USEC
A Global Energy Company

December 15, 2006
GDP 06-0059

Mr. Jack R. Strosnider
Director, Office of Nuclear Material Safety and Safeguards
Attention: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Portsmouth Gaseous Diffusion Plant (PORTS)
Docket No. 70-7002, Certificate No. GDP-2
Transmittal of Revision 84 to Certification Application

Dear Mr. Strosnider:

In accordance with 10 CFR 76, the United States Enrichment Corporation (USEC) hereby submits six (6) copies of Revision 84 (December 15, 2006) to USEC-02, Application for United States Nuclear Regulatory Commission Certification, Portsmouth Gaseous Diffusion Plant. Revision 84 incorporates changes to the Safety Analysis Report, the Emergency Plan, the Fundamental Nuclear Materials Control Plan (FNMCP), and the Portsmouth Gaseous Diffusion Plant Security Program (GDPSP) to reflect plant changes implemented during the period August 1, 2006 through November 30, 2006.

The above changes have been reviewed in accordance with 10 CFR 76.68 and have been determined not to require prior NRC approval. Revision bars are provided in the right-hand margin to identify the changes. Revision 84 was effective December 15, 2006.

The Revision 84 changes to the FNMCP and the GDPSP contain certain trade secrets and commercial and financial information exempt from public disclosure pursuant to Section 1314 of the Atomic Energy Act of 1954 (AEA), as amended, and 10 CFR 2.390 and 9.17(a)(4). In accordance with 10 CFR 76.33(e) and 2.390(b), the Revision 84 changes to these plans are being submitted under separate cover (USEC letter GDP 06-0058).

Should you have any questions regarding this matter, please contact Mark Smith at (301) 564-3244. There are no new commitments contained in this submittal.

Sincerely,

S. A. Toelle

Steven A. Toelle
Director, Regulatory Affairs

NMSS01

Enclosures:
1. Oath and Affirmation
2. USEC-02, Application for United States Nuclear Regulatory Commission Certification, Portsmouth Gaseous Diffusion Plant, Revision 84, Copy Numbers 1 through 6.

cc: G. Janosko, NRC HQ	(w/o)
J. Henson, NRC Region II	USEC-02, Copy Nos. 21, 172
M. Thomas, NRC Senior Resident Inspector - PGDP	USEC-02, Copy Nos. 22
D. Martin, NRC Project Manager - PGDP	(w/o)
D. Hartland, NRC Region II	(w/o)
R. DeVault, DOE	USEC-02, Copy Nos. 24
C. Voth, DOE	USEC-02, Copy Nos. 25

Enclosure 1
GDP 06-0059

Oath and Affirmation

OATH AND AFFIRMATION

I, Steven A. Toelle, swear and affirm that I am the Director, Regulatory Affairs, of the United States Enrichment Corporation (USEC), that I am authorized by USEC to sign and file with the Nuclear Regulatory Commission Revision 84 (December 15, 2006) to the USEC Application for United States Nuclear Regulatory Commission Certification, Portsmouth Gaseous Diffusion Plant (USEC-02), as described in USEC Letter GDP 06-0059, that I am familiar with the contents thereof, and that the statements made and matters set forth therein are true and correct to the best of my knowledge, information, and belief.

S. A. Toelle

Steven A. Toelle

On this 15th day of December, 2006, the person signing above personally appeared before me, is known by me to be the person whose name is subscribed to within the instrument, and acknowledged that he executed the same for the purposes therein contained.

In witness hereof I hereunto set my hand and official seal.

