design Requirements for the Demonstration Bulk Vitrification System." CH2M Hill Hanford Group, Inc.

HNF-SD-GN-ER-501, Rev. 1B, "Natural Phenomena Hazards, Hanford Site, South Central Washington." (As revised by ECN 672877, May 15, 2002)

DOE-STD-1020-2002, Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities, January 2002

RD&D Permit DOE/ORP-2003-23, Rev 1 May 2004 Section 6 "Waste Analysis Plan"

Principals of Heat Transfer, 5th edition, 1997, Frank Kreith

1997 Uniform Building Code (International Building Code)

AISC Manual of Steel Construction- Allowable Stress Design, 9th edition

ACI Manual of Concrete Practice, 1997, American concrete Institute, Farmington Hills, MI

Design of Welded Structures, O.W. Blodgett, 1996, James F. Lincoln Arc Welding Foundation

Mechanics of Materials, 4th Edition, R.C. Hibbeler

ASME N510, Testing of Air Treatment Systems

ASNT SNT-TC-1A, Recommended Practice for Nondestructive Testing

IQRPE Design Assessment Report No. DR-002, Rev. 0, *Foundations Systems, Review of Calculation 145579-CA-011, Revision 3, Melt Area Support Structure & Foundation (Fdn #1)*

Drawing F-145579-00-A-0021, Rev 0J, Full DBVS Feed Preparation & Melt Process Flow Diagram

Cengel, Y.A. & R.H. Turner, *Fundamentals of Thermal-Fluid Sciences*, McGraw-Hill Co., 2001

Hollman, J.P., *Heat Transfer*, 3rd Edition, McGraw-Hill Co., 1972

ATTACHMENT A

In-Container Vitrification (ICV™) SYSTEM

IQRPE DISPOSITION OF CALCULATIONS, SPECIFICATIONS, AND DRAWINGS

(Seven Sheets)

ATTACHMENT A

IN-CONTAINER VITRIFICATION (ICV™) SYSTEM

IQRPE DISPOSITION OF CALCULATIONS, SPECIFICATIONS, AND DRAWINGS

Calculation Number	Calculation Title	Observations / Comments
145579- D-CA-001 Rev 2	Area 35- Transient Heat Transfer Calculation of ICV™ Box (includes calculation 0509206.01-M-001 Rev 1, "DBVS ICV™ Box Thermal Analysis")	IQRPE reviewed and concurs with the calculations.
145579-B-CA-004, Rev 3	ICV™ Box Support curbs Type "C" , "D" and "E" Final DBVS Design	IQRPE reviewed and concurs with the calculations.
145579-D-CA-010, Rev 0	ICV™ Box Weight Calculations, Final DBVS Design	IQRPE reviewed and concurs with the calculations.
145579-D-CA-011, Rev 4.	ICV™ Box Structural Analysis, Final DBVS Design	IQRPE reviewed and concurs with the calculations.
145579-C-CA-013, Rev 2	ICV™ Box Storage Slab and Access Slabs (foundations #16, 17, 18)	Calculation CA-013 was reviewed as part of IQRPE review package DR-002.
145579-C-CA-014, Rev 0	ICV™ Box Assembly Building Foundation	There is no hazardous waste to be stored or treated in the ICV™ Box Assembly Building, therefore the ICV™ Box Assembly Building and Foundation are not applicable to IQRPE review.
145579-D-CA-028, Rev 0.	ICV™ Box Center of Gravity Calculation, Final DBVS Design	IQRPE reviewed and concurs with the calculations.
145579-D-CA-060, Rev A	"Heat Transfer Analysis- ICV Lid" (includes calculation 0509206.01-M-002 Rev 1, "DBVS ICV™ Off-Gas Hood Thermal Analysis")	IQRPE reviewed and concurs with the calculations.
Document Number	**Document Title**	**Comments**
145579-D-DS-029.1, Rev 0 Data Sheet and & TECN D-DS-029.1.R00.1	ICV™ Electrodes and Accessories	A preliminary review of this drawing and data sheet was conducted. The preliminary IQRPE review noted no exceptions. This data sheet will need to be revised during the detailed design.

145579-D-DS-047.1, Rev 0 Data Sheet and & TECN D-DS-047.1.R00.1	ICV™ Box Lid Ceramic Sleeve and Collar	A preliminary review of this drawing and data sheet was conducted. The preliminary IQRPE review noted no exceptions. This drawing/data sheet will receive IQRPE review at final design.
145579-D-DS-048.1, Rev 0	Electrode Extension Winch Hoist Data Sheet	A preliminary review of this data sheet was conducted. The preliminary IQRPE review noted no exceptions. This data sheet does not require IQRPE review.
145579-D-DS-050.1, Rev 1 Data Sheet; and Attachment Dwg F-145579-35-D-0019, Rev B	ICV™ Box Lid Seals	A review of this drawing and data sheet was conducted. The IQRPE review noted no exceptions.
145579-D-DS-056.1, Rev 0	Electrode Torque Wrench Data Sheet	A preliminary review of this data sheet was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This data sheet does not require IQRPE review at final design.
145579-D-SP-012, Rev 0	ICV™ Box Transporter System Specification	A preliminary review of this spec was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
145579-D-DS-012.1, Rev 0	Equipment 35-D48-003 Air Pallet Data Sheet	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This data sheet will receive IQRPE review at final design.
145579-D-SP-022, Rev 0	Electrode Cable Clamp Assembly Specification	A previous review of this spec was conducted by the IQRPE, however this specification is now defined as out of scope requiring no further IQRPE review.
145579-D-DS-022.1, Rev 0	Equipment 34-D51-048/049 Electrode Cable Clamp Assembly Data Sheet	A preliminary review of this data sheet was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This data sheet does not require IQRPE review at final design.

F-145579-34-D-0004, Rev E	AWTE Floor- electrode Cable Clamp Assembly	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This data sheet does not require IQRPE review at final design.
145579-D-SP-023, Rev 0	ICV™ Box and Lid Specification	A preliminary review of this spec was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
F-145579-35-A-0100, Rev N	Bulk Vitrification ICV™ Box P&ID	A review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
F-145579-00-D-0007, Rev E	Bulk Vitrification ICV™ Package Sampling and Storage Area General Arrangement Plan	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-00-D-0020, Rev E	Bulk Vitrification Sampling & Storage Area G.A. Sections	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-00-D-0041, Rev F	Bulk Vitrification Melt Area G.A. Elevations North and West	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-00-D-0051, Rev F	Bulk Vitrification Melt Area General Arrangement Plan Views	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-00-A-0021, Rev 0D	DBVS Feed Preparation and Melt Process Flow Diagram	This drawing was not include in the latest revision of the IQRPE review package Rev D. A preliminary review of this drawing was previously conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.

F-145579-34-D-0011, Rev B	Bulk Vitrification Area 34~ Waste Transfer ICV™ Box Ventilation Ducts	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0004, Rev 4A	Bulk Vitrification ICV™ Box Data Sheet	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0005, Rev 2A	ICV™ Box Lid Assembly	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0006, Rev 2A	ICV™ Box Lid Steelwork- 1 of 3	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0007, Rev 1A	ICV™ Box Lid Steelwork- 2 of 3	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0008, Rev 1	ICV™ Box Plans and Sections	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0009, Rev 1A	ICV™ Box Lid Details Steelwork- 3 of 3	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0010, Rev D	ICV™ Box Ceramic Details	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.

F-145579-35-D-0011, Rev 2A	ICV™ Box Assembly Details	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0012, Rev F	ICV™ Box Lid Camera, T/C and Grounding Assembly	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0013, Rev D	ICV™ Box Camera and Trolley Details	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0014, Rev H	ICV™ Shell Starter Path Details	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0016, Rev K	ICV™ Box Refractory Assembly	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0017, Rev K	ICV™ Box Refractory Details	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0018, Rev 1	Bulk Vitrification Assembly Enclosure G.A. Plans and Elevations	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0019, Rev 2	ICV™ Box Gasket Details	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.

F-145579-35-D-0020, Rev E	ICV™ Box Electrode Details	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0021, Rev E	ICV™ Box Breather HEPA Filter	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0022, Rev 1	ICV™ Box Lid Tool and Radar Plate	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-35-D-0024, Rev B	Bulk Vitrification ICV Box Port Connections	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-00-F-0014, Rev 0	Bulk Vitrification ICV™ Box Instrument Locations	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-00-B-0018, Rev G	Bulk Vitrification Miscellaneous Steel Structures	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-00-B-0022, Rev I	Bulk Vitrification ICV Box Storage Area Curb Layout & Details	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-00-B-0025, Rev D	Bulk Vitrification Melt Area Steel Curbs	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.

F-145579-00-D-0007, Rev E	Bulk Vitrification ICV Package Sampling and Storage Area GA Plan	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
F-145579-00-D-0020, Rev E	Bulk Vitrification Sampling and Storage Area GA Sections	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
H-14-106790, Rev 0	Bulk Vitrification ICV Box Storage Area Plan / Details	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
H-14-106792, Rev 1	Bulk Vitrification Melt Area FDN Plans & Sections	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will receive IQRPE review at final design.
H-14-106797, Rev 0	ICV Box Assembly Building Fdn-Plan & Details	A preliminary review of this drawing was previously conducted by the IQRPE, however this building is now determined as out of scope, requiring no further IQRPE review.

ATTACHMENT B

In-Container Vitrification (ICV™) SYSTEM DESIGN DELIVERABLES

TO BE REVIEWED WITH THE INSTALLATION CERTIFICATION PACKAGE

(Two Sheets)

ATTACHMENT B

IN-CONTAINER VITRIFICATION (ICV™) SYSTEM DESIGN DELIVERABLES, TO BE REVIEWED WITH THE INSTALLATION CERTIFICATION PACKAGE

Submittal Number	Submittal Title
145579-D-DS-023.1 ICV™ Box and Lid Datasheet	Factory Acceptance Test Plan
145579-D-DS-023.1 ICV™ Box and Lid Datasheet	Visual Weld/NDE Procedures
145579-D-DS-023.1 ICV™ Box and Lid Datasheet	Welding procedures, weld map, procedure qualification records and welder qualification records
145579-D-DS-023.1 ICV™ Box and Lid Datasheet	AWS CWI certificate
145579-D-DS-023.1 ICV™ Box and Lid Datasheet	Protective coating test procedures
145579-D-DS-023.1 ICV™ Box and Lid Datasheet	Vendor cut sheets
145579-D-DS-023.1 ICV™ Box and Lid Datasheet	Outline drawings and layout drawings indicating weights and dimensions for lifting device
145579-D-DS-023.1 ICV™ Box and Lid Datasheet	Nameplate data
145579-D-DS-023.1 ICV™ Box and Lid Datasheet, Rev 0	As-builts of fabricated items
145579-D-DS-023.1 ICV™ Box and Lid Datasheet	Material Certificates
145579-D-DS-023.1 ICV™ Box and Lid Datasheet	Test Results
145579-D-DS-012.1 Air Pallet Data Sheet	Visual weld/NDE procedures
145579-D-DS-012.1 Air Pallet Data	AWS CWI certificate
145579-D-DS-012.1 Air Pallet Data Sheet	Outline drawings and layout drawings indicating weights and dimensions
145579-D-DS-012.1 Air Pallet Data Sheet	Electrical schematics, wiring, diagrams and nameplate lists (review by Buyer)
145579-D-DS-012.1 Air Pallet Data Sheet	Calculations (review by Buyer)
145579-D-DS-012.1 Air Pallet Data Sheet	Installation and maintenance manuals (review by Buyer)

