Independent Qualified Registered Professional Engineer Design Assessment Report for ETF Brine Loadout System
Independent Qualified Registered Professional Engineer
Design Assessment Report
For
ETF Brine Loadout System

IQRPE Design Assessment Report
No. DA-325497-01
Rev. 0

Prepared By

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At the request of

Richland, Washington 99352

Meier Project No. 18-8506
WRPS Subcontract No. 64658, Release 23

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TABLE OF CONTENTS

1.0 INTRODUCTION .............................................................................................................4
1.1 PROJECT DESCRIPTION ...............................................................................................4

1.2 DESIGN REVIEW REQUIREMENTS ..........................................................................22
1.3 DESIGN OVERVIEW FOR ETF BRINE LOADOUT SYSTEM ...................................22
1.3.2 Tote Loading Station ...............................................................................................22
1.3.3 Fill Head Assembly ..................................................................................................23
1.3.4 Piping Assemblies ....................................................................................................23
1.3.5 Pipe-In-Pipe Heat Exchangers ................................................................................23
1.3.6 Piping Supports ........................................................................................................23

1.4 SCOPE OF IQRPE DESIGN ASSESSMENT ..............................................................23
1.4.1 Portions of the ETF Brine Loadout System Included in Scope for IQRPE Certification ........................................................................................................23
1.4.2 Portions of the ETF Brine Loadout System Not Included in Scope for IQRPE Certification ........................................................................................................24

2.0 ASSESSMENT SUMMARY ...........................................................................................24
2.1 CODES, STANDARDS, AND REGULATIONS ............................................................24
2.1.1 Structural Design Standards ....................................................................................24
2.1.2 Waste Compatibility ................................................................................................26
2.1.3 Anticipated Chemistry and Controls ......................................................................29
2.1.4 Pressure Control System .......................................................................................30
2.1.5 Secondary Containment System ............................................................................32
2.1.6 Ancillary Equipment Design ..................................................................................33
2.1.7 P&ID Review ..........................................................................................................33
2.1.8 Corrosion Assessment ............................................................................................33
2.1.9 Recommended Inspection Schedule ........................................................................34

3.0 DESIGN REVIEW ASSESSMENT CERTIFICATIONS ..............................................35

4.0 REFERENCES ..................................................................................................................37

Figures

Figure 1: Hanford Map Showing the Location of the 200 East and West Areas ..................6
Figure 2: Hanford Site Map Showing the Location of the ETF .......................................7
Figure 3: Aerial Photograph Showing the ETF Facility in the 200 East Area ....................8
Figure 4: Aerial Photograph Showing an Overview of the ETF Facility ..........................9
Figure 5: Photograph of Outside of the ETF Facility ......................................................10
Figure 6: ETF Brine Loadout System General Arrangement (H-2-838177, Sheet 1) ........11
Figure 7: Plan View of ETF Brine Loadout System General Arrangement (H-2-838177, Sheet 2) ..........................................................12
Figure 8: Brine Loadout System Tote Fill Station (H-2-838178, Sheet 1) ......................13
Figure 9: ETF Brine Loadout System Tote (RPP-SPEC-63202) ....................................14
Figure 10: ETF Brine Loadout Tote Fill Head Assembly (H-2-838181, Sheet 1) .........................15
Figure 11: ETF Brine Loadout Tote Fill Head Valve Assembly (H-2-838181, Sheet 3)..............16
Figure 12: Brine Loadout System Concentrate Piping (H-2-838183, Sheet 2).........................17
Figure 13: ETF Brine Loadout System Double Tube Heat Exchanger (H-2-838183, Sheet 14) ........................................................................................................................................18
Figure 14: ETF Brine Loadout System Vessel Vent System (H-2-838184, Sheet 2).................19
Figure 15: ETF Brine Loadout System Verification Water System (H-2-838185, Sheet 2)......20
Figure 16: ETF Brine Loadout System Drainage Piping (H-2-838190, Sheet 2)....................21

Tables
Table 1: ETF Brine Loadout System Materials of Construction ..............................................27
1.0 INTRODUCTION

Washington Administrative Code (WAC) 173-303-640 provides a set of requirements for owner/operators of dangerous waste tank systems. This Design Assessment Report is prepared for Washington River Protection Solutions, LLC (WRPS) by an Independent Qualified Registered Professional Engineer (IQRPE) to certify that the proposed tank system will have sufficient structural integrity and is acceptable for storing and treating dangerous waste per WAC 173-303-640(3). IP-325497-01, Independent Qualified Registered Professional Engineer Inspection Plan for ETF Brine Loadout System, identifies the IQRPE inspections required for the procurement and testing related to the Effluent Treatment Facility (ETF) Brine Loadout System Project.

The IQRPE maintains “independence” at all times. However, comments and suggestions by others are considered by the IQRPE during the preparation of reports and plans. Only the IQRPE can implement changes to the master IQRPE documents.

1.1 PROJECT DESCRIPTION

Background

Currently the ETF Secondary Treatment Train produces a powdered waste form that is disposed of at the Environmental Restoration Disposal Facility (ERDF). ETF anticipates receiving a new waste stream from Waste Treatment Plant (WTP) Direct-Feed Low-Activity Waste (DFLAW) which will both exceed the capacity of the dryer equipment used to make powder and will carry with it new treatment requirements which are anticipated to be fulfilled by stabilization in a cement-based waste form. The addition of a Brine Loadout System to the Secondary Treatment Train allows the ETF concentrate (aka brine), which would have been fed to the existing dryer equipment, to be loaded into Intermediate Bulk Container (IBC) totes for shipment to an offsite vendor for stabilization.