Rita Peak

Rita Peak, Notary Public
State of Maryland, Montgomery County
My commission expires December 1, 2009

Enclosure 2 to
GDP 06-0059

USEC-02
Application for the United States
Nuclear Regulatory Commission Certification
Portsmouth Gaseous Diffusion Plant
Revision 84 (December 15, 2006)

NUCLEAR REGULATORY COMMISSION CERTIFICATION
PORTSMOUTH GASEOUS DIFFUSION PLANT
USEC-02

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NUCLEAR REGULATORY COMMISSION CERTIFICATION
PORTSMOUTH GASEOUS DIFFUSION PLANT
USEC-02

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6.5-6	60	6.6-4	57	6.6-16	83
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Appendix A

Applicable Codes, Standards, and Regulatory Guidance

This Appendix lists the various industry codes, standards, and regulatory guidance documents which have been referenced in certification correspondence. The extent to which PORTS satisfies each code, standard, and guidance document is identified below, subject to the completion of applicable actions required by the Compliance Plan.

1.0 American National Standards Institute (ANSI)

1.1 ANSI N14.1, Uranium Hexafluoride - Packaging for Transport, 2001 Edition

PORTS satisfies the requirements of this standard, except for those portions superseded by Federal Regulations, with the following clarifications:

a. Text Deleted.

b. Cylinders and valves that were already owned and operated by PORTS and were not purchased to ANSI N14.1- 2001 were manufactured to meet the version of the ANSI standard or specification committed to at the time of the placement of the purchase order and satisfy only Sections 4, 5, 6.2.2 - 6.3.5, 7, and 8 of ANSI N14.1-2001.

c. Text Deleted.

d. Text Deleted.

e. Tinning of cylinder valve and plug threads: ANSI N14.1 - 1995 and prior editions requires the use of ASTM B32 50A, a 50/50 tin/lead solder alloy described in the 1976 and previous editions of the ASTM standard. ANSI N14.1 - 2001 requires that cylinder valve and plug threads be tinned with solder alloys meeting the requirements of ASTM B32 with a minimum tin content of 45% such as alloy SN50. Some cylinder valve and plug threads that were purchased to meet the 1990 or the 1995 edition of the standard were tinned using a method that is conservative with respect to the 2001 edition of the standard (minimum tin content of 46% versus 45%) rather than meeting the 1990 or 1995 edition of the standard.

