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

0078555

JUL 30 2008

08-ESQ-144

Ms. Jane A. Hedges, Program Manager
Nuclear Waste Program
Washington State
Department of Ecology
3100 Port of Benton Blvd.
Richland, Washington 99354

RECEIVED
JUL 31 2008
EDMC

Dear Ms. Hedges:

SUBMITTAL OF HANFORD FACILITY RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) PERMIT MODIFICATION NOTIFICATION FORM 24590-WTP-PCN-ENV-05-013

Reference: WA7890008967, "Dangerous Waste Portion of the Hanford Facility Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste, Part III, Operating Unit 10, 'Waste Treatment and Immobilization Plant.'"

This letter transmits Hanford Facility RCRA Permit Modification Notification Form 24590-WTP-PCN-ENV-05-013, attached, for the Washington State Department of Ecology review and approval. The form describes a requested Class 1 modification to the Reference.

Modification Notification Form 24590-WTP-PCN-ENV-05-013 updates the Engineering Specification (24590-PTF-3PS-MWK0-TP001) for Activated Carbon Bed Adsorbers found in Appendix 7.7 of the Reference. The permit version of the specification is being replaced by the attached engineering source document. Permit version and source documents are not identical. Many aspects of the permit document (e.g., ghosting, certain notes, references, holds, etc.) have no counterpart or equivalent on the source document. Potential permit affecting changes between the current and previous versions of the source document are summarized on the permit change notice form.

If you have any questions, please contact me, or your staff may contact Lori A. Huffman, Division Director, Environmental Compliance Division, (509) 376-0104.

Sincerely,

Shirley J. Olinger, Manager
Office of River Protection

ESQ:LAH

Attachment

cc: See page 2

cc w/attach:
J. Colby, BNI
W. S. Elkins, BNI
B. G. Erlandson, BNI
P. A. Fisher, BNI
J. S. Hill, BNI
S. K. Murdock, BNI
P. E. Peistrup, BNI
Administrative Record
BNI Correspondence
Environmental Portal, LMSI

cc electronic:
D. C. Becker, Ecology
B. L. Becker-Khaleel, Ecology (1 hard copy)
R. K. Biyani, Ecology
E. A. Fredenburg, Ecology
T. Z. Gao, Ecology
A. A. Hamar, Ecology
J. L. Hensley, Ecology
S. J. Lijek, Ecology
B. Speer, Ecology
T. R. Williams, Ecology
S. A. Thompson, FHI
A. C. McKarns, RL
D. J. Sommer, SCS

cc w/o attach:
D. A. Klein, BNI
J. Cox, CTUIR
S. G. Harris, CTUIR
S. L. Dahl, Ecology
G. P. Davis, Ecology
G. P. Bohnee, NPT
K. Niles, Oregon Energy
S. R. Weil, RL
R. Jim, YN

Attachment
08-ESQ-144

Hanford Facility RCRA Permit Modification Notification
Form 24590-WTP-PCN-ENV-05-013

Quarter Ending September 30, 2008

24590-WTP-PCN-ENV-05-013

Hanford Facility RCRA Permit Modification Notification Form

Part III, Operating Unit 10

Waste Treatment and Immobilization Plant

Index

Submitted by Co-Operator:

D. A. Klein — Date: 6/18/08

Reviewed by ORP Program Office:

S. J. Olinger — Date: 7/29/08

Quarter Ending September 30, 2008

24590-WTP-PCN-ENV-05-013

Hanford Facility RCRA Permit Modification Notification Form	
Unit: **Waste Treatment and Immobilization Plant**	Permit Part & Chapter: **Part III, Operating Unit 10**

Description of Modification:

The purpose of this Class 1 modification is to update 24590-WTP-3PS-MWK0-TP001, *Engineering Specification for Activated Carbon Bed Adsorbers*.

The following specification is being submitted to replace the specification currently in Appendix 7.7.

Appendix 7.7			
Replace:	24590-WTP-3PS-MWK0-TP001, Rev. 0	With:	24590-WTP-3PS-MWK0-T0001, Rev. 3

Revisions are the result of ongoing design (changes from vendor preliminary data to vendor detailed design) and incorporates general criteria from a design verification review. The following identifies the significant changes that have been revised on the attached specification.

- Revised LAW instrumentation requirements for remote mounting of analyzers and transmitters (Section 3.16.2.10).
- Reformatted Section 3.4, Performance.
- Revised Figures 1 and 2 to clarify instrumentation requirements.
- Changed CO and COx analyzers from supplier's scope to buyer's scope (Section 3.16.2).
- Added Figure 3, Hg Monitor Probe connection detail.
- Added Section 5.5, Coating, to add project coating specification.
- Deleted Section 2.2.7, WAC 296-24, General Safety and Health Standards.
- Added Section 2.2.9, 29 CFR 1910, Occupational Safety and Health Standards (OSHA), and added appropriate references to 29 CFR 1910 in other sections of specification.
- Added Reference Documents and Drawings 2.4.20 through 2.4.28.
- Revised Section 3.6, Environmental Conditions, to reflect Equipment Qualification data sheet information.
- Added Section 11, References.
- Added Appendices B and C to clarify testing requirements for carbon media.
- Revised various sections to reflect addition of Appendices D-J.
- Added Appendix D, WTP Specific Tailoring of ASME AG-1-1997.
- Added Appendix E, WTP Specific Tailoring of ASME B31.3-1996.
- Added Appendix F, WTP Specific Tailoring of AISC (ASD).
- Added Appendix G, WTP Specific Tailoring of ASME NQA-1-1989.
- Added Appendix H, WTP Specific Tailoring of IEEE Std. 384.
- Added Appendix I, WTP Specific Tailoring of IEEE Std. 323.
- Added Appendix J, WTP Specific Tailoring of IEEE Std. 344.

There are no outstanding change documents that have not been incorporated into this modification.

Quarter Ending September 30, 2008

24590-WTP-PCN-ENV-05-013

WAC 173-303-830 Modification Class: [1] [2]	Class 1	Class [1]1	Class 2	Class 3
Please mark the Modification Class:	X			

Enter Relevant WAC 173-303-830, Appendix I Modification citation number: A.1

Enter wording of WAC 173-303-830, Appendix I Modification citation:

A.1. Administrative and informational changes.

Modification Approved: ☐ Yes ☐ No (state reason for denial)	Reviewed by Ecology:	
Reason for denial:	B. Becker-Khaleel	Date

[1] Class 1 modifications requiring prior Agency approval.

[2] If the proposed modification does not match any modification listed in WAC 173-303-830 Appendix I, then the proposed modification should automatically be given a Class 3 status. This status may be maintained by the Department of Ecology, or down graded to a Class '1, if applicable.

ISSUED BY
RPP-WTP PDC

RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

ENGINEERING SPECIFICATION

FOR

Activated Carbon Bed Adsorbers

Please note that source, special nuclear, and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA) are regulated at the U. S. Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts that pursuant to AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

Content applicable to ALARA? ☒ **Yes** ☐ **No**

ADR No.
24590-WTP-ADR-M-04-0004

Rev
0

Quality Level
Q
DOE Contract No. DE-AC27-01RV14136

NOTE: Contents of this document are Dangerous Waste Permit affecting.

REV	DATE	BY	CHECK	REVIEW	E&NS	QA	DPEM
3	4/8/08	R. Jablonski	C. Knauss	G. Goolsby	more Rosenthal	M. Ehlinger	J. Julyk
2	18-May-05	D. Pease	K. Chin	C. Morley	S. Woolfolk/ Todd Allen	G. Warner	M. Hoffmann
1	02-Nov-04	D. Pease	S. Ngakan	C. Morley	S. Woolfolk/ M. Medsker	G. Warner	M. Hoffman
0	06-Aug-04	D. Pease	S. Ngakan	C. Morley	B. Spezialetti	G. Warner	M. Hoffmann

SPECIFICATION No.
24590-WTP-3PS-MWK0-T0001

Rev
003

Revision History

Revision	Reason for Revision
0	Issued for Purchase of HLW adsorbers. LAW adsorbers are on hold pending approval of ABAR 24590-WTP-SE-ENS-03-1261 Rev 0.
1	Issued for Purchase based on DTD number 24590-LAW-DTD-ENS-04-0002, with LAW adsorber ITS equipment for carbon bed fire mitigation on hold. This includes: Isolation valves, high temperature switch and interlock, and COx monitor and interlocks.
2	Incorporated SCN number 24590-WTP-3PN-MWK0-00001 and SDDRs 24590-WTP-SDDR-PROC-04-01020, 24590-WTP-SDDR-PROC-04-01040, 24590-WTP-SDDR-PROC-05-00392, 24590-WTP-SDDR-PROC-05-00602, 24590-WTP-SDDR-PROC-05-00652, 24590-WTP-SDDR-PROC-05-00701, and 24590-WTP-SDDR-M-05-00018. Revised LAW instrumentation requirements for remote mounting of analyzers and transmitters. Revised Figures 1 and 2 to clarify instrumentation requirements. Added appendix B and C to clarify testing requirements for carbon media. LAW adsorber ITS equipment for carbon bed fire mitigation is still on hold. This includes: Isolation valves, high temperature switch and interlock, and COx monitors and interlocks.
3	Incorporated SCN 24590-WTP-3PN-MWK0-00002 and ~~SDDRs 24590-WTP-SDDR-M-06-00286, 24590-WTP-SDDR-M-06-00287,~~ and 24590-WTP-SDDR-MS-07-00051. Revised Appendix B and C testing requirements. Added WTP specific tailoring of codes (appendix D-J). Updated HLW ITS List. Updated Environmental Requirements based on EQ Room Data Sheets. Changed CO and COx analyzers from supplier's scope to buyer's. Added Hg Monitor Probe connection detail (Fig 3).

RJ 4/23/08

Contents

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1 Scope

1.1 Project Description and Location

The Hanford Tank Waste Treatment and Immobilization Plant (WTP) is a complex of waste treatment facilities where the US Department of Energy (DOE) Hanford Site tank waste will be pretreated and immobilized into stable glass form via vitrification. The WTP Contractor will design, build, and startup the WTP pretreatment and vitrification facilities for the DOE Office of River Protection (ORP). The waste treatment facilities will pretreat and immobilize the low activity waste (LAW) and high level waste (HLW) currently stored in underground storage tanks at the Hanford Site.

The Hanford Site occupies an area of about 560 square miles and is located along the Columbia River, north of Richland, WA in the U.S.A. The WTP Facility will be constructed at the east end of the 200 East Area of the Hanford Site. The counties of Benton, Franklin, and Grant surround the Hanford Site.

1.2 Equipment, Material, and Services Required

This specification provides the requirements for the design, analysis, fabrication, project management, quality assurance, inspection, testing, qualification, and labeling of the Activated Carbon Bed Adsorbers, associated filters, gaskets, insulation, piping, fasteners, shims, and special tools for use in the High Level Waste (HLW) and Low Activity Waste (LAW) facilities. This specification also provides the requirements for the conception, demonstration, design, fabrication, quality assurance, inspection, testing, qualification, and supply of activated carbon, testing equipment, testing apparatus, testing materials, manuals, instructions, and procedures.

The scope of work for the Seller includes all work specifically defined in this specification. Work shall include, but is not limited to, the following:

1.2.1 Provide fully detailed designs, drawings, supporting calculations, supporting analysis, supporting models, procedures, and all labor, materials, fasteners, tooling, equipment, apparatus, instrumentation, shop drawings, and services necessary to manufacture, test, inspect, label, and package Activated Carbon Bed Adsorbers in accordance with this specification and the Mechanical Data Sheets in Section 2 of the purchasing documents.

1.2.2 Provide Buyer with a breakdown (by paragraph) of the following codes, industry standards, and referenced documents to be applied to each aspect of the Activated Carbon Bed Adsorbers detailed design, drawings, analysis, fabrication, quality assurance, inspection, testing, qualification, labeling, packaging, handling, and shipment for review prior to beginning detailed design:

- ASME AG-1-1997, including WTP specific tailoring
- ASME AG-1a-2000
- ASME N509-1989
- ASME B&PVC, Section VIII, Div 1

If an entire section or part of the above listed codes and standards applies, a breakdown by paragraph is not required. Only the part or section shall be listed.

1.2.3 Provide design calculation in accordance with this specification and applicable codes. Calculations shall include, but not be limited to:

- Code calculations
- Seismic calculations
- Support calculations (Include resultant reactions at support locations)
- Calculations associated with lifting and erection of the vessel
- Nozzle loads and movements per thermal and seismic calculations
- Thermal and discontinuity stresses as applicable
- Fatigue analysis as applicable for pressure vessels in fatigue services

1.2.4 Provide a three-dimensional (3-D) computational fluid dynamics (CFD) model and analysis of the Activated Carbon Bed Adsorbers. CFD model and analysis shall include necessary Buyer supplied inlet piping to model the velocity profile of the offgas air stream entering the adsorber.

1.2.5 Provide thermal calculations for the Activated Carbon Bed Adsorber units and support frames in accordance with the requirements of this specification and Mechanical Data Sheets (MDSs) in section 2 of the purchasing documents. Select insulation material (i.e. calcium silicate, mineral wool, etc.) to meet thermal requirements of this specification.

1.2.6 Provide an analysis of the Activated Carbon Bed Adsorber design to determine expected adsorber changeout frequency.

1.2.7 Delete.

1.2.8 Provide connecting piping and actuated on/off control valves to configure two (2) Activated Carbon Bed Adsorber units in a single offgas stream to be operated in either series or parallel with the ability to isolate one unit for maintenance and still operate. Activated Carbon Bed Adsorber units shall be configured for automatic (remote) operation from Buyer's integrated control network.

1.2.9 Provide internal water deluge fire suppression system to allow flooding of the Activated Carbon Beds. Fire detection shall include a combination of carbon monoxide (CO/COx) monitors, temperature monitors, and isolation valves. CO/COx monitors shall be interlocked to isolation valves. Process water for carbon bed flooding is a backup to bed isolation. Provide high liquid level interlocks operated from radar level indicators.

1.2.10 Provide fire detection and suppression system acceptance tests.

1.2.11 Provide control logic and I/O mapping for automatic configuration and fire suppression system.

1.2.12 In addition to the field testing requirements set forth in ASME AG-1, Section TA, and/or ASME N509, Section 9, conduct the following acceptance tests in the shop, on each Activated Carbon Bed Adsorber unit prior to shipment:

- Visual Inspection
- Structural Capability Test
- System Bypass Test

- Mechanical Test
- Differential Pressure Test
- Airflow Distribution Test
- Electrical Air Heater Performance Test (per design)

1.2.13 Provide challenge gas and challenge gas injection and sampling ports/manifolds.

1.2.14 Provide detailed bag-in/bag-out procedure for removal and replacement of adsorbent and any other filter(s) required.

1.2.15 Provide all personnel, equipment, apparatus, labor, personal protection equipment (PPE), materials, glovebags, bags, HEPA filters, etc. to simulate field conditions, demonstrate, and videotape the bag-in/bag-out procedure using fully assembled Activated Carbon Bed Adsorber equipment in shop.

1.2.16 Provide material certified test reports, welding procedures, insulation installation procedures, testing procedures, testing results, quality assurance procedures, quality assurance inspection results, and all other procedures and documentation required per this specification.

1.2.17 Provide transportation, storage, and installation instructions for the Activated Carbon Bed Adsorber units per the Seller's recommendations and the requirements of this specification.

1.2.18 Package and prepare the Activated Carbon Bed Adsorber units for shipment to the WTP site. Packaging shall be sufficient to allow outdoor storage for a period of up to one year at the WTP site, without Buyer action except routine inspection. Environmental conditions for storage are found in section 3.6 of this specification.

1.2.19 Provide all equipment, instrumentation, labor, and materials to perform a shop lifting test, demonstrating that the lifting lugs or attachment points are adequate to support the Activated Carbon Bed Adsorber units without distortion. Lifting lugs or attachment points shall be placed such that the equipment remains essentially level during the lift without tilting or swaying. Seller shall provide shop test report on lifting points provided on the Activated Carbon Bed Adsorber equipment.

1.2.20 Provide Material Safety Data Sheets (MSDSs) for loaded Activated Carbon Bed Adsorber and all other materials used in the construction of the Activated Carbon Bed Adsorber units.

1.2.21 Provide operation and maintenance manuals, with sequence of operations, and recommended spare parts list.

1.2.22 Provide a set of special tools for each Activated Carbon Bed Adsorber required for operation, bag-in/bag-out, sampling, and maintenance.

1.2.23 Provide design for structural attachment to the Buyer's provided embeds.

1.2.24 Provide junction boxes to accommodate wiring to remote mounted Seller control panels as requirement for LAW Buyer supplied instrumentation racks. Seller shall provide wiring schedule, diagrams, and documentation to facilitate installation of wiring from equipment to remote control panels and LAW instrumentation racks.

1.3 Work by Others

Any item not specifically listed as being supplied by the Buyer shall be provided by the Seller. The Buyer shall supply the following:

1.3.1 Shipping to jobsite.

1.3.2 Unloading and storage of all materials and equipment at jobsite.

1.3.3 Activated Carbon Bed Adsorber installation labor at jobsite.

1.3.4 Foundation, embeds, and anchor bolts.

1.3.5 Electric power supply.

1.3.6 External wiring.

1.3.7 External connection to Buyer's instrumentation and controls.

1.3.8 Control system.

1.3.9 Piping external to the Activated Carbon Bed Adsorber unit package.

1.3.10 Pressure drop indicators for pressure drop piping connections.

1.3.11 Installation of insulation.

1.3.12 Instrument racks.

1.4 Acronyms

AGS	American Glovebox Society
AISC	American Institute of Steel Construction
ASD	Adjustable Speed Drive
ASME	American Society of Mechanical Engineers
ASTM	International Society for Testing and Materials
AWS	American Welding Society
CFD	Computational Fluid Dynamics
CFR	Code of Federal Regulations
3-D	Three-Dimensional
DF	Decontamination Factor
DOE	US Department of Energy

ESF	Engineered Safety Feature
ERDA	Energy Research and Development Administration
FMEA	Failure Mode and Effect Analysis
HEPA	High Efficiency Particulate Air
HCl	Hydrogen Chloride
HLW	High Level Waste
HF	Hydrogen Fluoride
HVAC	Heating, Ventilation, and Air-Conditioning
HOP	High Level Waste Secondary Offgas Treatment System
FFB	Foundation Field Bus
ICN	Integrated Control Network
IEEE	Institute of Electrical and Electronics Engineers
ISA	Instrument Service Air
ITS	Important to Safety
LAW	Low Activity Waste
LVP	Low Activity Waste Secondary Offgas System
MR	Material Requisition
MDS	Mechanical Data Sheet
MSDS	Material Safety Data Sheet
NDE	Nondestructive Evaluation/Examination
NRTL	Nationally Recognized Testing Laboratory
ORP	Office of River Protection
OSHA	Occupational Safety and Health Administration
P&ID	Piping and Instrumentation Diagram
PMI	Positive Material Identification
PPE	Personal Protection Equipment
ppm	Parts per million
psf	pounds per square foot (lb/ft^2)
PSV	Pressure Safety Valve
QA	Quality Assurance
QAP	Quality Assurance Program
QL	Quality Level
SC	Seismic Category
scfm	Standard Cubic Feet per Minute

SDDR	Supplier Deviation Disposition Request
SS	Stainless Steel
TBD	To Be Determined
UL	Underwriters Laboratories, Inc.
VSL	Vitreous State Laboratory of The Catholic University of America
WAC	Washington Administrative Code
WTP	Hanford Tank Waste Treatment and Immobilization Plant

1.5 Definitions

Activated Carbon Bed Adsorber Unit: Refers to complete Carbon Bed equipment assembly. This includes two (2) full capacity Carbon Bed Adsorbers, connecting pipe work, valves, instrumentation, and support frame for Carbon Bed Adsorbers and piping.

Activated Carbon Bed Adsorber expert: One who has extensive knowledge regarding the characteristics and application of Activated Carbon Bed Adsorbers. Must have a minimum of five (5) years experience.

Adsorbent Media: A solid having the ability to concentrate and hold other substances.

Adsorber: A device or vessel containing adsorbent (e.g., an adsorber cell filled with adsorbent).

Bag-in/Bag-out: A method of introducing and removing items from a contaminated enclosure where a bag provides a physical barrier at all times during the operation that prevents the spread of contamination.

Buyer's Representative(s): The Buyer's designee(s), who shall witness onsite operations at the seller and sub-seller sites and perform onsite inspections and surveillance.

Bypass, Leakage: A pathway through which contaminated air can escape treatment by the installed HEPA and/or adsorber banks. Examples are leaks in filters and filter mounting frames, defective or inefficient isolation dampers that result in the uncontrolled flow through adjacent plenums, and unsealed penetrations for electrical conduits, pipes, floor drains, etc.

Challenge Gas: A gas of known characteristics, under specified conditions, used for the purpose of testing. For in-shop and in-place/field testing of adsorbers required by this specification. The challenge gas to be used shall depend on what is recommended by the Activated Carbon Bed Adsorber manufacturer. Challenge gas shall be an environmentally safe non-ozone depleting substance, if possible.

Engineered Safety Feature (ESF): A nuclear air treatment system, HVAC system, gas processing system, or a component that serves to control and limit the consequences of releases of energy and radioactivity.

Glovebag: A temporary barrier to contain or prevent the spread of contamination generally during system maintenance or production. The area or component is surrounded by the portable glovebox boundary material, usually a flexible plastic film. Personnel perform work inside the glovebag through glovesleeves and gloves while remaining outside the containment area. Other access ports are provided to allow for equipment and service penetrations as necessary. Additional openings can be provided through the use of zippers, velcro closures, and bag-out ports.

HEPA Filter: A high efficiency particulate air filter having a fibrous medium with a particle removal efficiency of at least 99.97 % when tested with essentially monodispersed 0.3 μm test aerosol particles.

Mounting Frame: A structure against which adsorbers may be snugly mounted and supported in a position that permits the passage of air or gas and provides a surface to hold the sealing gasket, thereby avoiding a potential bypass or leakage path for the non-filtered air or gas.

Paragraph: When a paragraph of this specification, referenced documents, referenced codes, or referenced standards is referenced in this specification, the paragraph referenced and all subparagraphs and sub-subparagraphs of the paragraph referenced shall be considered inclusive.

Quality Level: The quality level identifies the quality requirements to be applied to the equipment. The identified quality levels are Q and CM (Commercial). Quality requirements are specifically defined on the associated mechanical data sheets (MDSs) and supplier quality assurance program (QAP) requirements data sheets.

Seismic Category: Specific requirements for each seismic category are defined in reference documents listed in section 2.4 of this specification.

Special Tools: Any tooling required to perform maintenance on the Activated Carbon Bed Adsorber unit or for Activated Carbon Bed Adsorber and discharge filter removal and replacement. Includes tools that must be specially designed and fabricated and tools that are readily available in the commercial market.

1.6 Safety/Quality Classifications

1.6.1 Activated Carbon Bed Adsorber units for HLW shall meet the quality level requirements of Q as shown on the associated MDSs and supplier quality assurance program requirements data sheet. Seismic category shall be SC-III as shown on the associated MDSs and defined in reference documents listed in section 2.4 of this specification.

1.6.2 Activated Carbon Bed Adsorber units for LAW shall meet the quality level requirements of Q as shown on the associated MDSs and supplier quality assurance program requirements data sheet. Seismic category shall be SC-III as shown on the associated MDSs and defined in reference documents listed in section 2.4 of this specification.

2 Applicable Documents

2.1 General

2.1.1 Work shall be done in accordance with the referenced codes, standards, and documents listed below, which are an integral part of this specification.

2.1.2 When specific chapters, sections, parts, or paragraphs are listed following a code, industry standard, or reference document, only those chapters, sections, parts, or paragraphs of the document are applicable and shall be applied. For the codes and standards listed in section 2, the specific revision or effective date identified, as well as the specific revision or effective date of codes and standards that they incorporate by reference (daughter codes and standards), shall be followed. If a date or revision is not identified, the latest issue, including addenda, at the time of quotation, shall apply. The effective dates and revisions listed in section 2 shall apply to subsequent references to the codes and standards within this specification. When more than one code, standard, or referenced document covers the same topic, the requirements for all must be met with the most stringent governing. The use of any other edition, revision, or issue requires buyer's approval.

2.1.3 Unless specified otherwise, requirements apply to both HLW and LAW design, fabrication, testing, storage, and handling.

2.2 Codes

2.2.1 ASME AG-1-1997, Code on Nuclear Air and Gas Treatment, Sections AA, FE, FF, and TA. See Appendix D for WTP specific tailoring.

2.2.2 ASME AG-1a-2000, Addenda to ASME AG-1-1997 Code on Nuclear Air and Gas Treatment, Section HA.

2.2.3 ASME B31.3-1996, Process Piping. See Appendix E for WTP specific tailoring.

2.2.4 ASME Boiler and Pressure Vessel Code, Section VIII, Div. 1, Rules for Construction of Pressure Vessels.

2.2.5 DOE-RL-92-36, Hanford Site Hoisting and Rigging Manual.

2.2.6 AWS D1.6, Structural Welding Code-Stainless Steel.

2.2.7 Delete.

2.2.8 AISC (ASD), 9th Edition, American Institute of Steel Construction. See Appendix F for WTP specific tailoring.

2.2.9 29 CFR 1910, Occupational Safety and Health Standards (OSHA).

2.3 Industry Standards

2.3.1 AGS-G001 ©1998, Guideline for Gloveboxes, Second Edition.

2.3.2 ASME N509-1989, Nuclear Power Plant Air-Cleaning Units and Components, Sections 1, 2, 3, 4 – (Paragraphs 4.3, 4.4, 4.6.1 through 4.6.7.2, 4.11, 4.12. 4.13(a)), 5 – (Paragraphs 5.5, 5.6.5.5 and 5.6.5.6), 7 – (Paragraph 7.2), 8 – (Paragraph 8.2), 9, Appendix C, and Appendix D.

2.3.3 ASME N510-1989, (Rev.1995), Testing of Nuclear Air Treatment Systems, Sections 1 through 8, 11, 13, 14, 15, and appendices.

2.3.4 ASME NQA-1-1989, Quality Assurance Program Requirements for Nuclear Facilities. See Appendix G for WTP specific tailoring.

2.3.5 ASME Y14.100, Engineering Drawing Practices.

2.3.6 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

2.3.7 ASTM F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

2.3.8 ASTM F594, Standard Specification for Stainless Steel Nuts.

2.3.9 ERDA 76-21, Nuclear Air Cleaning Handbook, Chapter 1 (All), Chapter 2 (Paragraphs 2.1 through 2.4.16), Chapter 3 (Paragraphs 3.1, 3.4.1, 3.4.2, 3.4.5, 3.4.6), Chapter 4 (Paragraphs 4.3 through 4.3.5, 4.5.9), Chapter 7 (All), Chapter 8 (All), Chapter 9 (Paragraph 9.4.1).

2.3.10 NACE Standard RP0198, The Control of Corrosion Under Thermal Insulation and Fireproofing Materials-A Systems Approach.

2.3.11 PIP INIH1000, Hot Insulation Installation Details.

2.3.12 RR-C-271D, Federal Specification for chains and attachments, welded and weldless.

2.3.13 NEMA 4, Enclosures for Electrical Equipment.

2.3.14 IEEE Std. 384, Standard Criteria for Independence of Class 1E Equipment and Circuits. See Appendix H for WTP specific tailoring.

2.3.15 IEEE Std. 323, Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations. See Appendix I for WTP specific tailoring.

2.3.16 IEEE Std. 344, Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations. See Appendix J for WTP specific tailoring.

2.4 Reference Documents/Drawings

2.4.1 24590-WTP-3PS-G000-T0001, *General Specification for Supplier Quality Assurance Program Requirements*

2.4.2 24590-WTP-3PS-G000-T0002, *Engineering Specification for Positive Material Identification (PMI) for Shop Fabrication*

2.4.3 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling, and Storage Requirements*

2.4.4 24590-WTP-3PS-NWP0-T0001, *Engineering Specification for General Welding and NDE Requirements for Supplier Fabricated Piping*

2.4.5 24590-WTP-3PS-MVB2-T0001, *Engineering Specification for Welding of Pressure Vessels, Heat Exchangers and Boilers*

2.4.6 24590-WTP-3PS-JQ07-T0001, *Engineering Specification for Instrumentation for Package Systems*

2.4.7 24590-WTP-3PS-SS00-T0001, *Engineering Specification for Welding of Carbon Structural Steel*

2.4.8 24590-WTP-3PS-SS00-T0002, *Engineering Specification for Welding of Structural Stainless Steel and Welding of Structural Carbon Steel to Structural Stainless Steel*

2.4.9 24590-WTP-3PS-FB01-T0001, *Engineering Specification for Structural Design Loads for Seismic Category III and IV Equipment and Tanks*

2.4.10 24590-WTP-3PS-NN00-T0001, *Engineering Specification for Thermal Insulation for Mechanical Systems*

2.4.11 24590-WTP-3PS-JA03-T0001, *Engineering Specification for Gas Analyzers*

2.4.12 24590-WTP-3PB-P000-TS11V, *Piping Material Classification, Pipe Class S11V*

2.4.13 24590-WTP-3PB-P000-TS11N, *Piping Material Classification, Pipe Class S11N*

2.4.14 24590-WTP-3PS-PV00-T0001, *Engineering Specification for Technical Supply Conditions for Valves*

2.4.15 24590-WTP-3PS-JV15-T0001, *Engineering Specification for Actuators for On/Off Valves*

2.4.16 24590-WTP-3PS-EKP0-T0001, *Engineering Specification for Electrical Requirements for Packaged Equipment*

2.4.17 24590-WTP-3PS-MUMI-T0002, *Engineering Specification for Low Voltage Induction Motors*

2.4.18 24590-WTP-3PS-PS02-T0001, *Engineering Specification for Shop Fabrication of Piping*

2.4.19 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication*

2.4.20 24590-WTP-3PS-JQ06-T0005, *Environmental Qualification of Control and Electrical Systems and Components*

2.4.21 24590-WTP-J8-50-00001, *Controls and Instrumentation Radar Installation Wave Guide Spool Joining Details.*

2.4.22 24590-WTP-MV-M59T-00016002, *Vessel Connections Standard Details Sheet 2 of 3*

2.4.23 24590-WTP-3PS-AFPS-T0001, *Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and Equipment*

2.4.24 24590-WTP-3PS-G000-T0015, *Engineering Specification for Environmental Qualification of Mechanical Equipment*

2.4.25 24590-WTP-3PS-G000-T0014, *Engineering Specification for Supplier Design Analyses*

2.4.26 24590-HLW-M6-HOP-00011, *P&ID - HLW Melter Offgas System Melter 1 Secondary Offgas Treatment Sheet 3 of 3.*

2.4.27 24590-HLW-M6-HOP-20011, *P&ID - HLW Melter Offgas System Melter 2 Secondary Offgas Treatment Sheet 3 of 3.*

2.4.28 24590-LAW-M6-LVP-00004, *P&ID - LAW Melters Secondary Offgas Vessel Vent Process System Mercury Mitigation Equipment.*

3 Design Requirements

3.1 General Requirements

3.1.1 The Activated Carbon Bed Adsorbers and support frame shall be designed per this specification, the applicable documents listed in section 2 of this specification, and the MDSs in section 2 of the purchasing documents.

3.1.2 The detailed design of the Activated Carbon Bed Adsorbers shall be performed by personnel who have past experience in the design, fabrication, and testing of Activated Carbon Bed Adsorber banks or HEPA filter banks to meet the requirements set forth in ASME AG-1, ASME AG-1a, and NQA-1. Qualifications for personnel conducting the detailed design of the Activated Carbon Bed Adsorber shall be provided to the Buyer for review.

3.1.3 All calculations, modeling, analyses, drawings, and documentation shall be performed and/or completed using U.S. customary units.