The Brine Loadout System will tie-in to the existing concentrate tank recirculation loops on tanks 60J-TK-1A and 60J-TK-1B. Approximately five (5) gpm will be taken off the recirculation loop and fed to the new tote loading station in Room 137. The Brine Loadout System in Room 137 consists of a tote loading platform with three (3) tote stations, secondary containment, and flexible hose connections. The totes have a maximum recommended temperature of 100 °F, therefore a pipe-in-pipe heat exchanger will be added to each brine recirculation loop to ensure the brine is cooled to 100 °F prior to loadout.

For brine loading, empty totes are raised by a forklift and placed on the brine loading station platform. Fill lids are placed on the totes and connected to the fill line from the concentrate tank recirculation loops. The brine loadout filling station uses an inline flowmeter with flow totalizer and shutoff valve to fill the totes. The fill lid also includes a tie-in to the ETF Vessel Offgas (VOG) System and a high level switch. Near the fill station there is an operator interface that allows the operator to select which concentrate tank and tote position will be utilized and start the fill. Once a fill cycle is initiated, it will take approximately one (1) hour to fill a tote. After the fill is complete, the operator will initiate a flush cycle and valve in the next tote on the fill station. After filling, the operator will disconnect the fill head, install the shipping lid, and move the tote using a forklift to the tote storage area in the 2025E Container Storage Area, or moved by forklift to the 2025E Truck Bay, or the Outdoor Container Storage Area.
This activity constitutes a design modification to an existing facility. In accordance with TFC-ESHQ-ENV_PP-C-11, Independent Qualified Registered Professional Engineer Assessment Process, and WAC-173-303-640(3)(a), modification of an existing facility requires that the IQRPE attest that the modifications will not impact the structural integrity of the component and is acceptable for handling dangerous waste.

The overall details of the design change are documented in Modification Traveler MT-50388, Brine Load-Out System for ETF and H-2-838176, Instrumentation Brine Loadout System P&ID. Relevant codes and standards include ASME B31.3-2016, Process Piping and HNF-27957, 200 Area ETF, Load-In, and LERF Pipe Class Specification.

The scope of the IQRPE assessment will include the installation of the new piping and equipment to support the operation of the Brine Loadout System. Included within the scope of the piping changes are:

- New cooling water piping to supply water the concentrate heat exchangers (ETF piping system 95C; H-2-838186, Mechanical Brine Loadout System Clg Water Pipe Spools)
- New vessel vent piping (ETF piping system 45D; H-2-838184, Mechanical Brine Loadout System Vessel Vent Pipe Spools)
- New concentrate piping (ETF piping system 60J; H-2-838183, Mechanical Brine Loadout System Concentrate Pipe Spools)
- New verification water piping (ETF piping system 60H; H-2-838185, Mechanical Brine Loadout System Verif Water Pipe Spools)
- Basin drain piping (ETF piping system 20B; H-2-838190, Mechanical Brine Loadout System Basin Drain Pipe Spools)

The cooling water lines do not handle dangerous waste and thus are not included within the scope of this IQRPE assessment.

The ETF Brine Loadout System Project will occur on the Hanford Nuclear Waste Site in the 200 East Area.

The components procured and installed to support the ETF Brine Loadout System Project include:

- Intermediate Bulk Container Tote
- Tote Loading Station
- Fill Head Assembly
- Piping Assemblies
- Pipe-In-Pipe Heat Exchangers
- Piping Supports

IQRPE Scope

Meier Architecture • Engineering (Meier) provided an IQRPE to perform the Design Assessment per WRPS Statement of Work (SOW) No. 325497, IQRPE Support to ETF Brine Loadout System (BMA 64658). The scope includes a review of the procurement and testing activities for the ETF Brine Loadout System Project.

A review of design documents (drawings, calculations, specifications, etc.) was completed by the IQRPE. Fabrication activities associated with the work scope covered under this task include the fabrication of pipe-in-pipe heat exchangers, piping assemblies, and the fill head assembly. These
are detailed in Table 2 of IP-325497-01. Installation inspections will be completed by the IQRPE and documented in IA-325497-01, Independent Qualified Registered Professional Engineer Installation Assessment Report for ETF Brine Loadout System.

The IQRPE performed the design assessment to the requirements of WAC 173-303-640, Tank Systems, for the components detailed above.

**Figure 1: Hanford Map Showing the Location of the 200 East and West Areas**
Figure 2: Hanford Site Map Showing the Location of the ETF
Figure 3: Aerial Photograph Showing the ETF Facility in the 200 East Area
Figure 4: Aerial Photograph Showing an Overview of the ETF Facility
Figure 5: Photograph of Outside of the ETF Facility
Figure 6: ETF Brine Loadout System General Arrangement (H-2-838177, Sheet 1).
Figure 7: Plan View of ETF Brine Loadout System General Arrangement (H-2-838177, Sheet 2)
Figure 8: Brine Loadout System Tote Fill Station (H-2-838178, Sheet 1)
Figure 9: ETF Brine Loadout System Tote (RPP-SPEC-63202)
Figure 10: ETF Brine Loadout Tote Fill Head Assembly (H-2-838181, Sheet 1)
Figure 11: ETF Brine Loadout Tote Fill Head Valve Assembly (H-2-838181, Sheet 3)
Figure 12: Brine Loadout System Concentrate Piping (H-2-838183, Sheet 2)
Figure 13: ETF Brine Loadout System Double Tube Heat Exchanger (H-2-838183, Sheet 14)
Figure 14: ETF Brine Loadout System Vessel Vent System (H-2-838184, Sheet 2)
Figure 15: ETF Brine Loadout System Verification Water System (H-2-838185, Sheet 2)
Figure 16: ETF Brine Loadout System Drainage Piping (H-2-838190, Sheet 2)
1.2 DESIGN REVIEW REQUIREMENTS

Many of the components required for the transfer of dangerous or mixed waste are regulated by WAC 173-303-640(3) requirements. WAC codes require an IQRPE’s review of the design of these components prior to installation.