Submittal Number	Submittal Title
145579-D-DS-029.1 ICV™ Electrodes & Accessories	Outline drawings and layout drawings indicating weights and dimensions (review by Buyer)
145579-D-DS-047.1 Ceramic Sleeve and Collar	Outline drawings and layout drawings indicating weights and dimensions
145579-D-DS-022.1 Electrode Cable Clamp Assembly	Outline drawings and layout drawings indicating weights and dimensions (review by Buyer)
P&ID F-145579-35-A-0100, Bulk Vitrification ICV™ Box P&ID, latest revision	Review updated P&ID to address IQRPE comments
F-145579-00-A-0021, Process Flow Diagram	Review updated Process Flow Diagram to address IQRPE comments
(Test results- future #'s)	Review results of ICV box vitrification testing are required to be reviewed by the IQRPE for independent review of corrosion effects with materials and configuration of construction

ATTACHMENT C

CODES, STANDARDS, AND REGULATIONS

INCORPORATED INTO

TECHNICAL SPECIFICATIONS, DATA SHEETS AND CALCULATIONS

(Nine Sheets)

ATTACHMENT C

CODES, STANDARDS, REGULATIONS, AND REFERENCES

INCORPORATED INTO

TECHNICAL SPECIFICATIONS, DATA SHEETS, AND CALCULATIONS

10 CFR 830	"Nuclear Safety Management," *Code of Federal Regulations*, as amended.
10 CFR 830, Subpart A	*Quality Assurance Requirements*
29 CFR 1910	"Occupational Safety and Health Standards," *Code of Federal Regulations,* as amended.
40 CFR 264	"Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," subpart J. *Code of Federal Regulations*, as amended.
ACI 302.1R	*Guide to Concrete Floor and Slab Construction*
AISC Allowable Stress Design	*Manual of Steel Construction – Allowable Stress Design*, Ninth Edition, American Institute of Steel Construction, Chicago, Illinois.
AISC Manual of Steel Construction	Load & Resistance Factor design, 3rd Edition 2003, 2nd Printing American Institute of steel Construction Chicago, IL
AISC Load and Resistance Factor Design	*Manual of Steel Construction – Load and Resistance Factor Design.* Third Edition, American Institute of Steel Construction, Chicago, Illinois.
ANSI Y14.5M	*Dimensioning and Tolerancing,* American National Standards Institute, New York, New York.
ANSYS	*ANSYS* Heat Transfer Program Version 10.0 Verification 2005
ASCE 4-98	*Seismic Analysis of Safety-Related Nuclear Structures*, American Society of Civil Engineers, Reston, Virginia.

ASCE 7-98	*Minimum Design Loads for Buildings and Other Structures,* American Society of Civil Engineers, Reston, Virginia.
ASCE 7-02	*Minimum Design Loads for Buildings and Other Structures, 2002. ASCE, Reston Virginia*
ASHRAE Fundamentals Handbook	*2001 ASHRAE Handbook – Fundamentals,* American Society of Heating, Refrigerating, and Air Conditioning Engineers, Atlanta, Georgia.
ASME B&PV Code Sect I, VIII and IX	*ASME Boiler and Pressure Vessel Code,* American Society of Mechanical Engineers, New York, New York .
ASME B&PV Code Sect II Part D Subpart 2	Physical Properties Tables
ASME B16.5	*Pipe Flanges and Flanged Fittings,* American Society of Mechanical Engineers, New York, New York.
ASME B16.9	*Factory-Made Wrought Steel Buttwelding Fittings,* American Society of Mechanical Engineers, New York, New York.
ASME B16.11	*Forged Fittings, Socket Welding and Threaded,* American Society of Mechanical Engineers, New York, New York.
ASME B18.2.1	*Square and Hex Bolts and Screws Inch Series,* American Society of Mechanical Engineers, New York, New York.
ASME B18.2.2	*Square and Hex Nuts,* American Society of Mechanical Engineers, New York, New York.
ASME B31.3	*Process Piping,* American Society of Mechanical Engineers, New York, New York.
ASME NQA-1, 1994	*Quality Assurance Program Requirements for Nuclear Facilities,* American Society of Mechanical Engineers, New York, New York.
ASME PCC-1	*Guidelines for Pressure Boundary Bolted Flange Joint Assembly,* American Society of Mechanical Engineers, New York, New York.
ASNT SNT-TC-1A	*Recommended Practice,* American Society of Nondestructive Testing, Columbus, Ohio.

ASTM A36/A36M	*Standard Specification for Carbon Structural Steel, American Society of Testing and Materials,* New York, New York.
ASTM A53/A53M	*Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless,* American Society of Testing and Materials, New York, New York.
ASTM A105/A105M	*Standard Specification for Carbon Steel Forgings for Piping Applications,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A106	*Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A108	*Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A182/A182M	*Standard Specification for Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A193/A193M	*Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A194/A194M	*Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service or Both,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A234/A234M	*Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy for Moderate and High Temperature Service,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A240/A240M	*Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and*

Strip for Pressure Vessels and for General Applications, American Society for Testing and Materials, West Conshohocken, Pennsylvania

ASTM A269 — *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service,* American Society of Testing and Materials, New York, New York.

ASTM A276 — *Standard Specification for Stainless Steel Bars and Shapes,* American Society of Testing and Materials, New York, New York.

ASTM A307 — *Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength,* American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM A312/A312M — *Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes,* American Society for Testing and Materials, West Conshohocken, Pennsylvania

ASTM A325 — *Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength,* American Society for Testing and Materials, West Conshohocken, Pennsylvania

ASTM A354 — *Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and other Externally Threaded Fasteners,* American Society for Testing and Materials, West Conshohocken, Pennsylvania

ASTM A403/A403M — *Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings,* American Society for Testing and Materials, West Conshohocken, Pennsylvania

ASTM A480/A480M — *Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip,* American Society for Testing and Materials, West Conshohocken, Pennsylvania

ASTM A500 — *Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes,* American Society for Testing and Materials, West Conshohocken, Pennsylvania

ASTM A563a	*Standard Specification for Carbon and Alloy Steel Nuts,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A569	*Standard Specification for Steel, Carbon (0.15 Maximum, Percent) Hot-Rolled Sheet and Strip Commercial,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM C518	*Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM D5162	*Standard Practice for Discountability (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates,* American Society for Testing
ASTM E96	*Standard Test Methods for Water Vapor Transmission of Materials,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM E285	*Standard Test Method for Oxyacetylene Ablation Testing of Thermal Insulation Materials,* American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM F 436	*Standard Specification for Hardened Steel Washers*, American Society of testing and materials, West Conshohocken, Pennsylvania
AWS D1.1/D1.1M	*Structural Welding Code* – Steel, American Welding Society, Miami, Florida
AWS D1.1-96	Structural Welding Code
AWS D1.6	*Structural Welding Code* – Stainless Steel, American Welding Society, Miami, Florida.
AWS QC-1	*Standard for AWS Certification of Welding Inspectors*, American Welding Society, Miami, Florida.

Bagaasen, L.M., J.H. Westsik, Jr., and T.M. Brouns, 2005, *Waste-Form Qualification Compliance Strategy for Bulk Vitrification* , PNNL-15048, Pacific Northwest national Laboratory, Richland, Washington

Cengel, Y.A. & R.H. Turner	*Fundamentals of Thermal-Fluid Sciences*, McGraw-Hill Co., 2001
DOE-O 414.A	*Quality Assurance*
DOE G 440.1-6	*Implementation Guide for use with Suspect/Counterfeit Items Requirements of DOE O 440.1, worker Protection Management; 10CFR830.120; and DOE 5700.6C, Quality Assurance*
Hollman, J.P.	*Heat Transfer*, 3rd Edition, McGraw-Hill Co., 1972
Fuller, P., 2004	*Hydraulic Fluid Compatibility with TraceTek Leak Detection System and Mini-Probe*, RPP-19524, Revision 1, CH2M HILL Hanford group, Inc., Richland, Washington
Glover, Thomas J. 1999	Pocket Reference, Sequoia Publishing, Inc.
GN-ER-501	*Natural Phenomena Hazards Hanford Site Washington*
HNF-SD-GN-ER-501	*Natural Phenomena Hazards*, Hanford Site, Washington, Revision 1B, Westinghouse Hanford Company, Richland, Washington.
Houghton Mifflin Co.	Engineering Fluid Mechanics, 5th Edition, John A. Roberson & Clayton T. Crowe
IEC 61000-4-2	*Electromagnetic Compatibility (EMC) – Part 4-2: Testing and Measurement Techniques – Electrostatic Discharge Immunity Test,* International Engineering Consortium, Chicago, Illinois.
IEEE Std C2	*National Electrical Safety Code*, Institute of Electrical and Electronics Engineers, New York, New York
IEEE C62.41.1	*IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits,* Institute of Electrical and Electronics Engineers, New York, New York.
IEEE C62.41.2	*IEEE Recommended Practice on Characterization of Surges in Low Voltage (1000 V and Less) AC Power Circuits,* Institute of Electrical and Electronics Engineers, New York, New York

IEEE C37.90.2	*IEEE Standard for Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers,* Institute of Electrical and Electronics Engineers, New York, New York.
IEEE 141	*IEEE Recommended Practice for Electric Power Distribution for Industrial Plants,* Institute of Electrical and Electronics Engineers, New York, New York.
IEEE 142	*IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems,* Institute of Electrical and Electronics Engineers, New York, New York.
IEEE 242	*IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems,* Institute of Electrical and Electronics Engineers, New York, New York.
IEEE 519	*Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems,* Institute of Electrical and Electronics Engineers, New York, New York.
ISA-82.03-1988	*Standard for Safety Standard for Electrical and electronic Test, Measuring Controlling, and Related Equipment*, The Instrumentation, Systems and Automation Society Research Triangle Park, North Carolina
ISO 668	*Series 1 Freight Containers Classification, Dimensions and Ratings,* International Organization for Standardization, Geneva, Switzerland.
ISO 1161	*Series 1 Freight Containers – Corner Fittings – Specification,* International Organization for Standardization, Geneva, Switzerland.
ISO 1496-2	*Series 1 Freight Containers – Specification and Testing – Part 2: Thermal Containers,* International Organization for Standardization, Geneva, Switzerland.
Lincoln Electric Co.	*The Procedure Handbook of Arc Welding*
James F. Lincoln Arc Welding Foundation	*Design of Welded Structures*, 1966 printing

MSS SP-72	*Ball Valves with Flanged or Butt-Welding Ends for General Service,* Manufacturing Standardization Society of the Valve and Fittings Industry, Inc. Vienna, Virginia.
MSS SP-82	*Valve Pressure Testing Methods,* Manufacturing Standardization Society of the Valve and Fittings Industry, Inc. Vienna, Virginia.
NFPA 70	*National Electrical Code,* 2002 Edition, National Fire Protection Association, Quincy, Massachusetts.
RCRA-1976	*Resource Conservation and Recovery Act of 1976,* 42 U.S.C. 6901 et seq.
SAE J429	*Mechanical and Material Requirements for Externally Threaded Fasteners,* Society of Automotive Engineers, Warrendale, Pennsylvania.
TFC-ENG-STD-06	*Design Loads for Tank Farm Facilities*, Revision A, CH2M HILL Hanford Group, Inc., Richland, Washington
TFC-ENG-STD-12	*Tank Farm Equipment Identification Numbering and Labeling Standard*, Revision A, CH2M HILL Hanford Group, Inc., Richland, Washington (Replaces Cancelled RPP-8530)
UBC, 1997	*1997 Uniform Building Code*, International Conference of Building Officials, Whittier, California.
UL-Listed	*Electrical Appliance and Utilization Equipment Directory*, Underwriters Laboratories, Inc., Northbrook, Illinois.
UL 142	*Standard for Safety-Steel Aboveground Tanks for Flammable and Combustible Liquids*, Underwriters Laboratories, Inc., Northbrook, Illinois.
UL 508A	*Standard for Industrial Control Panels,* Underwriters Laboratories, Inc., Northbrook, Illinois
UL-840	*Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment,* Underwriters Laboratories, Inc., Northbrook, Illinois