3.1.4 The design of the Activated Carbon Bed Adsorber pressure boundary shall be per the requirements of ASME Boiler and Pressure Vessel Code, Section VIII, Div.1. (Code stamp is not required) Design pressure used shall be as specified on the MDSs. Design temperature shall be determined by Seller based on thermal analysis specified in section 3.13.5 for conditions generated during a carbon bed fire.

3.1.5 The design of the Activated Carbon Bed Adsorbers shall be per Seller and shall meet the performance requirements of this specification, appendices, and MDSs in section 2 of the purchasing documents.

3.1.6 Each Activated Carbon Bed Adsorber shall be equipped with a fire suppression system. Fire detection shall include a combination of CO monitors and carbon bed temperature monitors for fire detection. Refer to Figure 1 and 2 for additional information related to CO/COx monitors and temperature monitors specific to each HLW and LAW Activated Carbon Bed Adsorber. (For HLW, each fire detection system shall allow the isolation of one carbon bed upon detection of a fire, such that one Activated Carbon Bed Adsorber will not affect the fire detection capability in the other unit.) Refer to Figure 1 for HLW CO monitor and isolation valve configuration requirements. (For LAW, COx monitors shall be located on the inlet and outlet of the Activated Carbon Bed Adsorber unit.) LAW Activated Carbon Bed Adsorber shall only be isolated with pneumatic valves on the inlet as shown in Figure 2.

3.1.7 The Activated Carbon Bed Adsorbers shall be designed for carbon bed isolation as the primary means of fire suppression. Seller shall also design a water flood fire suppression system in accordance with applicable requirements of ASME AG-1, subarticle FE-4620, and MDSs in section 2 of the purchasing documents. Seller shall account for increased pressure inside the carbon bed vessel caused by activation of the fire suppression system and flooding of the carbon bed with water. (i.e. PSV valves with vent lines routed to offgas piping downstream of isolation.) Seller shall work closely with Buyer in determining required flow-rates for fire suppression water.

3.1.8 The Activated Carbon Bed Adsorber units and all permanently attached appurtenances (i.e. piping manifold, insulation, valves, and maintenance platforms) shall be designed to fit within the space envelope specified on the MDSs in section 2 of the purchasing documents.

3.1.9 Piping including supports shall be designed per the requirements of ASME B31.3 (Process Piping). Flanges used for connection to Buyer's piping shall be class 150 and meet the requirements of ASME B31.3.

3.1.10 The CFD model and analysis, thermal analysis, Activated Carbon Bed Adsorber analysis, and seismic analysis to be provided per this specification must verify that the final detailed design of the Activated Carbon Bed Adsorber and support frame meets the requirements set forth in this specification.

3.1.11 Each Activated Carbon Bed Adsorber Bed unit shall include all items listed or implied including, but not limited to, the following:

- Housing with inlet, outlet, support frame with anchorage provisions, platform supports, discharge filter receiver, piping connections and manifolds for testing and sampling, piping connections for pressure drop indication, insulation supports and hold-downs, lifting lugs, internal baffles, and mixing vanes (if mixing vanes required).
- Fire suppression system, inlet and drain piping, shall be piped to equipment edge with flange.
- Activated Carbon Bed Adsorbers, with pneumatic loading and gravity unloading of activated carbon.
- Platform with grating and guardrails

3.1.12 All testing and sampling piping, connections, ports, and manifolds shall be permanently attached to the Activated Carbon Bed Adsorbers and easily accessible for shop and field testing. If required pipe length is not feasible within the space envelope or down stream of

carbon bed isolation valves, the Seller shall supply mixing vanes/diffusers to adequately mix test gases in accordance with applicable code requirements. Refer to Figures 1 and 2 for additional clarification on test port locations. The Seller shall work closely with the Buyer to determine best locations for testing and sampling piping, connections, ports, and manifolds.

3.1.13 The Activated Carbon Bed Adsorbers shall be designed for use with a bag-in/bag-out procedure to be developed by the Seller to facilitate adsorber removal and replacement operations. The Seller shall work closely with the Buyer on developing the bag-in/bag-out procedure.

3.1.14 The Activated Carbon Bed Adsorber shall be designed to attach insulation to the exterior of the pressure boundary. The design shall ensure the insulation is installed per the requirements of Buyer Specification 24590-WTP-3PS-NN00-T0001, *Thermal Insulation for Mechanical Systems* and section 4.3 of this specification.

3.1.15 Containment of melter offgas is an ITS function of the activated carbon bed adsorber units for both HLW and LAW. Design of the pressure boundary and support frame shall ensure containment of melter offgas during nominal, maximum, and design conditions. Pressure boundary must also be maintained during and post SC-III event. Refer to Tables 1 and 2 included in this specification for a detailed breakdown of ITS and Non-ITS equipment/components.

3.2 Basic Function

3.2.1 General

3.2.1.1 Each offgas stream consists of two (2) Activated Carbon Bed Adsorbers that can be operated in either series or parallel with the ability to isolate one unit for maintenance during operation. During normal operation, the Activated Carbon Bed Adsorbers will operate in a lead/lag series arrangement.

3.2.1.2 The Activated Carbon Bed Adsorber units are located downstream of HEPA filter banks operating with a minimum particulate removal efficiency of 99%.

3.2.1.3 Each Activated Carbon Bed Adsorber unit shall consist of a vessel, connecting piping, air actuated on/off control valves, adsorber bed(s), insulation, water fire suppression system, and a discharge filter.

3.2.2 HLW Activated Carbon Bed Adsorber

3.2.2.1 HLW Activated Carbon Bed Adsorbers shall be used to remove mercury (Hg) from the HLW melter secondary offgas HOP system.

3.2.2.2 Each Activated Carbon Bed Adsorber vessel shall be designed with a Seller specified activated carbon media and number of beds to meet performance criteria specified in section 3.4 of this specification and the MDSs in section 2 of the purchasing documents.

3.2.3 LAW Activated Carbon Bed Adsorber

3.2.3.1 LAW Activated Carbon Bed Adsorber shall be used to remove mercury (Hg), iodine (I2), HCl, and HF from the LAW melter secondary offgas LVP system.

3.2.3.2 Each Activated Carbon Bed Adsorber vessel shall be designed with a Seller specified activated carbon media and beds to meet performance criteria specified in section 3.4 of this specification and the MDSs in section 2 of the purchasing documents. The Seller may supply separate or mixed beds for acid gas removal.

3.3 Optional Electric Preheater

3.3.1 If determined necessary by Seller, to prevent condensate from forming in the activated carbon media during startup or after replacement, the Seller shall propose an electric preheater.

3.3.2 Electric preheater shall use an electric element and fan to preheat the carbon bed upon start-up or after media replacement.

3.3.3 The preheater shall be mounted on a 4 ft by 4 ft skid frame that must be located within the space envelope specified in the MDSs in section 2 of the purchasing documents.

3.3.4 Seller shall submit proposed control system and instrumentation for the preheater in accordance with Buyer specification 24590-WTP-3PS-JQ07-T0001 *Instrumentation for Package Systems*, and with the requirements of this specification.

3.4 Performance

3.4.1 General

3.4.1.1 The Activated Carbon Bed Adsorber units shall be designed for a minimum service life of 40 years. Where specific components cannot meet the specified service requirement, they shall be identified, and a mechanism for their replacement and/or maintenance shall be incorporated into the design. Refer to section 10.1.12 of this specification for additional component design reliability requirements.

3.4.1.2 The Activated Carbon Bed Adsorbers shall be designed for a minimum adsorbent life expectancy as required by the MDSs when operating 8,760 hours per year.

3.4.1.3 As applicable to design, the root mean square of the velocities in a traverse shall be within ± 20 % of the average velocity across the front face of the Activated Carbon Beds. If required, ports shall be provided on one foot intervals to confirm velocity distribution.

3.4.1.4 Instrumentation, valves, and related appurtenances shall meet the performance requirements of Buyer specification 24590-WTP-3PS-JQ07-T0001, *Instrumentation for Package Systems*.

3.4.1.5 Actuators for On/Off valves shall meet the performance requirements of Buyer specification 24590-WTP-3PS-JV15-T0001, *Actuators for On/Off Valves*.

3.4.2 HLW

3.4.2.1 Refer to MDSs in Section 2 of the purchasing documents for specified mercury decontamination factors (DF)/removal efficiencies and carbon media design life requirements.

3.4.2.2 Carbon media performance shall be affirmed by warranty testing specified in Appendix B of this specification.

3.4.3 LAW

3.4.3.1 Refer to MDS in Section 2 of the purchasing documents for specified mercury, iodine, HCl, and HF decontamination factors (DFs)/removal efficiencies and carbon media design life requirements.

3.4.3.2 Carbon media performance shall be affirmed by warranty testing specified in Appendix B of this specification.

3.5 Design Conditions

3.5.1 The Activated Carbon Bed Adsorber units shall be designed to meet design conditions specified in the MDSs in Section 2 of the purchasing documents.

3.5.2 The Activated Carbon Bed Adsorber units shall be considered non-ESF as defined in ASME AG-1, Article AA-1000.

3.5.3 The Activated Carbon Bed Adsorber units shall be designed to meet Level C service limits as defined in ASME AG-1, Paragraph AA-4214.

3.6 Environmental Conditions

3.6.1 The HLW Activated Carbon Bed Adsorber units will be installed indoors in an area maintained between 59 °F and 83 °F dry-bulb temperature during normal operation. The LAW Activated Carbon Bed Adsorber unit will be installed indoors in an area maintained between 59 °F and 95 °F dry-bulb temperature during normal operation. HLW and LAW Nominal radiation exposure is 10 mRad/hr. See Equipment Environmental Qualfication data, located in the MDSs, for additional room environmental conditions.

3.6.2 Prior to installation, the Activated Carbon Bed Adsorber units may be stored outdoors at ambient temperature extremes ranging from (-)35 °F dry-bulb to 118 °F dry-bulb and a relative humidity of 0 to 100%.

3.6.3 Control and electrical equipment required to meet ITS functions of containment of melter offgas, bed isolation for fire suppression, and prevention of flooding of secondary offgas system on introduction of liquids (LAW only) shall be designed and fabricated to meet environmental qualifications in accordance with engineering specification 24590-WTP-3PS-JQ06-T0005, *Engineering Specification for Environmental Qualification of Control and*

Electrical Systems and Components, for a harsh environment. See Table 1 and 2 for list of ITS components.

3.6.4 *Control and electrical equipment shall be exposed to a maximum room temperature of 161* °F for LAW and 153 °F for HLW. See Equipment Environmental Qualification data, located in the MDSs, for additional room environmental conditions.

3.6.5 Mechanical equipment/components required to meet ITS functions of containment of melter offgas, bed isolation for fire suppression, and prevention of flooding of secondary offgas system on introduction of liquids (LAW only) shall be designed and fabricated to meet environmental qualifications in accordance with engineering specification 24590-WTP-3PS-G000-T0015, *Engineering Specification for Environmental Qualification of Mechanical Equipment*, for a harsh environment. See Table 1 and 2 for list of ITS components.

3.7 Mechanical Requirements

3.7.1 General

3.7.1.1 Sample ports shall be provided downstream of each bed for monitoring HCl and HF.

3.7.1.2 Each carbon bed shall be equipped with three (3) vertical and three (3) horizontal ports to obtain physical samples at three locations within the bed. The Seller shall provide special tools to physically retrieve samples. Seller may also propose the use of cylindrical media samples located external to the housing.

3.7.1.3 Valves and actuators shall meet the requirements of Buyer specification 24590-WTP-3PS-PV00-T0001, *Technical Supply Conditions for Valves*, and 24590-WTP-3PS-JV15-T0001, *Actuators for On/Off Valves*. Valve type, fail position, material, and flange requirements shall be as specified on the MDSs in section 2 of the purchasing documents. Refer to figures 1 and 2 for additional information.

3.7.2 Loadings

3.7.2.1 Pneumatic loading shall lift activated carbon media to the fill chute. The carbon media shall be gravity loaded through the fill chute. If permissible in the equipment space envelope required on the MDSs, Seller may propose an alternative loading system using an integral jib crane to lift carbon media super sacks for bulk loading.

3.7.2.2 Pneumatic loading system shall be complete with hopper, piping, vacuum blower, mounting equipment, and air filters necessary to safely lift the activated carbon adsorbent media. If determined necessary by Seller, vibration equipment shall be designed and supplied for loading of the carbon media into the Activated Carbon Bed Adsorbers.

3.7.2.3 The loading equipment shall be transferable to other Activated Carbon Bed Adsorber units within that facility. Rate of loading shall be specified by the Seller to minimize possible damage or degradation of the Activated Carbon Media.

3.7.2.4 Transferable loading equipment may be located in maintenance aisle ways as shown in the MDSs in section 2 of the purchasing documents. Location shall be specified by the Seller. Seller shall work closely with the Buyer with respect to equipment size.

3.7.3 Unloading System

3.7.3.1 Spent carbon media shall be gravity unloaded directly into 55 gal drums for disposal. Seller shall allow for clearance of the 55 gal drum and bag-in/bag-out operations in accordance with applicable code requirements. If required to meet the space envelope specified in the MDSs, the Seller may propose the use an unloading system to elevate the carbon media into a 55 gal drum. Buyer prefers to use loading equipment for unloading.

3.7.3.2 If determined necessary by Seller, vibration equipment shall be designed and supplied for unloading of the carbon media.

3.7.3.3 Spent carbon is considered hazardous and potentially radioactive and must be contained during unloading through the use of a bag-out procedure as required in section 3.11 of this specification.

3.8 Discharge Filter Requirements

3.8.1 The discharge filters for the Activated Carbon Bed Adsorber units shall be rated for at least 300 °F with an efficiency of 99% at 5 microns and have a minimum capacity of two (2) times the design flowrate. Each discharge filter shall also be equipped with a differential pressure gage to measure pressure drop across the filter.

3.9 Lifting Requirements

3.9.1 Lifting lugs shall be installed on each Activated Carbon Bed Adsorber unit for balanced lifting and handling. Seller shall identify the weight and center of gravity of each unit and submit a report for Buyer review.

3.9.2 All lifting points shall be designed and tested in accordance with the requirements of Buyer specification 24590-WTP-3PS-G000-T0003, *Packaging, Handling, and Storage Requirements*. The allowable design stress shall equal the applicable code allowable design stress at ambient temperature.

3.9.3 The lifting lugs shall be designed to permit lifting of the Activated Carbon Bed Adsorber units without distortion or damage to the components or lifting lugs.

3.9.4 Lifting lugs shall be accessible without removal of covers and guardrails.

3.9.5 The lifting lugs must accept standard lifting equipment. Chain blocks or braiding shall not be permitted. If applicable, the lifting lugs shall be designed to accept Crosby shackles or equivalent meeting Federal Specification RR-C-271D.

3.9.6 Sampling and testing connections and ports shall not be used for lifting.

3.9.7 Seller shall provide any special designed equipment that is required to handle the component and is not available from a commercial source. Such equipment may include but is not limited to rigging devices such as spreader beams, structural lifting devices, strongbacks, and yokes. Rigging devices shall be designed, tested, and tagged in accordance with the applicable requirements of DOE-RL-92-36.

3.9.8 All lifting points on the Activated Carbon Bed Adsorber units shall be proof tested in shop. Test and examination certificates shall be provided to the Buyer for review.

3.10 Loadings

3.10.1 The Activated Carbon Bed Adsorber and support frames shall be self-supporting, capable of carrying the static loads of components, thermal expansion loads, seismic loads, full flood fire suppression water loads, and capable of handling the stresses imposed during shipment, installation, and operation.

3.10.2 Loads to be considered for the structural design of the Activated Carbon Bed Adsorbers and support frame shall be in accordance with applicable codes, standards, and reference documents listed in section 2 of this specification. As a minimum, loadings and stresses to be imposed shall meet Level C service limits as described in ASME AG-1, Paragraph AA-4214 and be in accordance with Buyer specification 24590-WTP-3PS-FB01-T0001, *Engineering Specification for Structural Design Loads for Seismic Category III and IV Equipment and Tanks.*

3.10.3 Loads and stresses imposed for design of the vessel housings shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Div. 1.

3.10.4 Nozzle design shall consider seismic, thermal, and combination loads. Loads shall be in accordance with the requirements of the MDSs in section 2 of the purchasing documents.

3.11 Bag-in/Bag-out Procedure Requirements

3.11.1 Seller shall provide a detailed bag-in/bag-out procedure using a pneumatic loading system and gravity unloading of the Activated Carbon Bed Adsorber media and discharge filters using PPE, bags, a glovebag (if required), and special tools. Procedure shall assume carbon bed is isolated and not in operation. If unloading system is used, Seller's bag-out procedure shall include this additional equipment.

3.11.2 Bag-in/bag-out procedure shall note the necessary steps needed to safely bag-out media after a water deluge (i.e. additional drying of media, vibration, etc.).

3.11.3 Procedure shall include proposed means of activated carbon adsorbent media delivery (i.e. 40 lb bags, 55 gal drums, etc.).

3.11.4 Seller shall work with Buyer to determine PPE requirements to be included in the procedure for personnel conducting adsorbent and filter removal and replacement.

3.11.5 If a glovebag is required to perform the bag-in/ bag-out procedure, it shall conform to AGS-G001, and ERDA 76-21, Paragraph 2.2.1 and Chapter 7. Seller shall work with Buyer to determine whether or not a glovebag will be necessary.

3.11.6 Drawings of bags and glovebag (if glovebag is required) to be used shall be included in the bag-in/bag-out procedure. Drawings shall show configuration with dimensions and identify any equipment, filters, either/or apparatus to be an integral part of the bags and glovebag. Drawings shall also identify material, manufacturer, either/or model numbers of all bag and glovebag components.

3.11.7 The bag-in/bag-out procedure shall be written to ensure that confinement is not broken at any time.

3.11.8 Personnel shall not need to break the plane of the pressure boundary or discharge filter access openings at any time to perform the bag-in/bag-out procedure.

3.12 CFD Model and Analysis Requirements

3.12.1 The 3-D CFD model, required per section 1 of this specification, shall demonstrate the effects of internal structures and components on offgas flow distribution through the Activated Carbon Bed Adsorbers.

3.12.2 The 3-D CFD model shall include the following components of the Activated Carbon Bed Adsorber units:

- Housing including inlet (with transition fittings and necessary inlet piping to model turbulent flow entering the unit), outlet, inlet plenum, outlet plenum, discharge filter, manifolds for testing and sampling, and any required internal baffles, mixing vanes, and/or cross-venting holes.
- Activated carbon bed(s).

3.12.3 The 3-D graphical results from the CFD model shall include:

- Analysis of changes to the Activated Carbon Bed Adsorber units to enhance offgas flow effectiveness.
- Analysis of the effect of including additional baffles, mixing vanes, and/or cross-venting holes as required to study local offgas flow effects to achieve uniform offgas flow distribution through the adsorbers.
- Analysis of changes to the Activated Carbon Bed Adsorber units to minimize the overall dimensions.

3.12.4 The 3-D graphical results from the CFD model shall demonstrate uniform offgas distribution through the adsorber beds at 75% of the design flowrate with ± 10 % variation in flowrate.

3.12.5 Provide pressure drop to velocity relationship per adsorber bed(s) as part of the CFD analysis based on carbon media testing.

3.12.6 The Seller shall provide the documented results from the 3-D CFD analysis in report form to the Buyer. The CFD report shall provide a complete offgas flow analysis and shall include 3-D graphical results of the model and any calculations performed. The reports shall, at minimum, include:

- Definition of analysis objective
- Identification of equipment for analysis

- General description of equipment supplemented by drawings and sketches
- Functional requirements per this specification
- Purpose of analysis
- Definition of design criteria and inputs with corresponding sources
- Results of literature searches and other applicable background data
- Applicable codes, standards, and reference documents per section 2 of this specification broken down by chapter, section, and paragraph, as applicable
- Analysis methodology
- Description of computer(s) used to conduct analysis
- Description of software/computer programs used for modeling and any calculations and limitations, justification for choice of program, and evidence and description of program validation method.
- Assumptions (indicate those that must be verified as the design proceeds)
- Analyses conducted with results
- Summary of analysis results
- Conclusions
- Location for Buyer review signatures

All assumptions shall be plainly identified and data present (including their uncertainty) with precise logic. Actual accomplishments of the work shall be clearly stated.

3.12.7 The final CFD report shall convey information to several disciplines, many of whom may be less familiar with the general subject than the authors. Care shall be taken to use simple statements and expressions and to make statements as concise as possible. If highly technical terms are necessary, they shall be adequately explained and defined.

3.13 Thermal Requirements

3.13.1 Refer to MDSs in section 2 of the purchasing documents for mechanical design data pertaining to thermal design information.

3.13.2 Thermal analyses shall include the effects of stresses resulting from potential variations in temperatures due to startup, normal operation, shutdowns, carbon bed fire, and thermal cycling of the Activated Carbon Bed Adsorber units. Analyses shall determine nozzle deflections in all directions per thermal expansion or other approved method. The calculations shall consider that the maintenance platforms shall be connected together with mechanical fasteners during normal operation.

3.13.3 Thermal analyses shall confirm the insulation temperature of Seller selected insulation and all exterior uninsulated portions of the Activated Carbon Bed Adsorber units with potential for personnel exposure, do not exceed 140 °F at maximum design temperature, in accordance with the requirements of Buyer specification 24590-WTP-3PS-NN00-T0001, *Thermal Insulation for Mechanical Systems*. Thermal calculations shall also confirm heat loss to the room is within the requirements of the MDSs. Refer to section 4.3 of this specification for addition insulation requirements.

3.13.4 The thermal analyses shall confirm the thickness and extent of insulation required on the bottom of the Activated Carbon Bed Adsorber units so that the average temperature of the

Buyer's concrete foundation directly under and within three feet of the skid boundary does not exceed 100 °F.

3.13.5 Seller shall perform a thermal analysis to determine and define the thermal conditions generated during a carbon bed fire. This analysis shall define the maximum and design temperatures for the carbon bed pressure boundary and isolation valves. Seller shall determine equilibrium design temperature for a carbon bed fire based on Seller specified CO/COx analyzer set points and the carbon bed being isolated. This equilibrium design temperature shall be used in ASME Boiler and Pressure Vessel Code, Section VIII, Div.1 calculations for design of the Activated Carbon Bed Adsorber pressure boundary. If determined necessary, based on Seller operating procedures, operators shall have the option of activating the water deluge fire suppression system. Seller shall assume a minimum response time of one hour or any operator action. Design temperature determined by this thermal analysis shall confirm valve selection (valve material, seat material, leak tightness, etc.) for pressure boundary valves and process isolation valves.

3.14 Activated Carbon Bed Adsorber Design Analysis Requirements

3.14.1 The Seller shall conduct and submit separate Activated Carbon Bed Adsorber design analyses for LAW and HLW facilities. The design analysis of the Activated Carbon Bed Adsorber units shall be conducted by an Activated Carbon Bed Adsorber expert to determine the expected adsorbent changeout frequency for the final Activated Carbon Bed Adsorber design. Seller shall provide personnel qualifications to the Buyer for review prior to beginning adsorber design.

3.14.2 Analysis shall be conducted considering operation of the Activated Carbon Bed Adsorber units at design conditions outlined in this specification and MDSs.

3.14.3 Analysis shall determine expected adsorbent changeout frequency based on the gas composition and load information specified in the MDSs in Section 2 of the purchasing documents.

3.14.4 Assume that the offgas flow through the Activated Carbon Bed Adsorbers may vary as much as ± 10 % from the design flowrate specified in the MDSs in section 2 of the purchasing documents.

3.14.5 Seller shall provide the documented results of the Activated Carbon Bed Adsorber analysis with any graphical results, as applicable, in report form to the Buyer prior to fabrication. Refer to section 3.12.6 and 3.12.7 for the minimum requirements of the report.

3.14.6 The final Activated Carbon Bed Adsorber design analysis report shall convey information to several disciplines, many of whom may be less familiar with the general subject than the authors. Care shall be taken to use simple statements and expressions and to make statements as concise as possible. If highly technical terms are necessary, they shall be adequately explained and defined.

3.15 Electrical Requirements

3.15.1 Electrical equipment necessary to meet the requirements of this specification and appendices shall be designed, fabricated, and tested in accordance with Buyer specification 24590-WTP-3PS-EKP0-T0001, *Electrical Requirements for Packaged Equipment*.

3.15.2 The Buyer will provide a single feed for each Activated Carbon Bed Adsorber unit. The Seller shall be responsible for determining electrical load and for the distribution of power within the Activated Carbon Bed Adsorber unit. The Seller shall provide a disconnect switch at the connection point for the Buyer's power feed for each Activated Carbon Bed Adsorber.

3.15.3 Delete

3.15.4 Motors shall operate continuously under running conditions at rated load and meet the requirements of Engineering Specification 24590-WTP-3PS-MUMI-T0002, *Low Voltage Induction Motors*.

3.16 Instrumentation and Control Requirements

3.16.1 General

3.16.1.1 Instrumentation included in the Seller's scope of work shall meet the requirements of Buyer specification 24590-WTP-3PS-JQ07-T0001, *Instrumentation for Package Systems*. Refer to Figure 1 and 2 for general instrumentation layout and additional requirements for both HLW and LAW respectively. Buyer shall provide the appropriate ABB control system components (i.e. I/O modules, power supplies) to the Seller for fabrication into the Seller's control panel. Seller shall provide non-ABB manufactured equipment (fiber optic converters, fiber optic patch cables and plates, terminals, circuit breaker, wiring, etc.) and panel fabrication.

Seller shall design their control panel to utilize the ABB control system equipment and provide a General Arrangement drawing with a Bill of Materials identifying all parts to be provided by the Buyer. Seller shall provide I/O list for all instruments.

Seller shall provide control narrative, logic drawings, and related items as specified in 24590-WTP-3PS-JQ07-T0001, *Instrumentation for Package Systems*. Buyer shall provide programming according to Seller's specification of the monitoring and control requirements. Buyer shall provide controller, software, and attend and support the factory test of the equipment at the Seller's facility.

3.16.1.2 Analyzers and analyzer systems included in the Seller's scope of work shall meet the requirements of Buyer specification 24590-WTP-3PS-JA03-T0001, *Gas Analyzers*. Refer to Figure 1 and 2 for general analyzer layout and additional requirements. Seller shall work closely with the Buyer in establishing the performance criteria and location of the Hg analyzer(s). Enclosures for gas analyzers shall be NEMA 4. Analyzer cabinets shall be SC-III and designed in accordance with Buyer specification 24590-WTP-3PS-FB01-T0001, *Engineering specification for Structural Design Loads for Seismic Category III and IV Equipment and Tanks*.

3.16.2 Activated Carbon Bed Adsorber

3.16.2.1 The following instruments shall be included with the HLW Activated Carbon Bed Adsorber Units as a minimum, refer to section 1.6 of this specification for additional QA with subsequent testing requirements for these instruments:

- Inlet temperature elements, thermowell, and indicating transmitter on inlet to each Activated Carbon Bed.
- Inlet CO analyzer sample collection tap and return for Buyer supplied ITS CO analyzer.
- Differential pressure indicating transmitter on each Activated Carbon Bed Adsorber vessel.
- Carbon Bed temperature elements, thermowells, and indicating transmitter. (two for each guard media and two for each primary media).
- Radar level indicator for each Activated Carbon Bed Adsorber vessel.
- Differential pressure indicating transmitter on each discharge filter.
- Outlet CO analyzer sample collection tap and return for Buyer supplied ITS CO analyzer.
- Delete.
- Mercury monitor sample tap from each Activated Carbon Bed Adsorber with common return for Buyer supplied mercury analyzer. See Figure 3 for Mercury monitor sample tap requirements.

3.16.2.2 The following instruments shall be included with the LAW Activated Carbon Bed Adsorber Units as a minimum, refer to section 1.6 of this specification for additional QA with subsequent testing requirements for these instruments:

- Two (2) inlet temperature elements (ITS).
- Two (2) inlet COx analyzer sample collection taps and returns for Buyer supplied ITS COx analyzer.
- Differential pressure instrument on each Activated Carbon Bed Adsorber vessel (with ISA purges on each pressure leg).
- Carbon Bed temperature elements with thermowells and transmitters. (two for guard media, two for primary media).
- Two (2) radar level indicators for each Activated Carbon Bed Adsorber vessel (ITS).
- Differential pressure instrument on each discharge filter (with ISA purges on each pressure leg).
- One (1) outlet temperature elements.
- Two (2) outlet COx analyzer sample collection taps and returns for Buyer supplied ITS COx analyzer.
- Mercury monitor sample tap from each Activated Carbon Bed Adsorber with common return for Buyer supplied mercury analyzer. See Figure 3 for Mercury monitor sample tap requirements.
- HF/HCl monitor sample tap and return tap for Buyer supplied HF/HCl analyzer.

3.16.2.3 Deleted.

3.16.2.4 As listed in 3.16.2.1 and 3.16.2.2, each Activated Carbon Bed shall have at least four (4) temperature instruments and transmitters. Temperature elements shall be provided with thermowells that meet the inspection and testing requirements per the specified Q quality level and the requirements of Buyer specification 24590-WTP-3PS-JQ07-T0001, *Instrumentation for Package Systems*. Seller shall work closely with the Buyer in determining the location of the temperature instruments.

3.16.2.5 As listed in 3.16.2.1 and 3.16.2.2, each Activated Carbon Bed vessel shall have radar level indicator(s). Radar level indicators shall be Ohmart-Vega meeting Appendix B requirements of Buyer specification 24590-WTP-3PS-JQ07-T0001, *Instrumentation for Package Systems*. Seller proposed substitutions shall be well documented as to the relative technical advantages and exclude commercial considerations.

3.16.2.6 Seller shall provide control logic required to operate the Activated Carbon Bed Adsorber Units including the fire suppression system in accordance with the performance requirements of this specification and MDSs.

3.16.2.7 The Activated Carbon Bed Adsorber Units shall be designed with a single instrumentation tie-in point for connection to Buyer's Integrated Control Network (ICN) in accordance with the requirements of Buyer specification 24590-WTP-3PS-JQ07-T0001, *Instrumentation for Package Systems*. Design drawings shall show the location of instrumentation tie-in point. Instrumentation specified ITS shall have a separate tie-in point for connection to Buyer's Programmable Protection System (PPJ) in accordance with section 3.4.4 of Buyer specification 24590-WTP-3PS-JQ07-T0001, *Instrumentation for Package Systems*, and the requirements of IEEE Std. 384.

3.16.2.8 The following instrumentation for LAW and HLW are specified ITS and shall have isolated hardwires to Buyer's programmable protection system (PPJ) in accordance with the requirements of section 3.4.4 of Buyer specification 24590-WTP-3PS-JQ07-T0001, *Instrumentation for Package Systems for ITS instrumentation*, and the requirements of IEEE Std. 384.

- Inlet temperature elements for LAW Activated Carbon Bed Adsorbers
- Radar level indicators for LAW Activated Carbon Bed Adsorbers
- Control and electrical components related to HLW and LAW Activated Carbon Bed Adsorber pneumatic isolation valves. (Instrument air supply shall have two solenoid valves in series, one solenoid valve is independently hardwired for connection to Buyer's PPJ, the second solenoid valve is wired to the Seller's control panel. All isolation valves are fail closed, refer to Figures 1 and 2 for additional information.)
- Buyer supplied inlet and outlet CO analyzers for HLW. Buyer supplied inlet and outlet COx analyzers for LAW.

3.16.2.9 The following instrumentation shall meet the requirements of Buyer specification 24590-WTP-3PS-JQ06-T0005, *Environmental Qualification of Control and Electrical Systems and Components*.

- Inlet temperature elements for LAW Activated Carbon Bed Adsorbers
- Radar level indicators for LAW Activated Carbon Bed Adsorbers

- Control and electrical components related to HLW and LAW Activated Carbon Bed Adsorber pneumatic isolation valves

3.16.2.10 LAW instrumentation shall be remote mounted in adjacent rooms. Seller shall design for remote mounting of the control system and related instrumentation. Instrumentation not mounted in Seller's control panel shall be mounted on Buyer procured instrument racks (i.e. transmitters, solenoid valves, etc.). Seller shall provide wiring schedule, junction boxes, tubing connections, connection diagrams, and documentation to facilitate installation of wiring from equipment to remote control panels and instrument racks. Instrumentation mounted on Buyer procured instrument racks shall be supplied with the necessary mounting brackets (universal). Installation of remote tubing and wiring is within Buyer's scope.

