

Attachment 51 – Appendix 4.0
Piping Material Index Table

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954, as amended) has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit and chapter 70.105 RCW. In the event of any conflict between Permit Condition III.10.A. and any statement relating to the regulation of source, special nuclear, and byproduct material contained in portions of the permit application that are incorporated into this permit, Permit Condition III.10.A. will prevail.

Additional appendices will be added to this appendix as new information is incorporated into this permit.



R10223107

Document title: **Piping Material Class Description**

ISSUED BY
APP-WTP PDC
3/6 3/2/04
INIT DATE

Contract number: DE-AC27-01RV14136
Department: Plant Design
Author(s): B. Gavino

Principal author signature: *B. Gavino*
Document number: 24590-WTP-PER-PL-02-001, Rev 5
Checked by: J. Sutton

Checker signature: *J. Sutton*
Date of issue: *3/04/04*
Issue status: Issued for Permitting Use
Approved by: M. Myatt
Approver's position: Discipline Engineering Manager

Approver signature: *[Signature] for M. MYATT*



EXPIRES: 07/09/04

This bound document contains a total of 33 sheets

River Protection Project
Waste Treatment Plant
2435 Stevens Center Place
Richland, WA 99352
United States of America
Tel: 509 371 2000

Notice

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

History Sheet

Rev	Date	Reason for revision	Revised by
0	09/20/02	Issued for Permitting Use	B. Gavino
1	02/10/03	Issued for Permitting Use	B. Gavino
2	03/27/03	Issued for Permitting Use	B. Gavino
3	12/23/03	Issued for Permitting Use	B. Gavino
4	02/26/04	Issued for Permitting Use	B. Gavino
5	3/4/04	Issued for Permitting Use	B. Gavino

Contents

Notice.....	1
History Sheet	2
1 Introduction	4
2 Applicable Documents.....	4
3 Description	4
3.1 Codes	4
3.2 Pipe Wall Thickness and Branch Reinforcements	4
3.3 Design Conditions	4
3.4 Pipe.....	5
3.5 Flanges	5
3.6 Fittings	5
3.7 Bolting and Gaskets	6
3.8 Valves	6
3.9 Method of Construction	7
3.10 Branch Connection	7
3.11 Corrosion Allowance	7

Appendices

Appendix A - Piping Material Class Summary.....	A-1
---	-----

1 Introduction

This document describes the minimum requirements for the piping material classes for the River Protection Project – Waste Treatment Plant. It summarizes the piping material requirements for pipe, fittings, flanges, valves, and all other piping components for each specific pipe class as applicable to specific fluid service. The piping classes apply to bulk piping components and do not cover specialty items identified on engineering data sheets.

2 Applicable Documents

24590-WTP-3PS-G000-TP002, “Positive Material Identification (PMI)

3 Description

Appendix A summarizes the requirements in the piping material classes. Piping regulated under the Dangerous Waste Permit is identified on permit drawings. All piping classes are shown in this document for completeness. The following general guidelines/requirements are considered in the development of the piping material classes.

3.1 Codes

The applicable design code(s) is as noted on the piping material class summary (Appendix A). Any conflicts between this document and the applicable design codes shall be brought to the attention of the RPP-WTP piping engineering group of the plant design discipline.

3.2 Pipe Wall Thickness and Branch Reinforcements

The specific pipe thickness or schedule number is supported by a wall thickness calculation and if necessary, by a branch reinforcement calculation. Any increases in the design conditions used as the basis of these piping class sheets must be supported by a revision to the wall thickness calculation or by additional calculation.

The commercially available pipe wall thickness specified in the piping class sheets meet or exceed the minimum calculated wall thickness.

Integrally reinforced branch connections do not require a separate calculation. The branch reinforcement for all non-integrally reinforced shall be supported by a branch reinforcement calculation.

3.3 Design Conditions

The service limits and the corrosion/erosion allowance referred to in the piping material class summary are enveloping conditions. Pressures and temperatures listed shall not be exceeded except as permitted by the applicable code.

3.4 Pipe

Nominal pipe sizes (NPS) $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $1\frac{1}{4}$, $2\frac{1}{2}$, $3\frac{1}{2}$, 5 and 22, and any other nominal pipe size not shown in ASME B36.10 / B36.19, should not be used except to match manufacturer's equipment connections or as specified on the P&IDs. Where necessary to match a manufacturer's equipment connection, a transition piece must be employed immediately adjacent to the equipment for the transition to the next acceptable pipe size.

In general, all NPS 2 and larger pipe with a schedule of standard weight and heavier has been specified as double random length and NPS $1\frac{1}{2}$ and smaller as single random length. The majority of pipe included in these classes is multiple stamped.

Example:

(Seamless API-5L Gr. B, ASTM A106 Gr. B and A53 Gr. B, or ASTM A312 TP 304/304L or ASTM A312 TP 316/316L).

For carbon steel material by ASME B31.3, Para./ Fig. 323.2.2, impact testing may be required.

Schedule 160 threaded pipe nipples for carbon steel and schedule 80S threaded pipe nipples for stainless steel have been used to provide enhanced mechanical strength.

3.5 Flanges

NPS 24 and smaller steel flange dimensions and ratings are to ASME B16.5.

NPS 26 through NPS 60 steel flange dimensions and ratings are to ASME B16.47 Series A. However, ASME B16.47 Series B may be used when needed to mate with existing equipment.

Flat faced flanges shall be used to match flat face equipment and other flat faced flanged components (e.g., copper alloy, cast iron flanges, GRP flanges and for NPS 30 and larger flanges in large diameter water lines).

Orifice flanges shall be in accordance with ASME B16.36 and shall be supplied in pairs, complete with jackscrews, but without bolts, gaskets, or orifice plates. Quantities on bill of material, material requisitions, etc., shall indicate sets, not individual flanges.

Blanks, either permanent or temporary are required to have sufficient thickness per the ASME B31.3 Code. Spectacle blinds in accordance with ASME B16.48 shall not be used as permanent blanks and shall be used only where required to isolate line for pressure testing, start up or maintenance. Gasket contact surface finishes shall be the same as the mating flanges.

3.6 Fittings

Buttweld fittings shall conform to the material requirements and wall thickness of the pipe with which they are used.

The wall thickness of reducing tees, concentric and eccentric reducers shall correspond on each end to the wall thickness of the mating pipe.

Half couplings shall not be used for branch connections in ASME B31.3 Piping Material Classes. Elbolets shall be used only where specifically allowed per the piping assembly details.

3.7 Bolting and Gaskets

Machine bolts shall not be used except as jackscrews and when bolting Cast Iron, Bronze, Ductile Iron, PVC, or Fiberglass flanges. Jackscrews shall be threaded full length. The length shall be measured from the bearing surface of the head and shall include the end point.

Stud bolts shall be threaded full length. Length of stud bolts shall be in accordance with ASME B16.5 or B16.47 as applicable, and referenced in piping material class as a bolt table. Bolt tables do not include increased lengths required for use with bolt tensioning and other non-standard components / equipment.

Cap screws are used where the valve or component design does not allow through bolts to be used for every bolthole. Cap screws shall be threaded full length. The length shall be measured from the bearing surface of the head and shall include the end point.