WAC-173-303-630	*Use and Management of Containers*, Washington Administrative Code, as amended
WAC 173-303-640	*Tank Systems*, Washington Administrative Code, as amended
WAC 173-400	*General Regulations for Air Pollution Sources*, Washington Administrative Code, as amended
Young, Hugh and Freedom, Roger	*University Physics*, 9th Edition, 1966, Addison Wesley Publishing Company

ATTACHMENT D

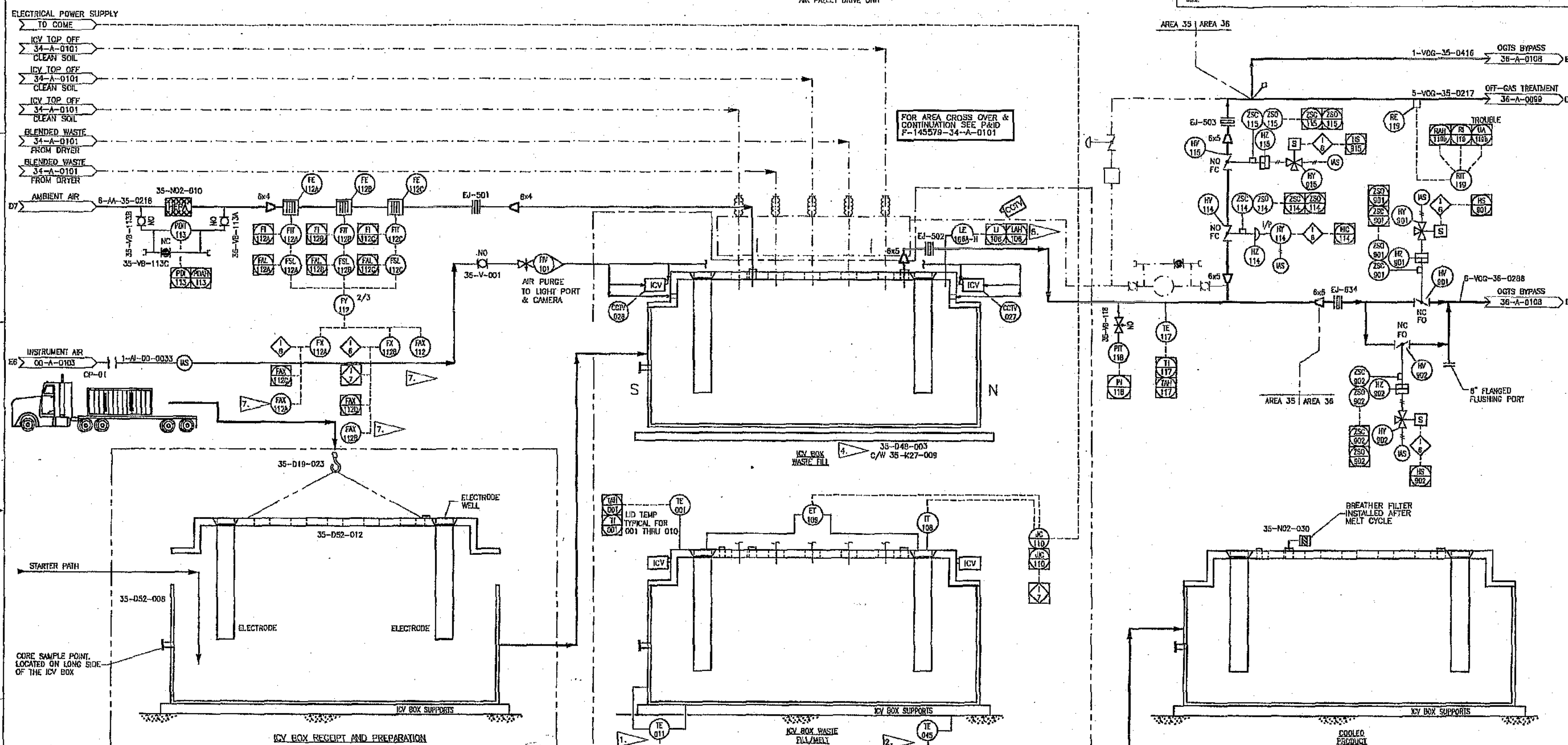
IN-CONTAINER VITRIFICATION (ICV™) SYSTEM
PIPING AND INSTRUMENTATION DIAGRAMS
AND ICV™ BOX OVERVIEW DRAWINGS

Drawing F-145579-35-A-0100, Rev P

Drawing F-145579-35-D-0006, Rev 2A

Drawing F-145579-35-D-0014, Rev H

Drawing F-145579-35-D-0016, Rev K


35-D52-006
ICV BOX
35-N02-010
ICV BOX INLET AIR HEPA FILTER
35-D19-023
ICV BOX ASSEMBLY CRANE
35-D52-012
ICV BOX LID
35-D48-003
AIR PALLET
c/w 35-K27-009
AIR PALLET DRIVE UNIT
35-N02-030
ICV BOX BREATHER HEPA FILTER
ELECTRICAL POWER SUPPLY
TO COME
ICV TOP OFF
34-A-0101
CLEAN SOIL
BLENDED WASTE
FROM DRYER
AMBIENT AIR
INSTRUMENT AIR
00-A-0103
FOR AREA CROSS OVER & CONTINUATION SEE P&ID F-145579-34-A-0101
AREA 35
AREA 36
OGTS BYPASS
36-A-0108
OFF-GAS TREATMENT
36-A-0099
TROUBLE
AIR PURGE TO LIGHT PORT & CAMERA
35-V-001
8" FLANGED FLUSHING PORT
ICV BOX WASTE FILL
ELECTRODE WELL
STARTER PATH
ELECTRODE
CORE SAMPLE POINT, LOCATED ON LONG SIDE OF THE ICV BOX
ICV BOX SUPPORTS
ICV BOX RECEIPT AND PREPARATION
LID TEMP TYPICAL FOR 001 THRU 010
TYPICAL FOR 011 THRU 044 ICV BOX TEMPERATURE
TYPICAL FOR 045 THRU 050 BUILDING FLOOR TEMPERATURE
ICV BOX WASTE FILL/MELT
ICV BOX TOP-OFF COOLING
BREATHER FILTER INSTALLED AFTER MELT CYCLE
COOLED PRODUCT

LOW ICV BOX INLET AIR FLOW (I/8)
- ISOLATES OGTS BLEED AIR SEE F-145579-36-A-0099, F-14579-36-0102 AND F-14579-36-A-0103

LOW ICV BOX INLET AIR FLOW (I/7)
- ISOLATES DRYER VAC PUMP SEE F-145579-33-A-0101
- SHUTS DOWN ELECTRODE POWER JIC-110 THIS SHEET
- ISOLATES AWIE SEE F-145579-34-A-0101

LOW ICV BOX INLET AIR FLOW (I/6)
- STOPS DRIED WASTE AND TOP OFF SOIL TRANSFER SEE F-145579-33-A-0100 AND F-145579-34-A-0101
- CLOSES VALVES HV-114 AND HV-115 THIS SHEET
- OPENS HV-901 AND HV-902 THIS SHEET
- ISOLATED NH_3 FEED TO SCR SEE F-145579-36-A-0101

NOTES:

1. THERMOCOUPLE HARNESSES ON EACH CONTAINER MANUALLY CONNECTED TO MCS AT MELT STATION SEE DRAWING F-145579-00-F-0014 FOR LOCATION.
2. FOR NUMBER AND PLACEMENT OF PERMANENT THERMOCOUPLES IN BUILDING FLOOR SEE DRAWING F-145579-00-F-0014.
3. NOT USED
4. AIR PALLET USED TO TRANSPORT ICV BOX BETWEEN STATIONS & IS REMOVED DURING THE FILL & MELT OPERATIONS.
5. SENSOR 35-LE-106 EMPLOYS A VERTICAL ARRAY OF EIGHT THERMOCOUPLES MONITORED IN THE MCS, TO INDICATE MELT LEVEL.
6. STARTUP OVERRIDE FOR OGTS BYPASS SYSTEM.
7. ALARM LOCATED ON SAFETY ANNUNCIATOR IN CONTROL ROOM.

Rev.	REVISION DESCRIPTION	Date	By	Chk'd	Approved Design Lead	Approved Proj Mgr
P	REVISE PER DBVS-DCL-014	28 MAR 06	PMM	JL	N/A	N/A
N	REVISE PER DBVS-DCL-010, -011 AND -012	16 FEB 06	SNM	JL	N/A	N/A
M	REVISE PER DVBS-DCL-008	28 JAN 06	SNM	JL	N/A	N/A
L	INCORPORATED ENGINEERING COMMENTS/INTERNAL REVIEW	03 JAN 06	CBT	KJM	N/A	N/A
K	ISSUED FOR REVIEW	19 SEP 05	WB	CBT	N/A	N/A
J	ISSUED FOR REVISION & 90% REPORT	26 MAY 05	AA	BM	FWS	FS

AMEC DRAWING NO: F-145579-35-A-0100 REV P

amec

AMEC PROJECT: 145579-FINAL DBVS DESIGN

U.S. DEPARTMENT OF ENERGY
Office of River Protection

BULK VITRIFICATION ICV BOX P&ID

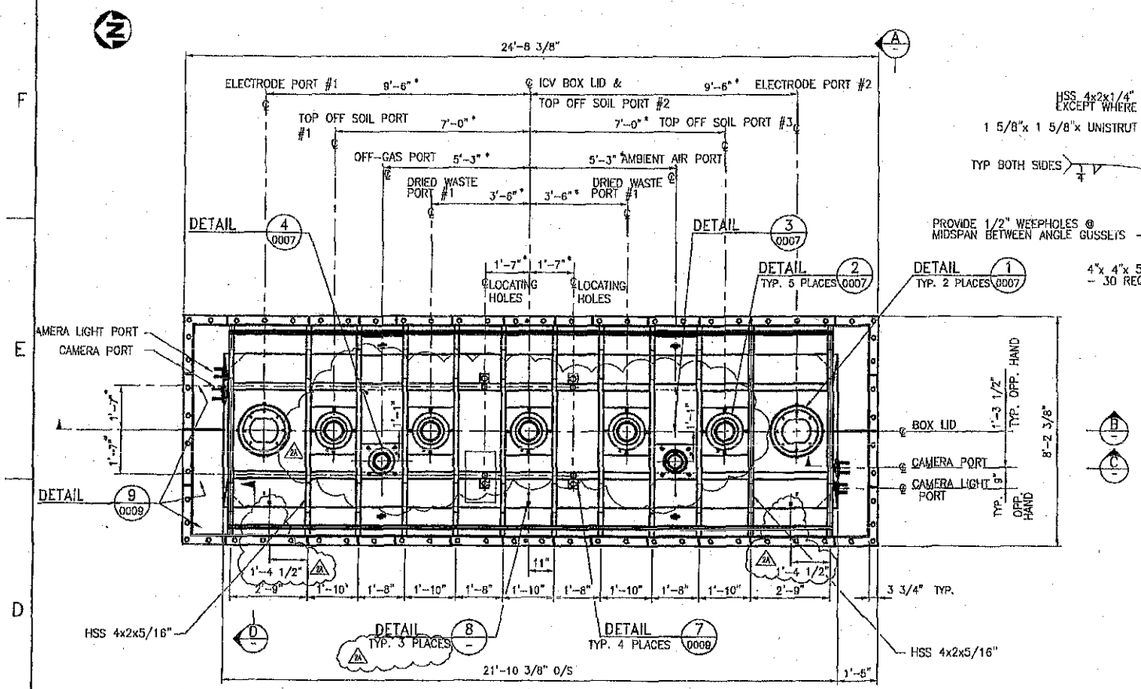
SIZE F

DWG NO	TITLE
DRAWING TRACEABILITY LIST	

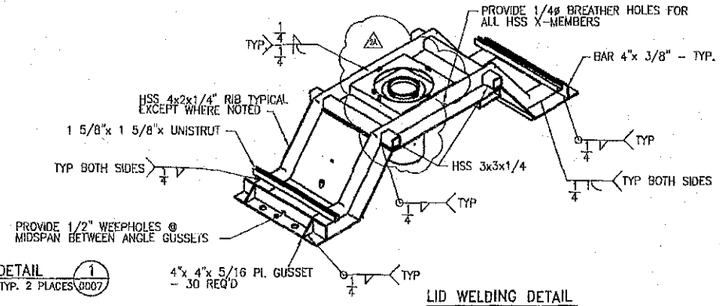
REF NUMBER	TITLE
REFERENCES	
NEXT USED ON	