3.16.2.11 Delete.

3.16.3 Optional Preheater

3.16.3.1 Seller shall propose control system for electric pre-heater with over heat protection in accordance with section 3.3 of this specification.

3.16.3.2 Proposed control system shall be in accordance with the requirements of Buyer specification 24590-WTP-3PS-JQ07-T0001, *Engineering Specification for Instrumentation for Package Systems.*

3.17 Accessibility and Maintenance

3.17.1 General

3.17.1.1 Accessibility and maintenance requirements shall be per this specification.

3.17.1.2 Seller's recommended accessibility and maintenance requirements for each piece of equipment shall be included in the Seller's applicable submittals.

3.17.1.3 Frequency of inspection and maintenance intervals shall be in accordance with Seller's recommendations.

3.17.1.4 All valves shall be accessible for maintenance and operation. Maintenance and replacement of valves shall be outlined in Seller's operation and maintenance procedures.

3.17.1.5 Seller shall design and supply any special tools required to perform maintenance activities and describe its use in applicable procedures.

3.17.1.6 If the equipment weight (i.e. valves, actuators, loading/unloading equipment, etc.) is in excess of 50 pounds the Seller shall design and supply jib cranes, lifting beams, or rigs in accordance with the requirements of DOE-RL-92-36.

3.17.2 Platform Requirements

3.17.2.1 Equipment, instrumentation, and electrical components that are 6 feet and over from ground level shall be provided with permanent work platforms with fixed ladders/stairs to perform maintenance.

3.17.2.2 The Activated Carbon Bed Adsorber unit maintenance platforms and ladders shall be designed to meet the requirements set forth in 29 CFR 1910, Occupational Safety and Health Standards (OSHA), Subpart D, Walking-Working Surfaces, and AISC 9th Edition.

3.17.2.3 The Activated Carbon Bed Adsorber unit maintenance platforms shall include guardrails. The guardrails shall be made out of piping.

3.17.2.4 The guardrails shall be designed per 29 CFR 1910.23.

3.17.2.5 The minimum live load for the column platforms shall be 100 psf. If platforms are to be used for laydown during maintenance, use a minimum live load of 250 psf.

3.17.2.6 The fixed ladder to be installed on the maintenance platforms shall meet the requirements set forth in 29 CFR 1910.27.

3.17.2.7 The maintenance platforms must be able to be attached to the Activated Carbon Bed Adsorber units without welding after the adsorbers are placed in the HLW and LAW facilities.

3.17.2.8 All openings in guardrails of each Activated Carbon Bed Adsorber unit maintenance platform shall have a safety gate or chain designed per the requirements of 29 CFR 1910.23.

4 Materials

4.1 General

4.1.1 Material used for the pressure boundary including control instrumentation shall comply with Buyer specification 24590-WTP-3PS-G000-T0002, *Positive Material Identification* (PMI) *for Shop Fabrication*. In accordance with the requirements of the PMI specification the Cr, Ni, Mo, content of the pressure boundary materials including weld consumables must be verified before and after fabrication.

4.1.2 Seller shall submit manufacturer cut sheets and MSDSs for all gaskets used for the pressure boundary. All gaskets, seal pads, caulks, and adhesives used must be certified for contact with austenitic stainless steel.

4.1.3 The Activated Carbon Bed Media shall have impurities less than 0.1 weight percent carbonate, oxide, or nitrate. Seller shall provide written certification that the amount of impurities in the carbon media is less than 0.1 weight percent carbonate, oxide, or nitrate.

4.1.4 Performance of the Activated Carbon Bed for removal of HCl, HF, and radioactive iodine (I^{129}) associated with the LAW system is required, (an HCl, HF, and iodine guard bed is not required for the HLW offgas). The guard bed for HF, located upstream of the mercury removal bed, may contain adsorbent such as acid washed activated carbon or activated alumina. The activated alumina media is not required to be acid washed.

4.1.5 The Activated Carbon Bed Media shall meet applicable ASTM methods for particle size distribution.

4.2 Construction

4.2.1 Materials used in the construction of the Activated Carbon Bed Adsorber units shall conform to the requirements of ASME AG-1, Article AA-3000, ASME AG-1a, Article HA-3000, this specification, and the MDSs in section 2 of the purchasing documents. Material property and performance data for any materials not covered in ASME AG-1, ASME AG-1a or this specification shall be submitted to the Buyer for review prior to incorporation into the design of the Activated Carbon Bed Adsorber units. All materials in contact with the adsorber and process piping shall be 300 series stainless steel. Performance data shall indicate that material is acceptable for environmental and specific service conditions.

4.2.2 All materials used in the construction of the Activated Carbon Bed Adsorber units shall be resistant to radiation levels indicated in subsection 3.6 of this specification and be able to operate under environmental and design conditions described in ASME N509 (paragraph 4.4) and MDSs in section 2 of the purchasing documents.

4.2.3 Seller shall maintain a record of ASME or ASTM numbers, material test reports, and manufacturer material certifications for all materials used for construction of the Activated Carbon Bed Adsorber units. Seller shall provide copies to the Buyer.

4.2.4 All materials used in the manufacture of the Activated Carbon Bed Adsorber units, support frames, and shims shall be new and unused. Where specific criteria are not provided, material selection shall be determined by the Seller and have properties and composition suitable for the specific service conditions and consistent with this specification.

4.2.5 Dissimilar metal couples shall be avoided due to corrosion potential.

4.2.6 Activated Carbon Bed Adsorber housing material shall be in accordance with the requirement of the MDSs. Discharge filter covers shall be constructed of 316 L stainless steel.

4.2.7 The Activated Carbon Bed Adsorber support frames, pipe supports, and maintenance platforms shall be made of Carbon Steel. Special attention shall be placed on securing the stainless steel carbon bed adsorbers and piping to the carbon steel support structure to prevent galvanic corrosion.

4.2.8 The discharge filter frame shall be composed entirely of 316 L stainless steel.

4.2.9 Deleted.

4.3 Insulation

4.3.1 The Seller shall provide detailed insulation installation procedures complete with sketches showing methods and details for applying and securing external insulation, metal jacketing, etc., to the Activated Carbon Bed Adsorber Units and necessary piping. The insulation procedures shall be in accordance with PIP INIH 1000 and NACE Standard RP0198, Buyer specification 24590-WTP-3PS-NN00-T0001 *Thermal Insulation for Mechanical Systems*, and this specification.

4.3.2 Procedures for insulation thicknesses greater than three (3) inches shall be applied in multiple layers with staggered joints. Each layer of multiple layer and double insulation shall be held in place separately.

4.3.3 Procedures for insulation installation shall include jacketing the insulation with 304 L stainless steel following the requirements of Buyer specification 24590-WTP-3PS-NN00-T0001 *Thermal Insulation for Mechanical Systems*, and this specification. The stainless steel jacketing shall be 0.024 inches thick flat and smooth sheet. The jacketing shall be furnished in the annealed or soft condition with a regular 2B mill finish and have a factory applied moisture barrier.

4.3.4 Seller shall recommend cements, mastics, and adhesives that will be suitable for the maximum design temperature of the Activated Carbon Bed Adsorber units. The mixing of cements, mastics, etc., shall be done with deionized water. All recommended cements, mastics, adhesives must by certified for contact with austenitic stainless steel.

4.3.5 Procedures shall include cleaning instructions for surfaces to be insulated. Procedures should note that surfaces to be insulated must be dry and free of loose scale, dirt, and oil before the insulation is applied.

4.3.6 The design shall provide for removable/replaceable insulation on flanges, manholes, doors, and access openings.

4.3.7 All recommended insulation components, including facings, mastic, and adhesives, shall meet ASTM E84 fire hazard rating not to exceed 25 for flame spread and 50 for fuel contributed and smoke developed. Ratings used are determined by Underwriters Laboratories, Inc. (UL).

4.4 Piping

4.4.1 All applicable materials used for piping and related appurtenances shall be in accordance with the requirements of the MDSs and Buyer specification 24590-WTP-3PB-P000-TS11V *Piping Material Classification Pipe Class S11V*, for HLW, and Buyer specification 24590-WTP-3PB-P000-TS11N *Piping Material Classification Pipe Class S11N*, for LAW.

4.4.2 Special attention shall be placed on securing stainless steel piping to the carbon steel support structure to prevent galvanic corrosion.

4.5 Prohibited Materials

4.5.1 Mercury and other low melting point metals, their alloys, or materials containing such metals as their basic constituents shall not be used in the construction of the Activated Carbon Bed Adsorber units and shims.

4.5.2 Molybdenum and halides shall not be used in direct contact with stainless steel.

4.5.3 Asbestos shall not be included in any component of the Activated Carbon Bed Adsorber units.

4.5.4 Halide containing materials shall not be used in any component of the Activated Carbon Bed Adsorber units, unless otherwise noted in this specification.

4.6 Storage of Special Materials (e.g., stainless steel) prior to work

4.6.1 Stainless steel is susceptible to corrosion caused by the contact and interaction with incompatible materials. All stainless steel material shall be stored in separate areas away from other materials.

4.6.2 Storage of activated carbon and testing media shall be per the manufacturer's instructions to prevent contamination and degradation. Activated carbon and testing media storage requirements and instructions shall be provided by the Seller to the Buyer for review prior to purchase.

5 Fabrication

5.1 General Requirements

5.1.1 The Activated Carbon Bed Adsorber units shall be fabricated per this specification and the applicable documents listed in section 2 of this specification.

5.1.2 ASME Boiler and Pressure Vessel Code, Section VIII, Div. 1 shall only be applied to the fabrication of the housing pressure boundary of the Activated Carbon Bed Adsorber units. The housing pressure boundary shall be fabricated in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Div. 1. **U-stamp and National Board Registration for the Activated Carbon Bed Adsorbers are not required.**

5.1.3 Identification of fabrication methods shall be included in the detailed design of the Activated Carbon Bed Adsorber units.

5.1.4 All fabrication shall be performed by personnel qualified in accordance with this specification and applicable documents in section 2 of this specification.

5.1.5 Piping shall be fabricated in accordance with the requirements of ASME B31.3 and Buyer specification 24590-WTP-3PS-PS02-T0001, *Shop Fabrication of Piping.*

5.2 Assembly

5.2.1 Flatness of the completed Activated Carbon Bed Adsorbers and support frames shall be 1/8 inch per foot minimum, with no greater than 3/16 inch over the entire length, except for areas around cutouts. Areas around cutouts shall be flat within 1/16 inch per foot.

5.2.2 Cutout locations shall be within ± 1/8 inch and cutout size shall be within ± 1/16 inch.

5.2.3 The Activated Carbon Bed Adsorber units and shims shall have edges that are both smooth and not sharp to the touch.

5.2.4 The method of fabrication shall minimize the number and amount of seams, overlaps, or other discontinuities, which could trap radioactive contamination.

5.3 Tolerances

All tolerances, surface flatness, and finish requirements for assembly and fabrication shall be determined and specified by the Seller when completing the detailed design to meet performance requirements set forth in this specification. At a minimum, all tolerances, surface flatness, and finish requirements shall be per all applicable codes, standards, and reference documents in section 2 of this specification.

5.4 Welding

5.4.1 Seller shall develop detailed welding, weld inspection, NDE, and weld repair procedures for fabrication of the Activated Carbon Bed Adsorber units and submit them to the Buyer for review prior to fabrication. Procedures shall include acceptance criteria. The procedures shall conform to the following, as applicable:

- Buyer Specification 24590-WTP-3PS-SS00-T0001
- Buyer Specification 24590-WTP-3PS-SS00-T0002
- Buyer Specification 24590-WTP-3PS-NWP0-T0001
- Buyer Specification 24590-WTP-3PS-MVB2-T0001 (Pressure Boundary Only)
- ASME AG-1a, Article HA-6000
- ASME AG-1, Articles FE-6000
- ASME Boiler and Pressure Vessel Code, Section VIII, Div. 1 (Pressure Boundary Only)
- ASME B31.3
- AWS D1.6

5.4.2 Activated Carbon Bed Adsorber welding, weld inspection, NDE, and weld repair shall be carried out in accordance with the applicable procedures developed per the previous paragraph.

5.4.3 Activated Carbon Bed Adsorber welder qualifications shall be performed in accordance with requirements of the referenced specifications and codes listed in section 5.4.1 of this specification.

5.4.4 Welding or material manipulation shall be carried out indoors and only when the ambient, piping, or plate temperature is above 41°F, or higher where elevated temperatures are called for by a process.

5.4.5 Personnel performing Activated Carbon Bed Adsorber weld inspections shall be qualified in accordance with ASME AG-1, Paragraph AA-6335, ASME Boiler and Pressure Vessel Code, Section VIII, Div. 1, Buyer specification 24590-WTP-3PS-SS00-T0002, *Specification for Welding of Structural Stainless Steel and Welding of Structural Carbon Steel to Structural Stainless Steel* and 24590-WTP-3PS-SS00-T0001, *Specification for Welding of Structural Carbon Steel.*

5.4.6 Repairs required as a result of weld rejection by either the Seller's or Buyer's inspection shall be fully documented in accordance with Seller's Quality Assurance Program (QAP). Activated Carbon Bed Adsorber weld repairs shall be performed in accordance with ASME AG-1, subsubarticle AA-6330 and ASME Boiler and Pressure Vessel Code, Section VIII

(housing pressure boundary only). Weld repair records shall be included with Seller's quality verification document package to be submitted to Buyer.

5.4.7 Joints and seams shall be fabricated in accordance with ASME AG-1a, subsubarticle HA-4330 and ASME Boiler and Pressure Vessel Code, Section VIII (housing pressure boundary only).

5.4.8 Welding procedures and welder qualification records shall be submitted to Buyer for review and permission to proceed prior to start of fabrication. Each procedure shall be prepared and qualified in accordance with the requirements of the listed standards in section 5.4.1 of this specification.

5.4.9 Seller shall submit a weld verification report including a weld map which identifies the specific weld procedure and NDE procedure utilized for each weld joint.

5.5 Coating

5.5.1 Seller shall provide coating for carbon steel surfaces in accordance with 24590-WTP-3PS-AFPS-T0001, *Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and Equipment*, Appendix D, Item # 8.20. System code D applies.

5.5.2 Coating finish color shall be in accordance with 24590-WTP-3PS-AFPS-T0001, *Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and Equipment*, Appendix E, ANSI 70 Gray.

5.5.3 All carbon steel to stainless steel weld areas shall remain free of any zinc filled coatings, such as the P02 primer contained in system code D. Surfaces that were previously coated with zinc filled material, and subsequently ground off, are considered to be contaminated with zinc. Stainless steel shall not be welded to these surfaces.

5.5.4 Zinc filled coatings shall be held back from the carbon steel to stainless steel welds by 3 to 4 inches for shop welds and 4 to 5 inches for field welds. Coating hold back requirements are further defined in 24590-WTP-3PS-AFPS-T0001, *Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and Equipment*, section 2.2.1.

5.5.5 The following coating materials may be applied directly to stainless steel surfaces:

- Sherwin Williams Macropoxy 646
- Carboline Carbogard 890

5.5.6 Insulated surfaces (applicable only to carbon steel in contact with stainless steel) with an operating temperature no greater than 200 °F shall be coated with system code H (see 24590-WTP-3PS-AFPS-T0001, *Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and Equipment*, Appendix C, Table 2, limited to the coating materials listed in section 5.5.5 above). The coating shall be applied to all carbon steel surfaces overlapping 1 inch on to the stainless steel. Insulated surfaces (applicable only to carbon steel in contact with stainless steel) with an operating temperature from 200 °F to 300 °F shall be coated with system code G (see 24590-WTP-3PS-AFPS-T0001, *Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and Equipment*, Appendix C, Table 2). The coating material specified for use in system code G is not acceptable for direct

application over stainless steel surfaces or stainless steel to carbon steel welds. Coat carbon steel surfaces with system code G to within 1-2 inches of the carbon steel-stainless steel weld. Do not overlap coating onto weld area or onto stainless steel material. Zinc primers without top-coating and hot dip galvanizing are not acceptable on surfaces that will be insulated.

5.5.7 Carbon steel components of gratings, platform assemblies, ladder assemblies, crane rail, and supports shall be hot dip galvanized in accordance with 24590-WTP-3PS-AFPS-T0001, *Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and Equipment,* Appendix D, Note 15.

5.5.8 Components that are coated to manufacturer's standard shall be in accordance with 24590-WTP-3PS-AFPS-T0001, *Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and Equipment,* section 6.2.1.2.

6 Tests and Inspections

6.1 General Requirements

6.1.1 The Activated Carbon Bed Adsorber units shall be tested and inspected per this specification, applicable documents listed in section 2 of this specification, and all appendices, addenda, and attachments. Seller shall submit shop and field test plans for Buyer review.

6.1.2 Seller shall conduct and be responsible for all testing and inspections required per this specification, applicable codes, applicable standards, and reference documents.

6.1.3 Seller shall submit a detailed test and inspection plan identifying all the inspections and tests planned, including recommended witness and hold points. Buyer's inspector will advise the Seller of witness and hold points and identify the shop tests that the Buyer intends to witness.

6.1.4 Seller shall develop and submit to Buyer detailed test procedures for conducting all shop and field acceptance testing required per this specification, applicable codes, standards, and reference documents for review by the Buyer prior to Activated Carbon Bed Adsorber fabrication. Procedures shall include acceptance criteria and detailed drawings of the shop and field testing configurations. Seller shall identify on drawings location of taps, ports, piping connections, and/or manifolds made on housing and ductwork in order to take measurements during shop and field tests. These taps, ports, piping connections, and/or manifolds shall be temporarily capped for use in the field during acceptance testing. Seller shall provide instructions on permanently sealing these taps after field acceptance testing. Drawings shall be scalable and shall include plan and elevation views of the following:

- Activated Carbon Bed Adsorber
- Any Seller furnished materials, fittings, and ductwork required to perform the tests
- Seller furnished discharge filter(s)
- All Seller furnished equipment, apparatus, and instrumentation

6.1.5 Seller shall develop and submit to Buyer detailed testing and inspection procedures for conducting all testing and inspections required per this specification, applicable codes,

standards, and reference documents for review by the Buyer prior to Activated Carbon Bed Adsorber fabrication.

6.1.6 Seller shall complete reports of all testing and inspections and submit them to Buyer. Reports shall identify the component tested, date performed, applicable test procedure, acceptance criteria, person performing the test or inspection, test results, and conclusions. Drawings of test setups shall be included. All testing and inspection results shall be certified.

6.1.7 Control and calibration of measuring and test equipment shall be in accordance with ASME AG-1, subarticle AA-5130.

6.1.8 All shop testing and inspection instruments used to conduct testing on the Activated Carbon Bed Adsorber units shall meet the requirements set forth in ASME AG-1, Article TA-3000. All testing and inspection instruments shall be in calibration and traceable to the appropriate national standard.

6.1.9 Any non-conforming work, in accordance with Seller's acceptance criteria, shall be redone by the Seller at Seller's cost.

6.2 Weld Testing and Inspection

6.2.1 Activated Carbon Bed Adsorber welds shall be inspected, examined, and tested in accordance with ASME AG-1, subarticle AA-6330, ASME Boiler and Pressure Vessel Code, Section VIII, Div. 1 (housing pressure boundary only), and Buyer specification 24590-WTP-3PS-MV00-T0001, *Pressure Vessel Design and Fabrication*.

6.2.2 Activated Carbon Bed Adsorber support frame welds shall be inspected, examined, and tested in accordance with Buyer specification 24590-WTP-3PS-SS00-T0002, *Engineering Specification for Welding of Structural Stainless Steel and Welding of Structural Carbon Steel to Structural Stainless Steel* and 24590-WTP-3PS-SS00-T0001, *Engineering Specification for Welding of Carbon Structural Steel.*

6.2.3 Piping shall be inspected, examined, and tested in accordance with ASME B31.3, Buyer specification 24590-WTP-3PS-PS02-T0001, *Shop Fabrication of Piping*, and Buyer specification 24590-WTP-3PS-NWP0-T0001, *General Welding and NDE Requirements for Supplier Fabricated Piping*.

6.2.4 As applicable, per code requirements, Seller shall submit Radiographic, Liquid Penetrant, and Ultrasonic Examination procedures for review, prior to fabrication.

6.2.5 Exposed radiograph film must be submitted along with technique and reader sheets. Film must be packaged in such a manner as to preclude moisture and handling damage.

6.3 Personnel Qualifications

6.3.1 All inspection and testing shall be performed by personnel qualified per the requirements set forth in this specification and all applicable documents in section 2 of this specification.

6.3.2 Seller shall submit personnel qualification documents, including years of experience for Seller's inspection and test personnel, for Buyer review.

6.4 Laboratory Tests

6.4.1 Seller shall conduct and be responsible for laboratory testing of Activated Carbon Media in accordance with appendix A, B, and C of this specification. Laboratory tests shall be conducted in accordance with the applicable sections of NQA-1. The test plan shall include a matrix cross-referencing the QA requirements to implementing procedures for the work and justifying elements that are not applicable.

6.4.2 Seller shall submit laboratory test plan and procedures for Buyer review prior to the start of testing in accordance with the requirements of the G-321-E in section 3 of the purchasing documents.

6.4.3 A final report shall be submitted for Buyer review in accordance with the requirements of section 10.7 of this engineering specification. The final report shall support the engineering design of the Activated Carbon Bed Adsorber Units. In addition to the requirements of section 10.7, the final report shall show conformance with required DFs as outlined in section 3.4 of this specification and specified in the MDSs. Any effects related to the design of the Activated Carbon Bed Adsorber Units shall be identified in the final report.

6.5 Shop Tests

6.5.1 Seller shall provide all materials, labor, tools, equipment, apparatus, instrumentation, testing media, and challenge gas to conduct all shop testing on the Activated Carbon Bed Adsorber units.

6.5.2 All shop tests requiring that adsorbent media be installed in the Activated Carbon Bed Adsorber units shall be conducted using activated carbon. The Seller shall ensure that the Activated Carbon Bed Adsorber does not become contaminated or degraded at any time before, during, or after completion of shop testing.

6.5.3 Testing media shall be loaded into adsorber cells and tested per applicable sections of ASME AG-1, Article FE-5000. Seller shall issue manufacturer's information for testing media to the Buyer for review prior to purchase.

6.5.4 Electrical and instrumentation tests shall be conducted in accordance with the requirements of Buyer specification 24590-WTP-3PS-EKP0-T0001, *Electrical Requirements for Packaged Equipment*, and 24590-WTP-3PS-JQ07-T0001, *Instrumentation for Package Systems*. Electrical and instrumentation test reports shall be submitted for Buyer review.

6.5.5 Seller shall conduct the following acceptance tests in the shop on each unit using air at ambient temperature, prior to shipment:

- Visual Inspection
- Structural Capability Test

- System Bypass Test
- Mechanical Test
- Differential Pressure Test
- Airflow Distribution Test
- Electrical Air Heater Performance Test (per design)

All Activated Carbon Bed Adsorber shop acceptance testing procedures shall conform to ASME AG-1 (Section TA), N509 (Section 9), N510, and ERDA 76-21 (Chapter 8).

6.5.6 Deleted.

6.5.7 Pneumatic testing per ASME Boiler and Pressure Vessel Code, Section VIII, Div. 1 shall be conducted on the Activated Carbon Bed Adsorber housing pressure boundary. U-stamp and National Board Registration for the Activated Carbon Bed Adsorbers are not required.

6.5.8 Structural Capability Test: Conduct at pressure and conditions specified in the MDSs.

6.5.9 System Bypass Test: At ± 10 % of design flowrate through the Activated Carbon Bed Adsorber, challenge gas leakage rate shall not exceed 0.1 % at 99.9 % efficiency.

6.5.10 All test results shall be documented, certified, and submitted to the Buyer for review.

6.6 Site Tests

All Activated Carbon Bed Adsorber field acceptance testing procedures shall conform to ASME AG-1 (Section TA), N509 (Section 9), N510, and ERDA 76-21 (Chapter 8).

6.7 Bag-in/Bag-out Procedure Demonstration

6.7.1 Demonstration shall be conducted in Seller's shop on one (1) of the fully assembled Activated Carbon Bed Adsorber units and witnessed by Buyer's Representatives. The Activated Carbon Bed Adsorber to be used for the demonstration shall be chosen by the Buyer.

6.7.2 Demonstration shall include removal and replacement of one (1) activated carbon adsorber bed adsorbent and the discharge filter(s) for one (1) Activated Carbon Bed Adsorber unit for each HLW and LAW facility. Actual adsorber bed adsorbent to be removed shall be chosen by the Buyer.

6.7.3 When conducting the demonstration, Seller personnel shall be wearing all PPE required per the final bag-in/bag-out procedure.

6.7.4 Field conditions shall be simulated in the shop when performing the bag-in/bag-out procedure demonstration, which will include pulling a vacuum on the Activated Carbon Bed Adsorber, room clearance, and lifting constraints.

7 Preparation for Shipment

7.1 General Requirements

7.1.1 The Activated Carbon Bed Adsorber units shall be packaged/prepared for shipment, handled, and stored in accordance with Buyer specification 24590-WTP-3PS-G000-T0003 *Engineering Specification for Packaging, Handling, and Storage Requirements*, and ASME AG-1a, Article HA-7000, (Level C).

7.1.2 The activated carbon media shall be packaged/prepared for shipment, handled, and stored in accordance with Buyer specification 24590-WTP-3PS-G000-T0003 *Engineering Specification for Packaging, Shipping, Handling and Storage Requirements*, ASME AG-1, Article FE-7000 and FF-7000, (Level B).

7.1.3 The Activated Carbon Bed Adsorber units, activated carbon media, and shims shall not be packaged for shipping until all shop tests and inspections have been performed and the Buyer's Representative reviews the results.

7.2 Cleanliness

7.2.1 Cleanliness shall be per the applicable documents in Paragraphs 7.1.1 and 7.1.2 of this specification.

7.2.2 Solvents and cleaning solutions used on stainless steel shall have a halogen content of less than 200 ppm.

7.3 Tagging

7.3.1 Tagging of the Activated Carbon Bed Adsorber units shall be as specified in ASME AG-1, Article FE-9000 and ASME AG-1a, Article HA-9000. Tagged information shall also include associated plant item number specified in the data sheets that are in Section 2 of the purchasing documents.

7.3.2 A stainless steel nameplate shall be rigidly attached to the Activated Carbon Bed Adsorber units in a prominent position for ease of visibility and include:

- manufacturer's name
- shop location
- date of manufacture
- serial number
- equipment ratings (pressure, flow, temperature)
- plant item number
- weight of assembly
- purchase order number

7.3.3 Nameplates shall be visible after the insulation is installed, or a duplicate nameplate shall be provided on the top of the insulation. Nameplate shall be located for easy access and reading.

7.3.4 All field testing materials and filters shall be tagged as required for field testing.

7.3.5 Seller shall use Buyer supplied tag numbers for valves, instrumentation, junction boxes, racks, and panels.

7.4 Documentation

7.4.1 Seller shall ensure that appropriate documentation is prepared and, if required, signed by the appropriate person(s). The shipping documentation shall accurately reflect specific traceability to the items being shipped.

7.4.2 Seller shall ensure that appropriate documentation is prepared for the Activated Carbon Bed Adsorber units, activated carbon, and shims. At a minimum, documentation shall include the following information, as applicable:

- Manufacturer name, model number, and serial number
- Plant Item Number

7.5 Shipment Preparation Instructions

7.5.1 Shipment of items shall be conducted in accordance with ASME AG-1a, Article HA-7300, Buyer specification 24590-WTP-3PS-G000-T0003 *Engineering Specification for Packaging, Handling, and Storage Requirements.*

7.5.2 The Activated Carbon Bed Adsorber units shall be shipped completely assembled except for activated carbon. Activated carbon shall be shipped separately.

7.5.3 Weatherproof shipping lists (two per packaged item) shall be prepared and submitted, and shall clearly identify the contents of each package sent to the Buyer. All submittals and shipping boxes shall be identified with the Buyer's purchase order number.

7.5.4 Seller shall provide a complete identification and location of temporary material contained within the equipment for shipment, handling, or storage that must be removed prior to commissioning (e.g., shipping blocks, desiccant bags, components shipped inside larger sections, etc.). In addition, the Seller shall provide instructions for removal of temporary materials, as required.

7.5.5 The Activated Carbon Bed Adsorber units and shims shall be mounted on skids, in crates, or in boxes as suited for the intended method of transport. Lifting weight and center of gravity shall be clearly marked on both the equipment and its shipping documents.

8 Quality Assurance

8.1 General Requirements

8.1.1 The Seller's QAP Requirements are included in Buyer specification 24590-WTP-3PS-G000-T0001, *General Specification for Supplier Quality Assurance Program Requirements.*

8.1.2 Seller's QAP Manual shall be submitted to Buyer for review in accordance with Buyer specification 24590-WTP-3PS-G000-T0001, *General Specification for Supplier Quality Assurance Program Requirements*.

8.1.3 Seller's QAP, as a minimum, shall contain the requirements detailed in the Supplier Quality Assurance Program Requirements Data Sheets listed in Section 2 of the purchasing documents.

8.2 Quality (Q) Related Components

8.2.1 Seller shall have in place a QAP meeting the requirements of ASME-NQA-1, marked as applicable in Supplier Quality Assurance Program Requirements Data Sheet attached to the purchasing documents, and Buyer specification 24590-WTP-3PS-G000-T0001, *General Specification for Supplier Quality Assurance Program Requirements*.

8.2.2 The successful bidder must pass a pre-award survey by the Buyer. Seller shall demonstrate that its quality program is in compliance with the procurement quality requirements listed in the Supplier Quality Assurance Program Requirements Data Sheet. The Seller shall allow the Buyer, its agent, and DOE access to their facility and records pertaining to this purchase order for the purpose of Quality Assurance (QA) Audits and Surveillance at mutually agreed times.

8.2.3 All items shall be manufactured in accordance with the Seller's QAP that meets the requirements of ASME NQA-1, and has been previously evaluated and accepted by the WTP Quality Organization.

8.2.4 Seller shall submit their QAP and work plan to Buyer for review prior to commencement of work. The plan shall include documents and procedures to implement the work and include a matrix of essential QA elements cross referenced with the documents/procedures.

8.3 Supplier Deviation

8.3.1 Each Supplier shall be required to identify and promptly document all deviations from the requirements of the procuring documents. In addition, the supplier shall be required to describe the recommended disposition based on appropriate analysis. Submittals of request for deviations from lower-tier suppliers shall be through the prime supplier to RPP-WTP.

Supplier-proposed deviations from procurement documents shall be initiated by use of Supplier Deviation Disposition Request (SDDR) form in section 2 of the purchasing documents.

9 Configuration Management

Equipment and or components covered by this specification are identified with Plant Item numbers shown in the MDSs. Each item shall be identified in accordance with Tagging in section 7 of this specification.

10 Documentation and Submittals

10.1 General

10.1.1 Seller shall submit to Buyer all detailed designs, documentation, procedures, instructions, calculations, analyses, laboratory results, models, manufacturer data, inspection plans and reports, test plans and reports, certifications, certificates, qualification records, manuals, MSDSs, video tapes, and drawings required per this specification, the applicable codes, standards, and reference documents in section 2 of this specification, and the purchasing documents.

10.1.2 All detailed designs, drawings, shop drawings, supporting calculations, supporting analyses, support models, procedures, instructions, manufacturer data, operation manuals, and maintenance manuals shall be issued to the Buyer for review prior to manufacture of the Activated Carbon Bed Adsorber units, special tools, and/or the purchase of special tools, filters, and gaskets.

10.1.3 Seller shall submit storage requirements and instructions for Buyer's review.

10.1.4 Seller shall submit to Buyer Engineering and Quality Verification documents in the forms and quantities shown in Form G-321-E, Engineering Document Requirements, and Form G-321-V, Quality Verification Document Requirements attached to the purchasing documents.