As a basis for the IQRPE certification, a review is performed on a final version of the document design package as prepared and reviewed by WRPS. Documents such as drawings, calculations, Engineering Change Notices (ECNs), Engineering Design Transmittals (EDTs), Technical Evaluations, and specifications included in the design review package that are marked as final, and have signatures of the preparer, checker, and approver are reviewed by the IQRPE as a completed document. All other documents will be reviewed as preliminary or supportive information.

The IQRPE maintains “independence” at all times. Comments and suggestions by others are considered by the IQRPE during the preparation of reports and plans. Only the IQRPE can implement changes to the master IQRPE documents.

1.3 DESIGN OVERVIEW FOR ETF BRINE LOADOUT SYSTEM

This IQRPE Design Assessment Report is prepared for the Owner by an IQRPE to certify that the proposed tank system will have sufficient structural integrity, and is acceptable for storing and treating dangerous waste per WAC 173-303-640(3)(a).

The components within the scope of this IQRPE Design Assessment for the ETF Brine Loadout System Project include only those that either will be, or have the potential to be, in direct contact with waste fluids. Included within this scope are the pipe stands which are relied upon to support waste containing piping components along their travel paths. All of these components are situated inside the temperature-controlled ETF 2025E Building. The piping installed for the ETF Brine Loadout System Project is required to comply with HNF-27957.

The following sections list and briefly describe the major ETF Brine Loadout System Project components included in this design review.

1.3.1 Intermediate Bulk Container Tote

The ETF Brine Loadout System Project will incorporate in its design a commercially-available 330-gallon IBC tote for the storage and transport of liquid waste. The tote is a rigid plastic container known as a ‘Payloader®’. The requirements for the manufacture and testing of the IBC are specified within RPP-SPEC-63202. The manufacturer-supplied top cover of the tote is removed and the fill head (H-2-838181, Mechanical Brine Loadout System Fill Head Assembly) is placed on it for routing and controlling the flow of waste liquid into the tote.

1.3.2 Tote Loading Station

The tote loading station, H-2-838178, Mechanical Brine Loadout System Tote Fill Station Assy, is the structure used for placing the totes when they are filled.

1 Payloader is a register trademark of Snyder Industries, Inc., Lincoln, Nebraska
1.3.3 Fill Head Assembly

The fill head assembly (H-2-838181) is placed on top of the tote when it is being filled at the tote loading station. It contains the piping and valving for transferring liquid waste to the tote.

1.3.4 Piping Assemblies

The various waste handling piping assemblies associated with the ETF Brine Loadout System Project include the: vessel vent piping (H-2-838184); concentrate piping (H-2-838183); verification water piping (H-2-838185); and the basin drain piping (H-2-838190).

1.3.5 Pipe-In-Pipe Heat Exchangers

The Pipe-In-Pipe Heat Exchangers are components included within the scope of the concentrate piping (H-2-838183) and are used to cool the brine to a temperature of 100 °F prior to loadout to the IBC totes which have a maximum recommended temperature of 100 °F.

1.3.6 Piping Supports

The piping supports (H-2-838187, Mechanical Brine Load Out System Pipe Support Details) are used to support the various piping assemblies associated with the ETF Brine Loadout System Project along their travel paths within the ETF 2025E Building.

1.4 SCOPE OF IQRPE DESIGN ASSESSMENT

This IQRPE design assessment includes a comprehensive review of the design package per WAC 173-303-640. Any exceptions taken by the IQRPE to incomplete or unavailable items in the design package are listed in Section 2.1 at the end of each subsection.

1.4.1 Portions of the ETF Brine Loadout System Included in Scope for IQRPE Certification

Documents included in this design review for the ETF Brine Loadout System Project include:

- Procurement Information
- Construction Specifications
- Technical Specifications
- Design and Fabrication Drawings
- ECNs
- Piping and Instrumentation Drawings (P&IDs)

A list of documents reviewed by the IQRPE as part of this Design Assessment Report is included in Section 4.0.
1.4.2 Portions of the ETF Brine Loadout System Not Included in Scope for IQRPE Certification

This design assessment was limited only to the previously identified ETF Brine Loadout System components, and no other systems or components were evaluated.

2.0 ASSESSMENT SUMMARY

Systems within the IQRPE scope of this assessment (Section 1.4.1) are adequately designed to prevent failure caused by corrosion or by structural loads imposed by the system’s intended service. These conditions are described in more detail below. The system design complies with the applicable requirements of WAC 173-303-640. Design documents that were reviewed as part of this assessment are referenced in Section 4.0.

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 applicable references is contained in Section 4.0.

2.1.1 Structural Design Standards

WAC 173-303-640 requires that an IQRPE certify that the proposed tank system will have sufficient structural integrity and is acceptable for storing and treating dangerous waste. This assessment must show, in accordance with WAC 173-303-640(3)(a), Design and Installation of New Tank Systems or Components, that the foundation, structural support, seams, connections, and pressure controls are adequately designed and that the tank system has sufficient structural strength, compatibility with the waste to be stored and treated, and corrosion protection to ensure that it will not collapse, rupture, or fail.

The ETF Brine Loadout System Project involves the installation of various equipment, piping, and components inside the temperature-controlled ETF 2025E Building. The nature and location of the task does not introduce any structural concerns related to freeze protection of piping, frost heaving of foundations, and back fill requirements to provide structural support to prevent excessive settlement and corrosion.