REVISIONS

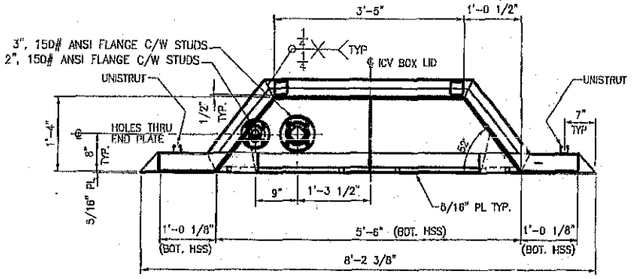
No.	AMEC Dwg No.	REFERENCE DRAWINGS
1	F-145579-35-D-0004	ICV BOX DATA SHEET
2	F-145579-35-D-0005	ICV BOX LID ASSEMBLY
3	F-145579-35-D-0007	ICV BOX STEELWORK 2 OF 3
4	F-145579-35-D-0009	ICV BOX STEELWORK 3 OF 3



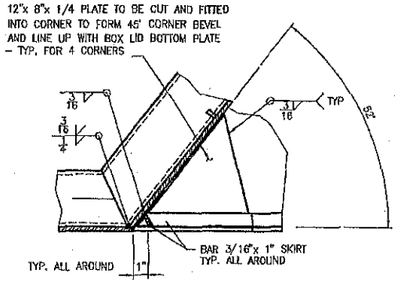
PLAN
SCALE 1/2" = 1'-0"



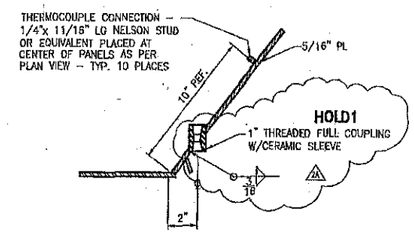
LID WELDING DETAIL



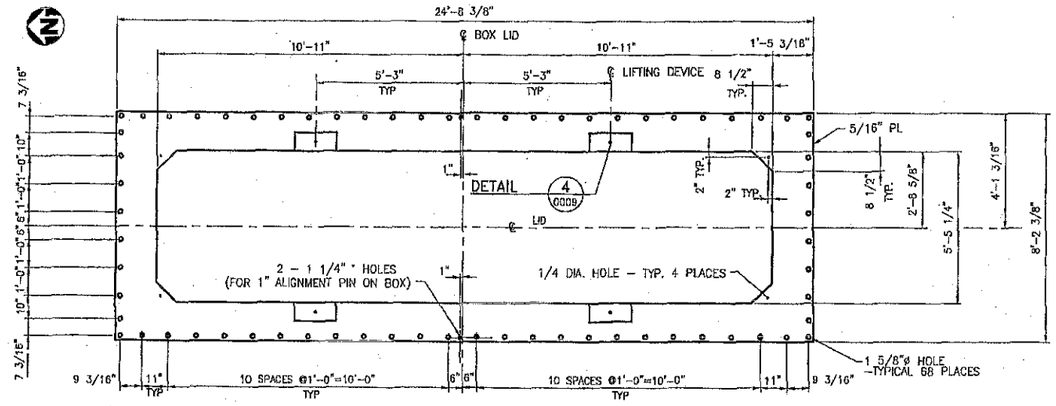
SECTION A
1"=1'-0"



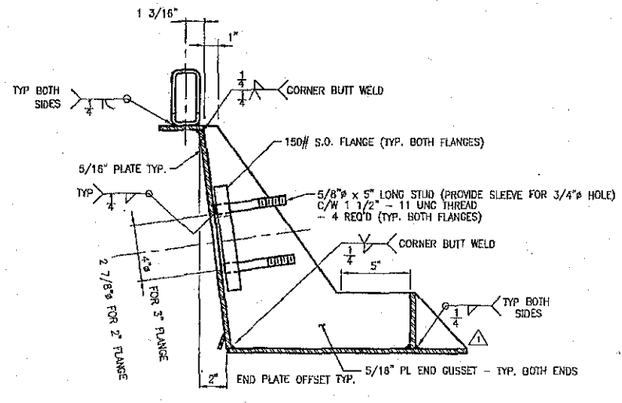
SECTION D
3"=1'-0"



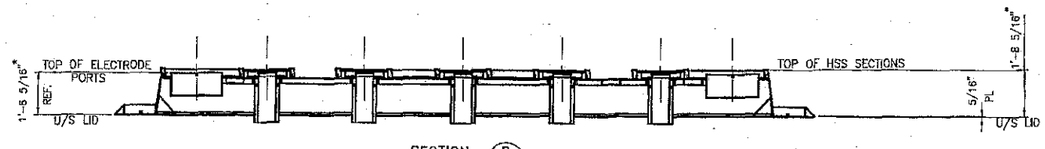
DETAIL 6 0005 / 8
3"=1'-0"



BOX LID BOTTOM PLATE
SCALE 1/2" = 1'-0"



SECTION C
3"=1'-0"
THRU 3" FLANGE (SIMILAR FOR 2" FLANGE)



SECTION B
1/2"=1'-0"

GENERAL NOTES:

1. ALL DIMENSIONS MARKED WITH * HAVE MAX. TOLERANCE + OR - 1/16"
2. ALL ITEMS TO BE FABRICATED FROM:
   STRUCTURAL SHAPES - ASTM A36 OR BETTER
   PIPE - ASTM A53, GR.B
   PIPE FITTINGS - ASTM A105

HOLDS:

1. HOLD FOR TEST MELT 38-C RESULTS WITH CERAMIC SLEEVE

Rev.	REVISION DESCRIPTION	Date	By	Chk'd	Approved (Design Lead)	Approved (Proj. Mgr.)
2A	ISSUED FOR CHEM APPROVAL/BOX DESIGN (PKG 6)	10 APR 08	THB	JM	SRH	JSG
2	ISSUED FOR DESIGN REPORT	06 MAR 08	SRF	JM	SH	JSG
1	ADDED GUSSETT	15 AUG 05	JBM	RDB	FWS	TH
0	ISSUED FOR CONSTRUCTION	19 MAY 05	JBM	AA	FWS	TH

AMEC DRAWING NO: F-145579-35-D-0006 REV: 2A
AMEC PROJECT: 145579-FINAL DBVS DESIGN
U.S. DEPARTMENT OF ENERGY
Office of River Protection
BULK VITRIFICATION
ICV BOX LID
STEELWORK 1 OF 3
SIZE: F
SCALE: AS NOTED

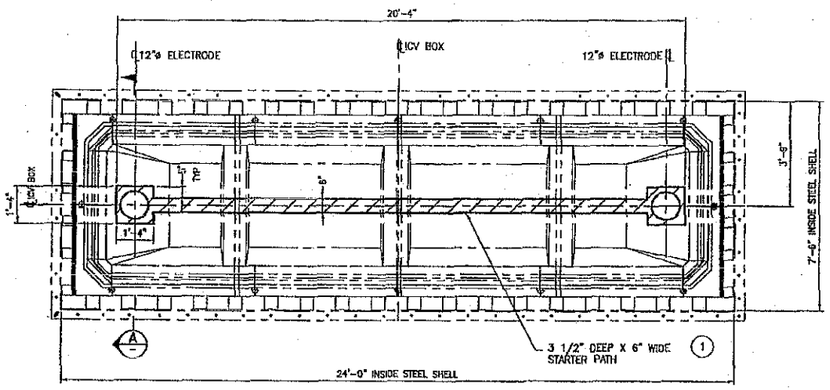
DWG NO	TITLE
DRAWING TRACEABILITY LIST	

REF NUMBER	TITLE
NEXT USED ON	REFERENCES

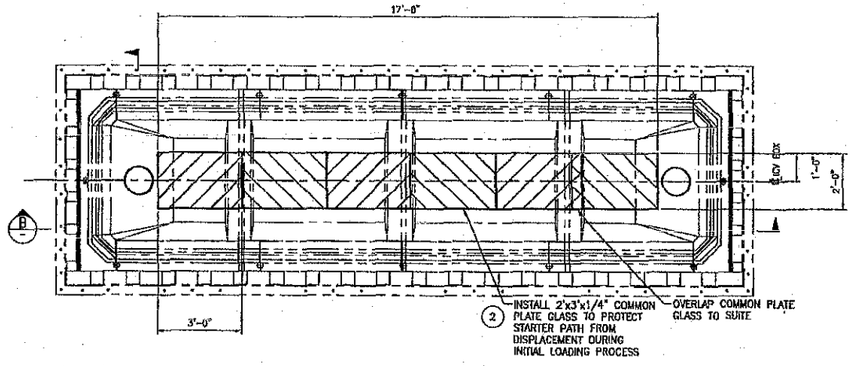
No.	AMEC Dwg. No.	REFERENCE DRAWINGS
1	F-145579-35-D-0004	ICV BOX DATA SHEET

PARTS/MATERIAL LIST

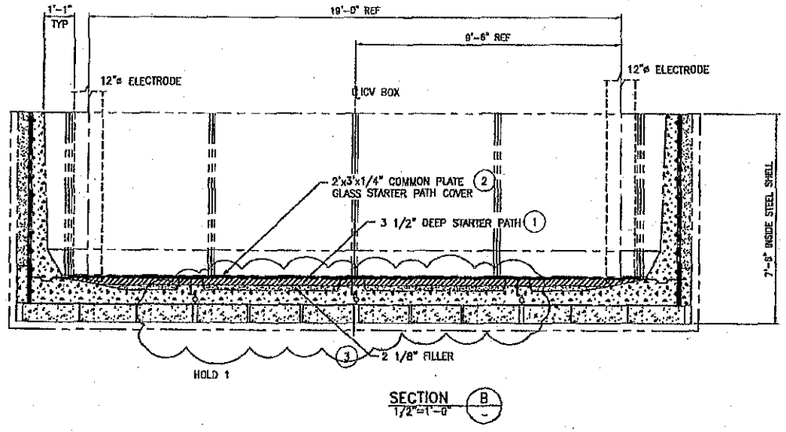
ITEM	REQD	PART/DASH NUMBER	NOMENCLATURE/DESCRIPTION	MATERIAL/REFERENCE	SHT	ITEM NO
1		1	STARTER PATH	SEE PDC	–	1
2	6	–	STARTER PATH COVER	2'x3'x1/4" COMMON PLATE GLASS	–	2
3	–	–	FILLER	SEE PDC	–	3



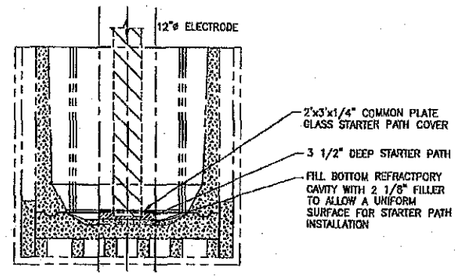
PLAN
1/2"=1'-0"