10.1.5 Seller shall submit a report identifying any deviations and/or conflicts per Section 2 of the purchasing documents to the Buyer for review.

10.1.6 Each documentation transmittal package shall have a documentation inventory sheet attached listing all documents and the number of pages each.

10.1.7 MDSs in Section 2 of the purchasing documents and motor data sheets shall be marked-up by the Seller and submitted to the Buyer for review with the detailed design. Seller shall fill in all information that is marked with an asterisk (*) and mark-up actual overall Activated Carbon Bed Adsorber dimensions based on the detailed design.

10.1.8 Seller shall provide all operation manuals (include media changeout operations and any media conditioning requirements), maintenance manuals, initial setup and startup instructions, special tools, and spare parts lists for Activated Carbon Bed Adsorber components, as applicable.

10.1.9 Provide nominal and maximum inlet and outlet nozzle loadings, deflections, and moments in all directions for Activated Carbon Bed Adsorber units per thermal and seismic analysis results.

10.1.10 Provide Activated Carbon Bed Adsorber unit support and anchorage design load analyses including seismic, thermal, and combination loads.

10.1.11 Provide MSDS for Seller's recommended challenge gas.

10.1.12 The Seller shall provide equipment reliability figures for all major components and sub-components of the Carbon Bed Adsorber system. The definition of components and sub-

components is at the vendor's discretion. The reliability figures shall include, as a minimum, the following:

- Failure rate, or mean time between failure (whichever is available)
- Estimated modes of failure (example, Drive gear failure, motor burnout, brake failure, etc.). This may be delineated in a FMEA. The method used to perform the FMEA (example, MIL-STD-1629) and the year shall be specified. In addition, all assumptions used to perform the FMEA shall be stated.
- Recommended maintenance and frequency, as applicable
- Estimated time to perform the recommended maintenance, as applicable

The data above shall be based on the physical and environmental conditions delineated in this specification. Where possible, the seller shall compare the figures for the equipment in this specification to similar equipment sold and serviced by the vendor. The source for all estimates and any underlying assumptions shall be stated. If software is used to perform the FMEA, the seller shall specify the software used and the version (example software, Relex, Isogen, Reliasoft, etc.)

10.1.13 Provide installation manual per the requirements of engineering specification 24590-WTP-3PS-G000-T0003, *Packaging, Handling, and Storage Requirements.*

10.1.14 Provide site handling and storage instructions per the requirements of section 3.9 and engineering specification 24590-WTP-3PS-G000-T0003, *Packaging, Handling, and Storage Requirements*.

10.1.15 All analyses shall be submitted in accordance with the requirements of 24590-WTP-3PS-G000-T0014, *Engineering Specification for Supplier Design Analyses.*

10.2 Drawings

10.2.1 Seller shall provide all drawings required per this specification and the applicable documents in section 2 of this specification.

10.2.2 All drawings shall be produced per the drawing practices set forth in ASME Y14.100, Engineering Drawing Practices.

10.2.3 Seller shall submit drawings and diagrams for Buyer's review prior to fabrication, and/or purchase of appurtenance equipment. Drawing and diagram submittals shall include as a minimum, but are not limited to, the following:

- Outline drawings showing dimensions, services, insulation, and foundation and mounting details.
- Outline drawing showing electrical and instrumentation tie-in points.
- Outline drawing showing locations of piping connections with nozzle schedule, including sizes of piping connections with nominal and maximum nozzle loadings, deflections, and moments in all directions.
- Insulation detail drawing(s) mapping installation
- Overall piping and instrumentation diagram (P&ID) for the Activated Carbon Bed Adsorber Units using Buyers supplied instrumentation and equipment tag numbers.

- Interconnection diagram showing details of all internal connections and Buyer external connections, including required location and sizes of wiring connections (including other connections to Buyer's control system).
- Overall single line diagram (wiring diagram) showing all electrical equipment and wiring in the Activated Carbon Bed Adsorber Unit.
- Control logic diagrams showing input signal paths required to accomplish a response.
- Assembly drawings with sufficient information and detail to facilitate assembly of the component parts of an equipment item.
- Shop detail drawings that provide information and detail to facilitate fabrication, manufacture, or installation.

10.3 30% Design Review

10.3.1 Seller shall conduct a 30 % design review with the Buyer. Seller shall submit all drawings, procedures, calculations, laboratory testing results, analyses, and information necessary to conduct the 30 % design review to the Buyer for review.

10.3.2 Finalized outline dimensions of the Activated Carbon Bed Adsorber units shall be included in the 30 % design review. Finalized dimensions shall, at a minimum, include the following:

- Overall dimensions and size for Activated Carbon Bed Adsorber units
- P&IDs
- Control logic diagrams
- Activated Carbon Bed Adsorber unit inlet and outlet nozzle locations
- Discharge filter location and size
- Testing port and manifold locations and size
- Adsorber cell overall dimensions
- Mounting details (anchor size, location, layout, etc.)
- Preliminary bag-in/bag-out plan
- Fire water inlet and drain locations and sizes

10.4 90% Design Review

Seller shall conduct a 90 % design review with the Buyer. Seller shall submit all drawings, procedures, calculations, analyses, and information necessary to conduct the 90 % design review to the Buyer for review.

10.5 Calculations

All calculations to be provided shall be orderly, complete, and sufficiently clear to permit verification. The body of the calculations shall include:

- A concise statement of the purpose of the calculation
- Input data, applicable criteria, and stated assumptions
- A list of references used, including drawings, codes, standards, and computer programs (indicate the version or issue date)
- A discussion of rationale used for design assumption basis
- Equations used for all computations

- Numerical calculations including identification of units used
- A concise statement addressing the calculation results and/or recommendations
- A table of contents for complex calculations

10.6 Schedules

10.6.1 A detailed schedule of laboratory testing, engineering, document submittals, material purchases, fabrication, shop tests, and shipment shall be submitted.

10.6.2 All procedures and instructions shall be completed and submitted to the Buyer a minimum of eight (8) weeks prior to Activated Carbon Bed Adsorber shipment.

10.7 Reporting Appendix A, B, and C Test Results

A test plan and supporting documentation (operating procedures, materials and testing equipment control lists, analytical procedures) must provide a full record of the testing requirements, testing equipment configuration, operating conditions, assumptions, and any other relevant information. In addition to, or consistent with, the test plan content required by the Quality Assurance Project Plan for RPP-WTP, current revision, the test plan shall include directly or by reference (as appropriate) the following information:

- **Document Number** – Test plan number in the document header.
- **Document Hierarchy** – Statement in the test plan text referencing the governing test specification.
- **Background** – Summary level discussion of past results and current data needs that provide context and relevancy of the testing to the WTP Project.
- **Test Prerequisites** – Definition and/or reference of laboratory testing, engineering analyses, small-scale testing needed to support testing.
- **Test Conditions** – Test variables and operating conditions (e.g., duration of operations at steady state conditions, range of equipment operating conditions, process flows, pressures, temperatures, differential pressures, etc.) identified in tables or other efficient formats.
- **Sample Data Requirements** – A table listing the sample type, location, frequency, number of replicates, and planned analyses to be performed. Minimum data accuracy requirements shall be addressed.
- **Test Modifications** – Test Plan shall contain a statement defining how changes or modifications in operations or testing will be documented in the "desk copy" or similar controlling documentation during the test and who has the authority to authorize changes or modifications depending on the significance of the change.
- **Equipment Configuration Record** – The equipment configuration for the test or document reference where the configuration can be found. Statement defining where any changes or modifications to the baseline equipment will be recorded, e.g., laboratory record book.
- **M&TE** – A list identifying measuring and test equipment (M&TE) used to collect data to meet Test Specification requirements, data reported to the project in the summary report or other data reporting formats, and M&TE relied upon for control or modeling purposes. Accuracy and sensitivity achievable for each instrument.

- **Supporting Procedures** – A list of applicable technical and operating procedures or a referenced document that contains the list of documents required for operating the test equipment and associated support systems, sample preparation and analytical procedures, etc.
- **Unique Sample Identification** – Description of or document reference defining method to label, store and maintain samples.
- **Reporting and Analyses Requirements** – Process data that will be obtained and reported, Rate versus time, average temperature versus time, and analyses are required to satisfy each test objective. Planned data analyses, e.g., comparison to theoretical or published predictions, empirical fitting, etc., required to meet objectives.
- **Personnel Qualification** – List of any special training needs.
- **Quality Assurance** – Statement identifying applicable quality assurance requirements. Any exceptions to the approved quality assurance plan shall be described.

A final report shall be submitted within 60 days of completing testing and sample analyses. Test report content shall include (compatible with the individual test objectives):

- Approval sheet signed by the principal investigator, data validation peer reviewer, and project manager,
- Summarize the tests performed, including the date of the tests, and applicable test specification and test plan,
- Provide a clear description of the purpose of the test and state how the completed test met that purpose,
- Describe the unit operations in which the tests were performed and contrast test conditions with planned operating conditions of the RPP-WTP, as appropriate,
- Present and discuss test results and compare against the "success" criteria. Discuss whether or not the findings of the test performed are consistent with previous test reports, whether the expected WTP design or operational conditions are appropriate for the system, or have implications for safety, permitting, or operability,
- Data collected and its acceptability,
- Actions taken in connection with any nonconformances noted,
- Identification of the measuring and test equipment used during the test,
- Describe deviations from the approved test plan, or expected configuration conditions, that occurred during the conduct of the test,
- Comprehensive list of all samples providing the date/time of sampling, sample type, and sample label,
- Data tables listing monitored parameter values.
- A discussion of how the test results validate equipment sizing and performance.

11 References

11.1 Incorporated Design Changes

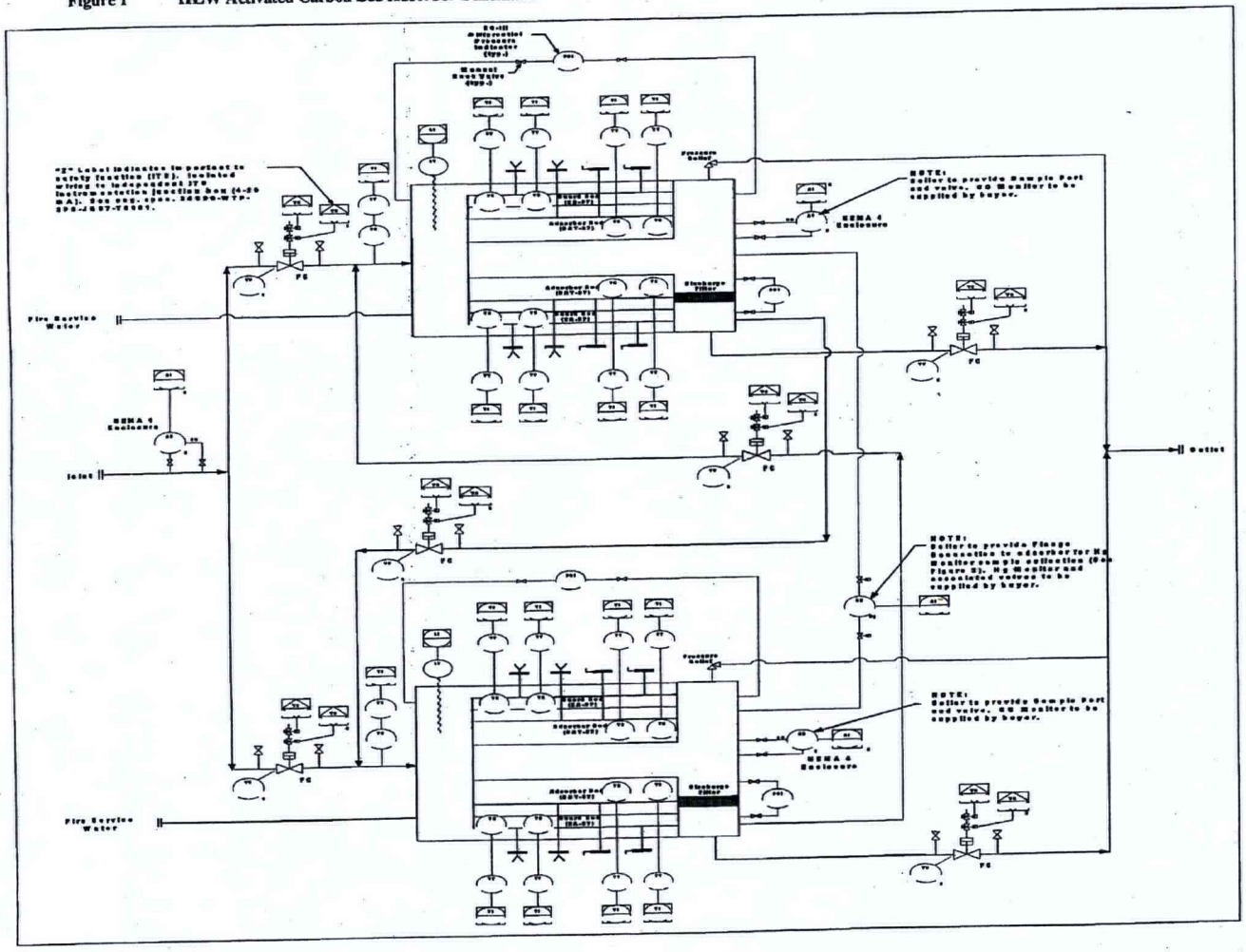
- 24590-WTP-3PN-MWK0-00001

- 24590-WTP-3PN-MWK0-00002
- 24590-WTP-SDDR-PROC-04-01020
- 24590-WTP-SDDR-PROC-04-01040
- 24590-WTP-SDDR-PROC-05-00392
- 24590-WTP-SDDR-PROC-05-00602
- 24590-WTP-SDDR-PROC-05-00652
- 24590-WTP-SDDR-PROC-05-00701
- 24590-WTP-SDDR-M-05-00018
- 24590-WTP-SDDR-MS-07-00051

11.2 Design Changes Incorporated by Reference

- 24590-WTP-SDDR-M-06-00286
- 24590-WTP-SDDR-M-06-00287

Figure 1 **HLW Activated Carbon Bed Adsorber Schematic**



Notes:

1. This figure is only intended to give a pictorial view of the offgas flow through the Activated Carbon Bed Adsorbers. Only the major components are shown. Refer to P&ID's 24590-HLW-M6-HOP-00011 and 24590-HLW-M6-HOP-20011 and the specification for all components to be included.
2. Deleted.
3. Pneumatic loading or manual system is not shown for clarity.
4. Buyer supplied mercury analyzer is pneumatically actuated to select Activated Carbon Bed Adsorber to be monitored.
5. Instrument air tubing is not shown. Instrument air shall be supplied on a common header, piped to equipment edge and flanged.
6. Seller shall supply a single electrical feed required for each Activated Carbon Bed Adsorber.
7. Except for ITS instrumentation interfaces, Seller shall supply a single instrumentation interface point for both Activated Carbon Bed Adsorbers in accordance with the requirements of Buyer specification 24590-WTP-3PS-JQ07-T0001.
8. Required PSV and vent lines for fire suppression system are not shown. System shall be per Seller's design.
9. Mercury analyzer is shown for clarity but is not included in the Seller's scope of supply. See figure 3 of this specification for Seller provided mercury probe connection flange requirements.
10. ITS solenoids identified for the isolation valves are part of actuators.
11. CO analyzers are shown for clarity but are not included in the Seller's scope of supply. Seller to provide 1/2" manual root valve for CO analyzer sample collection and return line.

Legend:

	Control Room Transmitter – Continuous Software (Operator Accessible)		Flange Connection
	Control Room Transmitter - Discrete Software (Operator Accessible)		Carbon Media Fill Chute
	Hardware – Field Mounted (Operator Accessible)		Radar or Sonic Signal (Not Guided)
	Actuated Butterfly Valve		Carbon Media Discharge
	Manual Valve		

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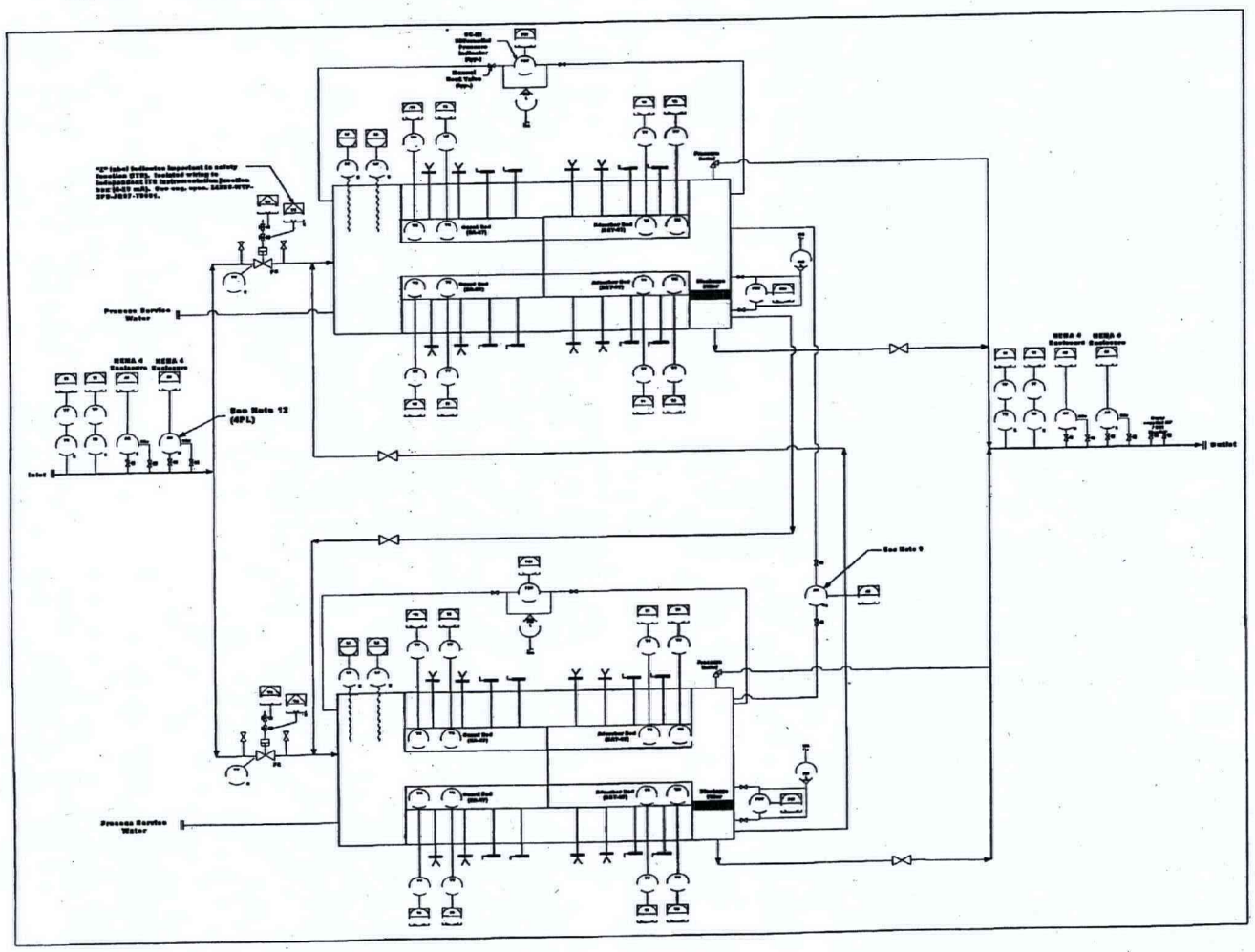
Signature: _____ Date: 4/14/08

Figure 2 **LAW Activated Carbon Bed Adsorber Schematic**



Notes:

1. This figure is only intended to give a pictorial view of the offgas flow through the Activated Carbon Bed Adsorbers. Only the major components are shown. Refer to P&ID 24590-LAW-M6-LVP-00004 and this specification for all components to be included.
2. Deleted.
3. Pneumatic loading or manual system is not shown for clarity.
4. Mercury analyzer is manually operated to select Activated Carbon Bed Adsorber to be monitored.
5. Instrument air tubing is not shown. Instrument air shall be supplied on a common header, piped to equipment edge and flanged.
6. Seller shall supply a single electrical feed required for each Activated Carbon Bed Adsorber.
7. Except for ITS instrumentation interfaces, Seller shall supply a single instrumentation interface point for both Activated Carbon Bed Adsorbers in accordance with the requirements of Buyer specification 24590-WTP-3PS-JQ07-T0001.
8. Required PSV and vent lines for fire suppression system are not shown. System shall be per Seller's design.
9. Mercury analyzer is shown for clarity but is not included the Seller's scope of supply. See figure 3 of this specification for Seller provided mercury probe flange connection requirements.
10. All transmitters and solenoids shall be remote mounted on Buyer supplied instrumentation racks located in adjacent rooms.
11. PDT's shall have rotometer ISA purges on each leg.
12. COx analyzers are shown for clarity but are not included in the Seller's scope of supply. Seller to provide 1/2" manual root valve for CO analyzer sample collection and return line.

Legend:

	Control Room Transmitter – Continuous Software (Operator Accessible)		Flange Connection
	Control Room Transmitter - Discrete Software (Operator Accessible)		Carbon Media Fill Chute
	Hardware – Field Mounted (Operator Accessible)		Radar or Sonic Signal (Not Guided)
	Actuated Butterfly Valve		Carbon Media Discharge
	Manual Valve		

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Signature: _____ Date: 4/10/08

Figure 3 Mercury Gas Monitor Probe Flange Connection

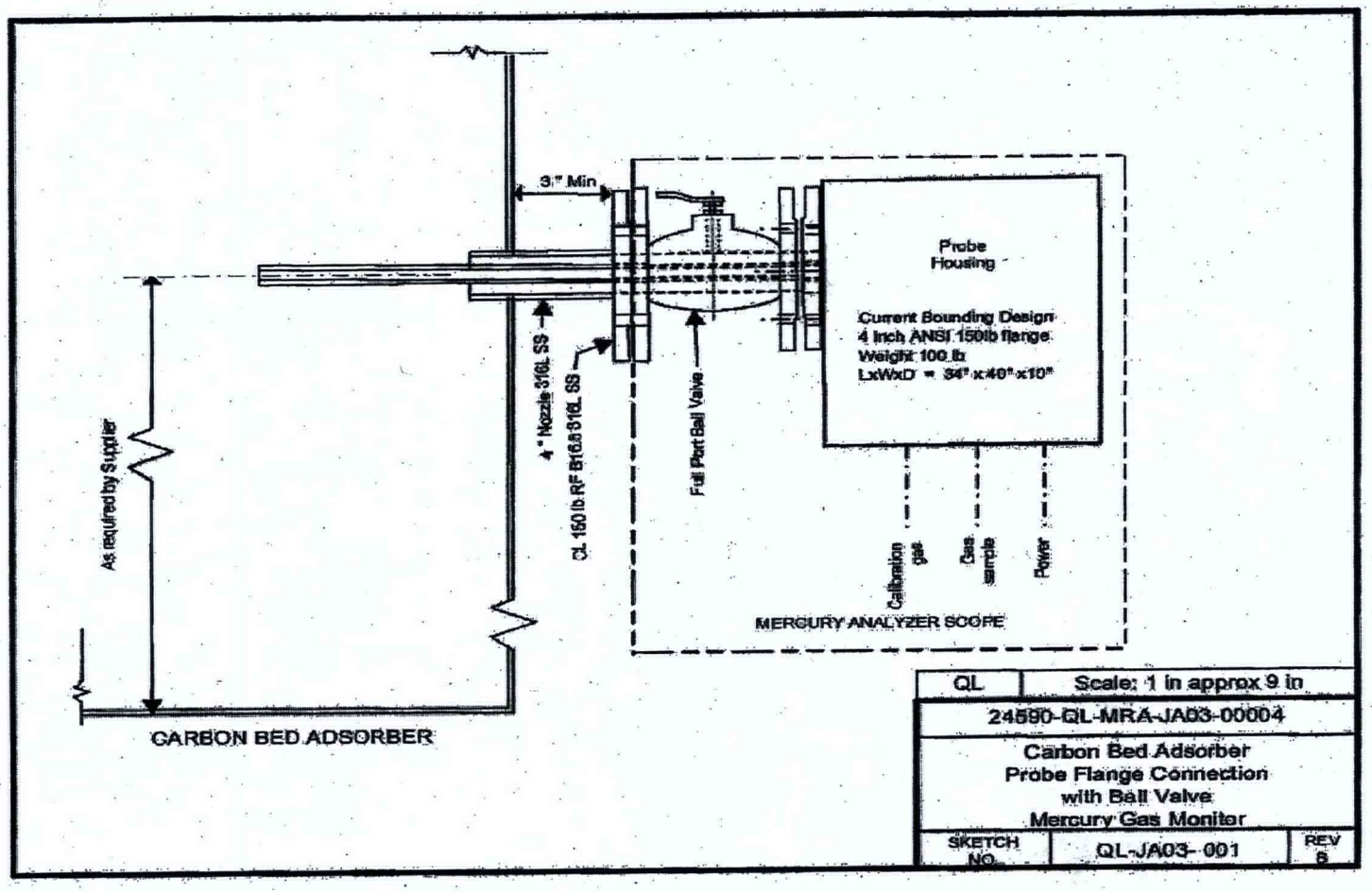

Table 1 Important to Safety Equipment List (HLW)

IMPORTANT TO SAFETY EQUIPMENT LIST

COMPONENT TAG NO.:
24590-HLW-MV-HOP-ADBR-00001A/B
24590-HLW-MV-HOP-ADBR-00002A/B

Important to Safety function for the activated carbon bed adsorber units for both HLW and LAW is defined in section 3.1.16 of engineering specification 24590-WTP-3PS-MWK0-T0001. This function is defined as containment of melter offgas during normal, maximum, and design conditions. Pressure boundary must be maintained during and post SO-III event.

Drawing Number	Item No.	Description	Material or Vendor	QTY	ITS/non-ITS	QL/CM	CQD	COMMENTS
08169 Inlet Air Slot	08169-1	Air Slot with Sample Holes	08168-1	1	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08169-2	Air Slot without Sample Holes	08168-2	1	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08169-3	Vertical Channel LH	12GA SHT 316L SS	1	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08169-4	Vertical Channel RH	12GA SHT 316L SS	1	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08169-5	Horizontal Channel	12GA SHT 316L SS	20	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08169-6	Lower Channel	12GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08169-7	Upper Channel	12GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08169-8	Vertical Flat Bar (116)	12GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08169-9	Vertical Flat Bar (123.53)	12GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08169-10	Backing Washer	12GA SHT 316L SS	3	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08169-11	Perforated Sheet (22.36)	20GA SHT 316L SS	10	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08169-12	Perforated Sheet (10.44)	20GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
08170 Outlet Air Slot	08170-1	Vertical Channel	12GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08170-2	Horizontal Channel	12GA SHT 316L SS	10	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08170-3	Lower Channel	12GA SHT 316L SS	1	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08170-4	Upper Channel	12GA SHT 316L SS	1	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08170-5	Vertical Flat Bar	12GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08170-6	Perforated Sheet (22.36)	20GA SHT 316L SS	10	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08170-7	Perforated Sheet (10.44)	20GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
08171 Bed Air Slot	08171-1	Air Slot with Sample Holes	08168-1	1	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08171-2	Air Slot without Sample Holes	08168-2	1	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08171-3	Vertical Channel	12GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08171-4	Horizontal Channel	12GA SHT 316L SS	20	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08171-5	Lower Channel	12GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08171-6	Upper Channel	12GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08171-7	Backing Washer	12GA SHT 316L SS	6	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	08171-8	Perforated Sheet (22.36)	20GA SHT 316L SS	20	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen

Drawing Number	Item No.	Description	Material or Vendor	QTY	ITS/non-ITS	QL/CM	CGD	COMMENTS
	D8171-9	Perforated Sheet (10.44)	20GA SHT 316L SS	4	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	D8171-10	Vertical Channel W/Holes	12GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
D8179	D8179-1	Inlet Air Slot with Sample Holes	D8169-1	1	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
Adsorber Assembly	D8179-2	Inlet Air Slot without Sample Holes	D8169-2	1	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	D8179-3	Outlet Air Slot	D8170	1	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	D8179-4	Bed Air Slot with Sample Holes	D8171-1	1	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	D8179-5	Bed Air Slots without Sample Holes	D8171-2	1	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen
	D8179-6	Tubing	1 1/2 OD x 0.120 WT, 316L SS	3	Non-ITS	CM	No	Does not function to contain melter offgas. This part forms part of the carbon media screen, used to fill the hole spaced used for the grab theif sample.
	D8179-7	Pipe Coupling	1-1/4 x 3000#, 316L SS	3	ITS	QL	Yes	
	D8179-8	Inlet Plate	12GA SHT 316L SS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Plate is used to channel air into the air slots and through the carbon media.
	D8179-9	Outlet Plate	12GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. Plate is used to channel air into the air slots and through the carbon media.
	D8179-10	Divider Plate	12GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. Plate is used in the top plenum of the carbon media beds to separate the different medias and aid in carbon media loading.
	D8179-11	Cover Plate	12GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. Plate is used to channel air into the air slots and through the carbon media.
D8183	D8183-1	Adsorber Assembly	D8179	1	ITS	QL	Yes*	The pipe coupling called out as part of this assembly functions to contain melter offgas, therefore, the whole assembly is designated ITS. * For item# D8183-1 should refer to drawing D8179 for the safety / quality designation and CGD requirements.
Housing Weldment	D8183-2	Back Panel	D8188-1	1	ITS	QL	Yes	
	D8183-3	Front Panel	D8188-2	1	ITS	QL	Yes	
	D8183-4	Bottom Panel	D8188-4	1	ITS	QL	Yes	
	D8183-5	Top Panel	D8188-5	1	ITS	QL	Yes	
	D8183-6	Top Panel W/Holes	D8188-6	1	ITS	QL	Yes	
	D8183-7	Top Panel	D8188-7	1	ITS	QL	Yes	
	D8183-8	Top End Panel	D8188-8	2	ITS	QL	Yes	
	D8183-9	Inlet End Panel	D8188-9	1	ITS	QL	Yes	
	D8183-10	Outlet End Panel	D8188-10	1	ITS	QL	Yes	
	D8183-11	Hopper Side Main Bed	D8188-11	8	ITS	QL	Yes	
	D8183-12	Hopper Side Guard Bed Panel	D8188-12	8	ITS	QL	Yes	
	D8183-13	Hopper End Main Bed Panel	D8188-13	8	ITS	QL	Yes	
	D8183-14	Hopper End Guard Bed Panel	D8188-14	8	ITS	QL	Yes	
	D8183-15	Hopper Bottom Panel	D8188-15	8	ITS	QL	Yes	
	D8183-16	Manway Flange	D8188-16	2	ITS	QL	Yes	
	D8183-17	Reinforcement Plate 18"	D8188-18	2	ITS	QL	Yes	
	D8183-18	Reinforcement Plate 14"	D8188-19	4	ITS	QL	Yes	
	D8183-19	Reinforcement Plate 8"	D8188-20	12	ITS	QL	Yes	
	D8183-20	Cylinder 18" I.D.	D8188-21	2	ITS	QL	Yes	
	D8183-21	Discharge Filter MTG Plate	D8198	1	Non-ITS	CM	No	Does not function to contain melter offgas. This is the internal mtk used to hold the discharge filters.
	D8183-22	Side Gate Assembly	D8215-2	8	ITS	QL	Yes	
	D8183-23	Lifting Lug	88216	4	Non-ITS	CM	No	Does not function to contain melter offgas. Lifting lugs do not form part of the pressure boundary and are only used to handle the housings for transportation and installation.
	D8183-24	Plate (126.62)	1/4 PL 316L SS	8	ITS	QL	Yes	
	D8183-25	Plate (120)	1/4 PL 316L SS	6	ITS	QL	Yes	
	D8183-26	Plate (64)	1/4 PL 316L SS	2	ITS	QL	Yes	
	D8183-27	Plate (6.25)	3/8 PL 316L SS	8	ITS	QL	Yes	
	D8183-28	Plate (5.62)	3/8 PL 316L SS	20	ITS	QL	Yes	