3.8 Valves

Valves specified to be drilled and tapped for drain connections, body cavity vents, etc., shall be supplied with the tapped holes fitted with solid, square head pipe plugs of the same basic material as the valve body, in accordance with ASME B16.14.

If ball valves are required to be "Fire Safe" they shall be in accordance with API 607 and shall have anti-static devices fitted in accordance with API 608.

Butterfly valves are used for positive shutoff in sizes 10 inch and larger. Wafer type butterfly valves have been specified for in-line service based on lower total installed and operation cost (TIC).

Tapped lugged wafer type (e.g., butterfly, check, etc.) valves have been specified for dead end application, and when fitted between cast iron or non-metallic flanges.

Unlined soft seated butterfly valves and plug valves, if required to be "Fire Safe" shall be in accordance with API 607.

Typical gear operated valve sizes:

Gate Valves

Classes 150 and 300	NPS	14 & Larger
Classes 600 and 900	NPS	8 & Larger
Classes 1500 and 2500	NPS	8 & Larger

Globe and Angle Valves

Classes 150 and 300	NPS	12 & Larger
Classes 600 and 900	NPS	6 & Larger
Classes 1500 and 2500	NPS	4 and Larger

Butterfly Valves

Classes 150 and 300	NPS	10 & Larger
Classes 600 and 900	NPS	6 & Larger
Classes 1500 and 2500	NPS	6 & Larger

Ball and Plug Valves

Classes 150 and 300	NPS	8 & Larger
Classes 600 and 900	NPS	6 & Larger
Classes 1500 and 2500	NPS	4 & Larger

Additionally, gear operators may be required on specific valves, to satisfy process, operational and/or other requirements.

3.9 Method of Construction

Basically, the method of construction is as follows:

- Shop fabricated carbon steel NPS 1½ and smaller pipe are socket welded while NPS 2 and larger are butt welded construction.
- Shop fabricated stainless steel NPS 1 pipe and smaller are socket welded while NPS 1½ and larger are butt welded.
- The small bore valves are socket welded up to size NPS 2 for both cases.
- Field fabrication for carbon and stainless steel piping NPS 2 and smaller should be socket weld.

Certain piping material classes in this document are required to be all butt weld construction based on the service requirements.

3.10 Branch Connection

The branch connection fittings are specified in the piping material class branch tables.

3.11 Corrosion Allowance

Corrosion allowance used is nominal. Utilizing good engineering practice and good judgment, it is permissible to adjust corrosion allowances for certain line sizes within piping class specifications. However, corrosion allowance shall not be less than 80% of the specified nominal corrosion allowance.

Appendix A- Piping Material Class Summary

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
B19A	Uniform Plumbing Code (WV) Potable Water	Based on Design 130 @ 200 150 @ 100	CL 150 MFR	0.0240	Copper 3/8" - 4", Type L (Type K, for Underground)	Wrought Copper	Wrought Copper	Cast Bronze/ Cast Iron	Bronze	EPDM
B19B	ASME B31.3, Category Normal Fluid Service (ZA) Non Dangerous, Non Radioactive Liquid Effluent (WL) Chilled Water Return	Based on Design 130 @ 200 150 @ 100	CL 150 MFR	0.0240	Copper 3/8" - 4", Type L (Type K, for Underground)	Wrought Copper	Wrought Copper	Cast Bronze/ Cast Iron	Bronze	EPDM

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
C12A	ASME B31.3, Category Normal Fluid Service (DB) High Pressure Steam (GA) Argon (GB) Breathing air (GH) Helium (GK) 150 Psig Air (GL) Instrument Air (GN) Nitrogen (GP) P-10 (GQ) Process Air (GZ) Vessel Vent, Non-Radioactive (WB) Tower Cooling Water Supply (WC) Tower Cooling Water Return (WH) HVAC Hot Water Supply (WJ) HVAC Hot Water Return (WK) Chilled Water Supply (WL) Chilled Water Return (WP) Process Water (WR) Raw Water (WS) Recirculated Cooling Water, Suspect Radioactive (WT) Floor Drains (C2 Areas) (ZA) Non-Dangerous, Non-Radioactive Liquid Effluent (ZU) Non-Radioactive Condensate	Based on ASME B16.5 285 @ -20/100 260 @ 200 230 @ 300 200 @ 400	CL 150 B16.5	0.0625	Carbon Steel ½"-1½", XS 2" - 24", STD 28", 30", STD 36" - XS	Carbon Steel	Carbon Steel	Carbon Steel	Trim 8	304 SS Spiral-Wound/ Graphite Filled
C12B	ASME B31.3, Category Normal Fluid Service (CD) Carbon Dioxide Liquid/ Gas (DB) High Pressure Steam (DC) Low Pressure Steam (DL) 0 to 10 psig Steam (GQ) Process Air (ZU) Non Radioactive Condensate	Based on ASME B16.5 285 @ -20/100 200 @ 400	CL 150 B16.5	0.0625	Carbon Steel ½" - 1½", XS 2" - 24", STD	Carbon Steel	Carbon Steel	Carbon Steel	Trim 8	304 SS Spiral-Wound/ Graphite Filled

**24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description**

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
C12D	ASME B31.3, Category Normal Fluid Service (XX) Diesel Oil (XM) Fuel Oil	Based on ASME B16.5 285 @ -20/100 260 @ 200	CL 150 B16.5	0.0625	Carbon Steel ½" - 1½", XS 2" - 24", STD	Carbon Steel	Carbon Steel	Carbon Steel	Trim 8	304 SS Spiral-Wound/ Graphite Filled
C12E	NOTE: Fluid Code WF (Fire Protection Water) piping identified with this pipe class shall be in accordance with 24590-BOF-3PS-PZ41-T0004, 24590-WTP-3PS-P00Z-PZ41-T0001, and 24590-WTP-3PS-PZ41-T0002. Accordingly, the associated piping and components will be modeled using SpecMaker as this system is to subcontract and therefore does not require PipeWorks stock code materials.									
C12H	NFPA 13 (WF) Fire Protection (WR) Raw Water	Based on Design 175 @ 150	MFR	Per NFPA 13	Carbon Steel ½" - 12", Sch. 40	Ductile Iron/ Carbon Steel	Malleable Iron	Cast Iron/ Cast Bronze	Bronze	EPDM
C12U	ASME B31.3, Category Normal Fluid Service Underground Services: (GK) 150 Psig Air (GQ) Process Air (WB) Tower Cooling Water Supply (WC) Tower Cooling Water Return (WK) Chilled Water Supply (WL) Chilled Water Return (WP) Process Water	Based on ASME B16.5 285 @ -20/100 200 @ 400	CL 150 B16.5	0.0625	Carbon Steel, Externally Coated ½" - 1½", XS 2" - 24" STD 30", STD	Carbon Steel, Externally Coated	Carbon Steel, Externally Coated	Carbon Steel, Externally Coated	Trim 8	304 SS Spiral-Wound/ Graphite Filled
C14A	ASME B31.3, Category Normal Fluid Service (DB) High Pressure Steam (DC) Low Pressure Steam (GV) Vessel Vent Radioactive (GW) Suspect Radioactive Vent (GZ) Vessel Vent, Non-Radioactive (PS) Suspect Radioactive Slurry (WP) Process Water (WR) Raw Water (ZR) Suspect radioactive Condensate (ZU) Non-Radioactive Condensate	Based on Design 200 @ 400	CL 150 B16.5	0.125	Carbon Steel ½" - 2", XS 3" - 24", STD 30", STD	Carbon Steel	Carbon Steel	Carbon Steel	Trim 8	304 SS Spiral-Wound/ Graphite Filled