PLAN – STARTER PATH COVER
1/2"=1'-0"



SECTION B
1/2"=1'-0"



SECTION A
1/2"=1'-0"

HOLD:

1. ICV REFRACTORY JOINT ASSEMBLY DIMENSIONS ON HOLD FOR VENDOR TESTING OF RE-DESIGN

NOTES:

1. STARTER PATH TO BE MANUALLY DISTRIBUTED TO A UNIFORM DEPTH OF NOT LESS THAN 3 1/2"

Rev.	REVISION DESCRIPTION	Date	By	CHK'd	Approved (Project Lead)	Approved (DOE-ORP)
H	ISSUED FOR DESIGN REPORT	06 MAR 06	SW	JLM	SB	JSG
G	REVISED – REVISED CORNER PANEL AND REFRACTORY JOINT	13 JAN 06	SW	SRB	KSW	JSG
F	REVISED – ISSUED FOR CH2M HILL APPROVAL & BOX REPORT	15 AUG 05	JBM	RDB	FWS	TH
E	REVISED – ISSUED FOR CH2M HILL REVIEW AND 90% REPORT	01 APR 05	RRB	TW	FWS	TH
D	ISSUED FOR CH2M HILL REVIEW AND 30% REPORT	03 MAR 05	TW	AA	FWS	TH
C	ISSUED FOR INFORMATION	09 FEB 05	JBM		FWS/TW	TH
B	ISSUED FOR APPROVAL	30 SEPT 04	JBM	TW	FWS	TH
A	ISSUED FOR REVIEW	09 SEPT 04	JBM	TW	GJ	TH

AMEC DRAWING NO. F-145579-35-D-0014 REV H

amec

AMEC PROJECT: 145579–FINAL DBVS DESIGN

U.S. DEPARTMENT OF ENERGY
Office of River Protection

BULK VITRIFICATION
ICV SHELL
STARTER PATH DETAILS

NAME	DATE	COMPANY
DRAWN BY		
RESPONSIBLE BY		
CHECKED BY		
DESIGN / AREA LEAD		
ENGINEERING MANAGER		
PROJECT MANAGER		
DESIGN AUTHORITY		

SIZE F | SCALE 1/2"=1'-0" | REV

DRAWING TRACEABILITY LIST

DWG NO	TITLE

REFERENCES

REF NUMBER	TITLE
NEXT USED ON	

REVISIONS

NO	REV BY	DESCRIPTION	REV BY (CHK'D)	REV BY (APP'D)	CHK'D	APP'D	DATE	COMPANY

RPP-24544 REV 1c

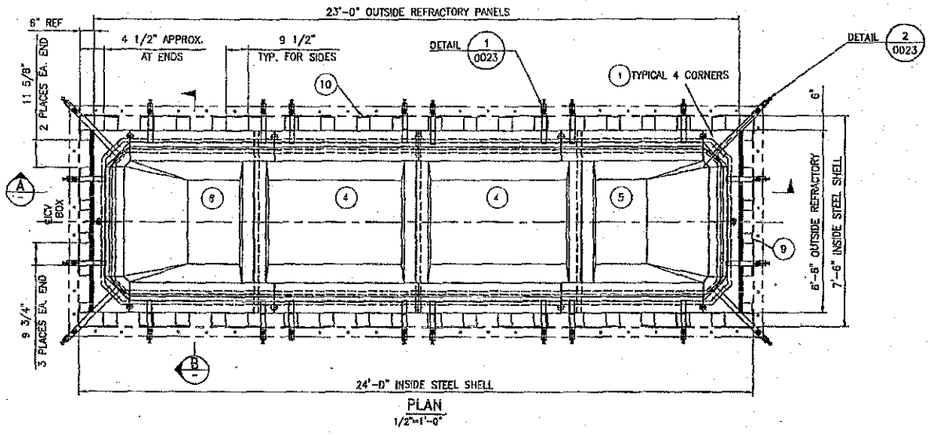
RPP-24544 REV 1c

No	AMEC Dwg. No.	REFERENCE DRAWINGS
1	F-145579-35-D-0004	ICV BOX DATA SHEET
2	F-145579-35-D-0008	ICV BOX ASSEMBLY
3	F-145579-35-D-0017	ICV BOX REFRACTORY DETAILS
4	F-145579-35-D-0023	ICV BOX REFRACTORY PANEL CLIP DETAILS

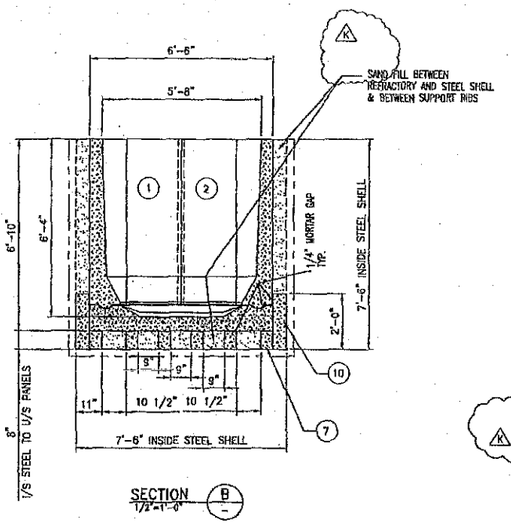
PARTS/MATERIAL LIST

ITEM	REQ'D	PART/DASH NUMBER	NOMENCLATURE/DESCRIPTION	MATERIAL/REFERENCE	SHT	ITEM NO
1	2	–	CORNER PANEL	VIBRACAST 60PC	0016	1
2	2	–	CORNER PANEL	VIBRACAST 60PC	0017	2
3	8	–	SIDE PANEL	VIBRACAST 60PC	0017	3
4	2	–	FLOOR PANEL	VIBRACAST 60PC	0017	4
5	1	–	FLOOR PANEL	VIBRACAST 60PC	0017	5
6	1	–	FLOOR PANEL	VIBRACAST 60PC	0017	6
7	36	–	SUPPORT RIBS – 24" x 7 3/4" x 5"	RESCO 110	0016	7
8	30	–	SUPPORT RIB –21 1/2" x 7 3/4" x 5"	RESCO 110	0016	8
9	12	–	END BACKING BRICK – 4.25"x4.25"x16"	RESCO 110	0016	9
10	36	–	SIDE BACKING BRICK – 5.75"x5.75"x24"	RESCO 110	0016	10
11	2	–	FILLER BOARD – 1.5" x 6'–6" x 6'–10"	KAOWOOL M BOARD	0016	11
12	16	–	BASE PICKUP INSERT – TYPE T–10 x 1 1/4"	N.A.	0017	12
13	24	–	EDGE PICKUP INSERT – TYPE T–3–A x 1"	N.A.	0016 0017	13
14	20	0023 MK 'A'	PANEL CLIP	A36, A307	0023	14
15	4	0023 MK 'B'	CORNER CLIP	A36, A307	0023	15
16	–	SUPER ADAMANT	MORTAR/RECOMMENDED (EJ BARTELLS)	N/A	0023	16
17	6	–	SUPPORT RIBS – 20" x 7 3/4" x 5"	RESCO 110	0016	17

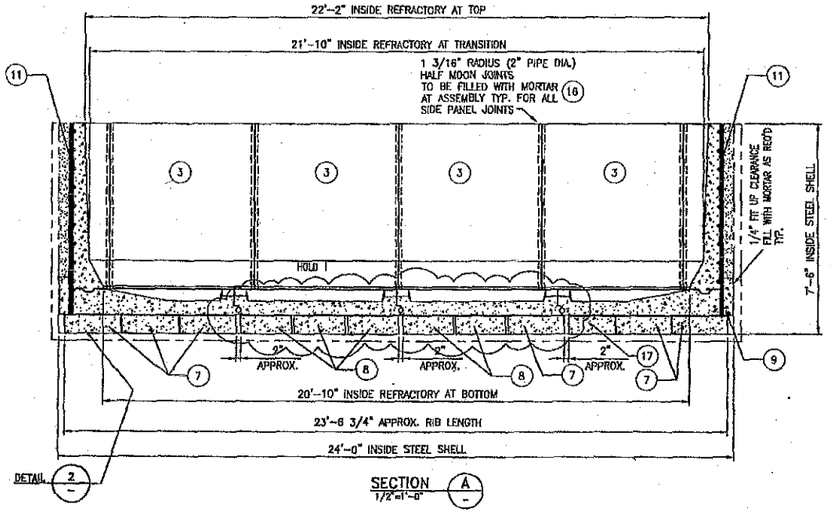
HOLD:
1. ICV REFRACTORY JOINT ASSEMBLY DIMENSIONS ON HOLD UNTIL VENDOR TESTING OF RE–DESIGN



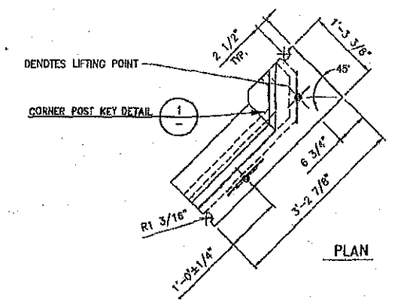
PLAN
1/2"=1'–0"



SECTION B
1/2"=1'–0"

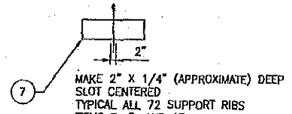


SECTION A
1/2"=1'–0"

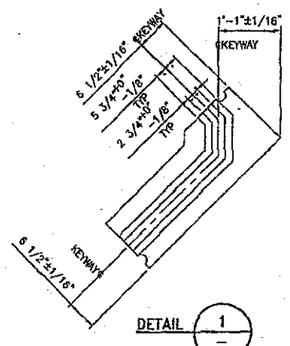


PLAN

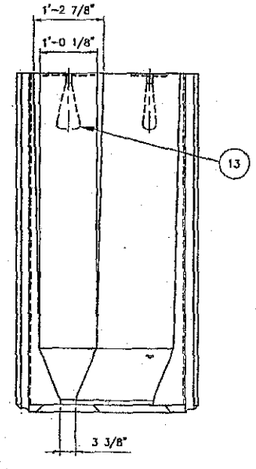
NOTES:
1. THIS DESIGN IS BASED ON:
   - THE CURRENT ICV BOX DESIGN DWG. F–145579–35–D–0004.
   - RESULTS FROM EIT MEETING DISCUSSIONS AND TEST BOX RESULTS
   - INPUT FROM EJ BARTELLS
2. SAND TO BE USED TO FILL SPACES BETWEEN REFRACTORY PANELS AND STEEL SHELL ON SIDES, ENDS AND BOTTOM.
3. HALF MOON JOINT DESIGN IS BASED ON INFORMATION FROM EJ BARTELLS – HALF MOON JOINTS ARE PREFERRED FOR:
   - EASE OF PRODUCTION
   - EASE OF INSTALLATION
   - STRENGTH OF JOINT
   - JOINT IS SEALED AGAINST LEAKAGE UNLIKE A LAP JOINT
4. ALLOWANCE HAS BEEN MADE FOR MORTAR BETWEEN ALL JOINTS BASED ON DISCUSSIONS WITH EJ BARTELLS.
5. FLOOR PANEL SUPPORT RIBS HAVE BEEN SPACED AT THE MAXIMUM DISTANCE RECOMMENDED TO ENSURE THAT LOADS ON FLOOR PANELS ARE TAKEN IN SHEAR AND NOT BENDING.
6. ALL DIMENSIONS SHOWN ARE NOMINAL AND BASED ON AN EXPECTED +/– 1/8" PRODUCTION TOLERANCE FOR DIMENSIONS OVER 12" AND +0/– 1/8" FOR ALL OTHER DIMENSIONS EXCEPT WHERE NOTED.
7. ALL LIFTING DEVICES TO BE REMOVED BEFORE ICV BOX LEAVES ASSEMBLY ENCLOSURE.
8. LIFTING COMPONENT INSERTS NOT TO PROTRUDE BEYOND REFRACTORY SURFACE.