2.1.1.1 ETF 2025E Building

The concrete floor of the ETF building in Room 137 was evaluated for the floor loading resulting from the installation of the totes and storage rack for the ETF Brine Loadout System Project. The Room 137 floor load was determined to be adequate for the totes to be placed directly on the concrete and are adequate for the rack posts with a 54” spacing between the posts (RPP-CALC-63161, ETF Concrete Floor Loading Analysis). Post-installed concrete anchors and cast-in-place concrete must meet the requirement established in RPP-SPEC-62968, ETF Brine Loadout and Tote Storage Construction Specification.
2.1.1.2 Intermediate Bulk Container Tote
The ETF Brine Loadout System Project will incorporate in its design a commercially-available 330-gallon Intermediate Bulk Container (IBC) for the storage and transport of liquid waste. The tote is a rigid plastic container known as a ‘Payloader®’. The applicable structural design requirements for the manufacture and testing of the IBC are specified within RPP-SPEC-63202.

2.1.1.3 Tote Loading Station
The structure of the tote loading station, (H-2-838178, Mechanical Brine Loadout System Tote Fill Station Assy) incorporates in its design an operator platform (H-2-838179, Mechanical/Structural Brine Loadout System Operator Platform) and a drip tray assembly situated under the totes (H-2-838182, Mechanical Brine Loadout System Drip Tray Assembly). The structural welds of the platform are welded and inspected in accordance with AWS D1.1/D1.1M, Structural Welding Code – Steel, or AWS D1.6/D1.6M, Structural Welding Code – Stainless Steel, as applicable, for the category of statically loaded criteria. The structural welds of the drip tray are welded and inspected in accordance with AWS D1.6/D1.6M for the category of statically loaded criteria.

2.1.1.4 Fill Head Assembly
The structural welds of the fill head assembly (H-2-838181, Mechanical Brine Loadout System Fill Head Assembly) are welded and inspected in accordance with AWS D1.6/D1.6M for the category of statically loaded criteria.

2.1.1.5 Piping Assemblies
The piping of the ETF Brine Loadout System Project, which includes the vessel vent piping (H-2-838184), concentrate piping (H-2-838183), verification water piping (H-2-838185), and the basin drain piping (H-2-838190), was evaluated for its adequacy relative to deadweight, seismic, and other design loads such as support and anchorage loads. The piping was analyzed for seismic loading to natural phenomena design category 2 (NCD-2) criteria and to seismic design category 2 (SDC-2). The process piping was determined to have met NCD-2 and ASME B31.3, Process Piping, requirements for gravity and seismic loading (RPP-CALC-63506, ETF Brine Load Out ASME B31.3 Piping Analysis). Specific fabrication details associated with each of the piping systems are discussed below.

2.1.1.5.1 Vessel Vent Piping
The pressure retaining components of the vessel vent piping (H-2-838184) are fabricated, welded, inspected, and tested in accordance with ASME B31.3 Process Piping or ASME B31.1 Power Piping.

2.1.1.5.2 Concentrate Piping
The piping of the concentrate piping (H-2-838183) is welded and inspected in accordance with the criteria of ASME B31.3 for the category of normal fluid service. The pressure retaining

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2 Payloader is a register trademark of Snyder Industries, Inc., Lincoln, Nebraska
components of the concentrate piping are fabricated, welded, inspected, and tested in accordance with ASME B31.3 or ASME B31.1.

2.1.1.5.3 Verification Water Piping
The piping of the verification water piping (H-2-838185) is welded and inspected in accordance with the criteria of ASME B31.3 for the category of normal fluid service. The pressure retaining components of the verification water piping are fabricated, welded, inspected, and tested in accordance with ASME B31.3.

2.1.1.5.4 Basin Drain Piping
The piping of the basin drain piping (H-2-838190) is welded and inspected in accordance with the criteria of ASME B31.3 for the category of normal fluid service.

2.1.1.6 Pipe-In-Pipe Heat Exchangers
Two Pipe-In-Pipe Heat Exchangers (component numbers: 60J-E-02 & 60J-E-03; H-2-88988, P&ID Concentrate Receiving System Heat Exchanger) are included within the scope of the concentrate piping. They are commercially-manufactured double-tube heat exchanger units fabricated by Advanced Process Solutions (H-2-838183). No specific structural information has been provided for the units.

2.1.1.7 Piping Supports
The structural welds of the various pipe supports (H-2-838187, Mechanical Brine Load Out System Pipe Support Details) meet the requirements of AWS D1.1/D1.1M, Structural Welding Code – Steel, for the welding of structural carbon steel and AWS D1.6/D1.6M, Structural Welding Code – Stainless Steel, for the welding of structural stainless steel, as applicable, for the category of statically loaded criteria (H-2-838187, Mechanical Brine Load Out System Pipe Support Details). The structural analysis of the pipe supports is detailed within RPP-CALC-63506.

2.1.1.8 Structural Design Exceptions
Based on the above review, there are no IQRPE certification exceptions to the structural design of the piping materials used for the ETF Brine Loadout System Project.

The IQRPE concurs that structural considerations for the design of the ETF Brine Loadout System Project met the requirements of WAC 173-303-640.

2.1.2 Waste Compatibility
Regulations located in WAC 173-303-640(3)(a) require tank systems be compatible with the wastes transported or otherwise handled. Materials of ETF Brine Loadout System were obtained from drawings H-2-838181, H-2-838183, H-2-838184, H-2-838185 and H-2-838190. Component materials that either will be in contact with tank waste or have the possibility of coming into contact are summarized in Table 1, below.
This review does not cover waste compatibility issues that may be associated with secondary containment components such as the ETF floor itself or floor linings or coatings.