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
C14B	ASME B31.3, Category Normal Fluid Service (ZR) Suspect Radioactive Condensate (ZU) Non-Radioactive Condensate	Based on Design 200 @ 400	CL 150 B16.5	0.125	Carbon Steel ½" - 8", Sch XS* *Pipe thickness is mandated by BOF Mech System Engineering	Carbon Steel	Carbon Steel	Carbon Steel	Trim 8	304 SS Spiral-Wound/ Graphite Filled
	ASME B31.3, Category Normal Fluid Service <u>Underground Services</u> (GM) Ammonia	Based on Design 360 @ -28/ 150	None	0.0400	Carbon Steel, Externally Coated ½" - 2", XS	None	Carbon Steel, Externally Coated	None	None	None
C31J	ASME B31.3, Category Normal Fluid Service (GM) Ammonia	Based on Design 360 @ -28/ 150	None	0.0400	Carbon Steel ½" - 2", XS	None	Carbon Steel	Carbon Steel	316 SS/ PTFE	None
F10A	ASME B31.3, Category-Normal Fluid Service (ZS) Process Radioactive Condensate				Double Containmentment Pipe					
	CARRIER ENCASEMENT (JACKET)	Based on design 100 @ 120 Atm @ 120	MFR	0.000	Filament Wound Fiberglass Reinforced Thermosetting Resin Pressure Pipe	Filament Wound with integral Sockets Same working Pressure or Greater Than Pipe From Same Manufacturer		PVDF	PVDF	EPDM
G12A	Uniform Plumbing Code (WV) Potable Water	Based on Design 200 @ 150	CL 125/150/ MFR	0.050	Carbon Steel, Galvanized ½" - 3", XS 4" - 10", Sch 40 12", Std	Ductile Iron, Galvanized	Malleable Iron, Galvanized	Cast bronze/ Ductile Iron	Bronze	EPDM
G12B	ASME B31.3, Category Normal Fluid Service (GL) Instrument Air	Based on Design 210 @ 200	CL 150 B16.5	0.0400	Carbon Steel, Galvanized ½" - 2", XS 3" - 12", STD	Carbon Steel, Galvanized	Malleable Iron, Galvanized	Cast bronze/ Stainless Steel	Bronze	304 SS Spiral-Wound/ Graphite Filled
G12C	NFPA 13 (WF) Fire Protection Water (WR) Raw Water	Based on Design 175 @ 150	MFR	0.0400	Carbon Steel Galvanized ½" - 12", Sch. 40	Carbon Steel Galvanized	Malleable Iron, Galvanized	Bronze/ DI	Bronze	EPDM
H00A	Uniform Plumbing Code (WV) Potable Water	Based on Design 200 @ 150	MFR	0.000	Cement Lined Ductile Iron Pressure Pipe	Cement Lined Ductile Iron	None	None	-	SBR Rubber

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket	
H20A	AWWA Standards Underground Services: (WB) Tower Cooling Water Supply (WC) Tower Cooling Water Return (WK) Chilled Water Supply (WL) Chilled Water Return (WP) Process Water (WR) Raw Water (ZA) Non Dangerous, Non Radioactive liquid Effluent	Based on Design 250 @ 33 – 150 350* @ 135 *Short duration per Calc No. 24590-BOF-M6C-PCW-00001	MFR	0.000	Cement Lined Ductile Iron Pressure Pipe	Cement Lined Ductile Iron	None	Ductile Iron	Bronze	SBR Rubber (Part of Push-on Joint Fitting)	
HF0A	NFPA 24 (WF) Fire Protection Water (WR) Raw Water	Based on Design 175 @ 150	MFR	0.000	Cement Lined Ductile Iron Pressure Pipe	Cement Lined Ductile Iron	NONE	NONE	NONE	SBR Rubber	
LE0A	NOTE: Fluid Code WF (Fire Protection Water) piping identified with this pipe class shall be in accordance with 24590-BOF-3PS-PZ41-T0001, not per this piping material specification. Accordingly, the associated piping and components will be modeled using SpecMaker as this system is to subcontract and therefore does not require PipeWorks stock code materials.										
N11E	ASME B31.3, Category:Normal Fluid Service Highly Corrosive Process Fluids in High Active Cells (PF) Cs/Tc Concentrate/ Intermediate Product (WU) Floor Drains (C3 Areas) (ZF) Plant Washings (ZN) Neutral Effluent	Based on Design 110 @ 360	No Flanges	0.0400	UNS N06022 (Hastelloy C-22) ½" – 2", Sch 40S 3" – 8", Sch. 10S	UNS N06022	UNS N06022	No Valves	No Valves	No Gaskets	

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
N11F	ASME B31.3, Category-Normal Fluid Service	Based on Design 150 @ 200	CL 150 B16.5	0.0425	UNS N08367 (AL-6XN) ½" – 2", Sch. 40S 3" – 24", Sch 10S 30", Sch 10S	UNS N08367	UNS N08367	UNS N08367/316 SS	UNS N08367/316 SS	Hastelloy C276 Spiral-Wound/ Graphite Filled
	(GR) Radar Guide Tube									
	(GV) Radioactive Vessel Vent									
	(PC) HLW Feed Slurry									
	(PJ) HLW Melter Feed									
	(PW) Radioactive Gas/ Vapor									
	(WE) Demineralized Water									
	(ZF) Plant Washings									
	(ZH) Acidic Effluent									
	(ZJ) Alkaline Effluent									
	(ZR) Suspect Radioactive Condensate									
	(ZS) Process Radioactive Condensate									
	N11G	ASME B31.3, Category-Normal Fluid Service	Based on Design -14.7/25 @ 250	CL 150 B16.5	0.0425	UNS N08367 (AL-6XN) ½" – 2", Sch. 40S 3" – 12", Sch 10S 14" – 20", 0.25" Wall 24", 0.312" Wall	UNS N08367	UNS N08367	UNS N08367	UNS N08367
(DC) Low Pressure Steam										
(GQ) Process Air										
(GU) Nitric Acid Fume										
(GV) Radioactive Vessel Vent										
(HR) Recovered Nitric Acid										
(PF) Cs/Tc Concentrate / Intermediate Product										
(PW) Radioactive Gas / Vapor										
(ZF) Plant Washings										
(ZG) Pneumatic Line										
(ZR) Suspect Radioactive Condensate										
(ZS) Process radioactive Condensate										
(ZT) Thermocouple Sheathed Line In-Cell										
N11H	ASME B31.3, Category Normal Fluid Service	Based on Design 230 @ -20/ 100 195 @ 200 175 @ 300 160 @ 400 145 @ 500 140 @ 600	CL 150 B16.5	0.0425	UNS N08367 (AL-6XN) ½" – 2", Sch. 40S 3" – 24", Sch. 10S 30", Sch 10S	UNS N08367	UNS N08367	UNS N08367	UNS N08367	Hastelloy C276 Spiral-Wound/ Graphite Filled
	(GV) Radioactive Vessel Vent									
	(PW) Radioactive Gas/ Vapor									