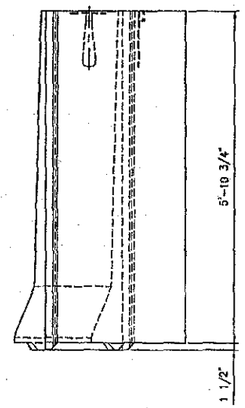
DETAIL 2



DETAIL 1



FRONT ELEVATION



END ELEVATION

CORNER PANEL 1
2 REQ'D 1"=1'–0"

K	ELIMINATE PROPRIETARY INFO	20 MAR 06	RE	JM	SB	JM
J	REVISED DIMENSIONS	06 MAR 06	SW	JM	SB	JSG
H	REVISED CORNER PANEL AND REFRACTORY JOINT	13 JAN 06	SW	SRB	KSW	JSG
G	REVISED LIFTING POINT LOCATIONS	9 SEPT 05	JSM	RDG	FWS	FWS
F	REVISED – ISSUED FOR CH2M HILL APPROVAL & BOX REPORT	15 AUG 05	JSM	RDB	FWS	TH
E	ISSUED FOR CH2M HILL REVIEW AND BOX REPORT	03 MAR 05	TW	AA	FWS	TH
D	ISSUED FOR INFORMATION	09 FEB 05	JSU		FWS/TH	TH
C	ISSUED FOR INFORMATION	17 JAN 05	JSM	AA	FWS	TH
B	ISSUED FOR APPROVAL	30 SEPT 04	JSM	TW	FWS	TH
A	ISSUED FOR REVIEW	23 SEPT 04	JSM	TW	GJ	TH
Rev.	REVISION DESCRIPTION	Date	By	Ck'd	Approved Design Auth	Approved for Use

AMEC DRAWING NO. F–145579–35–D–0016 REV k

amec

AMEC PROJECT 145579–FINAL DBVS DESIGN

U.S. DEPARTMENT OF ENERGY
Office of River Protection

BULK VITRIFICATION ICV BOX REFRACTORY ASSEMBLY

NAME	DATE	SIGNATURE
DRAWN BY		
DESIGNED BY		
CHECKED BY		
DESIGN / ANALYSIS		
ENGINEERING MANAGER		
PROJECT MANAGER		
DESIGN AUTHORITY		

BLOCK F | BLOCK NO | AMEC NO | DWG NO | REV
SCALE AS NOTED | SHEET | OF

DRAWING TRACEABILITY LIST

DWG NO	TITLE	REF NUMBER	TITLE
–	–	–	–

REFERENCES
NEXT USED ON

REV NO	REV BY	DESCRIPTION	REV BY CHECK	CHECKED BY	ENGR. COMPANY
–	–	–	–	–	–

REVISIONS

ATTACHMENT E

Engineering Corrosion Review

(Two Sheets)

Northwest Corrosion Engineering

10995 Warfield Road, Sedro-Woolley, WA 98284
Phone: (360) 826-4570 Fax: (360) 826-6321

April 18, 2005

Mr. Karl Walterskirchen
TechnoGeneral Services Company
710 North 4th Avenue
Pasco, WA 99301

SUBJECT: Corrosion Engineering Review – DBVS In-Container Vitrification System, Package 2.6 Revision B

Mr. Walterskirchen,

Corrosion Engineering related comments concerning DBVS Design Package 2.6 Rev B and the Corrosion Review comments provided by ChemMet, LTD, PC are outlined below.

Technical Specifications 145579-D-SP-012 Rev C – Air Pallet Caster System and 145579-D-SP-022 Rev 0 – Electrode Cable Clamp Assembly

1. Section 3.3.6 Protective Coatings requires that the Seller is to determine appropriate coating systems for all structural members. The coating systems, including surface preparation, materials, application methods and inspection criteria should be reviewed and approved by the Buyer prior to fabrication.
2. Provisions should be made to perform 3rd party coating inspection at the application location.

Technical Specification 145579-D-SP-023 Rev 0 – ICV Box and Lid Specification and Data Sheet 145579-D-DS-023.1 Rev 0

1. Section 3.3.6 Protective Coatings requires the use of Carboline – Thermaline 4700 to be applied. The data sheet requires that the surface be prepared to an SSPC-SP 10 and that a Silicone Zinc Primer be applied to the blasted surface (dry film thickness is not specified). Care must be taken to ensure that the surface profile does not exceed the coating manufacturer's recommended 0.5 – 1.0 mil range.
2. Provisions should be made to perform 3rd party coating inspection at the application location.

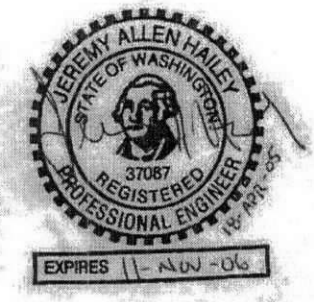
Corrosion Review -- Submitted by ChemMet, LTD, dated March 14, 2005 for Technical Specification ICV Box and Lid (145579-D-SP-023 Rev C) , ICV Box and Lid Datasheet (145579-D-DS-023.1 Rev C) and General Recommendations

1. No comments

We appreciate the opportunity to provide you with this service. Please feel free to contact our office if you have any questions or require additional information.

Sincerely,
Northwest Corrosion Engineering

Jeremy A. Hailey, P.E.
NACE Corrosion Specialist, No. 5401



Attachment 4
06-ED-039

Permit Tables III.1, V.1, V.2, V.3, V.4, V.5, V.7, and V.8

TABLE III.1.

DESCRIPTION OF DEMONSTRATION BULK VITRIFICATION SYSTEM (DBVS) FACILITY CONTAINER STORAGE AREAS

Dangerous Waste and Mixed Waste Container Storage Areas	Maximum Capacity Solids	Engineering Description (Drawing No., Specification No., etc.)	Narrative Description, Tables & Figures
ICV® Package Storage Area	2,718 m^3 (96,000 ft^3)	~~RESERVED~~Permit Attachment JJ, Appendix 1, Section 3, Drawing # H-14-106790, Section 5, Specification 145579-G-SP-001	Sections 2.3.2, 2.4, 4.2.9, 4.2.1.0, 4.2.11, 7.2.4, and 7.4 Figures 2-2, B-1, B-4, and 7-1
ICV® Package Sampling Area	54.4 m^3 (1,920 ft^3)	~~RESERVED~~Permit Attachment JJ, Appendix 1, Section 3, Drawing # H-14-106790, Section 5, Specification 145579-G-SP-001	Sections 2.4, 7.2.4, and 7.4. Figures 2-2, B-1, B-4, and 7-1
ICV® Package Preparation	54.4 m^3 (1,920 ft^3)	~~RESERVED~~Permit Attachment JJ, Appendix 1, Section 3, Drawing # H-14-106797, Specification 145579-G-SP-001	Sections 2.4, 7.2.4, and 7.4. Figures 2-2, B-1, B-4, and 7-1
ICV® Package Cooling Area	54.4 m^3 (1,920 ft^3)	~~RESERVED~~Permit Attachment JJ, Appendix 1, Section 3, Drawing # H-14-106790, Section 5, Specification 145579-G-SP-001	Sections 2.4, 7.2.4, and 7.4. Figures 2-2, B-1, B-4, and 7-1

TABLE V.1.

DEMONSTRATION BULK VITRIFICATION SYSTEM (DBVS) - PHASE 1 DESCRIPTION FOR NON-MAJOR COMPONENTS (E.G., PUMPS, FILTERS, FANS, COMPRESSORS, ETC. NOT SPECIFICALLY LISTED)

Sub-system Description	Sub-system Designation	Engineering Description (Drawing No., Specification No., etc.)	Narrative Description, Tables and Figures	Maximum Capacity (gallons)
Control system for feed from the Waste & Simulant Staging Tanks to Waste Dryer [a]* (Waste Transfer Pump Skid)	32-D58-007	RESERVED	Sections 2.3.2, 2.3.3, 4.2, 4.2.1, 4.2.2.1, 4.2.3, 4.2.4, 4.2.12, 4.2.17; Table 4-1; Figures 2-2, B-1, and B-4	N/A
Waste Dryer including: Dust Recycle Feed to Dryer [a] Waste Dryer Sintered Metal Filter Waste Dryer HEPA Filter	33-D25-006 00-A-0016 33-NO2-014 33-NO2-017	Permit Attachment LL; Appendix 3; Section 3, Drawing F-145579-33-A-0100; Section 5, Specification 145579-D-SP-006	Sections 2.3.3, 4.2, 4.2.1, 4.2.8, 4.2.12, 4.2.14, 4.2.15, 4.2.17; Tables 4-1, 4-5; Figures 2-2, B-1, B-2, B-4, and B-5	2645 NA
Waste Drying System including: Control system for clean soil feed to dryer [a]* The waste dryer steam supply control system [a]* Control System for glass former additives feed to dryer [a]*	33-D58-068	Permit Attachment LL, Appendix 3, Section 3, Drawings F-145579-31-A-0101, F-145579-33-A-0100 & F-145579-33-A-0105; Section 5, Specifications 145579-D-SP-006 & 145579-D-SP-007	Sections 2.3.3, 4.2, 4.2.1, 4.2.8, 4.2.12, 4.2.14, 4.2.15, 4.2.17; Tables 4-1, 4-5; Figures 2-2, B-1, and B-4	N/A
DRYER OFFGAS TREATMENT SYSTEM				

Sub-system Description	Sub-system Designation	Engineering Description (Drawing No., Specification No., etc.)	Narrative Description, Tables and Figures	Maximum Capacity (gallons)
Dryer Offgas Condenser including: Condenser chilled water feed control system [a]*	33-D10-005	Permit Attachment LL, Appendix 3, Section 3, Drawing F-145579-33-A-0101; Section 5, Specification 145579-D-SP-006	Sections 4.2.14, 4.2.17; Tables 4-2, 4-3, 4-5; Figures 2-2, B-1, and B-4	NA
ICV® STATIONS				
Vitrification Container Preparation*	~~RESERVED~~ N/A	~~RESERVED~~Permit Attachment LL, Appendix 3, Drawing # F-145579-35-D-0018.	Sections 4.2.9, 4.2.17; Tables 4-1, 4-5; Figures 2-2 and B-1	N/A
ICV® System (Container Waste Fill, ICV® Melt & Vented Cooling) including: Dry waste feed control system [a]	33-D64-088 33-D64-089	Permit Attachment LL, Appendix 5, Section 3, Drawings F-145579-33-A-0100, F-145579-33-A-0106 & F-145579-A-0101, Section 5, Specifications 145579-D-SP-017, 145579-D-SP-018,	Section 2.2.1, 4.2.11, 4.2.12, 4.2.17; Table 4-1; Figures 2-2, B-1, and B-4	N/A
Top-off, and Container Sealing including: Top-off soil feed control system [a]*	31-D74-007, 31-D74-008, 31-D74-009	Permit Attachment LL, Appendix 5, Section 3, Drawings F-145579-31-A-0100 & F-145579-34-A-0101, Section 5, Specifications 145579-D-DS-055.1 & 145579-D-SP-018	Section 2.2.1, 4.2.11, 4.2.12, 4.2.17; Table 4-1; Figures 2-2, B-1, and B-4	N/A
Transport to Storage Pad (Sample Point)*	~~RESERVED~~35-D48-003	~~RESERVED~~Permit Attachment LL, Appendix 6, Section 5, Specification 145579-D-DS-012.1	Section 2.2.1, 4.2.11; Figures 2-2, B-1, and B-4	N/A