### Table 1: ETF Brine Loadout System Materials of Construction

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Drawing Location</th>
<th>Item Number</th>
<th>Notes</th>
<th>Component Materials</th>
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<tr>
<td>ETF Brine Loadout Tote Fill Head Assembly</td>
<td>NUT</td>
<td></td>
<td>15</td>
<td>• FASTENAL</td>
<td>• 316 SST</td>
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<tr>
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<td></td>
<td></td>
<td>• 1/4-20 UNC HEX</td>
<td>• ASTM A194</td>
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<td></td>
<td>REDUCER</td>
<td>H-2-838181, Sheet 2</td>
<td>18</td>
<td>• (MCMASTER-CARR)</td>
<td>• 316 SST</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• 1” X 3/8-18 NPT FEMALE, STRAIGHT</td>
<td>• ASTM A351</td>
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<tr>
<td></td>
<td>PIPE</td>
<td></td>
<td>21, 22</td>
<td>• 3/8” SCH 40S</td>
<td>• ASTM A312 TP316L</td>
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<td></td>
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<td>23, 24</td>
<td>• AFLEX HOSE</td>
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<td></td>
<td>HEAVY DUTY CAP</td>
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<td>26</td>
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<td>• FLOWTEK</td>
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<td>GLOBE VALVE</td>
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<td>• ACTUATOR</td>
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<td></td>
<td></td>
<td>• WESTLOCK SWITCH</td>
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<td>• INLINE</td>
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<td>THERMOMETER</td>
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<td>19</td>
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<td>• BIMETAL 4” DIAL</td>
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<td>PIPE</td>
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<td>• 1 ½”</td>
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<td>• SCH 40S</td>
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<td></td>
<td></td>
<td></td>
<td>• ½”</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• CAM AND GROOVE W/ LOCKING LEVERS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ELBOW</td>
<td></td>
<td>25, 26</td>
<td>• 90 DEG</td>
<td>• ASTM A403 WP516L</td>
</tr>
<tr>
<td></td>
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<td>• ½”</td>
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<td></td>
<td>• LR, BW</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• CLASS 150</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FLANGES</td>
<td></td>
<td>27, 29</td>
<td>• ½”</td>
<td>• ASTM A182 GR F316L SS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• ¾”</td>
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<td></td>
<td></td>
<td>• 1 ½”</td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>• WN, RF</td>
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<tr>
<td></td>
<td>GASKETS</td>
<td></td>
<td>30, 31, 32</td>
<td>• FLEXITALLIC</td>
<td>GASKET, CL 150, 316L/FLEXICARB, 316L SS OUTER RING, OR EQUAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• ½”</td>
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<td>• ¾”</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>• 1 ½”</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Material/Properties</td>
<td></td>
<td></td>
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<td>------</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>PLUG</td>
<td>3/4&quot; CAM &amp; GROOVE, TYPE DP DUST PLUGS</td>
<td>SST</td>
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<tr>
<td>REDUCER</td>
<td>CONCENTRIC 3/4 X 1/2 BW</td>
<td>ASTM A403 WP316L</td>
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<tr>
<td>TEE</td>
<td>STRAIGHT 5/8 BW, CLASS 150</td>
<td>ASTM A403 WP316L, B16.9</td>
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<tr>
<td>WELDOLET</td>
<td>1/4&quot; CLASS 3000</td>
<td>ASTM A182 GR F304L</td>
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</tbody>
</table>

**ETF Brine Loadout System Double Tube Heat Exchanger**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Material/Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>GASKET</td>
<td>1&quot; RF, STYLE &quot;LS&quot; SPIRAL WOUND CL 150</td>
<td>316L/FLEXICARB, 316L SS OUTER RING, OR EQUAL</td>
</tr>
<tr>
<td>UNION</td>
<td>G&amp;L FITTINGS 3/4&quot; CL 3000</td>
<td>EPDM O-RING, ASTM A182 GR F316L</td>
</tr>
<tr>
<td>PIPE</td>
<td>1/2&quot; 1&quot; SCH 40S</td>
<td>ASTM A312 TP316L</td>
</tr>
<tr>
<td>FLANGES</td>
<td>1&quot; CL 150 ASME B16.5</td>
<td>ASTM A182 F316L</td>
</tr>
<tr>
<td>TEE, 1&quot; SCH 40S BW, ASME B16.9</td>
<td>1&quot; SCH 40S BW ASME B16.9</td>
<td>ASTM A403 WP316L</td>
</tr>
<tr>
<td>ELBOW</td>
<td>1/4&quot; 1&quot; LR 90DEG SCH 40S BW ASME B16.9</td>
<td>ASTM A403 WP316L</td>
</tr>
<tr>
<td>REDUCER</td>
<td>CONCENTRIC 1&quot; X 3/4&quot; SCH 40S BW ASME B16.9</td>
<td>ASTM A403 WP316L</td>
</tr>
<tr>
<td>WELDOLET</td>
<td>1&quot; FOR 4&quot; PIPE SCH 40S MSS SP-97</td>
<td>ASTM A403 WP316L</td>
</tr>
<tr>
<td>NIPPLES</td>
<td>3/4&quot; 1&quot; SCH 40S 1 1/2&quot; L</td>
<td>ASTM A312 TP316L</td>
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**ETF Brine Loadout System Drainage Piping**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Material/Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>BALL VALVES</td>
<td>1/2&quot; 1/4&quot;</td>
<td>SST</td>
</tr>
<tr>
<td>PIPE</td>
<td>1/2&quot; SCH 40S</td>
<td>ASTM A312 TP304</td>
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<tr>
<td>ELBOW</td>
<td>1/4&quot;</td>
<td>ASTM A403 WP304</td>
</tr>
<tr>
<td>FLANGES</td>
<td>1/2&quot; 1/4&quot; CL 150</td>
<td>ASTM A182 F304</td>
</tr>
<tr>
<td>GASKETS</td>
<td>1/2&quot; 1/4&quot; RF, STYLE &quot;LS&quot; SPIRAL WOUND CL 150</td>
<td>316L/FLEXICARB, 316L SS OUTER RING, OR EQUAL</td>
</tr>
<tr>
<td>REDUCER</td>
<td>CONCENTRIC</td>
<td>ASTM A403 WP304</td>
</tr>
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</table>
### Vessel Vent System