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
N11J	ASME B31.3, Category Normal Fluid Service (PW) Radioactive Gas/ Vapor	Based on Design -14.7/ 20 @ 1140	TBD	0.0400	UNS N06625 (Inconel 625) ½" - 4", Sch. 40S	UNS N06625	UNS N06625	UNS N06625	UNS N06625	TBD
N11V	ASME B31.3, Category Normal Fluid Service (PW) Radioactive Gas/ Vapor	Enveloping Conditions -14.7/ 230 @ 20/100 -14.7/ 195 @ 200 -14.7/ 175 @ 300 -14.7/ 160 @ 400 -14.7/ 145 @ 480	CL 150 B16.5	0.0425	UNS N08367 (AL-6XN) ½" - 2", Sch. 40S 3" - 10", Sch. 10S 12", 0.188" Nom 14" - 18", 0.250" Nom 20", 0.312" Nom 24", 0.312" Nom 30", 0.375" Nom	UNS N08367	UNS N08367	UNS N08367	UNS N08367	Hastelloy C276 Spiral-Wound/ Graphite Filled
N13A	ASME B31.3, Category-Normal Fluid Service (GV) Radioactive Vessel Vent (PA) Radwaste Aqueous (PW) Radioactive Gas/ Vapor (ZS) Process Radioactive Condensate	Based on Design 100 @ 120 150 @ 200 10 @ 600	CL 150 B16.5	0.0400	UNS N06022 (Hastelloy C-22) ½" - 2", Sch. 40S 3" - 8", Sch. 10S	UNS N06022	UNS N06022	TBD	TBD	Hastelloy C276 Spiral-Wound/ Graphite Filled
N14A	ASME B31.3, Category-Normal Fluid Service For High Erosion Pipe Sections in N06022 lines (ZF) Plant Washings	Based on Design 150 @ 400	No Flanges	0.125	UNS N06022 (Hastelloy C-22) ½" - 2", Sch. 80S 3" - 8", Sch. 40S	-	-	-	-	No Gaskets
N14B	ASME B31.3, Category-Normal Fluid Service For High Erosion Pipe Sections	Based on Design -14.7/ 20 @ 160	No Flanges	0.125	UNS N06022 (Hastelloy C-22) ½" - 2", Sch. 80S 3" - 8", Sch. 40S	-	-	-	-	No Gaskets

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
N31C	ASME B31.3, Category-Normal Fluid Service (GQ) Process Air (HN) Nitric Acid (JS) Sodium Hydroxide (PF) Cs/Tc Concentrate/ Intermediate Product (ZF) Plant Washings (ZG) Pneumercator Line (ZS) Process Radioactive Condensate (ZT) Thermocouple Sheathed Line In-Cell	Based on Design -14.7/ 150 @ 350	TBD	0.040d	UNS N06022 (Hastelloy C-22) ½" - 8", Sch 40S 10" - 16", 0.250" Nom	UNS N06022	UNS N06022	UNS N06022	UNS N06022	TBD
P10A	Uniform Plumbing Code <u>Underground Services:</u> (WV) Potable Water (ZV) Vacuum (ZZ) Rabbit Transport Line	Based on Design 150 @ 73 124 @ 100 80 @ 120	MFR	0.000	PVC 1" - 2", Sch. 80 3" - 12", Pressure Class 200	PVC	PVC	1" - 2", Bronze 3" - 12", Cast Iron/ internally coated	Bronze	Neoprene
P10B	ASME B31.3, Category Normal Fluid Service <u>Underground Services:</u> (WE) Demineralized Water (WP) Process Water (ZA) Non-Dangerous, Non-Radioactive Liquid Effluent	Based on Design 150 @ 73 124 @ 100 80 @ 120	MFR	0.000	PVC 1" - 2", Sch. 80 3" - 12", Pressure Class 200	PVC	PVC	1" - 2", Bronze 3" - 12", Cast Iron/ internally coated	Bronze	Neoprene
P10C	ASME B31.3, Category Normal Fluid Service (ZA) Non-Dangerous, Non-Radioactive Liquid Effluent	Based on Design 150 @ 73 150 @ 100 (≤8") 142 @ 100 (10" - 12") 110 @ 120 (≤6") 92 @ 120 (8" - 12")	MFR	0.000	PVC 12" & Smaller, Sch. 80	PVC	PVC	1" - 2", Bronze 3" - 12", Cast Iron/ internally coated	Bronze	EPDM
P10D	ASME B31.3, Category Normal Fluid Service (WE) Demineralized Water	Based on Design 150 @ 140	MFR	0.000	PVDF ½" - 2", Sch. 80	-	PVDF	PVDF	PVDF	PVDF Bonded EPDM

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
PF0A	NFPA 24 Underground Services: (WR) Raw Water	MFR Rating 175 @ 73 125 @ 100 84 @ 120	MFR	0.000	PVC 4" - 12", AWWA C900 Class 200	DI, Cement Lined AWWA C110	None	DI	By MFR	EPDM
<p>NOTE: Fluid Code WF (Fire Protection Water) piping identified with this pipe class shall be in accordance with 24590-BOF-3PS-PZ41-T0001, not per this piping material specification. Accordingly, the associated piping and components will be modeled using SpecMaker as this system is subcontract and therefore does not require PipeWorks stock code materials.</p>										
PG0A (To be issued)	Uniform Plumbing Code Underground Services WV Potable Water	150 @ 73 124 @ 100 80 @ 120	MFR	0.000	PVC 4" 12", AWWA C900 Class 200	DI, Cement Lined AWWA C110	None	DI	By MFR	Neoprene
S10A	ASME B31.3, Category Normal Fluid Service (GA) Argon (GB) Breathing Air (GK) Air, 150 psig (GL) Instrument Air (GQ) Process Air	Based on ASME B16.5 230 @ -20/100 195 @ 200	CL 150 B16.5	0.000	304L SS 1/2" - 4", Sch. 40S 6" - 24", Sch. 10S	304L SS	304L SS	316/ 316L SS	Trim 12	316L SS Spiral-Wound/ Graphite Filled
S10V	ASME B31.3, Category Normal Fluid Service (ZV) Vacuum	Based on Design -14.7 @ 100	CL 150 B16.5	0.000	304L SS 1/2" - 4", Sch. 40S 6", Sch. 10S	304L SS	304L SS	316/ 316L SS	Trim 12	316L SS Spiral-Wound/ Graphite Filled
S11B	ASME B31.3, Category-Normal Fluid Service In-Cell Piping (including bulges), not containing greater than 20% by weight Nitric Acid, with <2% solids (CD) Carbon Dioxide Liquid/ Gas (DB) High Pressure Steam (DC) Low Pressure Steam (DL) 0-10 Psig Steam (GK) 150 psig Air (GL) Instrument Air (GQ) Process Air (GV) Vessel Vent Radioactive (HN) Nitric Acid (HR) Recovered Nitric Acid (JS) Sodium Hydroxide (PA) Radwaste Aqueous (PB) LAW Feed (PF) Cs/Tc Concentrate/ Intermediate Product	Based on ASME B16.5, CL 150 230 @ -20/100 166 @ 360 160 @ 400	CL 150 B16.5	0.0400	316L SS 1/2" - 4", Sch. 40S 6" - 24", Sch. 10S 30", 0.375" Nom 36", 0.375" Nom 40", 0.375" Nom	316L SS	316L SS	316L SS	Trim 12	316L SS Spiral-Wound/ Graphite Filled