Drawing Number	Item No.	Description	Material or Vendor	QTY	ITS/non-ITS	QL/CM	CQD	COMMENTS
	D8183-29	I-Beam (131.88)	6 X 12.5 # HRS	9	ITS	QL	Yes	
	D8183-30	I-Beam (120)	6 X 12.5 # HRS	6	ITS	QL	Yes	
	D8183-31	I-Beam (64.5)	6 X 12.5 # HRS	2	ITS	QL	Yes	
	D8183-32	Pipe T.O.E. (4.5)	1/2 SCH 40 316L SS	1	ITS	QL	Yes	
	D8183-33	Pipe T.O.E. (12)	2 SCH 40 316L SS	1	ITS	QL	Yes	
	D8183-34	Pipe (23.62)	2 SCH 40 316L SS	1	ITS	QL	Yes	
	D8183-35	Pipe (16.00)	2 SCH 40 316L SS	1	ITS	QL	Yes	
	D8183-36	Pipe (3.00)	2 SCH 40 316L SS	1	ITS	QL	Yes	
	D8183-37	Pipe (6.88)	8 SCH 40 316L SS	12	ITS	QL	Yes	
	D8183-38	Pipe (6.38)	8 SCH 40 316L SS	8	ITS	QL	Yes	
	D8183-39	Pipe (6.38)	14 SCH 40 316L SS	1	ITS	QL	Yes	
	D8183-40	Weld Neck Flange	2 X 150# 316L SS	2	ITS	QL	Yes	
	D8183-41	Slip-on Flange	6 X 150# 316L SS	12	ITS	QL	Yes	
	D8183-42	Weld Neck Flange	14 X 150# 316L SS	4	ITS	QL	Yes	
	D8183-43	90° Elbow	2 SCH 40 316L SS	2	ITS	QL	Yes	
	D8183-44	Hex HD Bolt	HEX HD BOLT (1.75)	24	ITS	QL	Yes	
	D8183-45	Bag-out Flange	D8186-22	2	ITS	QL	Yes	
	D8183-46	Door Flange	D8186-23	2	ITS	QL	Yes	
	D8183-47	Re-Bar Flange	D8186-24	2	ITS	QL	Yes	
	D8183-48	Round Bar	1/4 DIA ROUND BAR 316L SS	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. This round bar is used to help hold a bag in place during a discharge filter bag-in/bag-out operation.
	D8183-49	Pipe Support Assy	D8228-1	1	ITS	QL	Yes	
	D8183-50	Pipe Support Assy	D8228-2	2	ITS	QL	Yes	
	D8183-51	Reinforcement PL (17.0 OD)	3/8 PL 316L SS	3	ITS	QL	Yes	
	D8183-52	Reinforcement PL (15.5 OD)	3/8 PL 316L SS	1	ITS	QL	Yes	
	D8183-53	Reinforcement PL (18 OD)	3/8 PL 316L SS	2	ITS	QL	Yes	
	D8183-54	Reinforcement PL (4.00 OD)	3/8 PL 316L SS	3	ITS	QL	Yes	
	D8183-55	Pipe Support Assy	D8574	1	ITS	QL	Yes	
	D8183-56	Plug	3/8 PL 316L SS	1	ITS	QL	Yes	
D8186 Housing WLDMT Details	D8186-1	Back Panel	3/8 PL 316L SS	1	ITS	QL	Yes	
	D8186-2	Front Panel	3/8 PL 316L SS	1	ITS	QL	Yes	
	D8186-3	Front Panel	3/8 PL 316L SS	2	ITS	QL	Yes	
	D8186-4	Bottom Panel	3/8 PL 316L SS	1	ITS	QL	Yes	
	D8186-5	Top Panel	3/8 PL 316L SS	1	ITS	QL	Yes	
	D8186-6	Top Panel w/ Hole	3/8 PL 316L SS	1	ITS	QL	Yes	
	D8186-7	Top Panel	3/8 PL 316L SS	1	ITS	QL	Yes	
	D8186-8	Top End Panel	3/8 PL 316L SS	2	ITS	QL	Yes	
	D8186-9	Inlet End Panel	3/8 PL 316L SS	1	ITS	QL	Yes	
	D8186-10	Outlet End Panel	3/8 PL 316L SS	1	ITS	QL	Yes	
	D8186-11	Hopper Side Main Bed	3/8 PL 316L SS	8	ITS	QL	Yes	
	D8186-12	Hopper Side Guard Bed Panel	3/8 PL 316L SS	8	ITS	QL	Yes	
	D8186-13	Hopper End Main Bed Panel	3/8 PL 316L SS	8	ITS	QL	Yes	
	D8186-14	Hopper End Guard Bed Panel	3/8 PL 316L SS	8	ITS	QL	Yes	
	D8186-15	Hopper Bottom Panel	3/8 PL 316L SS	8	ITS	QL	Yes	
	D8186-16	Manway Flange	3/4 PL 316L SS	2	ITS	QL	Yes	
	D8186-17	Manway Cover	1/2 PL 316L SS	2	ITS	QL	Yes	
	D8186-18	Reinforcement Plate 16"	3/4 X 1 RECT BAR 316L SS	2	ITS	QL	Yes	
	D8186-19	Reinforcement Plate 14"	3/4 X 1 RECT BAR 316L SS	1	ITS	QL	Yes	
	D8186-20	Reinforcement Plate 8"	3/8 X 1 RECT BAR 316L SS	12	ITS	QL	Yes	
	D8186-21	Cylinder 18" I.D.	3/16 PL 316L SS	2	ITS	QL	Yes	
	D8186-22	Bag-out Flange	3/16 PL 316L SS	2	ITS	QL	Yes	
	D8186-23	Door Flange	3/4 X 3 RECT BAR 316L SS	2	ITS	QL	Yes	
	D8186-24	Re-Bar Flange	1 X 3 RECT BAR 316L SS	2	ITS	QL	Yes	
D8196 Discharge Filter MTG Plate	D8196-1	Plate (32.88)	1/4 PL 316L SS	1	Non-ITS	CM	No	Does not function to contain melter offgas. This is the internal rack used to hold the discharge filters.
	D8196-2	Plate (33.38)	1/4 PL 316L SS	1	Non-ITS	CM	No	Does not function to contain melter offgas. This is the internal rack used to hold the discharge filters.
	D8196-3	Plate (23.75)	1/4 PL 316L SS	1	Non-ITS	CM	No	Does not function to contain melter offgas. This is the internal rack used to hold the discharge filters.
	D8196-4	Plate (21.75)	1/4 PL 316L SS	4	Non-ITS	CM	No	Does not function to contain melter offgas. This is the internal rack used to hold the discharge filters.

Drawing Number	Item No.	Description	Material or Vendor	QTY	ITS/non-ITS	QL/CM	CGD	COMMENTS
	D8186-5	Z-Bar (6.19)	12GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. This is the internal rack used to hold the discharge filters.
	D8186-6	Z-Bar (6.99)	12GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. This is the internal rack used to hold the discharge filters.
	D8186-7	Strip	20GA SHT 316L SS	4	Non-ITS	CM	No	Does not function to contain melter offgas. This is the internal rack used to hold the discharge filters.
	D8186-8	Pull Rod	18GA SHT 316L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. This is used to help remove the discharge filters during the bag in/bag-out operation.
D8215 Slide Gate Assembly	D8215-1	Pipe	6 SCH 40 316L SS	1	ITS	QL	Yes	
	D8215-2	Flange	1 PLATE 316L SS	1	ITS	QL	Yes	
	D8215-3	Flange	1 PLATE 316L SS	1	ITS	QL	Yes	
	D8215-4	Slide	7GA SHT 316L SS	1	ITS	QL	Yes	
	D8215-5	O-Ring	1/4 DIA SOLID NEOPRENE	1	ITS	QL	Yes	
	D8215-6	Hex HD Bolt	3/4-10UNC 316 SS	8	ITS	QL	Yes	
	D8215-7	Hex Nut	3/4-10UNC 316 SS	8	ITS	QL	Yes	
	D8215-8	Lock Washer	3/4 I.D. 316 SS	8	ITS	QL	Yes	
D8217	D8217-1	Adsorber Assembly	D8179	1	ITS	QL	Yes*	The pipe coupling spiled out as part of this assembly functions to contain melter offgas, therefore, the whole assembly is designated ITS. * For item# D8217-1 should refer to drawing D8179 for the safety / quality designation and CGD requirements.
Housing Weldment	D8217-2	Back Panel	D8186-1	1	ITS	QL	Yes	
	D8217-3	Front Panel	D8186-3	1	ITS	QL	Yes	
	D8217-4	Bottom Panel	D8186-4	1	ITS	QL	Yes	
	D8217-5	Top Panel	D8186-5	1	ITS	QL	Yes	
	D8217-6	Top Panel W/Holes	D8186-6	1	ITS	QL	Yes	
	D8217-7	Top Panel	D8186-7	1	ITS	QL	Yes	
	D8217-8	Top End Panel	D8186-8	2	ITS	QL	Yes	
	D8217-9	Inlet End Panel	D8186-9	1	ITS	QL	Yes	
	D8217-10	Outlet End Panel	D8186-10	1	ITS	QL	Yes	
	D8217-11	Hopper Side Main Bed	D8186-11	6	ITS	QL	Yes	
	D8217-12	Hopper Side Guard Bed Panel	D8186-12	6	ITS	QL	Yes	
	D8217-13	Hopper End Main Bed Panel	D8186-13	6	ITS	QL	Yes	
	D8217-14	Hopper End Guard Bed Panel	D8186-14	6	ITS	QL	Yes	
	D8217-15	Hopper Bottom Panel	D8186-15	6	ITS	QL	Yes	
	D8217-16	Manway Flange	D8186-16	2	ITS	QL	Yes	
	D8217-17	Reinforcement Plate 16"	D8186-18	2	ITS	QL	Yes	
	D8217-18	Reinforcement Plate 14"	D8186-19	4	ITS	QL	Yes	
	D8217-19	Reinforcement Plate 8"	D8186-20	12	ITS	QL	Yes	
	D8217-20	Cylinder 18" I.D.	D8186-21	2	ITS	QL	Yes	
	D8217-21	Discharge Filter MTG Plate	D8186	1	Non-ITS	CM	No	Does not function to contain melter offgas. This is the internal rack used to hold the discharge filters.
	D8217-22	Slide Gate Assembly	D8215-2	6	ITS	QL	Yes	
	D8217-23	Lifting Lug	SS316	4	Non-ITS	CM	No	Does not function to contain melter offgas. Lifting lugs do not form part of the pressure boundary and are only used to handle the housings for transportation and installation.
	D8217-24	Plate (126.62)	1/4 PL 316L SS	6	ITS	QL	Yes	
	D8217-25	Plate (120)	1/4 PL 316L SS	6	ITS	QL	Yes	
	D8217-26	Plate (64)	1/4 PL 316L SS	2	ITS	QL	Yes	
	D8217-27	Plate (6.25)	3/8 PL 316L SS	6	ITS	QL	Yes	
	D8217-28	Plate (5.62)	3/8 PL 316L SS	20	ITS	QL	Yes	
	D8217-29	I-Beam (131.88)	6 X 12.5 # HRS	6	ITS	QL	Yes	
	D8217-30	I-Beam (120)	6 X 12.5 # HRS	6	ITS	QL	Yes	
	D8217-31	I-Beam (64.5)	6 X 12.5 # HRS	2	ITS	QL	Yes	
	D8217-32	Pipe T.O.E. (4.5)	1/2 SCH 40 316L SS	1	ITS	QL	Yes	
	D8217-33	Pipe T.O.E. (12)	2 SCH 40 316L SS	1	ITS	QL	Yes	
	D8217-34	Pipe (23.62)	2 SCH 40 316L SS	1	ITS	QL	Yes	
	D8217-35	Pipe (18.00)	2 SCH 40 316L SS	1	ITS	QL	Yes	
	D8217-36	Pipe (3.00)	2 SCH 40 316L SS	1	ITS	QL	Yes	
	D8217-37	Pipe (8.88)	8 SCH 40 316L SS	12	ITS	QL	Yes	
	D8217-38	Pipe (6.38)	8 SCH 40 316L SS	6	ITS	QL	Yes	
	D8217-39	Pipe (6.38)	14 SCH 40 316L SS	1	ITS	QL	Yes	

Drawing Number	Item No.	Description	Material or Vendor	QTY	ITS/non-ITS	QL/CM	CQD	COMMENTS
	D8217-40	Weld Neck Flange	2 X 150# 316L SS	2	ITS	QL	Yes	
	D8217-41	Slip-on Flange	6 X 150# 316L SS	12	ITS	QL	Yes	
	D8217-42	Weld Neck Flange	14 X 150# 316L SS	4	ITS	QL	Yes	
	D8217-43	90° Elbow	2 SCH 40 316L SS	2	ITS	QL	Yes	
	D8217-44	Hex HD Bolt	HEX HD BOLT (1.75)	24	ITS	QL	Yes	
	D8217-45	Bag-out Flange	D8188-22	2	ITS	QL	Yes	
	D8217-46	Door Flange	D8188-23	2	ITS	QL	Yes	
	D8217-47	Re-Ber Flange	D8188-24	2	ITS	QL	Yes	
	D8217-48	Round Bar	1/4 DIA ROUND BAR 316L SS	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. This round bar is used to help hold a bag in place during a discharge filter bag-in/bag-out operation.
	D8217-49	Pipe Support Assy	D8228-1	1	ITS	QL	Yes	
	D8217-50	Pipe Support Assy	D8229-2	2	ITS	QL	Yes	
	D8217-51	Reinforcement PL (17.0 OD)	3/8 PL 316L SS	3	ITS	QL	Yes	
	D8217-52	Reinforcement PL (15.5 OD)	3/8 PL 316L SS	1	ITS	QL	Yes	
	D8217-53	Reinforcement PL (18 OD)	3/8 PL 316L SS	2	ITS	QL	Yes	
	D8217-54	Reinforcement PL (8.00 OD)	3/8 PL 316L SS	3	ITS	QL	Yes	
	D8217-55	Plug	3/8 PL 316L SS	1	ITS	QL	Yes	
D8216 Base Frame Assembly	D8216-1	W-Beam (278.60)	8 X 31# HRS ASTM A-36	2	ITS	QL	Yes	
	D8216-2	W-Beam (88.96)	6 X 31# HRS ASTM A-36	4	ITS	QL	Yes	
	D8216-3	W-Beam (46.80)	10 X 31# HRS ASTM A-36	6	ITS	QL	Yes	
	D8216-4	Plate	1.0 PL HRS ASTM A-36	6	ITS	QL	Yes	
	D8216-5	Channel (7.12)	4 X 5.4# HRS ASTM A-36	2	ITS	QL	Yes	
	D8216-6	Channel (81.25)	4 X 5.4# HRS ASTM A-36	1	ITS	QL	Yes	
D8220 Ladder Assembly	D8220-1	Flat Bar (191.5)	1/2 X 2 1/2 FL HRS ASTM A-36	2	Non-ITS	CM	No	Does not function to contain melter offgas. Ladder and all associated parts are external to the pressure boundary and form part of the maintenance platform.
	D8220-2	Flat Bar (35.5)	1/2 X 2 1/2 FL HRS ASTM A-36	2	Non-ITS	CM	No	Does not function to contain melter offgas. Ladder and all associated parts are external to the pressure boundary and form part of the maintenance platform.
	D8220-3	Flat Bar (5.5)	1/2 X 2 1/2 FL HRS ASTM A-36	2	Non-ITS	CM	No	Does not function to contain melter offgas. Ladder and all associated parts are external to the pressure boundary and form part of the maintenance platform.
	D8220-4	Flat Bar (10.25)	1/4 X 2 FL HRS ASTM A-36	2	Non-ITS	CM	No	Does not function to contain melter offgas. Ladder and all associated parts are external to the pressure boundary and form part of the maintenance platform.
	D8220-5	Pipe	3/4 BAR C8	16	Non-ITS	CM	No	Does not function to contain melter offgas. Ladder and all associated parts are external to the pressure boundary and form part of the maintenance platform.
	D8220-6	Flat Bar (13.06)	1/4 X 2 FL HRS ASTM A-36	2	Non-ITS	CM	No	Does not function to contain melter offgas. Ladder and all associated parts are external to the pressure boundary and form part of the maintenance platform.
	D8220-7	Flat Bar (6.00)	1/4 X 2 FL HRS ASTM A-36	2	Non-ITS	CM	No	Does not function to contain melter offgas. Ladder and all associated parts are external to the pressure boundary and form part of the maintenance platform.
D8222 Housing Assembly	D8222-1	Housing Weldment Unit A	D8183	1	ITS	QL	Yes	
	D8222-2	Manway Cover	D8188-17	2	ITS	QL	Yes	
	D8222-3	Slide Gate Assembly	D8215	6	ITS	QL	Yes	
	D8222-4	Access Door Discharge Filter	D8224	2	ITS	QL	Yes	
	D8222-5	Carbon Sample Plug Assembly	D8284	3	ITS	QL	Yes	
	D8222-6	Electrical Enclosure/gauge panel assy Unit A	D8285	1	ITS	QL	Yes*	PDITs contain a small amount of melter offgas making the pressure boundary function of the PDIT's an ITS function. This makes the assembly ITS. * For Item# D8222-6 should refer to drawing D8285 for the safety / quality designation and CQD requirements.
	D8222-7	Blind Flange Modified	8 X 150# 316L SS	3	ITS	QL	Yes	
	D8222-8	Blind Flange	6 X 150# 316L SS	6	ITS	QL	Yes	
	D8222-9	Pipe Plug	1 1/4 X 150# 316L SS	3	ITS	QL	Yes	
	D8222-10	Pipe Coupling	1-1/4 X 3000# 316L SS	3	ITS	QL	Yes	
	D8222-11	Pipe Coupling	1 1/2 X 3000# 316L SS	1	ITS	QL	Yes	
	D8222-12	Pipe T.O.E. (6.38)	1/2 SCH 40 316L SS	5	ITS	QL	Yes	
	D8222-13	Pipe T.O.E. (19.38)	1/2 SCH 40 316L SS	2	ITS	QL	Yes	

Drawing Number	Item No.	Description	Material or Vendor	QTY	ITS/non-ITS	QL/CM	CGD	COMMENTS
	D8222-14	Thermowell (27")	B8309-2	1	ITS	QL	Yes	
	D8222-15	Thermowell (46")	B8309-3	4	ITS	QL	Yes	
	D8222-16	Thermowell (80")	B8309-4	4	ITS	QL	Yes	
	D8222-17	Temperature Element (27")	2904100-015	1	ITS	CM	No	Additional Protection Class (APC), may be purchased as commercial component.
	D8222-18	Temperature Element (46")	2904100-015	4	ITS	CM	No	Additional Protection Class (APC), may be purchased as commercial component.
	D8222-19	Temperature Element (80")	2904100-015	1	ITS	CM	No	Additional Protection Class (APC), may be purchased as commercial component.
	D8222-20	Radar Level Detector	2904100-017	1	ITS	QL	Yes	
	D8222-21	Manual Valve 1/2"	2904100-019	8	ITS	QL	Yes	
	D8222-22	Ball Valve 2"	2904100-020	1	ITS	QL	Yes	
	D8222-23	Gasket B/O Door 3/8THK x 1WD	Silicone Closed Cell Sponge	128	ITS	QL	Yes	
	D8222-24	Gasket 8" Flange		12	ITS	QL	Yes	
	D8222-25	Gasket Manway 3/8THK x 1WD		2	ITS	QL	Yes	
	D8222-26	Hex Nut	1/2-13UNC 316 SS	24	ITS	QL	Yes	
	D8222-27	Hex Nut	3/4-10UNC 316 SS	224	ITS	QL	Yes	
	D8222-28	Hex HD Bolt (2.5)	3/4-10UNC 316 SS	32	ITS	QL	Yes	
	D8222-29	Hex HD Bolt (3.5)	3/4-10UNC 316 SS	192	ITS	QL	Yes	
	D8222-30	Flat Washer	1/2 I.D. 316 SS	24	ITS	QL	Yes	
	D8222-31	Flat Washer	3/4 I.D. 316 SS	224	ITS	QL	Yes	
	D8222-32	DELETED						
	D8222-33	Solenoid Valve 1/2"	2904100-022	1	ITS	QL	Yes	
D8223 Housing Assembly	D8223-1	Housing Weldment Unit B	D8217	1	ITS	QL	Yes	
	D8223-2	Manway Cover	D8188-17	2	ITS	QL	Yes	
	D8223-3	Slide Gate Assembly	D8215	8	ITS	QL	Yes	
	D8223-4	Access Door Discharge Filter	D8224	2	ITS	QL	Yes	
	D8223-5	Carbon Sample Plug Assembly	B8284	3	ITS	QL	Yes	
	D8223-6	Electrical Enclosure/gauge panel assy Unit A	D8286	1	ITS	QL	Yes *	PDITs contain a small amount of methyl oligas making the pressure boundary function of the PDITs an ITS function. This makes the assembly ITS. * For item# D8223-6 should refer to drawing D8285 for the safety / quality designation and CGD requirements.
	D8223-7	Blind Flange Modified	8 X 150# 316L SS	3	ITS	QL	Yes	
	D8223-8	Blind Flange	8 X 150# 316L SS	8	ITS	QL	Yes	
	D8223-9	Pipe Plug	1 1/4 X 150# 316L SS	3	ITS	QL	Yes	
	D8223-10	Pipe Coupling	1 1/4 X 3000# 316L SS	3	ITS	QL	Yes	
	D8223-11	Pipe Coupling	1 1/2 X 3000# 316L SS	1	ITS	QL	Yes	
	D8223-12	Pipe T.O.E. (9.36)	1/2 SCH 40 316L SS	5	ITS	QL	Yes	
	D8223-13	Pipe T.O.E. (19.36)	1/2 SCH 40 316L SS	2	ITS	QL	Yes	
	D8223-14	Thermowell (27")	B8309-2	1	ITS	QL	Yes	
	D8223-15	Thermowell (46")	B8309-3	4	ITS	QL	Yes	
	D8223-16	Thermowell (80")	B8309-4	4	ITS	QL	Yes	
	D8223-17	Temperature Element (27")	2904100-015	1	ITS	CM	No	Additional Protection Class (APC), may be purchased as commercial component.
	D8223-18	Temperature Element (46")	2904100-015	4	ITS	CM	No	Additional Protection Class (APC), may be purchased as commercial component.
	D8223-19	Temperature Element (80")	2904100-015	1	ITS	CM	No	Additional Protection Class (APC), may be purchased as commercial component.
	D8223-20	Radar Level Detector	2904100-017	1	ITS	QL	Yes	
	D8223-21	Manual Valve 1/2"	2904100-019	8	ITS	QL	Yes	
	D8223-22	Ball Valve 2"	2904100-020	1	ITS	QL	Yes	
	D8223-23	Gasket B/O Door 3/8THK x 1WD	Silicone Closed Cell Sponge	128	ITS	QL	Yes	
	D8223-24	Gasket 8" Flange		12	ITS	QL	Yes	
	D8223-25	Gasket Manway 3/8THK x 1WD		2	ITS	QL	Yes	
	D8223-26	Hex Nut	1/2-13UNC 316 SS	24	ITS	QL	Yes	
	D8223-27	Hex Nut	3/4-10UNC 316 SS	224	ITS	QL	Yes	
	D8223-28	Hex HD Bolt (2.5)	3/4-10UNC 316 SS	32	ITS	QL	Yes	
	D8223-29	Hex HD Bolt (3.5)	3/4-10UNC 316 SS	192	ITS	QL	Yes	
	D8223-30	Flat Washer	1/2 I.D. 316 SS	24	ITS	QL	Yes	
	D8223-31	Flat Washer	3/4 I.D. 316 SS	224	ITS	QL	Yes	
	D8223-32	DELETED						

Drawing Number	Item No.	Description	Material or Vendor	QTY	ITS/non-ITS	QL/CM	CGD	COMMENTS
	D8226-33	Solenoid Valve 1/2"	2904100-022	1	ITS	QL	Yes	
D8224 Access Door Discharge Filter	D8224-1	Plate-1	3/16 PL 316L SS	1	ITS	QL	Yes	
	D8224-2	Plate-2	3/16 PL 316L SS	2	ITS	QL	Yes	
	D8224-3	Plate-3	3/16 PL 316L SS	2	ITS	QL	Yes	
	D8224-4	Flat bar-1	3/4 X 2 RECT BAR 316L SS	2	ITS	QL	Yes	
	D8224-5	Flat bar-2	3/4 X 2 RECT BAR 316L SS	2	ITS	QL	Yes	
	D8224-6	Flat bar-3	1/4 X 2 RECT BAR 316L SS	1	Non-ITS	CM	No	Does not function to contain melter offgas. This bar is used to make a lifting lug for the access door.
D8228	D8228-1	I-Beam (25')	4 X 7.76 HRS ASTM A-36	1	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.
Crane Trolley Assembly	D8228-2	Square Tube (91.25)	4 X 4 X 1/4 WT HRS	4	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.
	D8228-3	Square Tube (113.75)	4 X 4 X 1/4 WT HRS	6	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.
	D8228-4	Angle (8.00)	2 X 2 X 1/4 WT HRS	7	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.
	D8228-5	Angle (3.00)	2 X 2 X 1/4 WT HRS	2	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.
	D8228-6	Angle (3.00)	2 X 2 X 1/4 WT HRS	2	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.
	D8228-7	Flat Bar (8.00)	1/4 X 2 FL HRS ASTM A-36	1	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.
	D8228-8	Flat Bar (87.56)	1/4 X 2 FL HRS ASTM A-36	2	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.
	D8228-9	Plate (3.00 X 4.00)	1/4 PL HRS ASTM A-36	1	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.
	D8228-10	Plate (8.00 X 8.00)	1/4 PL HRS ASTM A-36	3	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.
	D8228-11	Plate (8.00 X 8.00)	1/4 PL HRS ASTM A-36	1	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.
	D8228-12	Plate (7.00 X 7.00)	1/4 PL HRS ASTM A-36	6	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.
	D8228-13	Hex HD Bolt (2.00)	1/2-13UNC GR 8 PL	20	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.
	D8228-14	Hex Nut	1/2-13UNC GR 8 PL	20	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.
	D8228-15	Lock Washer	1/2 NOM ID GR 8 PL	20	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.
	D8228-16	Electric Hoist	McMaster - Carr	1	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.
D8229 Pipe Support Assembly	D8229-1	Pipe Support with Gusset	D8229-1	1	ITS	QL	Yes	
	D8229-2	Pipe Support without Gusset	D8229-2	1	ITS	QL	Yes	
	D8229-3	I-Beam	6 X 12.5# HRS ASTM A-36	2	ITS	QL	Yes	
	D8229-4	Angle	2 X 2 X 1/4 WT HRS ASTM A-36	1	ITS	QL	Yes	
	D8229-5	Plate (1.50 X 7.00)	1/4 PL 316L SS	2	ITS	QL	Yes	
	D8229-6	Plate (0.50 X 1.50)	1/4 PL 316L SS	4	ITS	QL	Yes	

Drawing Number	Item No.	Description	Material or Vendor	QTY	ITS/non-ITS	QL/CM	CQD	COMMENTS
	D8229-7	Sheet	12GA SHT 316L SS	2	ITS	QL	Yes	
	D8229-9	Stud	1/2-13UNC X 3.0 LG, 316L SS	4	ITS	QL	Yes	
	D8229-9	SQ Beveled Washer	18-8 SS	4	ITS	QL	Yes	
	D8229-10	Hex Nut	1/2-13UNC 316 SS	4	ITS	QL	Yes	
D8250	D8250-1	Channel (23.28 X 126.00)	3/16 PL HRS ASTM A-36	2	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
Platform Assembly	D8250-2	Channel (11.4 X 272.50)	3/16 PL HRS ASTM A-36	3	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-3	Channel (9.9 X 91.25)	3/16 PL HRS ASTM A-36	3	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-4	Channel (9.9 X 28.56)	3/16 PL HRS ASTM A-36	10	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-5	Channel (11.4 X 6.00)	3/16 PL HRS ASTM A-36	6	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-6	Pipe (278.40)	1 1/2 SCH 40 CS	2	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-7	Pipe (30.40)	1 1/2 SCH 40 CS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-8	Pipe (19.40)	1 1/2 SCH 40 CS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-9	Pipe (71.60)	1 1/2 SCH 40 CS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-10	Pipe (48.15)	1 1/2 SCH 40 CS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-11	Pipe (40.50)	1 1/2 SCH 40 CS	6	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-12	Pipe (40.50)	1 1/2 SCH 40 CS	4	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-13	Pipe (41.96)	1 1/2 SCH 40 CS	4	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-14	Pipe (88.73)	1 1/2 SCH 40 CS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-15	Pipe (58.10)	1 1/2 SCH 40 CS	8	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-16	Pipe (56.23)	1 1/2 SCH 40 CS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-17	Pipe (45.23)	1 1/2 SCH 40 CS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-18	Pipe (27.48)	1 1/2 SCH 40 CS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-19	Pipe (36.48)	1 1/2 SCH 40 CS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.

Drawing Number	Item No.	Description	Material or Vendor	QTY	ITS/non-ITS	QL/CM	CGD	COMMENTS
	D8250-20	Angle (6.88 X 7.70)	3/16 PL HRS ASTM A-36	2	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-21	Plate (7.00 X 7.00)	1/4 PL HRS ASTM A-36	8	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-22	Plate (5.50 X 7.00)	1/4 PL HRS ASTM A-36	2	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-23	Plate (3.5 X 7.00)	1/4 PL HRS ASTM A-36	8	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-24	Hook (3.00)	1/4 DIA BAR HRS ASTM A-36	2	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-25	Bracket (2.25)	1/4 X 2 FL HRS ASTM A-36	4	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-26	Plate (2.81 X 17.50)	3/16 PL HRS ASTM A-36	8	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-27	Plate (2.81 X 6.62)	3/16 PL HRS ASTM A-36	8	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-28	Flat Bar (276.50)	1/4 X 4 FL HRS ASTM A-36	2	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-29	Flat Bar (124.00)	1/4 X 4 FL HRS ASTM A-36	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-30	Flat Bar (69.75)	1/4 X 4 FL HRS ASTM A-36	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-31	Flat Bar (28.50)	1/4 X 2 FL HRS ASTM A-36	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-32	Chain (28.00)	3/16 304L SS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-33	Chain (82.50)	3/16 304L SS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-34	Grating (26.12 WD X 88.0 LG)	1 1/2 X 3/16 BEARING BAR	2	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-35	Grating (26.12 WD X 76.0 LG)	1 1/2 X 3/16 BEARING BAR	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-36	Grating (29.88 WD X 76.0 LG)	1 1/2 X 3/16 BEARING BAR	3	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-37	Grating (29.88 WD X 26.5 LG)	1 1/2 X 3/16 BEARING BAR	0	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-38	Angle (26.56)	1 1/2 X 1 1/2 X 3/16 ASTM A-36	2	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-39	Angle (63.25)	1 1/2 X 1 1/2 X 3/16 ASTM A-36	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.