<table>
<thead>
<tr>
<th>Component</th>
<th>Material Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>BALL VALVE</td>
<td>¾&quot; SST</td>
</tr>
<tr>
<td>BLOCK &amp; FEED VALVE</td>
<td>½&quot; SST</td>
</tr>
<tr>
<td>PIPE</td>
<td>½&quot; SCH 80, ASTM D1784</td>
</tr>
<tr>
<td>COUPLING</td>
<td>½&quot; SCH 80, ASTM D1784</td>
</tr>
<tr>
<td>BUSHING</td>
<td>¾&quot; X ½&quot; SCH 80, ASTM D1784</td>
</tr>
<tr>
<td>ELBOW</td>
<td>¾&quot; X ½&quot; SCH 80, ASTM D1784</td>
</tr>
<tr>
<td>FLANGE</td>
<td>¾&quot; X ½&quot; CLASS 150, ASTM D1784</td>
</tr>
<tr>
<td>GASKET</td>
<td>½&quot; THICK, VITON</td>
</tr>
</tbody>
</table>

All pipe and valve component materials in contact with waste are austenitic stainless steel, ethylene propylene diene monomer (EPDM), or polytetrafluoroethylene (Teflon) (PTFE). The Flexitallic® gasket consists of an austenitic stainless steel outer ring with an exfoliated graphite filler. The vent system components include CPVC pipes and fittings, stainless steel valves, and Viton gaskets, which are made of a fluoropolymer elastomer. Based on tank waste processing experience at Hanford, all metallic and nonmetallic materials in contact with waste are adequate for service.

### 2.1.3 Anticipated Chemistry and Controls

Information on the composition of the various ETF waste streams can be found in documents CHPRC-01579, 200 Area Effluent Treatment Facility Basin 44 Campaign 2011 Process Control Plan and RPP-PLAN-60845, Effluent Treatment Facility Basin 43 2016 Campaign Process Control Plan. The predicted ETF brine stream compositions are composed of a complex mixture of organic and inorganic, radioactive, and non-radioactive chemicals and compounds. The most prevalent and active compounds are sodium chloride, sodium carbonate, sodium hydroxide, sodium nitrate, sodium nitrite, sodium sulfate, and ammonium sulfate.

#### 2.1.3.1 Compatibility Exceptions

Based on the above review, there are no IQRPE certification exceptions to the anticipated waste compatibility or corrosion issues with the piping materials used for the ETF Brine Loadout System Project that may come into contact with the liquid waste stream.

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3 Flexitallic is a registered trademark of The Flexitallic Group, Houston, Texas
2.1.4 Pressure Control System

WAC 173-303-640 requires that an IQRPE certify that the proposed tank system has been designed with appropriate pressure control systems. The piping components of the ETF Brine Loadout System Project were evaluated for pressure control issues. There are five (5) different ETF piping systems that will be impacted by modifications made to the facility for the brine loadout project (ECN-714825, ETF Brine Loadout System – Piping Plan Update; ECN-714977, Cooling Tower Upgrade Project – Cooling Water Tie-in Stub Lines). Only four (4) of these piping systems either will be, or have the potential to be, in direct contact with waste fluids. The four (4) piping systems include: vessel vent piping (H-2-838184, Mechanical Brine Loadout System Vessel Vent Pipe Spools), concentrate piping (H-2-838183, Mechanical Brine Loadout System Concentrate Pipe Spools), verification water piping (H-2-838185, Mechanical Brine Loadout System Verif Water Pipe Spools), and the basin drain piping (H-2-838190, Mechanical Brine Loadout System Basin Drain Pipe Spools). The pressure control issues associated with these piping systems are discussed in more detail in the sections below.

2.1.4.1 Intermediate Bulk Container Tote

The commercially-available 330-gallon IBC tote used for the storage and transport of liquid waste is a rigid plastic container which must meet the relevant nationally recognized standards for pressure requirements associated with its manufacture and testing. These requirements are specified within RPP-SPEC-63202, ETF Brine Loadout System Intermediate Bulk Container Procurement Specification.

2.1.4.2 Tote Loading Station

There are no pressure control issues associated with the structure of the tote loading station, (H-2-838178, Mechanical Brine Loadout System Tote Fill Station Assy) used for positioning the IBC totes for filling.

2.1.4.3 Fill Head Assembly

The pressure retaining components of the fill head assembly (H-2-838181, Mechanical Brine Loadout System Fill Head Assembly) are fabricated, welded, inspected, and tested in accordance with ASME B31.3 for radioactive or hazardous service. It is constructed in accordance with RPP-SPEC-62968, ETF Brine Loadout and Tote Storage Construction Specification. The fill head assembly has a design pressure of 120 psig and a design temperature of 120 °F (H-2-838176, Instrumentation Brine Loadout System P&ID) and is hydrostatically tested to 1.5 times the rated pressure. The flexible hoses used on the assembly have a Maximum Allowable Working Pressure (MAWP) of 870 psig with a 4:1 burst rating. They have a 150 °F minimum temperature rating and are hydrostatically tested by the manufacturer to 1.5 times the MAWP (H-2-838181). The fill head assembly was analyzed for ASME B31.3 requirements in RPP-CALC-63506, ETF Brine Load Out ASME B31.3 Piping Analysis. The analysis determined that due to the flexibility provided by the fill head piping and its method of connection to the modified cap of the polymer IBC tote, in addition to taking into consideration its low design temperature of 120 °F, the piping of the fill head was judged to be enveloped by the ASME B31.3 analysis performed on the concentrate piping system.
2.1.4.4 Piping Assemblies