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
S11C	(PH) LAW Melter Feed	Based on ASME B16.5 230 @ -20/100 166 @ 360	CL 150 B16 5	0.0400	316L SS 1/2" - 4", Sch. 40S 6" - 14", Sch. 10S 16" - 20", 0.250" Nom	316L SS	316L SS	316/316L SS	Trim 12	316L SS Spiral-Wound/ Graphite Filled
	(PP) Ultrafilter Permeate									
	(PW) Radioactive Gas/Vapor									
	(PX) Radioactive Slurry									
	(PZ) Waste Feed									
	(RK) Sodium Permanganate									
	(RQ) Strontium Nitrate									
	(WB) Tower Cooling Water Supply									
	(WC) Tower Cooling Water Return									
	(WE) Demineralized Water									
	(WK) Chilled Water Supply									
	(WL) Chilled Water Return									
	(WN) Recirculated Chilled Water									
	(WP) Suspect Radioactive Process Water									
	(WS) Recirculated Cooling Suspect Radioactive									
	(WT) Floor Drains (C2 Areas)									
	(WU) Floor Drains (C3 Areas)									
	(ZD) Anti-Foaming Agent									
	(ZE) Plant Wash Fluid									
	(ZF) Plant Washings									
	(ZH) Acidic Effluent									
	(ZI) Alkaline Effluent									
	(ZK) Fresh Ion Exchange (IX) Resin									
	(ZL) Spent Ion Exchange (IX) Resin									
	(ZN) Neutral Effluent									
	(ZR) Suspect Radioactive Condensate									
(ZS) Process Radioactive Condensate										
(ZT) Thermocouple Sheathed Line In-Ceiling										
(ZY) Scrubber Effluent										
ASME B31.3, Category Normal Fluid Service										
(DB) High Pressure Steam										
(DC) Low Pressure Steam										

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
	0 – 10 psig Steam	160 @ 400			24", 0.312" Nom.					
(DL)	150 Psig Air									
(GK)	Instrument Air									
(GL)	Ammonia									
(GM)	Process Air									
(GQ)	Radioactive Vessel Vent									
(GV)	Vessel Vent, Non-									
(GZ)	Radioactive									
(IS)	Sodium Hydroxide									
(PB)	LAW Feed									
(PH)	LAW Melter Feed									
(PV)	Strontium Carbonate									
(RK)	Sodium Permanganate									
(WB)	Tower Cooling Water Supply									
(WC)	Tower Cooling Water Return									
(WD)	Inhibited Water									
(WE)	Deminerlized Water									
(WG)	Recirculated Emergency Cooling, Suspect Radioactive									
(WK)	Chilled Water Supply									
(WL)	Chilled Water Return									
(WN)	Recirculated Chilled Water, Suspect Radioactive									
(WP)	Process Water									
(WR)	Raw Water									
(WS)	Recirculated Cooling Water, Suspect Radioactive									
(WT)	Floor Drains C2 Areas									
(WU)	Floor Drains (C3 Areas)									
(WV)	Potable Water									
(ZA)	Non-Dangerous, Non-Radioactive Liquid Effluent									
(ZC)	Corrosion Inhibitors									
(ZD)	Antifoam reagent									
(ZE)	Plant Wash Fluid									
(ZI)	Alkaline Effluent									
(ZK)	Fresh Ion Exchange (IX) Resin									
(ZN)	Neutral Effluent									
(ZR)	Suspect Radioactive Condensate									

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
	(ZS) Process Radioactive Condensate (ZU) Non-Radioactive Condensate (ZY) Scrubber Effluent									
SIIE	ASME B31.3, Category Normal Fluid Service (GA) Argon (GH) Helium (GN) Nitrogen (GV) Radioactive Vessel Vent (PA) Radwaste Aqueous (WT) Floor Drains (C2 Areas) (WU) Floor Drains (C3 Areas) (ZN) Neutral Effluent	Based on ASME B16.5, Class 150 230 @ -20/100 195 @ 200 175 @ 300	CL 150 B16.5	0.0400	316L SS ½" - 4", Sch. 40S 6" - 14", Sch 10S 16" - 20", 0.250" Nom 24", 0.312" Nom	316L SS	316L SS	316/ 316L SS	Trim 12	316L SS Spiral- Wound/ Graphite Filled
SIIF	ASME B31.3, Category-Normal Fluid Service In-Cell Piping (including bulges) with <2% solids that may contain 20% by weight Nitric Acid (DB) High Pressure Steam (GQ) Process Air (GV) Radioactive Vessel Vent (HN) Nitric Acid (HR) Recovered Nitric Acid (PA) Radwaste Aqueous (ZC) Corrosion Inhibitor (ZE) Plant Wash Fluid (ZF) Plant Washings (ZG) Pnuemercator Line (ZR) Suspect Radioactive Condensate (ZS) Process Radioactive Condensate (ZT) Thermocouple Sheathed Line In-Cell	Based on ASME B16.5, Class 150 230 @ -20/100 166 @ 360	CL 150 B16.5	0.0400	304L SS ½" - 4", Sch. 40S 6" - 24", Sch 10S	304L SS	304L SS	304L SS	304 SS	316L SS Spiral- Wound /Graphite Filled
SIIG	ASME B31.3, Category Normal Fluid Service (XH) Hydraulic Oil (XJ) Transformer Oil (XL) Lubricating Oil	Based on ASME B16.5 230 @ -20/100 195 @ 200	CL 150 B16.5	0.0400	304L SS ½" - 4", Sch. 40S 6" - 10", Sch 10S	304L SS	304L SS	316/ 316L SS	Trim 12	304 SS Spiral- Wound, PTFE Filled

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
SI1K	ASME B31.3, Category Normal Fluid Service (GM) Ammonia (GZ) Vessel Vent, Non-Radioactive (GW) Suspect Radioactive Vent (HN) Nitric Acid (JS) Sodium Hydroxide (PK) Urea Solution (PV) Strontium Carbonate (RH) Hydrogen Peroxide (RK) Sodium Permanganate (RN) Sodium Nitrite (RQ) Strontium Nitrate (WP) Process Water (WT) Floor Drains (C2 Areas) (WU) Floor Drains (C3 Areas) (XH) Hydraulic Oil (ZA) Non Dangerous, Non Radioactive Liquid Effluent (ZH) Acidic Effluent (ZK) Fresh Ion Exchange [IX] Resin (ZM) Off-Specification Resin (ZY) Scrubber Effluent	Based on ASME B16.5 230 @ -20/100 195 @ 200	CL 150 B16.5	0.0400	304L SS 1/2" - 4", Sch 40S 6" - 14", Sch 10S 16" - 20", 0.250" Nom 24", 0.312" Nom	304L SS	304L SS	316/ 316L SS	Trim 12	316L SS Spiral-Wound /Graphite Filled