Drawing Number	Item No.	Description	Material or Vendor	QTY	ITS/non-ITS	QL/CM	COD	COMMENTS
	D8250-40	Angle (91.25)	1 1/2 X 1 1/2 X 3/16 ASTM A-36	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-41	Channel (8.90 X 93.25)	5/16 PL HRS ASTM A-36	3	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8250-42	Grating Retainer Plate (3.00 X 4.00)	3/16 PL HRS ASTM A-36	12	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
D8251	D8251-1	Channel (23.28 X 129.00)	3/16 PL HRS ASTM A-36	2	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
Platform Assembly	D8251-2	Channel (11.4 X 272.50)	3/16 PL HRS ASTM A-36	3	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8251-3	Channel (9.9 X 91.25)	3/16 PL HRS ASTM A-36	3	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8251-4	Channel (9.9 X 28.56)	3/16 PL HRS ASTM A-36	10	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8251-5	Channel (11.4 X 6.00)	3/16 PL HRS ASTM A-36	6	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8251-6	Pipe (276.40)	1 1/2 SCH 40 CS	2	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8251-7	Pipe (30.40)	1 1/2 SCH 40 CS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8251-8	Pipe (19.40)	1 1/2 SCH 40 CS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8251-9	Pipe (71.86)	1 1/2 SCH 40 CS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8251-10	Pipe (46.15)	1 1/2 SCH 40 CS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8251-11	Pipe (40.50)	1 1/2 SCH 40 CS	6	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8251-12	Pipe (40.50)	1 1/2 SCH 40 CS	4	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8251-13	Pipe (41.96)	1 1/2 SCH 40 CS	4	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8251-14	Pipe (68.73)	1 1/2 SCH 40 CS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8251-15	Pipe (68.10)	1 1/2 SCH 40 CS	8	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8251-16	Pipe (59.23)	1 1/2 SCH 40 CS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8251-17	Pipe (45.23)	1 1/2 SCH 40 CS	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.

Drawing Number	Item No.	Description	Material or Vendor	QTY.	ITS/non-ITS	QL/CM	CGD	COMMENTS
	D8261-38	Angle (28.56)	1 1/2 X 1 1/2 X 3/16 ASTM A-36	2	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8261-39	Angle (65.25)	1 1/2 X 1 1/2 X 3/16 ASTM A-36	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8261-40	Angle (91.25)	1 1/2 X 1 1/2 X 3/16 ASTM A-36	1	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8261-41	Channel (9.80 X 83.25)	3/16 PL HRS ASTM A-36	3	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
	D8261-42	Grating Retainer Plate (3.00 X 4.00)	3/16 PL HRS ASTM A-36	12	Non-ITS	CM	No	Does not function to contain melter offgas. Platform assembly and all associated parts are external to the pressure boundary and are used for maintenance operations.
D8282 Piping Assembly 14"	D8282-1	Inlet Pipe Assembly	D8282-1	1	ITS	QL	Yes	
	D8282-2	Crossover Pipe Assembly	D8282-2	1	ITS	QL	Yes	
	D8282-3	Outlet Pipe Assembly	D8282-3	1	ITS	QL	Yes	
	D8282-4	Crossover Pipe Assembly	D8282-4	1	ITS	QL	Yes	
	D8282-5	Butterfly Valve W/ Operator	2904100-009 W/ 2904100-011	6	ITS	QL	Yes	
	D8282-6	Weld Neck Flange	14 X 150# 316L SS	18	ITS	QL	Yes	
	D8282-7	Weld Neck Flange	2 X 150# 316L SS	1	ITS	QL	Yes	
	D8282-8	90° Elbow LR	14 SCH 40 316L SS	5	ITS	QL	Yes	
	D8282-9	Straight Tee	14 SCH 40 316L SS	2	ITS	QL	Yes	
	D8282-10	Pipe (Cut at Assembly)	14 SCH 10 316L SS	466 in	ITS	QL	Yes	
	D8282-11	Pipe (8.19)	2 SCH 40 316L SS	1	ITS	QL	Yes	
	D8282-12	Pipe T.O.E. (10.00)	1/2 SCH 40 316L SS	1	ITS	QL	Yes	
	D8282-13	Pipe T.O.E. (0.19)	1/2 SCH 40 316L SS	11	ITS	QL	Yes	
	D8282-14	DELETED						
	D8282-15	Manual Valve 1/2"	2904100-019	12	ITS	QL	Yes	
	D8282-16	Thermowell	58309-1	1	ITS	QL	Yes	
	D8282-17	Hex HD Bolt	1-8UNC 316 SS	120	ITS	QL	Yes	
	D8282-18	Flat Washer	316 SS	120	ITS	QL	Yes	
	D8282-19	Bellows Ass'y	2904100-021	4	ITS	QL	Yes	
	D8282-20	90° Elbow SR	14 SCH 40 316L SS	1	ITS	QL	Yes	
D8285 Electrical Enclosure	D8285-1	Panel (12.00 X 62.80)	12GA SHT 316L SS	1	ITS	QL	Yes	Panel is used for mounting of the PDITs which have an ITS pressure boundary function.
	D8285-2	Z-Bar 60"	7GA SHT 316L SS	1	ITS	QL	Yes	Used to mount the electrical enclosures with PDITs to the carbon bed adsorber units. PDITs have an ITS pressure boundary function.
	D8285-3	Enclosure	Hoffman	1	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-4	Sub-Panel	Hoffman	1	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-5	Temp. Transmitter	2904100-008	9	ITS	CM	No	Additional Protection Class (APC), may be purchased as commercial component.
	D8285-6	Diff. Press. X-Mitter	2904100-010	2	ITS	QL	Yes	
	D8285-7	5 Valve Manifold	Swagelok	2	ITS	QL	Yes	
	D8285-8	Mounting Channel	Allen Bradley	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-9	End Plate	Allen Bradley	10	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-10	End Clamp	Allen Bradley	5	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-11	Marker Card	Allen Bradley	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.

Drawing Number	Item No.	Description	Material or Vender	QTY	ITS/non-ITS	QL/CM	CGD	COMMENTS
	D8285-12	Terminal	Allen Bradley	166	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-13	Circuit Breaker	Allen Bradley	3	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-14	Spur Block J-Box	Pepperl+Fuchs	2	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-15	Profibus DP Station	2904100-043	1	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-16	Fiber Optic Repeater	2904100-041	1	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-17	Fiber Optic Housing	2904100-042	1	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-18	Power Supply	Phoenix	1	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-19	External GFCI Recpt.	Grace	2	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-20	Wire Duct	Panduit	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-21	Duct Cover	Panduit	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-22	Wire Duct	Panduit	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-23	Duct Cover	Panduit	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-24	Duct Cover	Panduit	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-25	Wire Duct	Panduit	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-26	Hex Nut	3/8-16UNC 316 SS	12	ITS	QL	Yes	
	D8285-27	Hex HD Bolt 1.00 LG	3/8-16UNC 316 SS	8	ITS	QL	Yes	
	D8285-28	Hex HD Bolt 2.00 LG	3/8-16UNC 316 SS	4	ITS	QL	Yes	
	D8285-29	Lock Washer	3/8-16UNC 316 SS	12	ITS	QL	Yes	
	D8285-30	TVSS	Ferraz Shawmut	1	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-31	Enclosure	Hoffman	2	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8285-32	Circuit Breaker	Allen Bradley	1	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
D8286	D8286-1	Panel (12.00 X 62.50)	12GA SHT 316L SS	1	ITS	QL	Yes	Panel is used for mounting of the PDITs which have an ITS pressure boundary function.
Electrical Enclosure	D8286-2	Z-Bar 50"	7GA SHT 316L SS	1	ITS	QL	Yes	Used to mount the electrical enclosures with PDITs to the carbon bed adsorber units. PDITs have an ITS pressure boundary function.
	D8286-3	Enclosure	Hoffman	1	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-4	Sub-Panel	Hoffman	1	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-5	Temp. Transmitter	2904100-008	9	ITS	CM	No	Additional Protection Class (APC), may be purchased as commercial component.
	D8286-6	Diff. Press. X-Mitter	2904100-016	2	ITS	QL	Yes	
	D8286-7	5 Valve Manifold	Swagelok	2	ITS	QL	Yes	
	D8286-8	Mounting Channel	Allen Bradley	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-9	End Plate	Allen Bradley	10	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-10	End Clamp	Allen Bradley	5	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-11	Marker Card	Allen Bradley	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-12	Terminal	Allen Bradley	166	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.

Drawing Number	Item No.	Description	Material or Vendor	QTY	ITS/non-ITS	QL/CM	GSD	COMMENTS
	D8286-15	Circuit Breaker	Allen Bradley	3	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-14	Spur Block 2-Box	Pepperl - Fuchs	2	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-15	Profibus DP Station	2904100-045	1	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-16	Fiber Optic Repeater	2904100-041	1	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-17	Fiber Optic Housing	2904100-042	1	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-18	Power Supply	Phoenix	1	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-19	External GFCI Recpt.	Grace	2	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-20	Wire Duct	Panduit	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-21	Duct Cover	Panduit	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-22	Wire Duct	Panduit	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-23	Duct Cover	Panduit	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-24	Duct Cover	Panduit	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-25	Wire Duct	Panduit	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-26	Hex Nut	3/8-16UNC 316 SS	12	ITS	QL	Yes	
	D8286-27	Hex HD Bolt 1.00 LG	3/8-16UNC 316 SS	8	ITS	QL	Yes	
	D8286-28	Hex HD Bolt 2.00 LG	3/8-16UNC 316 SS	4	ITS	QL	Yes	
	D8286-29	Lock Washer	3/8-16UNC 316 SS	12	ITS	QL	Yes	
	D8286-30	TVSS	Ferraz Shawmut	1	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-31	Enclosure	Hoffman	2	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
	D8286-32	Circuit Breaker	Allen Bradley	1	Non-ITS	CM	No	Does not function to contain melter offgas. Electrical enclosure internal component used for commercial instrumentation.
D8287 Piping Assembly 2"	D8287-1	Pipe (Cut at Assembly)	2 SCH 40 316L SS	30ft	ITS	QL	Yes	
	D8287-2	Weld Neck Flange	2 X 150# 316L SS	7	ITS	QL	Yes	
	D8287-3	90o Elbow	2 SCH 40 316L SS	9	ITS	QL	Yes	
	D8287-4	Tee	2 SCH 40 316L SS	1	ITS	QL	Yes	
	D8287-5	Gasket		7	ITS	QL	Yes	
	D8287-6	Rupture Disc		2	ITS	QL	Yes	
	D8287-7	Hex HD Bolt (2.5)	5/8-11UNC 316 SS	12	ITS	QL	Yes	
	D8287-8	Hex HD Bolt (3.00)	5/8-11UNC 316 SS	8	ITS	QL	Yes	
	D8287-9	Hex Nut	5/8-11UNC 316 SS	20	ITS	QL	Yes	
D8304 Finial Assembly	D8304-1	Base Frame Assembly (1A/B)	D8218	1	ITS	QL	Yes	
	D8304-2	Base Frame Assembly (2A/B)	D8218	1	ITS	QL	Yes	
	D8304-3	Housing Assembly (1A)	D8222	1	ITS	QL	Yes	
	D8304-4	Housing Assembly (2A)	D8222	1	ITS	QL	Yes	
	D8304-5	Housing Assembly (1B)	D8223	1	ITS	QL	Yes	
	D8304-6	Housing Assembly (2B)	D8223	1	ITS	QL	Yes	
	D8304-7	Platform Assembly (1A/B)	D8250	1	ITS	QL	Yes	
	D8304-8	Platform Assembly (2A/B)	D8251	1	ITS	QL	Yes	
	D8304-9	Ladder Assembly (1A/B)	D8220	1	Non-ITS	CM	No	Does not function to contain melter offgas. Ladder and all associated parts are external to the pressure boundary and form part of the maintenance platform.
	D8304-10	Ladder Assembly (2A/B)	D8220	1	Non-ITS	CM	No	Does not function to contain melter offgas. Ladder and all associated parts are external to the pressure boundary and form part of the maintenance platform.
	D8304-11	Crane Trolley Assembly (1A/B)	D8228	1	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the carbon media loading operation.

Drawing Number	Item No.	Description	Material or Vendor	QTY	ITS/non-ITS	QL/CM	CGD	COMMENTS
	D8304-12	Crane Trolley Assembly (2A/B)	D8228	1	Non-ITS	CM	No	Does not function to contain melter offgas. Crane trolley and all associated parts are external to the pressure boundary and are used as part of the canyon waste loading operation.
	D8304-13	Inlet Pipe Assembly (1A/B)	D8282-1	1	ITS	QL	Yes	
	D8304-14	Crossover Pipe Assembly (1A/B)	D8282-2	1	ITS	QL	Yes	
	D8304-15	Outlet Pipe Assembly (1A/B)	D8282-3	1	ITS	QL	Yes	
	D8304-16	Crossover Pipe Assembly (1A/B)	D8282-4	1	ITS	QL	Yes	
	D8304-17	Inlet Pipe Assembly (2A/B)	D8282-1	1	ITS	QL	Yes	
	D8304-18	Crossover Pipe Assembly (2A/B)	D8282-2	1	ITS	QL	Yes	
	D8304-19	Outlet Pipe Assembly (2A/B)	D8282-3	1	ITS	QL	Yes	
	D8304-20	Crossover Pipe Assembly (2A/B)	D8282-4	1	ITS	QL	Yes	
	D8304-21	Pipe Assembly 2" (1A/B)	D8287	1	ITS	QL	Yes	
	D8304-22	Pipe Assembly 2" (2A/B)	D8287	1	ITS	QL	Yes	
	D8304-23	Spacer (1A THK 4.0 X 4.0)	Alumina Silicate Ceramic	100	ITS	QL	Yes	
	D8304-24	Gasket 2"		10	ITS	QL	Yes	
	D8304-25	Gasket 14"		20	ITS	QL	Yes	
	D8304-26	Hex HD Bolt (1.50)	1/2-13UNC 316 SS	76	ITS	QL	Yes	
	D8304-27	Hex HD Bolt (2.00)	1/2-13UNC 316 SS	200	ITS	QL	Yes	
	D8304-28	Hex Nut	1/2-13UNC 316 SS	276	ITS	QL	Yes	
	D8304-29	Lock Washer	1/2 I.D. 316 SS	276	ITS	QL	Yes	
	D8304-30	Hex HD Bolt (2.50)	5/8-11UNC 316 SS	8	ITS	QL	Yes	
	D8304-31	Hex HD Bolt (3.00)	5/8-11UNC 316 SS	16	ITS	QL	Yes	
	D8304-32	Hex Nut	5/8-11UNC 316 SS	24	ITS	QL	Yes	
	D8304-33	Hex HD Bolt (4.50)	1-8UNC 316 SS	144	ITS	QL	Yes	
	D8304-34	Hex HD Bolt (2.50)	1-8UNC 316 SS	144	ITS	QL	Yes	
	D8304-35	Hex Nut	1-8UNC 316 SS	144	ITS	QL	Yes	
	D8304-36	Insulation	Calcium-Silicate	2400 ft²	Non-ITS	CM	No	Does not function to contain melter offgas. Insulation is not provided by IONEX.
	D8304-37	High Temperature Adhesive	Calbond A Gold	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. Insulation bonding material is not provided by IONEX.
	D8304-38	Sealing Caulk	PERMATEX HI-TEMP RED RTV	A/R	Non-ITS	CM	No	Does not function to contain melter offgas. RTV is recommended for sealing the joints of the cladding and is not provided by IONEX.
	D8304-39	Flat Washer	1/2 ID X 1.25 OD 316 SS	552	ITS	QL	Yes	
	D8304-40	Name Plate (S/Ns 01 THRU 06)	B8221	1	Non-ITS	CM	No	Does not function to contain melter offgas. Nameplate is external to the pressure boundary and is only used to identify the equipment.
	D8304-41	3-Way Solenoid Valve	Valcor	12	ITS	QL	No	Valcor solenoid valves have been procured from a qualified supplier. No CGD necessary.
	D8304-42	3-Way Solenoid Valve	ASCO	12	Non-ITS	CM	No	Does not function to contain melter offgas. This 3-way solenoid valve is used during normal operation to activate the 14 inch butterfly valves to either isolate the units for maintenance or adjust the flow of offgas.
D8317 Spreader bar	D8317-1	I-Beam	6 X 12.5# HRS ASTM A-36	2	Non-ITS	CM	No	Does not function to contain melter offgas. External to the pressure boundary and is considered a none permitate piece of plant equipment. Used only for handling the equipment during transportation and installation.
	D8317-2	Plate	1.0 PLATE ASTM A-36	4	Non-ITS	CM	No	Does not function to contain melter offgas. External to the pressure boundary and is considered a none permitate piece of plant equipment. Used only for handling the equipment during transportation and installation.
	D8317-3	Plate	1.0 PLATE ASTM A-36	4	Non-ITS	CM	No	Does not function to contain melter offgas. External to the pressure boundary and is considered a none permitate piece of plant equipment. Used only for handling the equipment during transportation and installation.

Drawing Number	Item No.	Description	Material or Vendor	QTY	ITS/non-ITS	QL/CM	CGD	COMMENTS
	D8317-4	Anchor Shackle (25000#)	McMaster - Carr	12	Non-ITS	CM	No	Does not function to contain melter offgas. External to the pressure boundary and is considered a none perminate piece of plant equipment. Used only for handling the equipment during transportation and installation.
	D8317-5	Sling (11200#)	McMaster - Carr	4	Non-ITS	CM	No	Does not function to contain melter offgas. External to the pressure boundary and is considered a none perminate piece of plant equipment. Used only for handling the equipment during transportation and installation.
	D8317-6	Name Plate (4.00 X 7.00)	11GA SHT 304L SS	2	Non-ITS	CM	No	Does not function to contain melter offgas. External to the pressure boundary and is considered a none perminate piece of plant equipment. Used only for handling the equipment during transportation and installation.
D8574 Inlet Pipe Support Assy	D8574-1	I-Beam	6 X 12.5# HRS ASTM A-36	1	ITS	QL	Yes	
	D8574-2	Angle (34.62)	2 X 2 X 1/4 ANGLE ASTM A-36	1	ITS	QL	Yes	
	D8574-3	Plate (22.38)	1/4 PL 316L SS	1	ITS	QL	Yes	
	D8574-4	Plate (21.38)	1/4 PL 316L SS	1	ITS	QL	Yes	
	D8574-5	Plate (4.00)	1/4 PL 316L SS	4	ITS	QL	Yes	
	D8574-6	Plate (7.00)	1/4 PL 316L SS	2	ITS	QL	Yes	
	D8574-7	Plate (2.75)	1/4 PL 316L SS	2	ITS	QL	Yes	
	D8574-8	Hex HD Bolt (2.0)	1/2-13UNC 316 SS	4	ITS	QL	Yes	
	D8574-9	Lock Washer	1/2 I.D. 316 SS	4	ITS	QL	Yes	
	D8574-10	Hex Nut	1/2-13UNC 316 SS	4	ITS	QL	Yes	

NOTE:
Weld filler metal used for pressure boundary welds has been specified ITS. Refer to IONEX CGD plans for dedication requirements specified to stainless steel and carbon steel filler metal.

Table 2 Important to Safety Equipment List (LAW)

IMPORTANT TO SAFETY EQUIPMENT LIST

COMPONENT TAG NO.:
24590-LAW-MVC-LVP-ADBR-00001A/B

Important to Safety function for the activated carbon bed adsorber units for both HLW and LAW is defined in section 3.1.15 of engineering specification 24590-WTP-3PS-MWK0-T0001. This function is defined as containment of melter offgas during normal, maximum, and design conditions. Pressure boundary must be maintained during and post SC-III event.

Drawing Number	Item No.	Description	Material or Vendor	QTY	ITS/non-ITS	QL/QM	CQD	COMMENTS

NOTE: ITS List shall be added to Table 2, as detailed design work is completed.

Appendix A

Mandatory Ammonium Nitrate Test Requirements for LAW Carbon Bed Adsorbers

Appendix A
Mandatory Ammonium Nitrate Test Requirements for LAW Carbon Bed Adsorbers

1.0 Purpose

The purpose of appendix A testing is to determine if sufficient amounts of ammonium nitrate can form in the LAW offgas pipeline, in the guard bed, and in the activated carbon bed adsorber media to increase the propagation rate of a bed fire.

2.0 Overview

The potential for ammonia and nitrous oxides to form ammonium nitrate within the LAW carbon bed adsorber media is unknown. A significant accumulation of ammonium nitrate within the bed media has been raised as a fire safety concern. It is postulated that ammonium nitrate may increase the rate a bed fire propagates, potentially modifying the current bed-fire mitigation strategy. It should be noted that VSL carbon bed testing has shown large temperature exotherms resulting from NOx. It may be necessary to condition the carbon media before testing with large NOx concentrations.

3.0 Objectives

1. Test 1 - Determine formation of NH_4NO_3 in the proposed LAW activated carbon adsorber media(s) configuration if the inlet gas contains NO_X and NH_3.
2. Test 2 - Assess the hazards associated with NH_4NO_3 adsorbed in the proposed LAW activated carbon adsorber media(s), (i.e. fire propagation).

4.0 Quality Assurance

Tests shall be performed in accordance with the applicable sections of NQA-1. The Test Plan will include a matrix cross-referencing the QA requirements to implementing procedures for the work, and justifying elements that are not applicable.

5.0 Test Conditions

Each of the tests in the following sections have been formulated to address the test objectives from Section 3.

The activated carbon beds proposed for the LAW off gas systems will operate under the conditions defined in mechanical data sheets. The appropriate media for each test will be selected and described in the Vendor Test Plan. The Test Plan will detail the test conditions and data collection for each test based on the media and operating conditions.

Testing will be done with a bench scale apparatus using air and water for humidity as the bulk gas.

Carbon test beds shall be insulated such that the temperature drop across the beds does not exceed 1.0 °C with dry hot air passing through the test beds at the test temperature.

5.1 Test 1 - Determine NH_4NO_3 formation in the proposed LAW activated carbon adsorption system(s).

a. Test conditions
- Sorbent - By vendor
- Bed residence time – By vendor
- Superficial gas velocity – by vendor
- Inlet HEPA temperature – 50 °C (bounding case in exception with mechanical data sheets)
- Relative humidity – 50 % (bounding case in exception with mechanical data sheets)
- Gas composition:
    a. Bulk gas – Air and water vapor
    b. Other constituents –
        i. Inlet NH_3 concentration - 10 ppm
        ii. Inlet CO concentration - 170 ppm
        iii. Inlet NO concentration - 4000 ppm
        iv. Inlet NO_2 concentration - 4000 ppm
- Inlet gas HEPA filtered to remove particulate ammonium nitrate formed prior to the carbon bed with two AG-1 certified HEPA filters operating in series.
- Eight (8) seconds gas residence time to simulate ammonium nitrate formation, prior to HEPA filtration.
- Residence time from the HEPA filters to the carbon bed is specified as 2.8 seconds.

b. Test duration
- By vendor

c. Data to be obtained
- Inlet and outlet NO, NO_2, NH_3 concentrations.
- Quantity of NH_4NO_3 - accumulated in the pipeline, HEPAs, and bed media at the end of test.
- Temperature profile of bed during loading.

5.2 Test 2 - Perform standard calorimeter test (i.e., ASTM E 1623-04 or equivalent) to measure exotherm of new bed media compared to bed media containing two years of accumulated ammonium nitrate.

5.3 Test 3 - If a substantial quantity of ammonium nitrate or a substantial exotherm is determined, re-run Test 1 and Test 2 with the addition of offgas pre-heat to 70 °C just prior to HEPA filtration.

5.4 Test 4 - If a substantial (>140 °F) temperature change is measured in the bed, re-run Test 1 with 50% of the NO and NO_2 concentrations.

6.0 Success Criteria

1. Quantization of ammonium nitrate formed in-situ on bed media, extrapolated to a two-year bed life.
2. Calorimeter test data of new bed media compared to bed media containing ammonium nitrate accumulated in two-years of bed life.
3. If Test 1 does not yield detectable levels of ammonium nitrate on the bed media, detection level shall be assumed and extrapolated to a two-year bed life. If Test 3 does not yield detectable levels of ammonium nitrate on the bed media, Test results shall take special note of this observation with no extrapolation to a two-year bed life.

Appendix B

Warranty Testing

Appendix B
Warranty Testing

1.0 Purpose

The purpose of appendix B testing is to validate performance guarantees related to removal efficiencies and design life for the carbon bed adsorber media in a prototypic LAW and HLW offgas.

2.0 Overview

Mercury is present in many of the DOE's mixed wastes including the high-level tank wastes, which will be processed in the WTP. When this waste is processed in the WTP Low-Activity Waste (LAW) and High-Level Waste (HLW) melter systems, the resulting offgas will contain mercury (Hg) and hydrogen fluoride (HF). Sulfur-activated carbon (S-AC) has been successfully used to remove mercury from offgas. However, it has generally been used with elemental mercury and under conditions that are not representative of WTP melter offgas. Concerns related to the adsorption behavior of elemental and oxidized forms of mercury, such as mercuric chloride, have been raised regarding mercury removal efficiency and breakthrough capacity, which could have a direct impact on sizing of the adsorption system and the frequency at which S-AC must be changed. Test apparatus will include two adsorbent columns (lead and lag adsorbers), each with guard and primary activated carbon media as described in the mechanical data sheets (24590-HLW-MVD-HOP-00011, 24590-HLW-MVD-HOP-20011, 24590-LAW-MVD-LVP-00004), representative of the WTP Lead and Lag Adsorbers.

VSL testing demonstrated that a rapid temperature rise resulted when water vapor was introduced to Kombisorb BAT-37. A temperature increase rapidly progressed through the VSL test bed. However, media temperatures quickly returned to normal as the bed became acclimated to water (except for heat losses). Introduction of NOx to the Kombisorb BAT 37 resulted in an initial temperature rise followed by a gradual temperature reduction as the media became acclimated to the NOx (elevated temperatures continued as long as NOx feed continued). Because virgin activated carbon media had a much greater sensitivity to NOx, it was necessary to establish a procedure for ramping feed of NOx to the bed (referred to as conditioning). The addition of Organics is very important, however acetonitrile (to be used in this phase of the testing) did not show much of a temperature effect. Nonetheless, the INL test plan should include a separate ramp procedure for NOx and organics.

VSL testing only evaluated the primary bed material, Kombisorb BAT 37. Because it may be possible that other important temperature effects may exist within the guard bed material, Kombisorb ZA-37, the testing shall also address the effects that the simulant offgas stream composition may have on the guard bed media temperature.

VSL testing identified the need to condition virgin Kombisorb BAT 37 to water, NOx, and organics. The Vendor Test Plan shall address conditioning of virgin activated carbon media, based on review of the following VSL steps:

- As NOx and organic ramping is initiated, actions should be taken to either stop ramps or reduce rates at a temperature threshold of 120°C.

- As NOx and organic approach full rates and during steady state operations, temperatures up to 130°C are permissible.
- Organic feed shall be stopped if activated carbon media temperature exceeds 130°C.
- If at any time the carbon media temperature reaches 140°C, both NOx and organic feed shall be stopped.

Steady-state for the activated carbon adsorbers will be reached when the gas outlet temperature for the lag bed operates at less than a 1°C change for one hour and monitoring of total hydrocarbons (THC) is maintained within a 1 to 3% variation for one hour. Once steady-state media temperatures and THC concentrations are reached, introduction of mercury to the test apparatus may be initiated.

3.0 Objectives

1. Test 1 - Determine removal efficiency and loading of mercury on the guard and primary beds for the lead and lag adsorbers with HLW simulated offgas. Confirm compliance with removal efficiency requirements and 12 month design life for the HLW lead adsorber. Confirm that the maximum media operating temperatures in the lead and lag adsorbers are below 130°C.

2. Test 2 - Determine removal efficiency and loading of mercury, hydrogen chloride, hydrogen fluoride, and iodine on the guard and primary beds for the lead and lag adsorber with LAW simulated offgas. Confirm compliance with removal efficiency requirements and 24 month design life for LAW lead adsorber. Confirm that the maximum media operating temperatures in the lead and lag adsorbers are below 130°C.

4.0 Quality Assurance

Tests shall be performed in accordance with the applicable sections of NQA-1. The Test Plan will include a matrix cross-referencing the QA requirements to implementing procedures for the work, and justifying elements that are not applicable.

5.0 Test Conditions

Each of the tests in the following sections have been formulated to address the test objectives from Section 3.

The activated carbon beds proposed for the HLW and LAW off gas systems will operate under the conditions defined in mechanical data sheets (24590-HLW-MVD-HOP-00011, 24590-HLW-MVD-HOP-20011, 24590-LAW-MVD-LVP-00004). The appropriate media for each test will be selected and described in the Vendor Test Plan. The Test Plan will detail the test conditions and data collection for each test based on the media and operating conditions, including steps for conditioning of virgin activated carbon media.

Testing will be done with a bench scale apparatus using air and water for humidity as the bulk gas.

Carbon test beds shall be insulated such that the temperature drop across the beds does not exceed 1.0°C with dry hot air passing through the test beds at test temperatures. Heat tracing may also be used in combination with the insulation as a means to compensate for differences between size of the test apparatus and the WTP activated carbon units. If heaters are used, the minimum number of zone controls shall be 4 (1 for the guard and 1 for the primary activated carbon media sections in both the lead and lag adsorbers).

5.1 Test 1 - Measure mercury removal efficiency and the mercury profile through the adsorbent bed using a simulated HLW offgas that includes acetonitrile.

A. Test conditions:
- Sorbent - Donau Kombisorb BAT 37 and ZA 37
- Residence time – by vendor, to match Mechanical Data Sheet
- Superficial gas velocity – by vendor, to match Mechanical Data Sheet
- Inlet temperature – 94°C ± 0.5°C
- Mercury concentration – 52,600 µg/dscm ± 50 µg/dscm
- Relative humidity – 18.6% ± 1%
- Gas composition (actual composition):
    a. Bulk gas – Air and water vapor
    b. Concentration of organic:
        i. acetonitrile – 2 ppm ± 0.05 ppm
    c. Other components
        i. CO_2 – 0.4% ± 0.03%
        ii. CO – 5.2 ppm ± 0.2 ppm
        iii. NO – 480 ppm ± 10 ppm
        iv. NO_2 – 370 ppm ± 10 ppm
        v. HF – 6.2 ppm ± 0.2 ppm

B. Test duration:
- Initial period to condition the virgin sorbents with the test gases and to reach steady-state operations.
- 100 hours (continuous operation) or until breakthrough of mercury.

C. Data to be obtained:
- Measure Total Hydrocarbons at the outlet of the lead and lag adsorbers
- Measure inlet and outlet mercury concentrations for the lead and lag adsorbers.
- Measure mercury profile in the lead and lag adsorbers (guard and primary beds) at end of test.
- Measure inlet and outlet offgas temperatures of lead and lag adsorbers.
- Measure sulfur content of three representative samples of virgin primary media and three representative samples of primary media taken after completion of testing from the location where maximum bed temperature was reached.
- Media temperature at two equally spaced locations along the centerline of the guard bed and primary bed for both the lead and lag adsorbers (total of 4 per adsorber).
- Time at which breakthrough occurs (if realized) for any adsorbed constituents for the lead and lag adsorbers. Breakthrough is defined as the concentration at which emissions reaches 50% of the specified removal efficiency. For example, breakthrough for mercury would be 26.3 µg/dscm using the DF of 1000 and maximum mercury loading of 52,552 µg/dscm shown in the mechanical data sheets.
- Limits established for step changes to NOx concentrations (and any other limiting gas stream components determined by testing).

D. Calculations:

- Hg removal efficiency and loading (mercury profile) for the lead and lag adsorbers.
- Estimated time for breakthrough of Hg for the lead and lag test adsorbers and for the WTP lead and lag adsorbers. (Mercury concentration specified in section A is the maximum concentration required for removal efficiency calculations. Design life shall be a ratio based on nominal mercury concentration 7,608 µg/dscm.)
- Correlation of lead and lag adsorber guard and primary bed temperatures and offgas constituents.
- Analysis of the impact of key gas components on sorbent temperatures during conditioning and operational phases.

E. Performance:

- Mercury removal efficiency - 99.9%
- Carbon media temperature maintained below maximum operating temperature (130°C)
- Media Design life - 12 months (WTP lead adsorber)

5.2 Test 2 - Measure mercury, hydrogen fluoride, and hydrogen chloride , and Iodine removal efficiencies through the adsorbent beds and organic removal using a simulated LAW offgas that also includes acetonitrile.