Sub-system Description	Sub-system Designation	Engineering Description (Drawing No., Specification No., etc.)	Narrative Description, Tables and Figures	Maximum Capacity (gallons)
MAIN OFFGAS TREATMENT SYSTEM				
Sintered Metal Filter #1	36-N02-019	RESERVED	Sections 4.2.12, 4.2.15, 4.2.17; Table 4-2; Figures B-2 and B-5	N/A
Sintered Metal Filter #2	36-N02-020	RESERVED	Sections 4.2.12, 4.2.15, 4.2.17; Table 4-2; Figures B-2 and B-5	N/A
Venturi Scrubber System (VSS)-1 Quencher #1	36-N83-034	RESERVED	Sections 4.2.4, 4.2.12, 4.2.15, 4.2.17; Tables 4-1, 4-3; Figures B-2 and B-5	RESERVED
VSS-1 Scrubber Feed System Tank #1[a]* includes: Caustic make-up feed control system[a]*	36-D74-052	RESERVED	Sections 4.2.4, 4.2.6, 4.2.12, 4.2.15, 4.2.17; Table 4-5; Figures B-2 and B-5	N/A
VSS-1 Heat Exchanger #1 includes: Chilled water feed control system[a]*	36-D30-046	RESERVED	Figures B-2 and B-5	RESERVED

Sub-system Description	Sub-system Designation	Engineering Description (Drawing No., Specification No., etc.)	Narrative Description, Tables and Figures	Maximum Capacity (gallons)
VSS -1 Scrubber #1	36-N73-035	RESERVED	Sections 4.2.4, 4.2.12, 4.2.15, 4.2.17; Tables 4-1, 4-2, 4-4, 4-5; Figures B-2 and B-5	RESERVED
VSS-1 Mist Eliminator #1	36-N24-036	RESERVED	Sections 4.2.15, 4.2.17; Tables 4-1, 4-2, 4-3; Figures B-2 and B-5	N/A
Venturi Scrubber System (VSS)-2 Quencher #2	36-N83-037	RESERVED	Sections 4.2.4, 4.2.12, 4.2.15, 4.2.17; Tables 4-1, 4-2, 4-3; Figures B-2 and B-5	RESERVED
VSS-2 Scrubber Tank Feed System #2[a]* includes: Caustic make-up feed control system[a]*	36-D74-054	RESERVED	Sections 4.2.4, 4.2.6, 4.2.12, 4.2.15, 4.2.17; Table 4-5; Figures B-2 and B-5	N/A
VSS-2 Heat Exchanger #2 includes: Chilled water feed control system[a]*	36-D30-047	RESERVED	Figures B-2 and B-5	RESERVED

Sub-system Description	Sub-system Designation	Engineering Description (Drawing No., Specification No., etc.)	Narrative Description, Tables and Figures	Maximum Capacity (gallons)
VSS-2 Scrubber #2	36-N73-038	RESERVED	Sections 4.2.4, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-4, 4-5; Figures B-2 and B-5	RESERVED
VSS-2 Mist Eliminator #2	36-N24-039	RESERVED	Sections 4.2.15, 4.2.17; Figures B-2 and B-5	N/A
Scrubber Condenser	36-D10-040	RESERVED	Figures B-2 and B-5	N/A
Mist Eliminator #3	36-N24-041	RESERVED	Figures B-2 and B-5	N/A
HEPA Filter Heater*	36-N84-042	RESERVED	Sections 4.2.6, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-2, 4-3, 4-5, 4-6; Figures 2-2 and B-2	N/A
HEPA Filters #1 #2 #3	 36-N02-043 36-NO2-044 36-NO2-045	 RESERVED RESERVED RESERVED	Sections 4.2.12, 4.2.15, 4.2.17; Tables 4-2, 4-6; Figures B-2 and B-5	N/A
Carbon Filter	36-NO2-064	RESERVED	Sections 4.2.12, 4.2.15, 4.2.17, 4.3.3; Tables 4-2, 4-6; Figures 2-2, B-2, and B-5	N/A
Offgas Polishing Filter	36-NO2-79	RESERVED	Figures 2-2 and B-3	N/A

Sub-system Description	Sub-system Designation	Engineering Description (Drawing No., Specification No., etc.)	Narrative Description, Tables and Figures	Maximum Capacity (gallons)
Tri-Mer Quencher includes: Water feed control system [a]*	36-N83-068	RESERVED	Sections 4.2.4, 4.2.6, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5; Figures 2-2, B-3, and B-6	RESERVED
Tri-Mer OX1 Tower including: H_2SO_4 feed control system [a]* $NaClO_2$ feed control system [a]*	36-D77-069	RESERVED	Sections 4.2.4, 4.2.6, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5; Figures 2-2, B-3, and B-6	RESERVED
Tri-Mer RC1 Tower & RC1 Tower Sump including: Na_2S feed control system [a]* NaOH feed control system [a]*	36-D77-070 36-D74-074	RESERVED RESERVED	Sections 4.2.4, 4.2.6, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5; Figures 2-2, B-3, and B-6	RESERVED
Tri-Mer OX2 Tower including: H_2SO_4 feed control system [a]* $NaClO_2$ feed control system [a]*	36-D77-071	RESERVED	Sections 4.2.4, 4.2.6, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5; Figures 2-2, B-3, and B-6	RESERVED

Sub-system Description	Sub-system Designation	Engineering Description (Drawing No., Specification No., etc.)	Narrative Description, Tables and Figures	Maximum Capacity (gallons)
Tri-Mer RC2 Tower & RC2 Tower Sump including: Na_2S feed control system [a]* NaOH feed control system [a]*	36-D77-072 36-D74-075	RESERVED RESERVED	Sections 4.2.4, 4.2.6, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5; Figures 2-2, B-3, and B-6	RESERVED
Tri-Mer CC Tower & CC Tower Sump including: NaOH feed control system [a]*	36-D77-073 36-D74-076	RESERVED RESERVED	Sections 4.2.4, 4.2.6, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5; Figures 2-2, B-3, and B-6	RESERVED
SCR Heater*	36-N84-078	RESERVED	Sections 4.2.4, 4.2.6, 4.2.7, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5, 4-6; Figures 2-2, B-3, and B-6	N/A
SCR Catalyst Bed including: Ammonia feed control system [a]*	36-D59-003	RESERVED	Sections 4.2.4, 4.2.6, 4.2.7, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5, 4-6; Figures 2-2, B-3, and B-6	N/A

Sub-system Description	Sub-system Designation	Engineering Description (Drawing No., Specification No., etc.)	Narrative Description, Tables and Figures	Maximum Capacity (gallons)
SCR Heat Exchanger*	36-D30-077	RESERVED	Sections 4.2.4, 4.2.6, 4.2.7, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5, 4-6; Figures 2-2, B-3, and B-6	N/A
Ammonia scrubber including: Dilute H2SO4 feed control system [a]*	RESERVED	RESERVED	Figures B-3 and B-6	N/A
Offgas Exhaust Stack*	36-N26-024	RESERVED	Section 4.2.12, 4.2.17; Figures 2-2, B-3, and B-6	N/A

[a] These subsystems only include feed control system components, with the exception of the boiler, which only includes the steam control system for the dryer. No substitution of terms as referenced in Permit Conditions II.G.2.e. and V. are to be made in this Permit for these subsystems.

* No substitution of terms as referenced in Permit Conditions II.G.2.e. and V. are to be made in this Permit for these subsystems.

N/A means no secondary containment required

TABLE V.2.

DEMONSTRATION BULK VITRIFICATION SYSTEM (DBVS) -PHASE 1 SECONDARY CONTAINMENT SYSTEMS INCLUDING SUMPS AND FLOOR DRAINS

Sump/Floor Drain I.D. No. & Room Location	**Maximum Sump Capacity (gallons)**	**Sump Dimensions (feet) & Materials of Construction**	**Engineering Description (Drawing No., Specification No., etc.)**
Waste Dryer Skid 33-D58-068	RESERVED	RESERVED	Permit Attachment LL, Appendix 3, Section 3, Drawing F-145579-33-A-0100, Section 5, Specification 145579-D-SP-006
RESERVED	RESERVED	RESERVED	RESERVED

TABLE V.3.

DEMONSTRATION BULK VITRIFICATION SYSTEM (DBVS) -PHASE 1 PROCESS AND LEAK DETECTION SYSTEM INSTRUMENTS AND PARAMETERS

Sub-system Locator and Name (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Failure State	Expected Range	Instrument Accuracy	Instrument Calibration Method No. and Range
Waste Dryer Skid	Level	TT-Mini Probe	33-LSH-018	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

TABLE V.4.

DEMONSTRATION BULK VITRIFICATION SYSTEM (DBVS) - PHASE 2 DESCRIPTION FOR NON-MAJOR COMPONENTS (E.G., PUMPS, FILTERS, FANS, COMPRESSORS, ETC NOT SPECIFICALLY LISTED)

Sub-system Description	Sub-system Designation	Engineering Description (Drawing No., Specification No., etc.)	Narrative Description, Tables and Figures	Maximum Capacity (gallons)
Control system for feed from the Waste & Simulant Staging Tanks to Waste Dryer [a]* (Waste Transfer Pump Skid)	32-D58-007	RESERVED	Sections 2.3.2, 2.3.3, 4.2, 4.2.1, 4.2.2.1, 4.2.3, 4.2.4, 4.2.12, 4.2.17; Table 4-1; Figures 2-2, B-1, and B-4	N/A
Waste Dryer including: Dust Recycle Feed to Dryer [a] Waste Dryer Sintered Metal Filter Waste Dryer HEPA Filter	33-D25-006 00-A-0016 33-NO2-014 33-NO2-017	Permit Attachment LL; Appendix 3; Section 3, Drawing F-145579-33-A-0100; Section 5, Specification 145579-D-SP-006	Sections 2.3.3, 4.2, 4.2.1, 4.2.8, 4.2.12, 4.2.14, 4.2.15, 4.2.17; Tables 4-1, 4-5; Figures 2-2, B-1, B-2, B-4, and B-5	2645 NA
Waste Drying System including: Control system for clean soil feed to dryer [a]* The waste dryer steam supply control system [a]* Control System for glass former additives feed to dryer [a]*	33-D58-068	Permit Attachment LL, Appendix 3, Section 3, Drawings F-145579-31-A-0101, F-145579-33-A-0100 & F-145579-33-A-0105; Section 5, Specifications 145579-D-SP-006 & 145579-D-SP-007	Sections 2.3.3, 4.2, 4.2.1, 4.2.8, 4.2.12, 4.2.14, 4.2.15, 4.2.17; Tables 4-1, 4-5; Figures 2-2, B-1, and B-4	N/A