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
S11M	ASME B31.3, Category-Normal Fluid Service (FD) Zircon Sand (GV) Radioactive Vessel Vent (GW) Suspect Radioactive Vent (PP) Ultrafilter Permeate (PU) Suspect Radioactive Gas/Vapor (PW) Radioactive Gas/ Vapor (WE) Demineralized Water (WP) Process Water (WT) Floor Drains (C2 Areas) (ZE) Plant Wash Solvent (ZF) Plant Washings (ZH) Acidic Effluent (ZI) Alkaline Effluent (ZL) Spent Ion Exchange Resin (ZN) Neutral Effluent (ZR) Suspect Radioactive Condensate (ZY) Scrubber Effluent	Based on ASME B16.5 230 @ -20/100 195 @ 200 175 @ 300	CL 150 B16.5	0.0400	316L SS ½" - 4", Sch. 40S 6" - 24", Sch. 10S 30", 0.375" Nom 36", 0.375" Nom 40", 0.375" Nom	316L SS	316L SS	316/ 316L SS	Trim 12	316L SS Spiral-Wound, Graphite Filled
S11N	ASME B31.3, Category Normal Fluid Service (PW) Radioactive Gas/ Vapor	Based on Design 230 @ -20/100 195 @ 200 140 @ 600 15 @ 1150	CL 150 B16.5	0.0400	316L SS ½" - 4", Sch. 40S 6" - 24", Sch. 10S 30", 0.375" Nom 36", 0.375" Nom 40", 0.375" Nom	316L SS	316L SS	316/ 316L SS	Trim 12	316L SS Spiral-Wound/ Graphite Filled
S11P	ASME B31.3, Category-Normal Fluid Service (GC) TV-Camera Access (GR) Radar Guide Tube (ZT) Thermocouple Sheathed Line In Cell	Based on ASME B16.5 230 @ -20/100 -14.7 @ 212 50 @ 237	CL 150 B16.5	0.0400	316L SS ¾" - 1", Sch. 10S (ZT Service) ¾" - 1½", 3" Sch. 40S (GR Service) 2", Sch. 40S (GC Service)	None	316L	316SS	UHMWPE	316L SS Spiral-wound/ Graphite Filled

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
S11R	ASME B31.3, Category Normal Fluid Service (FR) Sucrose (GU) Nitric Acid Fume (GZ) Vessel Vent, Non-Radioactive (HN) Nitric Acid (HR) Recovered Nitric Acid (HT) Citric Acid (SDG3) (WE) Demineralized Water (ZK) Fresh Ion Exchange (IX) Resin	Based on ASME B16.5 230 @ -20/100 195 @ 200	CL 150 B16.5	0.0400	304L SS ½" - 4", Sch. 40S 6" - 14", Sch 10S 16" - 20", 0.250" Nom 24", 0.312" Nom	304L SS	304L SS	304/304L SS	Trim 2	304SS Spiral-Wound /PTFE Filled
S11V	ASME B31.3, Category Normal Fluid Service (PW) Radioactive Gas/Vapor	Based on Design B16.5 -14.7/ 20 @ 675 -14.7/ 166 @ 360	CL 150 B16.5	0.0400	316L SS ½" - 12", Sch. 40S 14" - 24", 0.375" nom	316L SS	316L SS	316/316L SS	Trim 12	316L SS Spiral-Wound/ Graphite Filled
S11X	ASME B31.3, Category Normal Fluid Service (GV) Radioactive Vessel Vent (GX) Building Air Radioactive (JS) Sodium Hydroxide (PP) Ultrafilter Permeate (PU) Suspect Radioactive Gas/Vapor (PW) Radioactive Gas/Vapor (PX) Radioactive Slurry (WE) Demineralized Water (WT) Floor Drains (C2 Areas) (WU) Floor Drains (C3 Areas) (ZE) Plant Wash Fluid (ZF) Plant Washings (ZS) Process Radioactive Condensate	Based on ASME B16.5 -14.7/ 230 @ -20/100 -14.7/ 166 @ 360	CL 150 B16.5	0.0400	316L SS ½" - 4", Sch. 40S 6" - 12", Sch 10S 14" - 20", 0.250" Nom 24", 0.375" Nom 30", 0.375" Nom 36", 0.500" Nom 40", 0.500" Nom	316L SS	316L SS	316 SS	Trim 12	316L SS Spiral-Wound/ Graphite Filled
S11Y	ASME B31.3, Category Normal Fluid Service (ZG) Pneumercator Line (ZP) Pneumatic Sample Line (ZQ) Pneumatic Service Line	Based on ASME B16.5 230 @ -20/100	No Flanges	0.0400	316L SS ½" - 1", Sch. 40S	None	316L SS	316L SS	Trim 12	No Gaskets

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
S11Z	ASME B31.3, Category Normal Fluid Service In-Cell Piping (including bulges), not containing greater than 20% by weight Nitric Acid, with <2% solids (GQ) Process Air (GV) Vessel Vent Radioactive (JS) Sodium Hydroxide (PP) Ultrafilter Permeate (PU) Suspect Radioactive Gas/Vapor (PW) Radioactive Gas/Vapor (PX) Radioactive Slurry (WE) Demineralized Water (WT) Floor Drains (C2 Areas) (WU) Floor Drains (C3 Areas) (ZE) Plant Wash Fluid (ZF) Plant Washings (ZS) Process Radioactive Condensate (ZY) Scrubber Effluent	Based on ASME B16.5 -14.7/230 @ -20/100 166 @ 360	CL 150 B16.5	0.0400	316L SS ½" - 4", Sch. 40S 6" - 12", Sch 10S 14" - 20", 0.250" Nom 22" - 24", 0.375" Nom 30", 0.375" Nom 36", 0.500" Nom 40", 0.500" Nom	316L SS	316L SS	316L SS	Trim 12	316L SS Spiral-Wound/ Graphite Filled

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
S12A	ASME B31.3, Category Normal Fluid Service In-Cell Piping (including bulges), not containing greater than 20% by weight Nitric Acid, with $\geq 2\%$ solids (GV) Radioactive Vessel Vent (IS) Sodium Hydroxide (PA) Radwaste Aqueous (PB) LAW Feed (PC) HLW Feed Slurry (PH) LAW Melter Feed (PJ) HLW Melter Feed (PX) Radioactive Slurry (PZ) Waste Feed (WE) Demineralized Water (ZF) Plant Washings (ZK) Fresh Ion Exchange (IX) Resin (ZL) Spent Ion Exchange (IX) Resin (ZM) Off-Specification Resin (ZR) Suspect Radioactive Condensate (ZS) Process Radioactive Condensate	Based on ASME B16.5, Class 150 230 @ -20/100 166 @ 360 160 @ 400	CL 150 B16.5 (See Pipe Class Note 1060)	0.0937	316L SS 1/2" - 2", Sch 80S 2 1/2" - 12", Sch 40S 14" - 24", 0.375" Nom	316L SS	316L SS	316L SS (See Pipe Class Note 1060)	Trim 12	316L SS Spiral-Wound /Graphite Filled
S12C	ASME B31.3, Category Normal Fluid Service Lines not containing greater than 20% by weight Nitric Acid, with $\geq 2\%$ solids (PA) Radwaste Aqueous (PH) LAW Melter Feed (PX) Radioactive Slurry (PZ) Waste Feed (WE) Demineralized Water (ZS) Process Radioactive Condensate	Based on ASME B16.5 230 @ -20/100	CL 150 B16.5	0.0937	316L SS 1/2" - 2", Sch 80S 3" - 12", Sch 40S 14" - 24", 0.375" Nom	316L SS	316L SS	316/316L SS	Trim 12	316L SS Spiral-Wound / Graphite Filled