A. Test conditions

- Sorbents – Donau Kombisorb BAT 37 and ZA 37
- Residence time – by vendor to match mechanical data sheet
- Superficial gas velocity – by vendor to match mechanical data sheet
- Inlet temperature – 105 °C± 0.5 °C *(Nominal Condition on Mechanical Data Sheet)*
- Mercury concentration - 24,000 µg/dscm ± 50 µg/dscm
    i. Elemental mercury 85wt% ± 1 wt% Hg^0
    ii. Oxidized mercury 15wt% ± 1 wt% Hg^{+2} ($HgCl_2$)
- Relative humidity – 10.2 % ± 1% *(Nominal Condition on Mechanical Data Sheet)*
- Gas composition (actual composition):
    a. Bulk gas – Air and water vapor
    b. Concentration of organic:
        i. acetonitrile – 50 ppm ± 1.5 ppm
    c. Inlet hydrogen chloride (HCl) concentration - 46 ppm ± 1.5 ppm
    d. Inlet hydrogen fluoride (HF) concentration - 2.8 ppm ± 0.1 ppm
    e. Inlet iodine (I) concentration - 1.0 ppm ± 0.1 ppm
    f. Other components:
        i. Inlet CO concentration - 480 ppm ± 10 ppm
        ii. Inlet NO concentration - 3800 ppm ± 50 ppm
        iii. Inlet NO_2 concentration - 5600 ppm ± 50 ppm
        iv. Inlet CO_2 concentration - 1.2% ± 0.5%
        v. Inlet SO_2 concentration - 5.0 ppm ± 0.1 ppm

B. Test duration:

- Initial period to condition the virgin sorbent with the test gases and to reach steady-state operations.
- 100 hours or until breakthrough of mercury (Continuous).

C. Data to be obtained:

- Measure Total Hydrocarbons at the outlet of the lead and lag adsorbers
- Measure inlet and outlet mercury concentrations for the lead and lag adsorbers.
- Measure mercury profile in the lead and lag adsorbers (guard and primary beds) at end of test.
- Measure inlet and outlet hydrogen fluoride concentrations of the lead and lag adsorbers.
- Measure inlet and outlet hydrogen chloride concentrations of the lead and lag adsorbers.
- Measure inlet and outlet Iodine concentrations of the lead and lag adsorbers.
- Measure inlet and outlet organic concentrations of the lead and lag adsorbers.
- Measure inlet and outlet offgas temperatures of the lead and lag adsorbers.
- Measure sulfur content of three representative samples of virgin primary media and three representative samples of primary media taken after completion of testing from the location where maximum bed temperature was reached.
- Media temperature at two equally spaced locations along the centerline of the guard bed and primary bed for both the lead and lag adsorbers (total of 4 per adsorber).
- Time at which breakthrough occurs (if realized) for any adsorbed constituents for the lead and lag adsorbers.
- Limits established for step changes to NOx concentrations (and any other limiting gas stream components determined by testing).

D. Calculations:

- Mercury removal efficiency and loading (mercury profile) for the lead and lag adsorbers.
- Estimated time for breakthrough of mercury for the lead and lag test adsorbers and for the WTP lead and lag adsorbers. (Mercury concentration specified in Section A is the maximum concentration required for DRE. Design life shall be a ratio based on nominal mercury concentration 320 µg/dscm).
- Iodine removal efficiency and loading for the lead adsorber.
- Estimated time for breakthrough of iodine for the test lead and lag test adsorber and for the WTP lead and lag adsorbers.
- Hydrogen fluoride removal efficiency and loading for the lead adsorber.
- Estimated time for lead and lag adsorber breakthrough of hydrogen fluoride for the lead and lag test adsorbers and for the WTP adsorbers.
- Hydrogen chloride removal efficiency and loading for the lead and lag adsorbers.
- Estimated time for breakthrough of hydrogen chloride for the lead and lag test adsorber and for the WTP adsorbers.
- Correlation of lead and lag adsorber guard and primary bed temperatures and offgas constituents.
- Analysis of the impact of key gas components on sorbent temperatures during conditioning and operational phases.

E. Performance:

- Mercury removal efficiency - 99.8%
- Hydrogen chloride removal efficiency - 97%.
- Hydrogen fluoride removal efficiency - 97%

- Iodine removal efficiency - 99%
- Carbon media temperature maintained below maximum operating temperature (130°C)
- Design life - 24 months (WTP lead adsorber)

6.0 Success Criteria

1. Verification that specified removal efficiencies for required offgas constituents are achieved.
2. Quantization of load profiles for required offgas constituents and verification of WTP bed life.
3. Verification that carbon media temperature controls maintain carbon media temperature below its maximum allowable operating temperature of 130°C.

Appendix C

Permit Testing

Appendix C
Permit Testing

1.0 Purpose

The purpose of appendix C testing is to determine removal efficiency and loading of spiked organics for WTP offgas permitting.

2.0 Overview

Test apparatus shall consist of two adsorbent columns (each with guard and primary activated carbon media) as described in mechanical data sheets (MDSs), representing the WTP Lead and Lag Adsorbers.

Permit requirements for the WTP melter offgas systems specify compliance with Maximum Achievable Control Technology (MACT) incinerator standards for mercury and organic (VOC and SVOC) destruction. The WTP project has conducted systems tests at the Vitreous State Laboratory (VSL) of the melter offgas systems, to determine if the offgas systems, as designed, will meet MACT requirements. However, the test carbon bed used at VSL did not contain a guard bed and in other respects (e.g., gas residence time) the VSL test bed was not representative of the WTP carbon bed design. VSL testing has also shown large temperature exotherms exist, resulting from NOx and organics (allyl alcohol and naphthalene) in the offgas stream.

VSL testing only evaluated the primary bed material, Kombisorb BAT 37. Because it may be possible that other important temperature effects may exist within the guard bed material, Kombisorb ZA 37, the testing shall also address the effects the simulant offgas stream composition may have on guard bed media temperature.

VSL testing identified the need to condition virgin Kombisorb BAT 37 to water, NOx, and organics. The Vendor Test Plan shall address conditioning of virgin activated carbon media, based on review of the following VSL steps:

- As NOx and organic ramping is initiated, actions should be taken to either stop ramps or reduce rates at a temperature threshold of 120°C.
- As NOx and organic approach full rates and during steady state operations, temperatures up to 130°C are permissible.
- Organic feed shall be stopped if activated carbon media temperature exceeds 130°C.
- If at any time the carbon media temperature reaches 140°C, both NOx and organic feed shall be stopped.

Steady-state for the activated carbon adsorbers will be reached when the gas outlet temperature for the lag bed operates at less than a 1°C change for one hour and monitoring of total hydrocarbons (THC) is maintained within a 1 to 3% variation for one hour. Once steady-state media temperatures and THC concentrations are reached, introduction of mercury to the test apparatus may be initiated.

3.0 Objectives

1. Test 1 - Determine removal efficiency and loading of mercury, allyl alcohol, and naphthalene on the guard and primary test beds for the lead and lag adsorbers with HLW simulated offgas. Measure

media temperatures and establish maximum allowable changes in NOx and allyl alcohol concentrations required to maintain control of bed temperatures due to adsorption and exothermic reactions. Confirm that the maximum media operating temperatures in the lead and lag adsorbers are below 130°C.

2. Test 2 - Determine removal efficiency and loading of mercury, hydrogen chloride, allyl alcohol, and naphthalene on the guard and primary test beds for both lead and lag adsorbers with LAW simulated offgas. Measure media temperatures and establish maximum allowable changes in NOx and allyl alcohol concentrations required to maintain control of bed temperatures due to adsorption and exothermic reactions. Confirm that the maximum media operating temperatures for the lead and lag adsorbers are below 130°C.

4.0 Quality Assurance

Tests shall be performed in accordance with the applicable sections of NQA-1. The Test Plan will include a matrix cross-referencing the QA requirements to implementing procedures for the work, and justifying elements that are not applicable.

5.0 Test Conditions

Each of the tests in the following sections have been formulated to address the test objectives from Section 3.

The activated carbon beds proposed for the HLW and LAW off gas systems will operate under the conditions defined in this section of Appendix C. The appropriate media for each test will be selected and described in the Vendor Test Plan. Test media shall be consistent with that proposed for the WTP carbon bed adsorbers. The Test Plan will detail the test conditions and data collection for each test based on the media and operating conditions, including steps for conditioning of virgin activated carbon media.

Testing will be done with a bench scale apparatus using air and water for humidity as the bulk gas. Carbon test beds shall be insulated such that the temperature drop across the beds does not exceed 1.0°C with dry hot air passing through the test beds at test temperatures. Heat tracing may also be used in combination with the insulation as a means to compensate for differences between size of the test apparatus and the WTP activated carbon units. If heaters are used, the minimum number of zone controls shall be 4 (1 for the guard and 1 for the primary activated carbon media sections in both the lead and lag adsorbers).

5.1 Test 1 - Measure mercury and allyl alcohol/naphthalene removal efficiencies, using a simulated HLW offgas.

A. Test conditions:

- Sorbent - Donau Kombisorb BAT-37 and ZA-37
- Residence time – by vendor, to match Mechanical Data Sheet
- Superficial gas velocity – by vendor, to Match Mechanical Data Sheet
- Inlet temperature – 94°C ± 0.5°C
- Mercury concentration – 52,600 µg/dscm ± 50 µg/dscm
- Relative humidity – 18.6 % ± 1%
- Gas composition:
    a. Bulk gas – Air and water vapor
    b. Concentrations of organics:

i. Allyl alcohol – 1400 ppm ± 20 ppm (dry)
ii. Naphthalene – 35 ppm ± 1 ppm (dry)

c. Other components (actual composition):
i. CO_2 – 1,2% ± 0.03%
ii. CO – 900 ppm ± 20 ppm
iii. NO – 480 ppm ± 10 ppm
iv. NO_2 – 370 ppm ± 10 ppm
v. HF – 6.2 ppm ± 0.2 ppm

B. Test duration:
- Initial period to condition the virgin sorbent with the test gases and to reach steady-state operations.
- 100 hours (continuous operation) or until breakthrough of mercury.

C. Data to be obtained:
- Measure Total Hydrocarbons at the outlet of the lead and lag adsorbers
- Measure inlet and outlet mercury concentrations for the lead and lag adsorbers.
- Measure mercury profile in the lead adsorber (guard and primary beds) at end of test.
- Measure inlet and outlet offgas temperatures for the lead and lag adsorbers.
- Measure sulfur content of three representative samples of virgin primary media and three representative samples of primary media taken after completion of testing from the location where maximum bed temperature was reached.
- Measure inlet and outlet allyl alcohol and naphthalene concentrations in the lead and lag adsorbers.
- Media temperature at two equally spaced locations along the centerline of the guard bed and primary bed for both the the lead and lag adsorbers (total of 4 per adsorber).
- Time at which breakthrough occurs (if realized) for allyl alcohol and naphthalene for the lead and lag adsorbers.
- Limits established for step changes to NOx and allyl alcohol concentrations (and any other limiting gas stream components determined by testing).

D. Calculations:
- Mercury removal efficiency and loading (mercury profile) for the lead and lag adsorbers.
- Estimated time for breakthrough of mercury for the lead and lag test adsorbers and for the WTP lead and lag adsorbers.
- Allyl alcohol and naphthalene removal efficiency and loading for the lead and lag adsorbers.
- Estimated time for breakthrough of allyl alcohol and naphthalene for the lead and lag adsorbers.
- Correlation of guard and primary bed temperatures and offgas constituents for the lead and lag adsorber.
- Analysis of the impact of key gas components on sorbent temperatures during conditioning and operational phases.

E. Performance:
- Mercury removal efficiency - 99.9%
- Carbon media temperature maintained below maximum allowable operating temperature for the media (130°C)

5.2 Test 2 - Measure mercury, hydrogen chloride, allyl alcohol, and naphthalene removal efficiencies using a simulated LAW offgas.

A. Test conditions.
- Sorbents – Donau Kombisorb BAT-37 and ZA-37
- Residence time – by vendor, to match Mechanical Data Sheet
- Superficial gas velocity – by vendor, to Match Mechanical Data Sheet
- Inlet temperature – 105°C ± 0.5°C *(Nominal Condition on Mechanical Data Sheet)*
- Mercury concentration - 24,000 µg/dscm ± 50 µg/dscm
  i. Elemental mercury 85wt% ± 1 wt% Hg^0
  ii. Oxidized mercury 15wt% ± 1 wt% Hg^{+2} ($HgCl_2$)
- Relative humidity – 10.2% ± 1% *(Nominal Condition on Mechanical Data Sheet))*
- Gas composition:
  a. Bulk gas – Air and water vapor
  b. Concentrations of organics:
     i. Acetonitrile – 50 ppm ± 1.5 ppm
     ii. Allyl alcohol – 100 ppm ± 3 ppm (dry)
     iii. Naphthalene – 35 ppm ± 1 ppm (dry)
  c. Inlet hydrogen chloride concentration - 46 ppm ± 1.5 ppm
  d. Other components (actual composition):
     i. Inlet CO concentration - 480 ppm ± 10 ppm
     ii. Inlet NO concentration - 3800 ppm ± 50 ppm
     iii. Inlet NO_2 concentration - 5600 ppm ± 50 ppm
     iv. Inlet CO_2 concentration - 2% ± 0.5%v.
     v. Inlet SO_2 concentration - 5.0 ppm ± 0.1 ppmB.

B. Test duration:
- Initial period to condition the virgin sorbent with the test gases and to reach steady-state operations.
- 100 hours (continuous operation) or until breakthrough of mercury.

C. Data to be obtained:
- Measure Total Hydrocarbons at the outlet of the lead and lag adsorbers
- Measure inlet and outlet mercury concentrations for the lead and lag adsorbers.
- Measure mercury profile in the lead adsorber (guard and primary beds) at end of test.
- Measure inlet and outlet hydrogen chloride concentrations of the lead and lag adsorbers.
- Measure inlet and outlet allyl alcohol and naphthalene concentrations of the lead and lag adsorbers.
- Measure inlet and outlet offgas temperatures of lead and lag adsorbers.
- Measure sulfur content of three representative samples of virgin primary media and three representative samples of primary media taken after completion of testing from the location where maximum bed temperature was reached.

- Media temperatures at two equally spaced locations along the centerline of the guard bed and primary bed for both the lead and lag adsorbers (total of 4 per adsorber).
- Time at which breakthrough occurs (if realized) for allyl alcohol and naphthalene for the lead and lag adsorbers.
- .Limits established for step changes to NOx and allyl alcohol concentrations (and any other limiting gas stream components determined by testing).

D. Calculations:
- Mercury removal efficiency and loading (mercury profile) for the lead and lag adsorbers.
- Estimated time for breakthrough of mercury for the lead and lag test adsorbers and for the WTP lead and lag adsorbers.
- Hydrogen chloride removal efficiency and loading for the lead and lag adsorbers.
- Estimated time for breakthrough of hydrogen chloride for the lead and lag test adsorbers and for the WTP lead and lag adsorbers.
- Allyl alcohol and naphthalene removal efficiency and loading for the lead and lag adsorbers.
- Estimated time for breakthrough of allyl alcohol and naphthalene for the lead and lag adsorbers.
- Correlation of guard and primary bed temperatures and offgas constituents for the lead and lag adsorbers.
- Analysis of the impact of key gas components on sorbent temperatures during conditioning and operational phases.

E. Performance:
- Mercury removal efficiency - 99.8%
- Hydrogen chloride removal efficiency - 97%
- Carbon media temperature maintained below maximum allowable operating temperature for the media (130°C)

6.0 Success Criteria

1. Quantization of the removal efficiencies required offgas constituents.
2. Quantization of load profiles for required offgas constituents and determination of WTP bed life.
3. Quantization of carbon media temperature and controls to maintain carbon media below the maximum allowable operating temperature for the activated carbon media of 130°C.

Note that it is possible that the specified test conditions may result in activated carbon media temperatures that do not satisfy the success criteria. In that event, the testing will continue at the reduced allyl alcohol rate that is required to satisfy the success criteria. Because the reduced rate may not satisfy project needs, additional scope for addition of an optional testing may be required to be performed as follows:

Optional Test:
- Retest with the lead bed only on-line to demonstrate the maximum allyl alcohol and naphthalene rates that satisfy the success criteria.

Appendix D

WTP Specific Tailoring of ASME AG-1-1997

Appendix D
WTP Specific Tailoring of ASME AG-1-1997

35.0 ASME AG-1, Code on Nuclear Air and Gas Treatment

Revision: 1997 (R2000)
Sponsoring Organization: The American Society of Mechanical Engineers

WTP Specific Tailoring

The following tailoring of ASME AG-1 is required for use by the RPP-WTP project as an implementing standard for the use of Important-to-Safety (ITS) radial HEPA filter systems and the use of ITS axial flow HEPA filters as inblast units in the Laboratory C5V Exhaust System. Where not specifically identified herein, the remainder of the code requirements are invoked.

Section FK is added as an addendum to ASME AG-1-1997 with the ASME AG-1a-2000 Addenda AG-1 edition invoked on the project.

Page 228.9; Article HA-2000 Reference Documents

Revise Article HA-2000 as follows:

Change the code edition of ASME N509 as applied as a referenced (daughter) standard to AG-1 from 1989, reaffirmed December 6, 1996 to 2002.

Justification: The version of the ASME N509 Standard currently referenced as a daughter by AG-1 was issued in 1989 and Reaffirmed in 1996. At the time the N509-1989 (R1996) code was selected to be a daughter of AG-1, the ASME AG-1 code did not include requirements for HEPA filter housings. These requirements were later added in the 2000 Addenda to the AG-1 code. The ASME N509-2002 edition does not provide component requirements for HEPA filter housings and HEPA filters but instead refers the user to AG-1 for this information. Therefore, by making this change it will reduce potential redundancies and conflicts.

Page 228.16; Subsubarticle HA-4420 Access Doors and Panels

Revise Subsubarticle HA-4420 as follows for remote change housings:

Not applicable. The requirements of this article are not applicable to Remote Change Radial HEPA Filter Housings; the access doors and panels shall satisfy HA-4500, Pressure Boundary Leakage, and HA-5300, Pressure Boundary Leakage Testing.

Justification: Remote housings are not designed to "incorporate a means for adjusting compression forces, gasket compression..." There are not hinges or latches in the design and they are not designed for manual operation. Therefore, the requirements described in this code article are not applicable.

The remote housing design requires remote access, using a grapple to manipulate doors in a cave environment that may become subject to contamination and high radiation fields. The design incorporates low maintenance features not subject to failure (i.e., vertical housings and heavy doors). The housing doors seal by virtue of their weight alone. Door guides are included. A bar placed across the tops of the doors (and pinned in position) is used to ensure the doors remain in place during seismic events.

Page 228.18; Paragraph HA-4443 Clamping Mechanism

Revise Paragraph HA-4443 as follows for remote change and safe change radial HEPA housings:

Replace the text with: The requirements of this article are not applicable to Safe Change and Remote Change Radial HEPA Filter Housings. For Safe Change and Remote Change Radial HEPA filter housings, the design shall ensure that the housing knife-edge is embedded into the pliable filter sealant and will provide a seal for the complete perimeter of each filter.

Justification: The remote change housings are not side access housings and are not designed for manual operation. There are no clamping mechanisms or filter indexing mechanisms. The weight of the remote filter and differential pressure across the filter is relied upon to ensure that the knife-edge is embedded into the fluid seal.

The safe change housings are front access and are not walk-in style. The filter is not accessed from its side. Therefore, filter retrieval features and filter indexing mechanisms do not apply. A clamping mechanism that is capable of moving the filter (e.g., for side access housings) is not required. The safe change housings are designed to allow a person to insert and remove each filter.

Subarticle FK-4100 General Design

Revise second paragraph of Subarticle FK-4100 as follows for remote change and safe change radial HEPA filter designs:

Replace the text with: For Remote Change and Safe Change Radial HEPA Filters, the total media area provided within the filter pack shall be such that maximum media velocity is 6.5 ft/min (2.0 m/min) at the rated flow.

Justification: The RPP-WTP radial filter design is based upon a UK Atomic Energy Standard Specification AESS 30/95100. This Standard contains an equivalent requirement to that found in AG-1. It states: "The effective area of filter medium used for each insert shall be not less than 3.0 sq m for every 100 l/s rated airflow." The Project proposes to meet this criterion. Converting these metric units for a UK 950 l/s (~2,000 cfm) rated filter equates to approximately 6.5 ft/min media velocity or a minimum of 308 sq. ft of media.

The DOE Nuclear Air Cleaning Handbook (Reference DOE-HDBK-1169-2003 Chapter 2.3.7 and Figure 2.8(a)) illustrates the importance and intent behind this code requirement. AG-1 Subsubarticle FK-1130 states that a HEPA filter shall have *"a minimum efficiency of 99.97% (that is, a maximum particle penetration of 0.03%) for 0.3 micrometer diameter test aerosol particles."* This defines the minimum performance of a HEPA type filter. The curves depicted in Figure 2.8(a) of the Handbook show that at 10.5 ft/min air velocity, the 0.30-micron particle size can be expected to penetrate a HEPA filter such that the AG-1 FK-1130 performance requirement would not be met.

Numerous aerosol penetration tests have been performed on the proposed filter design both inside prototype housings and on individual prototype radial filters designed with a media area of 23.6 sq. ft., or approximately 8.5 ft/min media velocity. Each test demonstrated that a filter design with media velocities of this magnitude would meet the qualification performance requirements as stated in AG-1 (e.g., 99.97% efficiency or better for penetration of 0.3-micron particles).

The proposed RPP-WTP design uses a filter with approximately 325 sq. ft. of effective media area, or a media velocity of approximately 6.1 ft/min. This represents a small improvement on the UK design and therefore continues to meet the UK Standard requirement.

Further addition of filter media to meet the more restrictive AG-1 Section FK requirement would possibly result in other undesirable design and performance characteristics (e.g., increased DP, reduced pleat spacing). The filter geometry is also limited by many other design restrictions including: available building space, personnel filter handling limitations, and waste disposal package limitations.

Table FK-4000-1

Revise Table FK-4000-1 rating information for the 2,000 acfm filter as follows for remote change and safe change HEPA radial filter designs:

TABLE FK-4000-1 (TAILORED)
TYPE 1 RADIAL FLOW HEPA FILTER – NOMINAL RATINGS

Maximum Rated Air Flow		Maximum Resistance	
(acfm)	(m^3/hr)	Inches WC	Pa
40	68	1.3	325
100	170	1.3	325
250	425	1.3	325
500	850	1.3	325

1000	1700	1.3	325
1500	2550	1.3	325
2000	3400	1.6	400

Justification: A new filter design is being developed with the intent of qualifying it in accordance with the AG-1 code. The RPP-WTP radial flow HEPA filter design originated from UK Atomic Energy Standard Specification AESS 30/95100. The radial flow HEPA filters will be designed for a maximum initial pressure drop of approximately 1.55 inches WC at a rated flow of 2,000 cfm. This is just slightly greater than (~ delta of 0.15 inches WC) the acceptance criterion stated in UK Atomic Energy Standard Specification AESS 30/95100. This increase in observed pressure drop is primarily due to small design differences between the UK design and the design proposed for use in the RPP-WTP. These differences include increases in filter pack depth, increases in facegaurd to media pack gaps (used to enhance protection of the media), and space to accommodate the filters gel seal channel. The UK filter pack depth is approximately 68mm or ~2.7 inches. The RPP-WTP filters are available in 1-inch increment pack depths with a 3-inch pack depth proposed for use on the RPP-WTP. The slightly deeper RPP-WTP media pack design will increase the filter media area and increase the removal efficiency for small particles. The benefits gained in the RPP-WTP radial filter design are viewed to outweigh the negligible increase in airflow resistance (~ 3 to 5% of typical filter loading at change-out of filter element).

Paragraph FK-6211 Flatness and Squareness

Revise Paragraph FK-6211 (a) as follows for remote change and safe change radial HEPA filter designs:

Type 1 filter flange and end cap tolerances shall meet the following criteria: parallel within $\frac{1}{8}$ in., flat within $\frac{3}{16}$ in.

Justification: TAILORING OF PARALLELISM TOLERANCE: The tailoring presented above changes the code requirement for flange to end cap parallelism from 1/16 in. to 1/8 in. For the Remote Change Filter, the inlet flange, which includes the gel channel with a nominal width of 3/4 in., creates the seal and supports the filter inside the housing. The outlet end cap is fully suspended inside the housing by the opposite inlet flange (i.e., outlet end cap does not touch the housing and is not used to form the seal). Parallelism to within 1/8 in. will ensure that an adequate housing-to-filter seal is created. For the Safe Change Filter, as with the remote filter, the seal is formed by insertion of a housing knife-edge into a filter gel filled channel with a nominal width of 3/4 in. The gel channel is located on the filter inlet flange. Parallelism to within 1/8 in. will ensure an adequate housing-to-filter seal is created.

TAILORING OF SQUARENESS TOLERANCE: The "squareness" tolerance from FK-6211 is being addressed with a tolerance for circular runout as stated in tailoring for FK-6212. Circular runout controls the cumulative variations that may be present in the positional relationship between the inlet flange and outlet end cap. Inspection for circular runout is equivalent to and meets the code requirement to maintain the squareness characteristic while taking into account the entire length of the filter. Maintaining radial

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filter circular runout to within the 3/32" tolerance will ensure the filter forms an adequate seal within the filter housing.

Paragraph FK-6212 Overall Dimensions

Replace Paragraph FK-6212 as follows for the remote change and safe change radial HEPA filter design: Type 1 filter length shall be (+0 / -1/8 in.), circular runout of filter flange with respect to the filter end cap shall be within 3/32 in., all other dimensions ±1/16 in.

Justification: "Seal ring" and "seal face" are terms specific to Section FK radial filters with gaskets and therefore dimensions and tolerances associated with these terms are not applicable to the Type 1 gel seal radial filters to be used at the RPP-WTP.

TAILORING OF CONCENTRICITY: Concentricity is the condition in which the axes of all cross-sectional elements of a surface of revolution are common to the axis of a datum feature. Concentricity is being replaced with a tolerance for circular runout as a more practical method to verify roundness. Runout refers to the result of rotating a part about its central axis while measuring with a dial indicator its surface deviation from perfect roundness. With circular runout, the dial indicator is not moved along the direction of the axis of the part (as with "total runout"). Circular runout is therefore applied independently at each single circular element along the length of the part as the part is rotated through 360 degrees. The tolerance for circular runout provided in the tailored text controls the cumulative variations that may be present in the positional relationship between the inlet flange and outlet end cap. The 3/32 in. tolerance provided for circular runout will ensure the filter forms an adequate seal within the filter housing.

TAILORING OF GENERAL DESIGN TOLERANCE OF +/- 1/16 IN.: REPLACE: "all other dimensions +/- 1/16 in. " WITH: "all other dimensions +/- 1/16 in. with exception that design filter media to faceguard gap shall be +/- 1/8 in. (i.e., to maintain a minimum media to faceguard gap of 1/8")."

Justification: The proposed design is verified to be safe through code required filter qualification testing as described in Section FK-5100.

Section FG Mounting Frames

Not Applicable.

Justification: The ASME Committee on Nuclear Air and Gas Treatment (CONAGT) has stated that Section FG only applies to walk in housings. None of the filter housings (i.e., radial or axial filter designs) to be installed on the RPP-WTP Project is a "walk in" design. Reference ASME Technical Interpretation File # 05-990, RPP-WTP CCN # 107935).

Page 607; Paragraph TA-4632 Airflow Distribution Test (AD)

Revise Paragraph TA-4632 as follows for remote change and safe change radial HEPA housings:

Replace "downstream" with "upstream". Add for clarity: "For Remote Change and Safe Change Radial HEPA filter banks, flow measurement location is upstream vs. code required downstream."

Justification: The requirement for flow measurements to be taken downstream of each HEPA filter in a bank is in order to verify equal flow distribution between filters in a bank. In traditional axial flow systems, a measurement location downstream is preferred due to the improvements in the flow conditions (i.e., flow straightening) inside the housing created by the filter itself. However, due to the difference in configuration created by the radial filter, the flow profile both entering and exiting the filter is extremely complex (i.e., not uniform over the filter face). Testing and analysis (computational fluid dynamic models) performed on prototype units to date have determined that taking the flow measurement upstream and inside the filter (inlet) using a hot wire anemometer provides the most repeatable measurement. Accuracy of the measurement is still hindered by flow conditions and anemometer placement; however, increased precision is obtained by taking an average of multiple measurements at multiple locations within each filter inlet. Predicted results from CFD modeling have agreed with actual field measurements using this technique. The project intends to design (based on the prototype tests) and use an anemometer instrument developed specifically for the radial filter design and place it at the inlet (i.e., upstream) side of the filter. Verification, in the field, of acceptable air distribution between filters in a bank can then be accomplished, as the code requires.

Page 607; Paragraph TA-4633 Air-Aerosol Mixing Test (AA)

Revise Paragraph TA-4633 as follows for axial housings used as LAB CSV Inbleeds:

This article is not applicable to LAB CSV inbleed axial filter housings.

Justification: The intent of this test is to verify that the test aerosol is uniformly mixed in the air stream when it reaches the filter in order to verify that each filter in a filter bank is being challenged. This test is concerned primarily with designs and layouts where a single point injection of aerosol in close proximity to the filter bank may result in non-uniform distribution of the test agent.

The Laboratory Facility CSV Inbleed housing is designed such that each filter is assigned its own aerosol injection manifold. The manifold design and its proximity to the filters have been qualified to meet the aerosol mixing test criteria presented in AG-1. The housing is not designed to accommodate the air-aerosol mixing field-commissioning test per TA-4633. However, the housing design is not being modified for RPP-WTP use and aerosol mixing, by virtue of the manufacturer test sections, will not be impacted by the installation in the RPP-WTP Laboratory Facility.

Appendix E

WTP Specific Tailoring of ASME B31.3-1996

Appendix E
WTP Specific Tailoring of ASME B31.3-1996

26.0 ASME B31.3-1996, Process Piping

Revision: 1996
Sponsoring Organization: ASME

WTP Specific Tailoring

The following tailoring of ASME B31.3, *Process Piping*, is required for use by the WTP contractor as an Implementing Standard for: (1) the fabrication and installation of those portions of the C5V ductwork that are being embedded in concrete, (2) the use of ASME B16.9 welding tees in accordance with ASME B31.3-2002, (3) use of vacuum box leak testing, and (4) the ASME B31.3-1998, paragraph 345.2.3(c), allowance for not leak testing closure welds outside of inaccessible areas.

- The tailored sections of ASME B31.3 applicable to embedded ductwork will only be utilized to the extent that it will cover the fabrication, installation, and inspection (and associated testing) of Category D fluid service piping being used as C5 ductwork. Air testing requirements for this ductwork will be compliant with ASME AG-1. Below is a description of those portions of ASME B31.3 that apply to fabrication, installation, and inspection of Category D fluid service piping and the sections of the SRD that they will apply to.
- The tailored sections of ASME B31.3 applicable to welding tees will only be used for ASME B16.9 welding tees. As long as the stress intensification factors from ASME B31.3-2002 are used in the stress analysis for the welding tees, welding tees fabricated to either the 1996 or the 2002 edition of ASME B31.3 can be used. Below is a description of those portions of ASME B31.3, Appendix D, Table D300, that apply to welding tees and the section of the SRD to which they will apply.
- The tailored paragraphs of ASME B31.3 applicable to vacuum box leak testing, in lieu of hydrostatic or pneumatic leak testing, will only be used to leak test full penetration circumferential piping field butt welds inside an inaccessible area (as defined in Appendix H, Section 6.0) out to the first isolation component outside the inaccessible area. Further, if the 100 % volumetric inspection using ultrasonic examination per ASME B31.3 paragraph 344.6, is conducted for welds to be vacuum box tested, then the ultrasonic examination shall be conducted using a method that creates and maintains a reproducible computerized image(s) of the entire weld in the axial and radial direction.
- The tailored paragraphs of ASME B31.3 adopting the provisions of ASME B31.3 (c) - 1998 Addendum paragraph 345.2.3(c) are applicable to all ASME B31.3 piping in all facilities except for closure welds in accessible areas.