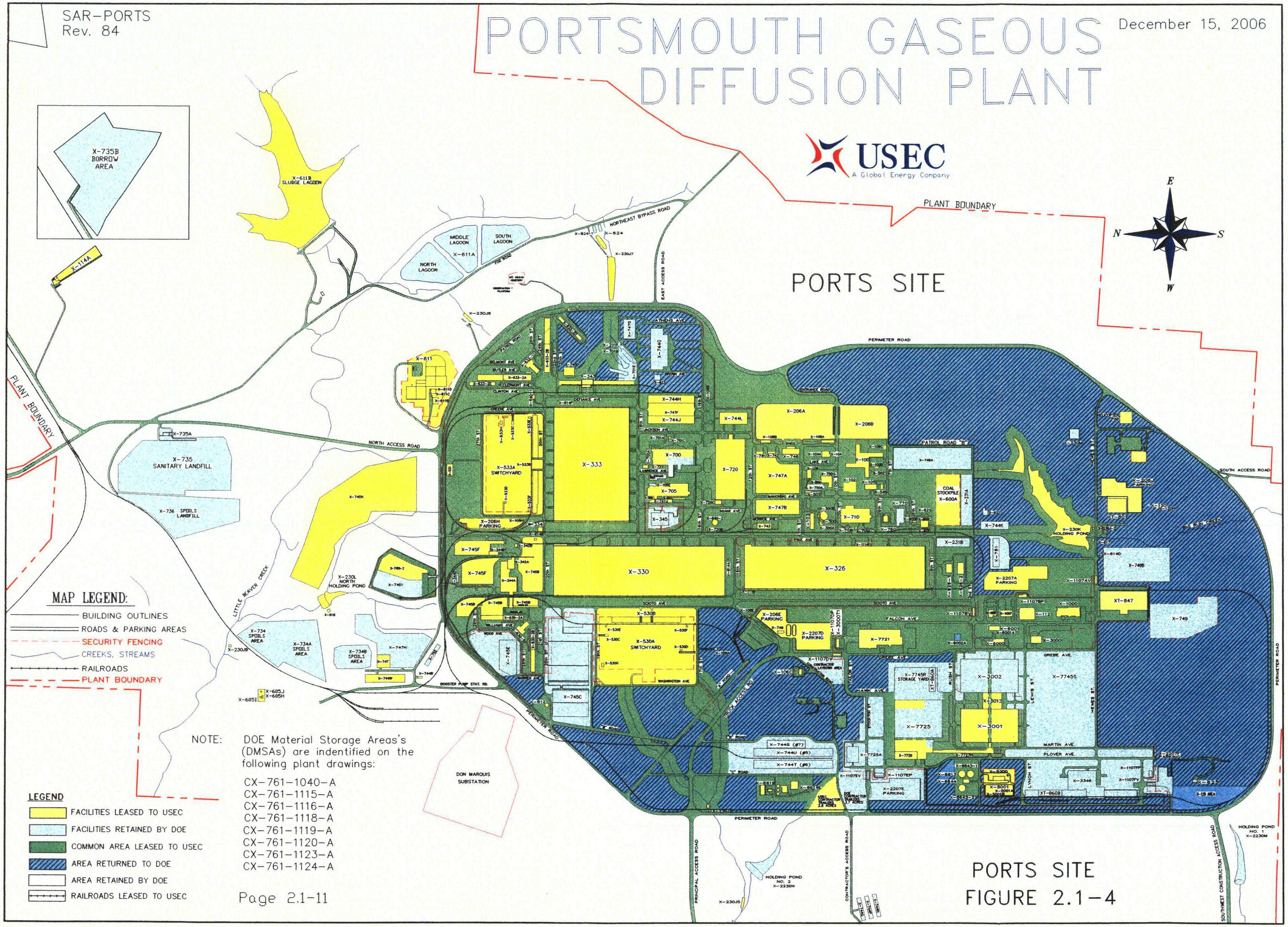
f. Cylinder Valve Protectors (CVPs): For 48X, 48Y and 48G cylinders; the 1990 standard requires these devices to be fabricated from ASTM A285 Grade C or A516 steel. The 2001 standard requires these devices to be fabricated from weldable carbon steel with a minimum tensile strength of 45,000 lbs/in^2 and a maximum carbon content of 0.26%, such as ASTM A-36 steel. Likewise, the set screws are to be manufactured to specific requirements for each CVP. (Addendum 1 to ANSI N14.1-2001 also allows an alternate cylinder valve protector design.) Cylinders in use at PORTS may meet the CVP design allowed by ANSI N14.1-1990 or either of the CVP designs allowed by ANSI N14.1-2001. Alternately, the CVPs for any cylinders in use at PORTS may be steel, similar in design to those specified in ANSI N14.1-1990 and 2001, and meet the intent of this standard. Set screws that are employed in these CVPs are also steel and are manufactured in accordance with the ANSI N14.1-1990 or 2001 design, a derivative of this design, or a grade 5 bolt.

g. Use of steel or aluminum-bronze plugs in UF_6 cylinders is acceptable at PORTS for the following operations: heating, feeding, sampling, filling, transferring between cylinders and onsite transport and storage.

h. None of the Model 48HX cylinders in use by USEC were manufacturered to the ANSI N14.1-2001 standard and this model of cylinder is no longer in production. However, the 2001 edition of this standard mistakenly lists the minimum volume for this cylinder as 139 ft^3 and the maximum fill limit at 26,840 pounds. Previous editions of the standard list the minimum volume for this cylinder type as 140 ft^3 and the maximum fill weight as 27,030 pounds. Model 48HX cylinders at PORTS will comply with the volume requirements and fill limits that are listed in the 1990/1995 editions of ANSI N14.1 and are also flowed down into the TSRs.

i. Use of cylinders (procured under ANSI N14.1, 2001 Edition) with cylinder lifting lug corners having a 1/8" x 45 degree chamfer rather than a ¾" corner radius (as specified in the ANSI N14.1, 2001 Edition) is acceptable at PORTS for all cylinder operations.