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
S12D	ASME B31.3, Category Normal Fluid Service <u>In-Cell Piping (including bulges) with $\geq 2\%$ solids that may contain $\geq 20\%$ by weight Nitric Acid</u>	Based on ASME B16.5 230 @ -20/100 166 @ 360	No Flanges	0.0937	304L SS 1/2" - 2", Sch. 80S 3" - 12", Sch. 40S 14" - 24", 0.375" Nom	304L SS	304L SS	(Later, if necessary)	(Later, if necessary)	No Gaskets
S14A	ASME B31.3, Category Normal Fluid Service <u>In-Cell Piping (including bulges) with high erosion solids that may contain $\geq 20\%$ by weight Nitric Acid</u> (PC) HLW Feed Slurry (PD) SR/TRU Precipitate (PE) Entrained Solids Concentrate (PG) HLW Washed Solids Concentrate (PJ) HLW Melter Feed (PX) Radioactive Slurry	Based on ASME B16.5 230 @ -20/100 166 @ 360	No Flanges	0.125	304L SS 1/2" - 1", Sch. 160 1 1/2" - 2", Sch. 80S 3" - 12", Sch. 40S 14" - 24", 0.375" Nom	304L SS	304L SS	(Later, if necessary)	(Later, if necessary)	No Gaskets
S14D	ASME B31.3, Category Normal Fluid Service (FX) Mixed Glass Formers	Based on ASME B16.5 230 @ -20/100 195 @ 200	CL 150 B16.5	0.125	316L SS 1/2" - 1", Sch. 160 1 1/2" - 2", Sch. 80S 3" - 12", Sch. 40S	316L SS	316L SS	316/316L SS	Trim 12	316L SS Spiral-Wound/ Graphite Filled
S14E	ASME B31.3, Category Normal Fluid Service <u>High Erosion Pipe Sections not containing greater than 20% by weight Nitric Acid.</u> (PX) Radioactive Slurry (WD) Inhibited Water (WE) Demineralized Water (WG) Recirculated Emergency Cooling Suspect Radioactive (WS) Recirculated Cooling Suspect Radioactive (ZB) Biocides (ZC) Corrosion Inhibitors (ZR) Suspect Radioactive Condensate (ZS) Process Radioactive Condensate	Based on ASME B16.5 230 @ -20/100 166 @ 360	No Flanges	0.125	316L SS 1/2" - 1", Sch. 160 1 1/2" - 2", Sch. 80S 3" - 12", Sch. 40S 14" - 24", 0.375" nom	-	-	-	-	No Gaskets

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
S14F	ASME B31.3, Category Normal Fluid Service <u>In-Cell, High Erosion Pipe Sections not containing greater than 20% by weight Nitric Acid,</u> (PF) Cs/Tc Concentrate/ Intermediate Product (ZG) Pneumercator Line	Based on ASME B16.5 230 @ -20/100 166 @ 360	No Flanges	0.125	316L SS ½" - 1", Sch. 160 1½" - 2", Sch. 80S 3" - 12", Sch 40S 14" - 24", 0.375" nom	-	-	-	-	No Gaskets
S30B	ASME B31.3, Category Normal Fluid Service <u>Underground Service</u> (GM) Ammonia	Based on design 300 @ -50 360 @ 150	No Flanges	0.0400	304L SS 1" - 2", Sch. 40S	NONE	304L SS	NONE	NONE	No Gaskets
S30J	ASME B31.3, Category Normal Fluid Service (CD) Carbon Dioxide Liquid/ Gas (GM) Ammonia (ZX) Special Decontaminant	Based on design 300 @ -50 360 @ 150	CL 300 B16.5	0.0400	304L SS ½" - 12", Sch 40S	304L SS	304L SS	316/ 316L SS	Trim 12	316L SS Spiral-Wound/ Graphite Filled
S31H	ASME B31.3, Category Normal Fluid Service <u>In-Cell Piping (including bulges), not containing greater than 20% by weight Nitric Acid, with <2% solids (WS) Recirculated Cooling Water, Suspect Radioactive Plant Washings</u> (ZF) Plant Washings	Based on ASME B16.5 600 @ -20/100 500 @ 215 360 @ 600	CL 300 B16.5	0.0400	316L SS ½" - 12", Sch. 40S	316L SS	316L SS	316 SS	Trim 12	316L SS Spiral-Wound/ Graphite Filled
S31U	ASME B31.3, Category Normal Fluid Service <u>In-Cell Piping (including bulges) with <2% solids that may Contain ≥ 20% by weight Nitric Acid</u>	Based on ASME B16.5 600 @ -20/100 500 @ 215	No Flanges	0.0400	304L SS ½" - 12", Sch. 40S	304L SS	304L SS	(Later, if necessary)	(Later, if necessary)	No Gaskets

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
S32A	ASME B31.3, Category Normal Fluid Service In-Cell Piping (including bulges), not containing greater than 20% by weight Nitric Acid, with $\geq 2\%$ solids (GQ) Process Air (GW) Suspect Radioactive Vent (PH) LAW Meller Feed (PX) Radioactive Slurry (PZ) Waste Feed (ZF) Plant Washings (ZH) Pneumercator Line (ZJ) Acidic Effluent (ZN) Neutral Effluent (ZS) Process Radioactive Condensate (ZX) Special Decontaminant (ZY) Scrubber Effluent	Based on ASME B16.5 600 @ -20/100 500 @ 215	No Flanges	0.0937	316L SS 1/2" - 3/4", Sch 160 1" - 4", Sch 80S 6" - 12", Sch 40S 14", 0.406" Nom. 16", 0.438" Nom 18", 0.500" Nom 20", 0.562" Nom 24", 0.594" Nom.	316L SS	316L SS	(Later, if necessary)	(Later, if necessary)	No Gaskets

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
S32B	ASME B31.3, Category Normal Fluid Service Lines not containing greater than 20% by weight Nitric Acid, with \geq 2% Solids)									
	(PB) LAW Feed (PC) HLW Feed Slurry (PE) Entrained Solids Concentrate (PH) LAW Melter Feed (PJ) HLW Melter Feed (PX) Radioactive Slurry (WU) Floor Drains (C3 Areas) (ZF) Plant Washings (ZL) Spent Ion Exchange (IX) Resin (ZN) Neutral Effluent (ZS) Process Radioactive Condensate		No Flanges	0.0937 0.0650 for gravity drain lines	316L SS 1" - 2", Sch 80S 1" - 2", Sch 40S (Gravity drain lines only) 3" - 8", Sch 40S	316L SS	None	No Valves	No Valves	No Gaskets
S32C	ENCASEMENT (JACKET)	Based on Design 400 @ 200	No Flanges	0.0000	Carbon Steel, A106 Gr. B 3" - 10", STD	Carbon Steel, A105	Carbon Steel, A105	No Valves	No Valves	No Gaskets
	ASME B31.3, Category Normal Fluid Service In-Cell Piping (including bulges) with \geq 2% solids that may contain \geq 20% by weight Nitric Acid	Based on ASME B16.5 600 @ -20/100 500 @ 215	No Flanges	0.0937	304L SS 1/2" - 3/4", Sch 160 1" - 4", Sch 80S 6" - 12", Sch 40S 14", 0.406" Nom. 16", 0.438" Nom 18", 0.500" Nom 20", 0.562" Nom 24", 0.594" Nom	304L SS	304L SS	Carbon Steel, A105	(Later, if necessary)	(Later, if necessary)