2.1.4.4.1 Vessel Vent Piping
The pressure retaining components of the vessel vent piping (H-2-838184) are fabricated, welded, inspected, and tested in accordance with ASME B31.3 or ASME B31.1. The vessel vent piping has a design pressure of 2 psig. and a design temperature of 120 °F (H-2-838176). The ASME code sections of the piping are hydrostatically tested to 1.5 times the rated pressures. Hydrostatic pressure testing is performed per ASME B31.3 and RPP-SPEC-62968. The vessel vent piping was analyzed for ASME B31.3 requirements in RPP-CALC-63506 and was found to be acceptable in meeting ASME B31.3 requirements for pressure related issues.

2.1.4.4.2 Concentrate Piping
The pressure retaining components of the concentrate piping (H-2-838183) are fabricated, welded, inspected, and tested in accordance with ASME B31.3 or ASME B31.1. The concentrate piping has a design pressure of 75 psig. and a design temperature of 230 °F (H-2-838176). The ASME code sections of the piping are hydrostatically tested to 1.5 times the rated pressures. Hydrostatic pressure testing is performed per ASME B31.3 and RPP-SPEC-62968. The vessel vent piping was analyzed for ASME B31.3 requirements in RPP-CALC-63506 and was found to be acceptable in meeting ASME B31.3 requirements for pressure related issues.

2.1.4.4.3 Verification Water Piping
The pressure retaining components of the verification water piping (H-2-838185) are fabricated, welded, inspected, and tested in accordance with ASME B31.3. The verification water piping has a design pressure of 75 psig. and a design temperature of 230 °F (H-2-838176). The ASME code sections of the piping are hydrostatically tested to 1.5 times the rated pressures. Hydrostatic pressure testing is performed per ASME B31.3 and RPP-SPEC-62968. The verification water piping was analyzed for ASME B31.3 requirements in RPP-CALC-63506 and was found to be acceptable in meeting ASME B31.3 requirements for pressure related issues.

2.1.4.4.4 Basin Drain Piping
The basin drain piping (H-2-838190) is welded and inspected in accordance with ASME B31.3 for the category of normal fluid service. The piping has a design pressure of 2 psig. and a design temperature of 120 °F (H-2-838176). The piping is hydrostatically pressure tested per ASME B31.3 and RPP-SPEC-62968. The test pressure is maintained for 10 minutes with a visual verification that no leakage is present. The basin drain piping was analyzed for ASME B31.3 requirements in RPP-CALC-63506 and was found to be acceptable in meeting ASME B31.3 requirements for pressure related issues.

2.1.4.5 Pipe-In-Pipe Heat Exchangers
Two Pipe-In-Pipe Heat Exchangers (component numbers: 60J-E-02 & 60J-E-03; H-2-88988, P&ID Concentrate Receiving System Heat Exchanger) are included within the scope of the concentrate piping. They are commercially-manufactured double tube heat exchanger units fabricated by Advanced Process Solutions (H-2-838183). Heat exchangers are installed in the
system to reduce the brine temperature to a value compatible with the HPDE material of the IBC totes. The sizing of the heat exchanger was determined in RPP-CALC-63095, *ETF Concentrate Tank Heat Loss and Heat Exchanger Sizing Analysis*. A heat exchanger with a length of 4’ 4” and flowrate of 15 gpm was found to be adequate in keeping temperatures within acceptable ranges to accommodate a required maximum temperature reduction of 100 °F.

The heat exchanger uses the ETF cooling water system as the source of its cooling fluid. The waste flow rate through the recirculation line and heat exchanger is 35 gpm. The cooling water flow rate of 15 gpm to each of the heat exchangers is achieved with acceptable fluid velocities ranging from 3-11 fps. The cooling water system piping has a design pressure of 150 psig. and a design temperature of 120 °F (H-2-88988). The cooling water pressure at the heat exchanger is significantly higher than the brine pressure. The higher cooling water pressure ensures that if an internal leak were to develop in the heat exchanger, flow from the clean cooling water system would migrate into the contaminated brine system. An additional measure of protection to keep contaminated brine out of the cooling water system is provided by virtue of the fact that the concentrate pump dead head pressure (100.4 psia) is less that the cooling water minimum return pressure of 80 psig (RPP-CALC-63096, *ETF Brine Loadout Process Piping Flow Analysis*, Attachment 4, *CT Recirculation Pump Vendor Data*).

### 2.1.4.6 Piping Supports

There are no pressure control issues associated with the piping supports (H-2-838187, *Mechanical Brine Load Out System Pipe Support Details*).

### 2.1.4.7 Pressure Control System Exceptions

Based on the above review, there are no IQRPE certification exceptions to the pressure control system review.

The IQRPE concurs that this design basis meets the requirements of WAC 173-303-640.

### 2.1.5 Secondary Containment System

WAC 173-303-640 requires that an IQRPE certify that the proposed tank system has been designed with an appropriate secondary containment system. Secondary containment for tank systems that store, accumulate, or treat dangerous waste must be designed and installed to meet the requirements of WAC 173-303-640(4)(b).