Piping providing a confinement function in accordance with SRD 4.4-3 will comply with the following sections of ASME B31.3-1996, *Process Piping*. These sections of ASME B31.3 are applicable for embedded ductwork.

Chapter 3, Materials

Chapter 5, Fabrication

Table 341.3.2, Visual acceptance criteria for Category D fluid service piping

Justification: Due to wall thickness requirements of duct embedded in concrete, piping materials are required. ASME B31.3 will apply to materials, fabrication, and inspection standards as appropriate. Testing requirements for nuclear air treatment systems will be consistent with ASME AG-1.

Piping providing a confinement function in accordance with SRD 5.1-2 will comply with the following sections of ASME B31.3-1996, *Process Piping*. These sections of ASME B31.3 are applicable for embedded ductwork.

Chapter 3, Materials

Chapter 5, Fabrication

Table 341.3.2, Visual acceptance criteria for Category D fluid service piping

Justification: Due to wall thickness requirements of duct embedded in concrete, piping materials are required. ASME B31.3 will apply to materials, fabrication, and inspection standards as appropriate. Testing requirements for nuclear air treatment systems will be consistent with ASME AG-1.

Piping providing a confinement function in accordance with SRD 4.2-2 will comply with ASME B31.3-1996, *Process Piping*, with the following modification:

In Table D300, the description of welding tee per ASME B16.9 shall be revised so it is consistent with that shown in Table D300 of ASME B31.3-2002:

Description	Flexibility Factor k	Stress Intensification Factor [Notes (3), (3)] Out-of-Plane, i_o	In-Plane i_i	Flexibility Characteristic, h	Sketch
Welded tee per ASME B16.9 [Notes (2), (4), (6), (11), (13)]	1	$\frac{0.9}{h^{2/3}}$	$3/4\, i_o + 1/4$	$3.1\frac{T}{r_2}$	Same as ASME B31.3-1996

This means that for welding tees per ASME B16.9, note 11 in Table D300 is also changed to:

(11) If $r_3 \geq 1/8D_o$ and $T_c \geq 1.5\overline{T}$, a flexibility characteristic of $4.4\overline{T}/r_2$ may be used.

Justification: The use of a lower flexibility characteristic for welding tees per ASME B.16.9 in accordance with ASME B31.3-2002 will increase both the out-of-plane and in-plane stress intensification factors. The increased stress intensification factors will reduce the allowable out-of-plane and in-plane moments that can be applied to the welding tee and keep the calculated stress below the stresses allowable by ASME B31.3-1996.

Important to Safety piping within the scope of SRD 4.2-2 shall comply with ASME B31.3-1996, Chapter V, Paragraph 345, using the following approach for vacuum box leak testing. Vacuum box leak testing, in lieu of hydrostatic or pneumatic leak testing, may be used to leak test full penetration circumferential piping, field butt welds inside an inaccessible area (as defined in Appendix H, Section 6.0) out to the first isolation component outside the inaccessible area, only under the following conditions:

Vacuum Box Leak Test Method - The vacuum box leak test shall be in accordance with a Bubble Test - Vacuum Box Technique method specified in ASME BPV Code, Section V, Article 10, Appendix II, subject to the requirements listed below:

(a) Sensitivity of the test shall be demonstrated to be not less than 1E-3 atm-ml/sec at 15 psig.

(b) The test pressure shall be a partial vacuum of at least 7 psi below atmosphere, applied to the outside of the weld.

(c) The required partial vacuum shall be maintained for at least 20 sec examination time.

In addition, the following limitations and restrictions shall apply to the application of vacuum box leak testing in lieu of a hydrostatic or a pneumatic leak test:

- Vacuum box leak testing will only be used to leak test circumferential piping field welds inside an inaccessible area (as defined in Appendix H, Section 6.0). This includes any welds in extensions of piping systems contained or originating in accessible areas between the inaccessible area boundary and the first isolation valve or device beyond the inaccessible area boundary;
- It shall only be used for piping field welds where required to avoid damage to components, ensure the safety to construction workers, perform leak tests of field welds where physical limitations prevent hydrostatic or pneumatic leak testing as prescribed in ASME B31.3-1996 paragraph 345.4 and paragraph 345.5 respectively;
- Pipe welds that are to be vacuum box leak tested will be assessed for suitability. The number of welds to be vacuum box leak tested shall be limited to a maximum of three welds between termination points (two termination or closure welds and one intermediate weld) on a given pipe system except where physical limitations prevent examination by hydrostatic or pneumatic leak testing. DOE will be informed of such exceptions, and may at its discretion and within 48 hours of being informed, respond to BNI on the suitability of the use of vacuum box leak testing for such instances. Termination points may be tanks, vessels, valves, etc. (Specifically excluded from the definition of termination points are junctions where the piping changes design class). This could be either the last two closure welds in an inaccessible area or the last closure weld in the inaccessible area and the last closure weld outside the

inaccessible area. In addition, vacuum box leak testing would be permitted for the connection welds between construction modules if this is limited to one module-to-module weld per piping run within the cells. This is in addition to termination welds on the piping run. A module is defined as a pre-leak-tested subassembly containing multiple pipe spools;

- Vacuum box leak testing shall be limited to full penetration girth butt welds, on straight pipe or between straight pipe and pipe components of the same nominal pipe size and same wall thickness on both sides of the weld at the weld location. The following configurations are candidates for vacuum box testing:

  (a) Straight pipe to straight pipe connection butt welds

  (b) Straight pipe to 90° elbow connection butt welds

  (c) Straight pipe to 45° elbow connection butt welds

  (d) Straight pipe to concentric reducer connection butt welds

  (e) Straight pipe to eccentric reducer connection butt welds

  (f) Straight pipe to butt welding tee connection butt welds

  (g) Straight pipe to butt welding reduced outlet tee connection butt welds

  (h) Straight pipe to valve nozzle connection butt welds

  (i) Straight pipe to tank or vessel nozzle connection welds

  (j) Straight pipe to safe-end of a weldolet connection butt welds - full penetration butt welded connection only

  (k) Straight pipe to pipe cap connection butt welds

  Prior to the application of vacuum box testing using any of the candidate configurations on piping butt welds at the WTP, the Contractor must successfully demonstrate to the DOE, for the candidate configuration, that (1) all portions of the weld to be inspected are visible and can be inspected in accordance with the ASME Boiler and Pressure and Vessel Code, Section V, Article 10, Appendix II - 1995; (2) the vacuum box can adequately maintain a partial vacuum of 7 psid; and (3) vacuum box leak testing can be accomplished in the time limits and other requirements established by this procedure. The DOE shall be advised at least 7 days in advance of any demonstration to qualify a new weld configuration so that they can witness the demonstration. The Contractor shall document any demonstration relied upon to justify the use of vacuum box leak testing on a new configuration. Further, vacuum box leak testing shall be conducted with a vacuum box that completely encapsulates the weld, at the test location;

- All welds shall be 100 % volumetrically inspected in accordance with ASME B31.3-1996, paragraphs 344.5 or 344.6. If the 100 % volumetric inspection is conducted using ultrasonic examination per ASME B31.3-1996 paragraph 344.6, then the ultrasonic examination shall be conducted using a method that creates and maintains a reproducible computerized image(s) of the entire weld in the axial and radial direction;

- It shall be limited to welds made using the Orbital welding machines. The only exception is that vacuum leak box testing may be used on manual welds if the 100 % volumetric inspection was conducted by radiography per ASME B31.3-1996 paragraph 344.5;

- The piping systems and or components on both sides of the weld to be vacuum box leak tested shall have been subjected to a hydrostatic leak test in accordance with ASME B31.3-1996

paragraph 345.4, a pneumatic test in accordance with ASME B31.3-1996 paragraph 345.5, a combination pneumatic-hydrostatic leak test in accordance with ASME B31.3-1996 paragraph 345.6, or in the case of components, leak tested in accordance with the Code or Standard applicable to the design of the component;

- At a minimum, a flexibility analysis in accordance with ASME B31.3-1996 paragraphs 319.4.2 (a) and (b) shall be required on any piping systems that contain welds that are to be vacuum leak box tested. In addition, a comprehensive flexibility analysis in accordance with ASME B31.3-1996 paragraphs 319.4.2 (c) and (d) shall be performed on any piping systems that contain welds that are to be vacuum box leak tested when the piping systems have a design temperature greater than or equal to 150 °F;
- For manual welds, the requirements of ASME B31.3-1996 paragraph 344.7.1 (a) through (g) shall be invoked on any weld to be vacuum box leak tested with the exception that the requirement of subparagraph 344.7.1 (c) "... aided by liquid penetrant or magnetic particle examination when specified in the engineering design" shall not be required. For welds made using Orbital welding machines, the requirements of ASME B31.3-1996 paragraph 344.7.1 (a), (b), (c), (d), and (g) shall be invoked. The requirements of 344.7.1 (e) and (f) shall not be required. The implementation of these requirements shall be documented in the weld inspection report;
- Pipe welds and the associated line numbers that are to be vacuum leak box tested shall be identified in advance of the testing. This identification shall be documented in the controlled document Weld List, which must include this information prior to the initiation of any vacuum box leak testing associated with those welds and line numbers. It is understood that the controlled document Weld List may need to be revised and updated periodically through the construction phase of the WTP Project; and
- The following special requirements shall be placed on the training programs used to certify the technicians that will be conducting the vacuum box leak tests:
  1. The BNI Construction Manager shall pre-approve the technician qualifying examination(s) for vacuum box leak testing;
  2. The BNI Construction Manager shall pre-approve the qualifications of each Level III technician preparing or giving the examinations for vacuum box leak testing;
  3. DOE ORP at their discretion shall reserve the right to observe any and/or all practical leak test examinations and review of the results of any and/or all written vacuum box leak test examinations;
  4. The minimum topical content of each Level II examination shall be specified by BNI, and approved by DOE;
  5. The 80 % correct criteria for passing the examination shall apply to each part of the three part examinations that are to be given;
  6. BNI shall provide reasonable assurance that they will take adequate measures to assure the integrity of written examination is maintained; and
  7. There shall be several versions of each examination in use to assure Level II knowledge and ability concerning vacuum box leak testing is confirmed.

Justification: The requirement for the vacuum box leak test sensitivity is consistent with the ASME B31.3 requirement for a sensitive leak test as given in ASME B31.3-1996 paragraph 345.8 and for at least 7 psi vacuum and an examination time of at least 20 seconds. The limitations in using vacuum box leak testing better define when this method can be used. DOE ORP may further change the definition and application of these special vacuum box leak testing criteria based on the Contractor's experience with their use, or the Contractor's request for a change.

Piping system closure welds outside of inaccessible areas (as defined in SRD Appendix H, Section 6.0) shall comply with the requirements of ASME B31.3-1998, subparagraph 345.2.3(c). When ASME B31.3-1998, subparagraph 345.2.3(c) is invoked the following restrictions shall apply:

- It shall not be invoked on any closure welds on piping systems in inaccessible areas as defined in Section 6.0 of Appendix H of the SRD. This includes any welds in extensions of piping systems contained or originating in inaccessible areas, between the inaccessible area boundary and the first isolation valve, or device beyond the inaccessible area boundary;
- It shall only be invoked on full penetration butt welds in straight pipe, full penetration butt welds at the safe-end of an equipment nozzle, or full penetration butt welds at the safe-end of branch connections. [The safe-end is defined as the piping to equipment nozzle connecting weld or the branch connection to branch piping connecting welds.];
- The requirements of ASME B31.3(c) - 1998, subparagraph 345.2.3 (c) shall be met;
- The piping systems and or components on both sides of the closure weld shall have been subjected to a hydrostatic leak test in accordance with ASME B31.3-1996 paragraph 345.4, a pneumatic leak test in accordance with ASME B31.3-1996 paragraph 345.5, a combination pneumatic-hydrostatic leak test in accordance with ASME B31.3-1996 paragraph 345.6, or in the case of components leak tested in accordance with the Code or Standard applicable to the design of the component;
- For manual welds, the requirements of ASME B31.3-1996 paragraph 344.7.1 (a) through (g) shall be invoked with the exception that the requirement of subparagraph 344.7.1 (e) "...aided by liquid penetrant or magnetic particle examination when specified in the engineering design" shall not be required. For welds made using the Orbital welding machines, the requirements of ASME B31.3 -1996 paragraph 344.7.1 (a), (b), (c), (d), and (g) shall be invoked. The implementation of these requirements shall be documented in the weld inspection report;
- Piping welds and the associated line numbers for which the closure weld classification is invoked shall be documented in a controlled document Weld List;
- Piping components may include mechanical elements other than piping; and
- In addition, BNI shall incorporate these requirements into the appropriate specification. DOE-ORP may further change the definition and application on the use of closure welds based on the Contractor's experience with their use or the Contractor's request for a change.

Justification: This change does not change the safety function of any pressure boundary components. The requirement to leak test pressure boundary field welds is primarily to ensure the reliability of the welds in addition to the reliability provided by the other required examinations. The exception allowed by ASME B31.3-1998, paragraph 345.2.3 that the final weld connecting piping systems or components which have been successfully tested in accordance with

paragraph 345 need not be leak tested provided the weld is examined in-process in accordance with paragraph 344.7 (a), (b), (c), (d), and (g) and passes with 100 % radiographic examination in accordance with paragraph 344.5 or 100 % ultrasonic examination in accordance with paragraph 344.6 provides adequate assurance that the weld is reliable and leak tight. The change continues to provide adequate safety since it requires that all piping closure welds that are not leak tested are in-process examined and 100 % volumetrically examined which exceeds the requirements of ASME B31.3-1996 for closure welds that are leak tested. The inability to hydrostatically or pneumatically leak test these closure welds does not affect the soundness of the welds.

Appendix F

WTP Specific Tailoring of AISC (ASD)

Appendix F

WTP Specific Tailoring of AISC (ASD)

9.0 AISC M016, Manual of Steel Construction, Allowable Stress Design (ASD)

Revision: 9th Edition
Sponsoring Organization: American Institute of Steel Construction

WTP Specific Tailoring

The following tailoring of M016 is required for use by the WTP contractor as an implementing standard for design of structural steel for Seismic Category III SSCs.

No specific section

Load combinations for design of structural steel members utilize those identified in UBC 97, section 1612.3.

Justification: These load combinations represent the commercial requirements for allowable stress design of structural steel. Use of these load combinations will ensure compliance with the commercial design in accordance with the UBC.

No specific section

Seismic detailing requirements shall be in accordance with UBC 97, Chapter 22, Division V, section 2214, for moderate seismic risk structures.

Justification: The requirements contained in this section contain accepted industry practice for design of important commercial steel structures. Use of this section will ensure compliance with the commercial design in accordance with the UBC.

Appendix G
WTP Specific Tailoring of ASME NQA-1-1989

Appendix G
WTP Specific Tailoring of ASME NQA-1-1989

C.37 ASME NQA-1-1989, Quality Assurance Program Requirements for Nuclear Facilities

Revision: 1989

Sponsoring Organization: The American Society of Mechanical Engineers

WTP Specific Tailoring

The following tailoring of ASME NQA-1-1989 is required for use by the WTP project as an implementing standard to perform Commercial Grade Dedication activities using ASME NQA-1-2004.

NQA-1-1989, Supplement S-1 **Terms and Definitions**

Replace the Commercial Grade Item definition with definition from NQA-1-2004, Part I, Section 400:

Commercial Grade Item: a safety class/safety significant structure, system, or component (SSC), or part thereof, that affects its safety function, that was not designed and manufactured in accordance with the requirements of this Standard.

Justification: By tailoring NQA-1-1989 to incorporate elements of NQA-1-2004, the Commercial Grade Item definition is broadened to reflect current industry practices related to Commercial Grade Dedication. Currently there are gaps among NQA-1 qualified suppliers and utilization of NQA-1-2004 will enable WTP to employ technically acceptable suppliers not available under the provision of NQA-1-1989. The NQA-1-1989 standard was established primarily to provide for the purchase of replacement parts for nuclear-related facilities and is not sufficient to support the purchase of commodities and equipment needed for a new facility.

Commercial Grade Items may be either off the shelf/catalog items or "engineered items", i.e., items for which some custom design effort is required by the supplier to meet purchaser requirements. If the critical characteristics of an "engineered item" cannot be verified solely based on material or performance attributes, verification of critical design characteristics should be based on NQA-1-2004, Section 704 (e.g., by design verification methods) or by application of alternate standards for qualification of suppliers of Safety Class/Safety Significant items.

NQA-1-1989, Supplement S-1 **Terms and Definitions**

Add to the reference section ASME NQA-1-1989, Supplement S-1, the following definitions from NQA-1-2004, Part I, Section 400:

Commercial Grade Service: a service that was not provided in accordance with the requirements of this standard.

Critical Characteristics: important design, material, and performance characteristics of a commercial grade item or service that, once verified, will provide reasonable assurance that the item or service will perform its intended safety function.

Dedication: an acceptance process performed in accordance with this Standard to provide reasonable assurance that a commercial grade item or service will successfully perform its intended safety function and, in this respect, is deemed equivalent to an item or services provided under the requirements of this Standard.

Dedicating Entity: the organization that performs the dedication process.

Justification: The tailoring of the NQA-1-1989, by adding definitions of Commercial Grade Service, Critical Characteristic, Dedication, Dedicating Entity, and Safety Function to NQA-1-2004, allows for the use of the Commercial Grade Dedication process to procure equipment requiring design services by the supplier. This incorporates definitions consistent with NQA-1-2004 text.

NQA-1-1989, Supplement 7S-1 Supplementary Requirements for Control of Purchased Items and Services

Replace NQA-1-1989 supplement 7S-1 Section 10, Titled Commercial Grade Items in its entirety with NQA-1-2004, Requirement 7, Section 700.

Justification: NQA-1-2004 provides greater flexibility for implementing the Commercial Grade Dedication process while assuring that equipment acquired under these processes will support their safety functions.

Modify new Section 701 General as follows:

701 General

When Commercial Grade Items or Services are utilized, the dedicating entity can utilize the requirements of this section for procurement and acceptance of items or services as an acceptable alternative to Sections 2 through 9 of this Supplement, except that Supplier evaluation and selection, where determined necessary by the Purchaser, shall be in accordance with Section 3.1 of this Supplement. The applicable requirements of this Standard shall apply to dedication activities for acceptance.

When a Commercial Grade Item has been delivered or installed, prior to the decision to dedicate, the dedicating entity can utilize the requirements of this section for acceptance of the item when the critical characteristics can be verified solely by inspections, tests, or analyses.

Justification: Corrects the section numbers to correspond to the appropriate section of NQA-1-1989 and provides for use of Commercial Grade Dedication for delivered and/or installed SSCs whose safety classification is subsequently upgraded.

Modify (referenced section number only) new Section 704.2 Source Verification as follows:

704.2 Source Verification

Source verification is only applicable to the actual item(s) or service(s) that are verified at the Supplier's facility or other applicable location. Source verification shall be performed in accordance with Section 8.2.2 of this Supplement, including a checklist or plan with the documented evidence of the source verification furnished to the dedicating entity and shall include or address the following:

(a) identification of the item(s) or service(s) included within the scope of the source verification

(b) identification of the critical characteristics, including acceptance criteria, to be controlled by the Supplier

(c) verification of the Supplier's processes and controls are effectively implemented for the identified critical characteristics

(d) identification of the activities witnessed during the source verification and the results obtained

(e) documentation of the adequacy of the Supplier's processes and controls.

Justification: Corrects the paragraph number to correspond to the appropriate section of NQA-1-1989.

Appendix H

WTP Specific Tailoring of IEEE Std. 384

Appendix H
WTP Specific Tailoring of IEEE Std. 384

19.0 IEEE-384, IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits

Revision: 1992

Sponsoring Organization: The Institute of Electrical and Electronics Engineers, Inc.

RPP-WTP Specific Tailoring

The following tailoring of IEEE-384 is required for use by the RPP-WTP project as an implementing standard for SDC, SC, SDS, or SS electrical equipment and circuit design.

All Sections Clarification of Nuclear Power Generating Station Terminology

The term "Standby Generator" in the Standard is synonymous with "Emergency Generator" in the RPP-WTP.

Justification: As determined by the ISM review process, the Standby Generators on the RPP-WTP are not classified as SDC or SC while the Emergency Generators are classified as SDC or SC.

Section 2.0, Purpose

Replace with the following:

This standard establishes the criteria for implementation of the independence requirements of IEEE 603-1998 (as tailored in C.33) and IEEE 308-1991 (as tailored in C.18).

Justification: This section was revised to clarify that SRD implementing standards IEEE 603-1998 and IEEE 308-1991 are tailored in Appendix C.

Section 3.0, References

The following reference standards, do not apply for the RPP-WTP.

- [1] ANSI/ANS-58.2-1988, Design Basis for Protection of Light Water Nuclear Power Plants Against the Effects of Postulated Pipe Rupture.

Justification: This document is applicable to the high pressure steam lines found in nuclear power generating stations and doesn't apply for the RPP-WTP.

- [4] ANSI/NFPA 803-1988, Fire Protection for Light Water Nuclear Power Plants.

Justification: This document specifically addresses nuclear power generating stations. Per section 4.5 of volume II of the SRD, the RPP-WTP will use NFPA 801-2003 as an implementing standard for fire protection.

- [11] IEEE Std 494-1974 (reaff 1990), IEEE Standard Method for Identification of Documents Related to Class 1E Equipment and Systems for Nuclear Power Generating Stations.

Justification: This standard has been withdrawn by the IEEE standards committee and no replacement standard has been recommended. This standard is not called out as an implementing standard in the SRD. Procedures for

identification of documents related to SDC, SC, SDS, or SS equipment will be developed internally for the RPP-WTP project.

Replace the 1991 version of IEEE 603 with the following version.

IEEE Std 603-1998, *IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations.*

Justification: SRD Safety Criterion 4.4-4 lists the 1998 version of IEEE 603 as an implementing standard for SDC and SC electrical power systems. The 1998 revision of IEEE 603 shall be used in place of the 1991 revision called out as a reference in the body of IEEE 384-1992 for SDC and SC electrical power systems only.

The following reference Standards shall be included:

- [16] DOE/RL-96-0006, Revision 1, *Top-level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors.*

Justification: Called out as a regulatory basis in the SRD.

- [17] ANSI/ISA-S84.01-1996, *Application of Safety Instrumented Systems for the Process Industries.*

Justification: Replaces IEEE-603 for Control and Instrumentation Systems at the WTP, per 24590-WTP-ABCN-ESH-01-027.

- [18] NFPA 801-2003, *Standard for Fire Protection for Facilities Handling Radioactive Materials.*

Justification: Called out as an implementing standard under safety criteria 4.5-1 through 4.5-4.

Section 4.0, Definitions

- The definition of **design basis events** shall be replaced with the following:

"Postulated events providing bounding conditions for establishing the performance requirements of structures, systems, and components that are necessary to: 1) ensure the integrity of the safety boundaries protecting the worker; 2) place and maintain the facility in a safe state indefinitely; or 3) prevent or mitigate the event consequences so that the radiological exposures to the general public or the workers would not exceed appropriate limits. The Design-Basis Events also establish the performance requirements of the structures, systems and components whose failure under Design-Basis Event conditions could adversely affect any of the above functions."

Justification: This definition is from DOE/RL-96-0006.

Section 5.3, Equipment and Circuits Requiring Independence

Replace with the following sentence:

Equipment and circuits requiring independence shall be determined during the ISM review cycle and shall be identified on documents and drawings in a distinctive manner.

Justification: The reference to IEEE-494 is not applicable since this standard has been withdrawn by the IEEE standards committee and no replacement standard has been recommended. This standard is not called out as an

implementing standard in the SRD. The ISM process will provide reliability requirements for each control strategy. These reliability requirements determine when control strategies require independence, redundancy, and seismic qualifications.

Section 6.1.3.2, Area Boundaries

Replace the reference to NFPA 803-1988[4] with NFPA 801-2003 [18].

Justification: Standard NFPA 803-1998 is not applicable for the RPP-WTP. Per section 4.5 of the SRD, NFPA 801-2003 shall be used for the RPP-WTP.

Section 6.5, Containment Electrical Penetrations

Not applicable for the RPP-WTP.

Justification: Containment electrical penetration assemblies are unique to the containment structure of Nuclear Power Generating Stations and have no equivalent in the RPP-WTP project.

Appendix I

WTP Specific Tailoring of IEEE Std. 323

Appendix I
WTP Specific Tailoring of IEEE Std. 323

23.0 IEEE-323, Qualifying Class 1E Equipment for Nuclear Power Generating Stations

Revision: 1983

Sponsoring Organization: The Institute of Electrical and Electronics Engineers, Inc.

RPP-WTP Specific Tailoring

The following tailoring of IEEE-323 is required for use by the RPP-WTP project as an implementing standard for ITS electrical and instrument system design.

Section 1.1, Scope

- This Standard applies to SSCs designated as SDC, SC, SDS, or SS (where the SS SSCs is required to perform a credited safety function in a harsh environment).

Justification: SS SSCs, which are required to perform a safety function in a harsh environment, have been included within the scope of this standard.

Section 2, References

The following reference Standard shall be included:

- [9] DOE/RL-96-0006, Revision 3, Top-level Radiological, Nuclear, and Process Safety Standards and Principles for the RPP Waste Treatment Plant Contractor.

Justification: The added references are applicable for the RPP-WTP project.

Section 3, Definitions

- Modify the definition of **harsh environment** to be: An environment expected as the result of the postulated service condition appropriate for the design basis event of the RPP-WTP. It is an environment that exceeds the conditions of a mild environment. Equipment that do not experience an environment beyond a mild environment during a design basis event can be considered to be in a mild environment.

Justification: A **harsh environment**, as defined by this standard, applies to a Nuclear Power Generating Station and are the result of a loss of cooling accident (LOCA)/high energy line brake (HELB) inside the containment and post-LOCA or HELB outside containment. The modified definition applies to RPP-WTP.

This modified definition is further supported by 10 CFR 50.49, Environmental qualification of electric equipment important to safety for nuclear power plants, which states, in section C: " Requirements for (1) dynamic and seismic qualification of electric equipment important to safety, (2) protection of electric equipment important to safety against other natural phenomena and external events, and (3) environmental qualification of electric equipment important to safety located in a mild environment are not included within the scope of this section. A mild environment is an environment that would at no time be significantly more severe than the environment that would occur during normal plant operation, including anticipated operational occurrences."

The definition of **mild environment** within the standard states:

"An environment expected as a result of normal service conditions and extremes (abnormal) in service conditions where seismic is the only design basis event (DBE) of consequences."

Therefore the normal operating environment for a SSC is considered a "mild environment" by this definition.

The following definition is applicable for the RPP-WTP:

- The definition of design basis events shall be added with the definition from DOE/RL-96-0006, which states:

  "Postulated events providing bounding conditions for establishing the performance requirements of structures, systems, and components that are necessary to: 1) ensure the integrity of the safety boundaries protecting the worker; 2) place and maintain the facility in a safe state indefinitely; or 3) prevent or mitigate the event consequences so that the radiological exposures to the general public or the workers would not exceed appropriate limits. The Design-Basis Events also establish the performance requirements of the structures, systems and components whose failure under Design-Basis Event conditions could adversely affect any of the above functions."

Justification: The above listed definition was added to be applicable to the RPP-WTP project.

Section 7, Simulated Test Profiles

Delete this section.

Justification: This section is specific to Nuclear Power Generating Stations and describes profiles and margin for LOCA/HELB harsh environments.

Appendix J

WTP Specific Tailoring of IEEE Std. 344

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WTP Specific Tailoring of IEEE Std. 344

22.0 IEEE-344, IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations

Revision: 1987(R1993)

Sponsoring Organization: The Institute of Electrical and Electronics Engineers, Inc.

RPP-WTP Specific Tailoring

The following tailoring of IEEE-344 is required for use by the RPP-WTP project as an implementing standard for SDC/SDS or SC/SS Seismic Class I electrical and instrument system design.

Pages 1-43, All Sections **Clarification of Nuclear Power Generating Station Terminology**

The term "Class 1E" in the Standard applies to "SC-I" in the RPP-WTP.

Justification: The Scope, section 1.0, of IEEE-344 applies to equipment that needs to function during and after an SSE for a Nuclear Power Generating Station. For RPP-WTP the equipment that needs to function during and after a design basis earthquake is SDC/SDS/SC/SS equipment which must be qualified to SC-1.

Page 1, Section 1.2 **References**

Delete reference [5] CFR (Code of Federal Regulations), Title 10; Energy, Part 100, Reactor Site Criteria, published by office of the Federal Register, 1992.

Justification: Reference [5] contains radiation dose criteria and seismic criteria for Nuclear Power Generating Stations and is not applicable to the RPP-WTP project. The applicable criteria for RPP-WTP is found in 24590-WTP-SRD-ESH-01-001-02, Safety Requirements Document (SRD) Volume II, Safety Criteria 2.0-1 for radiological dose and 2.0-2 for chemical hazards. The applicable seismic criteria is contained in 24590-WTP-SRD-ESH-01-001-02, Safety Requirements Document (SRD) Volume II, in section 4.1 General Design, Safety Criterion 4.1-3. This Safety Criterion defines Seismic Category (SC) I, II and III and provides seismic loads and source documents.

Delete reference [3] ANSI/IEEE Std 382-1985, *IEEE Standard for Qualification of Actuators for Power Operated Valve Assemblies with Safety-Related Functions for Nuclear Power Plants.*

Justification: This standard will be replaced with IEEE Std 382-1996. The IEEE Std 382-1996 includes a Required Input Motion (RIM) curve.

Pages 1-2, Section 2. **Definitions**

Delete the definitions for **Operating basis earthquake (OBE)** and **safe shutdown earthquake (SSE).**

Add a definition for **design basis earthquake** as: Earthquakes for RPP-WTP and the applicability to systems, structures and components (SSCs) is contained in 24590-WTP-SRD-ESH-01-001-02, Safety Requirements Document (SRD) Volume II, in section 4.1 General Design, Safety Criterion 4.1-3. This Safety Criterion defines Seismic Classes (SC) I, II and III and provide seismic loads and source documents.

Justification: The definition of OBE and SSE are applicable to Nuclear Power Generating Stations and the new definitions is applicable to the RPP-WTP project as defined in the SRD. This is consistent with the tailoring of AISC N690 as documented in ABCN-013.

Appendix C: Implementing Standards

Pages 1-43, All Sections Clarification of OBE and SSE

The term SSE in the standard is treated as a design basis earthquake. The requirement to apply and document the loads of a number of OBEs before an SSE is deleted from the standard.

Justification: The earthquake applicable to RPP-WTP is the design basis earthquake. The requirement to subject equipment to several OBEs prior to an SSE is not included in the requirements of the SRD for the RPP-WTP project. This is consistent with the tailoring of AISC N690 as documented in ABCN-013.

Page 13, Section 7.1.5.2, Repairs

In the fifth line delete the words, ", such as LOCA,".

Justification: LOCA is a term specific to Nuclear Power Generating Stations and not to the RPP-WTP project.

Page 15, Section 7.1.5, Vibrational Aging

In the last paragraph change the first sentence to read, "The purpose of the vibrational aging is to show that the lower levels of normal and transient vibration associated with plant operation will not adversely affect an equipment's performance of its safety function nor cause any condition to exist that, if undetected, would cause failure of such performance during a subsequent design basis earthquake.

Justification: This sentence within the standard included additional vibration aging of an OBE, but used the terms "lower intensity earthquake" rather than OBE. The rewording is needed to clarify the meaning of the sentence. The requirement to subject equipment to several OBEs prior to an SSE is not included in the requirements of the SRD for the RPP-WTP project. The earthquake applicable to RPP-WTP is the design basis earthquake. This is consistent with the tailoring of AISC N690 as documented in ABCN-013.

Page 16, Section 7.1.6.1, Hydrodynamic Loads

Delete the words, "and the loss-of-coolant accident (LOCA)

Justification: LOCA is a term specific to Nuclear Power Generating Stations and not to the RPP-WTP project.