Double Containment Pipe

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
S32D	ASME B31.3, Category Normal Fluid Service <u>In-Cell Piping (including bulges),</u> <u>not containing greater than 20% by</u> <u>weight Nitric Acid, with ≥2% solids</u> (GQ) Process Air (GW) Suspect Radioactive Vent (PH) LAW Melter Feed (PX) Radioactive Slurry (PZ) Waste Feed (ZF) Plant Washings (ZH) Acidic Effluent (ZN) Neutral Effluent (ZS) Process Radioactive Condensate (ZY) Scrubber Effluent	Based on ASME B16.5 500 @ 215	No Flanges	0.0937	316L SS 1/2", Sch 160 3/4" - 2", Sch 80S 3" - 4", Sch. 40S	316L SS	316L SS	316L SS	Trim 12	No Gaskets
S61A	ASME B31.3, Category Normal Fluid Service (PZ) Waste Feed	Based on Design 1000 @ 200	No Flanges	0.016	304L SS 2" - 3", Sch. 40S	None	None	None	None	No Gaskets
SJ0E	ASME B31.3, Category Normal Fluid Service (GL) Instrument Air	Based on ASME B16.5 3000 @ -20/100 2530 @ 200	CL 1500 B16.5	0.000	304L SS 1/2" - 1", Sch. 80S 1 1/2", 0.250" Nom 2", 0.312" Nom 3", 0.438" Nom	304L SS	304L SS	316/316L SS	Trim 12	Soft Iron RTJ/
SK0H	ASME B31.3, Category Normal Fluid Service (XH) Hydraulic Oil	Based on Design 4000 @ 145	No Flanges	0.000	316/316L SS Tubing 1/2" OD x 0.065" Wall 3/4" OD x 0.095" Wall 1" OD x 0.120" Wall 1 1/4" x 0.156" Wall 1 1/2" x 0.188" Wall	None	316/316L SS	None	None	No Gaskets

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket	
T11A	ASME B31.3, Category Normal Fluid Service (DB) High Pressure Steam (GQ) Process Air (HC) Cerium Decontaminant (HN) Nitric Acid (PA) Radwaste Aqueous (WC) Tower Cooling Water Return (WD) Inhibited Water (WS) Recirculated Cooling Water, Suspect Radioactive (ZG) Pneumercator Line (ZR) Suspect Radioactive Condensate (ZT) Thermocouple Sheathed Line In-Cell (ZX) Special Decontaminant	Based on Design 160 @ 400	Cl 150 B16.5* *316/ 316L SS lap joint flange	0.0400	Titanium ½" – 2", Sch. 40S 3" – 6", Sch. 10S	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium, Spiral-wound/ Graphite Filled
	ASME B31.3, Category Normal Fluid Service (ZF) Plant Washings (ZN) Neutral Effluent (ZR) Suspect Radioactive Condensate (ZS) Process Radioactive Condensate	Based on Design 150 @ 200	No Flanges	0.0425	UNS N08367 (AL-6XN) 2" – 4", Sch 40S	UNS N08367	-	-	-	-	No Gaskets
W11A	CARRIER	Based on Design 50 @ 104 to 200	No Flanges	0.0000	316L SS 4" – 6", Sch 40S	316L SS	316L SS	-	-	No Gaskets	
	ENCASEMENT (JACKET)										

Double Containment Pipe

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
W11B	ASME B31.3, Category Normal Fluid Service (PA) Radwaste Aqueous (WU) Floor Drains (C3 Areas) (ZN) Neutral Effluent									
	CARRIER	Based on Design 100 @ 215	No Flanges	0.040d	UNS N06022 (Hastelloy C-22) 1 1/2" - 4", Sch 40S	UNS N06022	-	-	-	No Gaskets
	ENCASEMENT (JACKET)	Based on Design 50 @ 104 to 200	No Flanges	0.000	Carbon Steel, A106 Gr B 4" - 6", STD	CS	CS			No Gaskets
W31A	ASME B31.3, Category Normal Fluid Service Lines not containing greater than 20% by weight Nitric Acid, with <2% Solids (PA) Radwaste Aqueous (PF) Cs/Tc Concentrate / Intermediate Product (PH) LAW Melter Feed (ZF) Plant Washings (ZH) Acidic Effluent (ZJ) Alkaline Effluent (ZN) Neutral Effluent (ZS) Process Radioactive Condensate (ZY) Scrubber Effluent									
	CARRIER	Based on Design 400 @ 200	No Flanges	0.0425	316L SS 3", Sch. 40S	316L SS	None	No Valves	No Valves	No Gaskets
	ENCASEMENT (JACKET)	Based on Design 50 @ 104 to 200	No Flanges	0.0000	Carbon Steel, A106 Gr. B 6", STD	Carbon Steel	Carbon Steel	Carbon Steel	Later, if necessary	No Gaskets

24590-WTP-PER-PL-02-001, Rev 5
Piping Material Class Description

Class	Design Code / Fluid Content	Press/Temp Limits Psig @ °F	Flange Pressure Class	Corrosion / Erosion Allow (in.)	Pipe	Large Fittings	Small Fittings	Valve Body	Valve Trim	Gasket
W32A	ASME B31.3, Category Normal Fluid Service (PA) Radwaste Aqueous (PB) LAW Feed (PC) HLW Feed Slurry (ZF) Plant Washings (ZH) Acidic Effluent (ZS) Process Radioactive Condensate				Double Containment Pipe					
	CARRIER	Based on Design 400 @ 200	No Flanges	0.0937 0.0650 for gravity drain limbs	316L SS 1 1/2", Sch 80S 1 1/2", Sch 40S (for gravity drain lines only 3", Sch 40S	-	-	None	None	No Gaskets
	ENCASEMENT (JACKET)	Based on Design 50 @ 104 to 200	No Flanges	0.000	316LSS 4" - 6", Sch 40S	316L SS	-	None	None	No Gaskets
W62F	ASME B31.3, Category Normal Fluid Service (PZ) Waste Feed (ZH) Acidic Effluent				Double Containment Pipe					
	CARRIER	Based on Design 1000 @ 200	No Flanges	0.0160	304L SS 3", Sch. 40S	304L SS	-	None	None	No Gaskets
	ENCASEMENT (JACKET)	Based on Design 50 @ 104 to 200	No Flanges	0.0000	Carbon Steel, A106 Gr. B 6", STD	Carbon Steel, A105	Carbon Steel, A105	Later, if necessary	Later, if necessary	No Gaskets

[View coversheet](#)Permit Number: WA7890008967
Modification to Revision 8
Expiration Date: September 27, 2004
Page 1 of 1

Attachment 51 – Appendix 4.0

Piping Material Index Table

The following drawings have been incorporated into Appendix 4.0 and can be viewed at the Ecology Richland Office. **New drawings are in bold lettering.**

Drawing Number	Description
24590-WTP-PER-PL-02-001, Rev 5	Piping Material Index Table
RESERVED	RESERVED