PORTSMOUTH GASEOUS DIFFUSION PLANT



MAP LEGEND:

- BUILDING OUTLINES
- ROADS & PARKING AREAS
- SECURITY FENCING
- CREEKS, STREAMS
- RAILROADS
- PLANT BOUNDARY

NOTE: DOE Material Storage Areas's (DMSAs) are indentified on the following plant drawings:

CX-761-1040-A
CX-761-1115-A
CX-761-1116-A
CX-761-1118-A
CX-761-1119-A
CX-761-1120-A
CX-761-1123-A
CX-761-1124-A

LEGEND

- FACILITIES LEASED TO USEC
- FACILITIES RETAINED BY DOE
- COMMON AREA LEASED TO USEC
- AREA RETURNED TO DOE
- AREA RETAINED BY DOE
- RAILROADS LEASED TO USEC

PORTS SITE
FIGURE 2.1-4

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Facility Number	Facility Description	Facility Number	Facility Description
X-100	Administration Building	X-605	Sanitary Water Control House
X-100B	Air Conditioning Equipment Building	X-605A	Sanitary Water Wells
		X-605H	Booster Pump House and Appurtenances
X-101	Health Services	X-605I	Chlorinator Building
X-102	Cafeteria	X-605J	Diesel Generator Building
X-103	Aux. Office Building	X-608	Raw Water Pump House
X-104	Guard Headquarters	X-608A	Raw Water Wells (1 to 4)
X-104A	Indoor Firing Range	X-608B	Raw Water Wells (5 to 15)
X-106	Tactical Response Building	X-611	Water Treatment Plant and Appurtenances
		X-611B	Sludge Lagoon
X-106C	New Fire Training Building	X-611C	Filter Building
X-108A	South Portal and Shelter	X-611D	Recarbonization Instrument Building
X-108B	North Portal and Shelter	X-611E	Clearwell & Chlorine Building
X-108E	Construction Portal	X-612	Elevated Water Tank
X-108H	Pike Avenue Portal	X-614A	Sewage Pumping Station
X-109A	Personnel Monitoring Station	X-614B	Sewage Lift Station
X-109B	Personnel Monitoring Station	X-614D	South Sewage Lift Station
X-109C	Personnel Monitoring Station	X-614P	Northeast Sewage Lift Station
X-111A	SNM Monitoring Portal (X-326)	X-617	South PH Control Facility
X-111B	SNM Monitoring Portal (NW X-326)	X-618	North Holding Pond Storage Building
X-112	Data Processing Building	X-621	Coal Pile Runoff Treatment Facility
X-114A	Outdoor Firing Range		

Figure 2.1-5a. Facilities leased to USEC at PORTS site (per agreement dated July 1, 1993).

Note: This list (facilities leased to USEC) excludes certain DOE Material Storage Areas (DMSAs) within selected facilities which have been retained by DOE. See supplement to Exhibit A of the Lease Agreement which distinguishes DMSAs for PGDP and PORTS and plant drawings CX-761-1115-A, CX-761-1116-A, and CX-761-1118-A.