Sub-system Description	Sub-system Designation	Engineering Description (Drawing No., Specification No., etc.)	Narrative Description, Tables and Figures	Maximum Capacity (gallons)
DRYER OFFGAS TREATMENT SYSTEM				
Dryer Offgas Condenser including: Condenser chilled water feed control system [a]*	33-D10-005	Permit Attachment LL, Appendix 3, Section 3, Drawing F-145579-33-A-0101; Section 5, Specification 145579-D-SP-006	Sections 4.2.14, 4.2.17; Tables 4-2, 4-3, 4-5; Figures 2-2, B-1, and B-4	NA
ICV® STATIONS				
Vitrification Container Preparation*	~~RESERVED~~ N/A	~~RESERVED~~Permit Attachment LL, Appendix 3, Drawing # F-145579-35-D-0018	Sections 4.2.9, 4.2.17; Tables 4-1, 4-5; Figures 2-2 and B-1	N/A
ICV® System (Container Waste Fill, ICV® Melt & Vented Cooling) including: Dry waste feed control system [a]	33-D64-088 33-D64-089	Permit Attachment LL, Appendix 5, Section 3, Drawings F-145579-33-A-0100, F-145579-33-A-0106 & F-145579-A-0101, Section 5, Specifications 145579-D-SP-017, 145579-D-SP-018,	Section 2.2.1, 4.2.11, 4.2.12, 4.2.17; Table 4-1; Figures 2-2, B-1, and B-4	N/A
Top-Off, and Container Sealing including: Top-off soil feed control system [a]*	31-D74-007, 31-D74-008, 31-D74-009	Permit Attachment LL, Appendix 5, Section 3, Drawings F-145579-31-A-0100 & F-145579-34-A-0101, Section 5, Specifications 145579-D-DS-055.1 & 145579-D-SP-018	Section 2.2.1, 4.2.11, 4.2.12, 4.2.17; Table 4-1; Figures 2-2, B-1, and B-4	N/A
Transport to Storage Pad (Sample Point)*	~~RESERVED~~35-D48-003	~~RESERVED~~Permit Attachment LL, Appendix 6, Section 5, Specification 145579-D-DS-012.1	Section 2.2.1, 4.2.11; Figures 2-2, B-1, and B-4	N/A

Sub-system Description	Sub-system Designation	Engineering Description (Drawing No., Specification No., etc.)	Narrative Description, Tables and Figures	Maximum Capacity (gallons)
MAIN OFFGAS TREATMENT SYSTEM				
Sintered Metal Filter #1	36-N02-019	RESERVED	Sections 4.2.12, 4.2.15, 4.2.17; Table 4-2; Figures B-2 and B-5	N/A
Sintered Metal Filter #2	36-N02-020	RESERVED	Sections 4.2.12, 4.2.15, 4.2.17; Table 4-2; Figures B-2 and B-5	N/A
Venturi Scrubber System (VSS)-1 Quencher #1	36-N83-034	RESERVED	Sections 4.2.4, 4.2.12, 4.2.15, 4.2.17; Tables 4-1, 4-3; Figures B-2 and B-5	RESERVED
VSS-1 Scrubber Feed System Tank #1[a]* includes: Caustic make-up feed control system [a]*	36-D74-052	RESERVED	Sections 4.2.4, 4.2.6, 4.2.12, 4.2.15, 4.2.17; Table 4-5; Figures B-2 and B-5	N/A
VSS-1 Heat Exchanger #1 includes: Chilled water feed control system [a]*	36-D30-046	RESERVED	Figures B-2 and B-5	RESERVED
VSS -1 Scrubber #1	36-N73-035	RESERVED	Sections 4.2.4, 4.2.12, 4.2.15, 4.2.17; Tables 4-1, 4-2, 4-4, 4-5; Figures B-2 and B-5	RESERVED

Sub-system Description	Sub-system Designation	Engineering Description (Drawing No., Specification No., etc.)	Narrative Description, Tables and Figures	Maximum Capacity (gallons)
VSS-1 Mist Eliminator #1	36-N24-036	RESERVED	Sections 4.2.15, 4.2.17; Tables 4-1, 4-2, 4-3; Figures B-2 and B-5	N/A
Venturi Scrubber System (VSS)-2 Quencher #2	36-N83-037	RESERVED	Sections 4.2.4, 4.2.12, 4.2.15, 4.2.17; Tables 4-1, 4-2, 4-3; Figures B-2 and B-5	RESERVED
VSS-2 Scrubber Tank Feed System #2[a]* includes: Caustic make-up feed control system [a]*	36-D74-054	RESERVED	Sections 4.2.4, 4.2.6, 4.2.12, 4.2.15, 4.2.17; Table 4-5; Figures B-2 and B-5	N/A
VSS-2 Heat Exchanger #2 includes: Chilled water feed control system [a]*	36-D30-047	RESERVED	Figures B-2 and B-5	RESERVED
VSS-2 Scrubber #2	36-N73-038	RESERVED	Sections 4.2.4, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-4, 4-5; Figures B-2 and B-5	RESERVED
VSS-2 Mist Eliminator #2	36-N24-039	RESERVED	Sections 4.2.15, 4.2.17; Figures B-2 and B-5	N/A
Scrubber Condenser	36-D10-040	RESERVED	Figures B-2 and B-5	N/A

Sub-system Description	Sub-system Designation	Engineering Description (Drawing No., Specification No., etc.)	Narrative Description, Tables and Figures	Maximum Capacity (gallons)
Mist Eliminator #3	36-N24-041	RESERVED	Figures B-2 and B-5	N/A
HEPA Filter Heater*	36-N84-042	RESERVED	Sections 4.2.6, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-2, 4-3, 4-5, 4-6; Figures 2-2 and B-2	N/A
HEPA Filters #1 #2 #3	 36-N02-043 36-NO2-044 36-NO2-045	 RESERVED RESERVED RESERVED	Sections 4.2.12, 4.2.15, 4.2.17; Tables 4-2, 4-6; Figures B-2 and B-5	N/A
Carbon Filter	36-NO2-064	RESERVED	Sections 4.2.12, 4.2.15, 4.2.17, 4.3.3; Tables 4-2, 4-6; Figures 2-2, B-2, and B-5	N/A
Offgas Polishing Filter	36-NO2-79	RESERVED	Figures 2-2 and B-3	N/A
Tri-Mer Quencher includes: Water feed control system [a]*	36-N83-068	RESERVED	Sections 4.2.4, 4.2.6, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5; Figures 2-2, B-3, and B-6	RESERVED
Tri-Mer OX1 Tower including: H_2SO_4 feed control system [a]* $NaClO_2$ feed control system [a]*	36-D77-069	RESERVED	Sections 4.2.4, 4.2.6, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5; Figures 2-2, B-3, and B-6	RESERVED

Sub-system Description	Sub-system Designation	Engineering Description (Drawing No., Specification No., etc.)	Narrative Description, Tables and Figures	Maximum Capacity (gallons)
Tri-Mer RC1 Tower & RC1 Tower Sump including: Na_2S feed control system [a]* NaOH feed control system [a]*	36-D77-070 36-D74-074	RESERVED RESERVED	Sections 4.2.4, 4.2.6, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5; Figures 2-2, B-3, and B-6	RESERVED
Tri-Mer OX2 Tower including: H_2SO_4 feed control system [a]* $NaClO_2$ feed control system [a]*	36-D77-071	RESERVED	Sections 4.2.4, 4.2.6, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5; Figures 2-2, B-3, and B-6	RESERVED
Tri-Mer RC2 Tower & RC2 Tower Sump including: Na_2S feed control system [a]* NaOH feed control system [a]*	36-D77-072 36-D74-075	RESERVED RESERVED	Sections 4.2.4, 4.2.6, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5; Figures 2-2, B-3, and B-6	RESERVED
Tri-Mer CC Tower & CC Tower Sump including: NaOH feed control system [a]*	36-D77-073 36-D74-076	RESERVED RESERVED	Sections 4.2.4, 4.2.6, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5; Figures 2-2, B-3, and B-6	RESERVED
SCR Heater*	36-N84-078	RESERVED	Sections 4.2.4, 4.2.6, 4.2.7, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5, 4-6; Figures 2-2, B-3, B-6	N/A

Sub-system Description	Sub-system Designation	Engineering Description (Drawing No., Specification No., etc.)	Narrative Description, Tables and Figures	Maximum Capacity (gallons)
SCR Catalyst Bed including: Ammonia feed control system [a]*	36-D59-003	RESERVED	Sections 4.2.4, 4.2.6, 4.2.7, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5, 4-6; Figures 2-2, B-3, and B-6	N/A
SCR Heat Exchanger*	36-D30-077	RESERVED	Sections 4.2.4, 4.2.6, 4.2.7, 4.2.12, 4.2.15, 4.2.17, 4.3; Tables 4-1, 4-2, 4-5, 4-6; Figures 2-2, B-3, and B-6	N/A
Ammonia scrubber including: Dilute H2SO4 feed control system [a]*	RESERVED	RESERVED	Figures B-3 and B-6	N/A
Offgas Exhaust Stack*	36-N26-024	RESERVED	Section 4.2.12, 4.2.17; Figures 2-2, B-3, and B-6	N/A

[a] These subsystems only include feed control system components, with the exception of the boiler, which only includes the steam control system for the dryer. No substitution of terms as referenced in Permit Conditions II.G.2.e. and V. are to be made in this Permit for these subsystems.

* No substitution of terms as referenced in Permit Conditions II.G.2.e. and V. are to be made in this Permit for these subsystems.

N/A means no secondary containment required

TABLE V.5.

DEMONSTRATION BULK VITRIFICATION SYSTEM (DBVS) – PHASE 2 SECONDARY CONTAINMENT SYSTEMS INCLUDING SUMPS AND FLOOR DRAINS

Sump/Floor Drain I.D. No. & Room Location	Maximum Sump Capacity (gallons)	Sump Dimensions (feet) & Materials of Construction	Engineering Description (Drawing No., Specification No., etc.)
Waste Dryer Skid 33-D58-068	RESERVED	RESERVED	Permit Attachment LL, Appendix 3, Section 3, Drawing F-145579-33-A-0100, Section 5, Specification 145579-D-SP-006
RESERVED	RESERVED	RESERVED	RESERVED

TABLE V.6.

DEMONSTRATION BULK VITRIFICATION SYSTEM (DBVS) – PHASE 2 PROCESS AND LEAK DETECTION SYSTEM INSTRUMENTS AND PARAMETERS

Sub-system Locator and Name (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Failure State	Expected Range	Instrument Accuracy	Instrument Calibration Method No. and Range
Waste Dryer Skid	Level	TT-Mini Probe	33-LSH-018	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

TABLE V.7.

MAXIMUM FEED AND FEED-RATES TO DEMONSTRATION BULK VITRIFICATION SYSTEM (DBVS) – PHASE 1 AND 2

Description of Waste	Phase 1	Phase 2
Tank 241-S-109 Waste	1080 gallons	300,000 gallons
# of ICV® Container Loads	3	50 minus number of ICV® Container Loads processed during Phase 1
Dryer Feed (pounds/hour) Mixed Waste Simulant Dangerous Waste Simulant Non-Dangerous Waste Soil	RESERVED RESERVED RESERVED RESERVED	RESERVED RESERVED RESERVED RESERVED
ICV® Feed (pounds/hour) Mixed Waste Simulant Dangerous Waste Simulant Non-Dangerous Waste Soil	RESERVED RESERVED RESERVED RESERVED	RESERVED RESERVED RESERVED RESERVED
Dryer Feed (pounds/hour)		
Total Chlorine/Chloride Feed-rate	RESERVED	RESERVED
Total Metal Feed-rates Arsenic Cadmium Chromium (total) Lead Mercury Beryllium	 RESERVED RESERVED RESERVED RESERVED RESERVED RESERVED	 RESERVED RESERVED RESERVED RESERVED RESERVED RESERVED
Total Organics (Organic Compounds listed on Table 6-1 of Attachment BB of this Permit.	RESERVED	RESERVED

TABLE V.8.

DEMONSTRATION BULK VITRIFICATION SYSTEM (DBVS) EMERGENCY PARAMETER CONTROL / RESPONSE SYSTEM (RESERVED)

Sub-system Designation	Instrument or Component Tag Number	Parameter Description	Setpoints Limits During Phase 1	Setpoints Limits During Phase 2 Campaign No.	Respond to Deviation from setpoint*
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

*(e.g., automatically cut-off and/or lock-out the dangerous and mixed waste feed to the DBVS, etc.)