Individual totes placed in the tote fill station (H-2-838178, *Mechanical Brine Loadout System Tote Fill Station Assy*) are equipped with localized secondary containment by virtue of the 210 gallon capacity drip trays (H-2-838182, *Mechanical Brine Loadout System Drip Tray Assembly*; H-2-838176, *P & ID Brine Loadout System*) located directly under the fill location for each of the totes. Every drip tray is equipped with its own leak detector: LDE-60J-316; -317 and -318 for totes #1, #2, and #3, respectively. Each of the three drip trays is equipped with a drain valve: 60J-322; -323, and -324 for totes #1, #2, and #3, respectively. The drip trays route their collected drainage to ETF 2025E Building Sump Tank 1 via drain line 1”-60J-049-163LS (H-2-838176).

The overall secondary containment for the ETF Brine Loadout System Project is accomplished by the floor and/or floor linings of the ETF 2025E Building.
2.1.5.1 Secondary Containment System Exceptions

Due to the fact that secondary containment was already incorporated into the ETF by virtue of its design, there are no exceptions to the IQRPE certification of the secondary containment review assessment.

The IQRPE concurs that this design basis meets the requirements of WAC 173-303-640.

2.1.6 Ancillary Equipment Design

WAC 173-303-640 requires that an IQRPE certify that the proposed tank system has been designed with appropriate ancillary equipment in accordance with the requirements of WAC 173-303-640(3)(f) and (4)(f). WAC 173-303-040 defines “Ancillary Equipment” as any device including, but not limited to, such devices as piping, fittings, flanges, valves, and pumps, that is used to distribute, meter, or control the flow of dangerous waste from its point of generation to a storage or treatment tank(s), between dangerous waste storage and treatment tanks to a point of disposal on-site, or to a point of shipment for disposal off-site. A review of the ancillary equipment design is normally part of the IQRPE review. The scope of this review includes components listed as in-scope in Section 1.3 and as described in the review sections above. Piping, fittings, flanges, valves, and pumps have been evaluated by the IQRPE throughout this report, which includes all ancillary equipment in-scope for this Design Assessment. No other ancillary equipment was identified.

2.1.6.1 Ancillary Equipment Design Exceptions

Based on the above review, there are no IQRPE certification exceptions to the ancillary equipment design review.

The IQRPE concurs that this design basis meets the requirements of WAC 173-303-640.

2.1.7 P&ID Review


The IQRPE concludes that the appropriate P&ID review has been made.

2.1.8 Corrosion Assessment

WAC 173-303-640 requires an IQRPE corrosion assessment of only the external portion of the primary containment that is in direct contact with soil or water.

The components of the ETF Brine Loadout System Project are entirely inside the temperature-controlled ETF 2025E Building and will not be in contact with either soil or water.

The IQRPE concludes that appropriate corrosion considerations have been made.

2.1.8.1 Corrosion Assessment Exceptions

Based on the above requirements, there are no IQRPE certification exceptions to the corrosion assessment review with the materials.
The IQRPE concurs that this design basis meets the requirements of WAC 173-303-640.

### 2.1.9 Recommended Inspection Schedule

Inspections completed for the initial installation are described in IA-325497-01, *Independent Qualified Registered Professional Engineer Installation Assessment Report for ETF Brine Loadout System*. Per the requirements of WAC 173-303-640(3)(c), the Installation Assessment Report provides Inspection Reports documenting installation and any modifications applicable to this Design Assessment.

WAC 173-303-640(6) provides guidelines for follow-up inspections. In general, the owner/operator should perform daily inspections of the system when processing waste to observe for any hazardous waste releases. Inspection access will be limited by shielding and other enclosures. Monitoring of leak detector alarms is recommended during waste processing.

In general, piping components should be inspected whenever any indication of a problem is suspected (e.g. water hammer or off-normal performance, etc.) or whenever access to another component is required for other activities (such as new installations requiring movement/modification of existing components, etc.). Should any of these parameters change (examples: extended operating life, increased operating temperature, or reduced pH of waste), the inspection schedule must be re-evaluated by an IQRPE. The design life of the ETF Brine Loadout System is 20 years (RPP-CALC-63506, *ETF Brine Load Out ASME B31.3 Piping Analysis*). If the system is to remain in service beyond 20 years, additional inspections, including Non Destructive Analysis (NDE), may be warranted.

The need for additional inspections will be as set forth by the owner/operator per WAC 173-303-640(6).

The IQRPE concludes that the appropriate inspection schedule considerations have been made.

#### 2.1.9.1 Inspection Schedule Exceptions

There are no IQRPE certification exceptions to the recommended inspection schedule.

The IQRPE concurs that this design basis meets the requirements of WAC 173-303-640.
3.0 DESIGN REVIEW ASSESSMENT CERTIFICATIONS

The ETF Brine Loadout System Project, as previously described, has been reviewed by the IQRPE and was assessed to be in compliance with the applicable sections of WAC 173-303-640(3). These results are based on a review of the applicable codes, standards, and documents.

The individuals listed below assisted in the preparation of this design assessment.

Registered Professional Engineers
Paul M. Giever
- P.E., Civil, Structural Engineering, License No. 28084
Alexander P. Butterfield
- P.E., Mechanical Engineering, License No. 52255
Andrew S. Klein
- P.E., Chemical, Fire Protection, License No. 47831
Michel J. Langevin
- P.E., Mechanical Engineering, License No. 23759

BS Degreed Engineer
Nathaniel R. Weinman
- E.I.T., Mechanical Engineering, Enrollment Number E-11818

The certifications below are in accordance with the requirements of WAC 173-303-810(13)(a).
Report Lead IQRPE:

WAC 173-303-810(13)(a)

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 and imprisonment for knowing violations.

Report Reviewed by:

[Signature]

Paul M. Giever, PE
Independent Qualified Registered Professional Engineer

September 10, 2019
(Date)
4.0 REFERENCES


RPP-CALC-63161, 2019, *ETF Concrete Floor Loading Analysis*, Rev. 00, Washington River Protection Solutions, LLC, Richland, Washington.