Facility Number	Facility Description	Facility Number	Facility Description
X-120H	Meteorological Tower	X-626-1	Recirculating Water Pump House
X-200	Site Prep, Grading, Landscaping	X-626-2	Cooling Tower
X-201	Land and Land Rights	X-630-1	Recirculating Water Pump House
X-202	Roads	X-630-2A	Cooling Tower
X-204	Railroad and Railroad Overpass	X-630-2B	Cooling Tower
X-206A	Main Parking Lot (N)		
X-206B	Main Parking Lot (S)	X-633-1	Recirculating Water Pump House
X-206E	Construction Parking	X-633-2A	Cooling Tower
X-206H	Pike Avenue Parking Lot	X-633-2B	Cooling Tower
X-206J	South Office Parking Lot	X-633-2C	Cooling Tower
X-208	Security Fence	X-633-2D	Cooling Tower
		X-640-1	Firewater Pump House
X-210	Sidewalks	X-640-2	Elevated Water Tank
X-215A	Electrical Distribution to Process Buildings	X-700	Converter Shop and Cleaning Building (Except Weld Shop Area and Locker Rooms)
X-215B	Electrical Distribution to Other Areas	X-700A	Air Conditioning Equipment Building
X-215C	Exterior Lighting		
X-215D	Electric Power Tunnel		
X-220A	Instrumentation Tunnels	X-705	Decontamination Building (Note)
X-220B1	Process Instrumentation Lines	X-705D	Heating Booster Pump Building
X-220B2	Carrier Communication Systems	X-710	Technical Services Building
X-220B3	Water Supply Telemetering Lines	X-710A	Technical Services Gas Manifold Shed
X-220C	Superior American Alarm System	X-710B	Explosion Test Facility
X-220D1	General Telephone	X-720	Maintenance & Stores Building (Note: Several office areas and locker rooms, and some former Instrument Shop and Stores areas have been returned to DOE. See lease drawings CX-LS-1226-A and CX-LS-1227-A for details)
X-220D2	Process Telephone		

Figure 2.1-5a. (Continued)

Note: The oxide conversion area (X-705E) will not be leased.

Facility Number	Facility Description	Facility Number	Facility Description
		X-744S	Warehouse S - Non UEA
X-120	South Weather Station	X-744T	Warehouse T - Non UEA
X-208-A	Boundary Fence	X-744U	Warehouse U - Non UEA
X-208B	SNM Security Fences X-326 and X-345	X-744Y	Waste Storage Yard
X-230A-3	Ambient Air Monitoring Station A-3 (S. Access Rd.)		
X-230A-6	Ambient Air Monitoring Station A-6 (at Power Pole 6 in Piketon)		
X-230A-8	Ambient Air Monitoring Station A-8 (at Power Pole 74 near X-735)		
X-230A-9	Ambient Air Monitoring Station A-9 (at Wakefield-Mound Rd.)		
X-230A-10	Ambient Air Monitoring Station A-10 (at Don Marquis substation)		
X-230A-12	Ambient Air Monitoring Station A-12 (at McCorkle Rd.)		
X-230A-15	Ambient Air Monitoring Station A-15 (at Loop Rd.)		
X-230A-23	Ambient Air Monitoring Station A-23 (at Taylor Hollow & McCorkle Rd.)		
X-230A-24	Ambient Air Monitoring Station A-24 (at Shyville Rd.)		
X-230A-28	Ambient Air Monitoring Station A-28 (at Camp Creek Rd.)		
X-230A-29	Ambient Air Monitoring Station A-29 (at W. Access Rd.)		
X-230A-36	Ambient Air Monitoring Station A-36 (at X-611)		
X-230A-37	Ambient Air Monitoring Station A-37 (at Mount Hope Rd.)		
X-230A-40	Ambient Air Monitoring Station A-40 (at X-100 Penthouse)		
X-230A-41	Ambient Air Monitoring Station A-41 (at Zahn's Corner)		

Figure 2.1-5b. Facilities retained by DOE at PORTS site.

Facility Number	Facility Description	Facility Number	Facility Description
X-230M	Clean Site NE of XT-801	X-745C	West Depleted Storage Yard
		X-745E	NW DU Storage Yard
		X-745G-1	Cylinder Storage Yard
		X-747F	Miscellaneous Material Storage Yard
		X-747G	Northeast Contaminated Storage Yard
X-231A	Southeast Oil Biodegradation Plot	X-747H	Northwest Surplus and Scrap Yard
X-231B	Southwest Oil Biodegradation Plot	X-749	South Contaminated Materials Storage Yard (Capped)
X-235	South Ground Water Collection System	X-749A	South Classified Burial Yard (Capped)
		X-749B	Peter Kiewit Landfill (Capped)
X-237	Little Beaver Ground Water Collection System	X-751	Mobile Equipment Maintenance Shop OANG
X-326-A L-Cage	L-Cage and Glove Box Area	X-752	Warehouse
		X-770	Mechanical Test
X-334	Transformer Cleaning Building	X-1000	Administration Building (except 2nd floor vault area)
		X-1107-B(V)	Interplant Vehicle Portal
X-344D	HF Neutralization Pit		
		X-1107-E (V&P)	Northwest Vehicle and Pedestrian Portals
		X-1107-F (V&P)	South Vehicle and Pedestrian Portals
		X-2200	Site Preparation, Grading and Landscaping
X-345	SNM Storage Building	X-2207-E	Northwest Parking Lot

Figure 2.1-5b. (Continued)

Facility Number	Facility Description	Facility Number	Facility Description
X-611A	Lime Sludge Lagoons (North, Middle, South)	X-2207-F	South Parking Lot
		X-2210	Sidewalks
		X-2230-M	Holding Pond #1
X-622	South Ground Water Treatment Building	X-2230-N	Holding Pond #2
		X-2230-T2	Recirculating Heating Water System
		X-3000	Office Building

Figure 2.1-5b. (Continued)

Facility Number	Facility Description	Facility Number	Facility Description
X-623	North Ground Water Treatment Building	X-3002	Process Building (except transfer corridor)
X-624	Little Beaver Ground Water Treatment Facility		
X-624-1	Little Beaver Groundwater Treatment Facility	X-3346	Feed and Withdrawal Facility
X-625	Pilot Scale Treatment Facility	X-6002	Boiler System (NE Corner X-3002 Facility)
X-700	Converter Shop and Cleaning Building (only Weld Shop Area and Locker Rooms)		
X-627	Groundwater Treatment Facility		
X-701A	Lime House	X-6002A	Oil Storage Facility
X-701B	Holding Pond (Drained)	X-7725	Recycle/Assembly (except the area west of column line C8 [except the Gas Test Area], Container Wash, Container Dry, Rotor Balance, Level IV Control Room, and all of the Level V area)
X-701C	Neutralization Pit and Tank	X-7725A	Waste Accountability Facility
X-701E	Neutralization Building	X-7726	Centrifuge Training and Test Facility (only Gas Test Stand Area)
X-701F	Effluent Monitoring Station		
X-705A	Incinerator		
X-705B	Contaminated Burnable Storage Facility	X-7745R	Recycle/Assembly Storage
X-705E	Oxide Conversion Area		
X-734	Old Sanitary Landfill	X-7745S	Area South of X-3001/X-3002
X-734A	Construction Spoils Disposal Area	XT-860A	RUBB Building at X-7725
X-734B	Construction Spoils Disposal Area	XT-860B	RUBB Building at X-3346
X-735	Sanitary Landfill	Z-SWMU-QUAD-IV	Southern end of railroad spur which is used as drum storage area
X-735A	Landfill Utility Building	Z-SWMU-QUAD-IV	Chemical and petroleum containment tanks east of X-533C
X-735B	Borrow Area		
X-736	West Construction Spoils Landfill	Z-SWMU-X701	Northeast oil biodegradation plot area, which was formerly used for the disposal of X-615 sludge

Figure 2.1-5b (Continued)

2.2 NEARBY INDUSTRIAL, TRANSPORTATION, AND MILITARY ACTIVITIES

2.2.1 Industrial Facilities

Economic activity in the vicinity near PORTS consists primarily of farming, lumbering, and small businesses. In addition, a gravel quarry is located west of PORTS, adjacent to the Scioto River. The quarrying is done by surface extraction; no explosives are used.

The only significant industry in the vicinity is located in an industrial park south of Waverly (see Figure 2.1-2). The industries include a cabinet manufacturer (2,000 employees) and an automotive parts manufacturer (200 employees). It is not expected that these activities would have any impact on PORTS operations.

2.2.2 Transportation Systems and Routes

Transportation routes and systems are depicted in Figure 2.1-2. The primary roadways near PORTS are U.S. Highway 23 and State Highway 335, which traverse a roughly north-south course, and State Highway 124 (same as State Highway 32), which traverses an east-west course just north of PORTS.

Rail transportation in the area is provided by the N&S Railway and the CSX Railway.

The Pike County Airport is located approximately 11 miles north-northeast of PORTS. No commercial flights or cargo shipping occurs there. The 4,900-ft runway supports single and twin engine planes and small jets. The Greater Portsmouth Regional Airport, located approximately 15 miles southeast of PORTS, provides only light plane service (Class I airport). The nearest commercial airports are Port Columbus International Airport in Columbus, Ohio, approximately 70 miles away, and the airport at Huntington, West Virginia (87 miles away).

2.2.3 Military Activities

The Ohio National Guard maintains an area on the Portsmouth site for the reconditioning and storage of equipment. This equipment primarily consists of mobile equipment that contains no armament; no ordnance is permitted at this location. The maintenance and reconditioning of this equipment is accomplished in and around the X-751 facility, located on the south end of the site.

Although PORTS once maintained a landing strip for air transportation, the strip is now obstructed with earthen berms. The southern end of the landing strip is maintained as a helicopter pad. The Plant Shift Superintendent coordinates helicopter approaches to ensure they do not fly over process buildings or hazardous material storage areas.

2.2.4 DOE Activities

In addition to administrating the lease agreement with USEC, DOE conducts various operations on the reservation including environmental restoration, decontamination and decommissioning (D&D), remedial activities [Resource Conservation and Recovery Act (RCRA)]; waste management, treatment, storage, and shipment of low-level radioactive waste (LLRW) and mixed waste; manages DOE non-leased facilities; and is responsible for regulating highly enriched uranium. DOE manages uranium inventories located in site cylinder yards, including cylinders from East Tennessee Technology Park (ETTP), until UF_6 conversion for disposal is accomplished

As part of DOE activities required to make GCEP Process Building X-3001 eventually available for the Lead Cascade centrifuge project, USEC has leased all or portions of X-3001, X-3012, X-7725, X-7726 and X-7727H as indicated in Figure 2.1-5a.

In addition, USEC has subleased certain GCEP areas to USEC, Inc. for Lead Cascade operation under the NRC License (See Section 2.2.6).

Due to the USEC decision to discontinue uranium enrichment at PORTS, it is necessary to provide an alternative heat source for DOE facilities that had been heated by the Recirculating Heating Water (RHW) System. The DOE alternative heating system (RHW Boiler System) consists of two hot work boilers, pumps, controls, and associated equipment in the northeast corner of the X-3002 GCEP Process Building. A natural gas pipeline will be installed from the Pike Natural Gas Company pipeline near the East Access road and buried about four feet underground to supply fuel for the boilers. The natural gas pipeline will be reduced in pressure to 100 psig when entering the PORTS site and is reduced east of X-622 to 30-40 psig for supply to the boilers in the X-3002 building. No. 2 fuel oil will be used to fire the boilers until the natural gas pipeline is installed and operable and will remain as a backup fuel supply. The Fuel Oil Storage Area is located approximately 250 feet east of the boilers and consists of three 40,000 gallons fuel oil tanks and a concrete containment dike surrounding and separating these tanks.

DOE has performed analyses (ASA-SM-3002-0001) for the natural gas pipeline, the fuel oil storage, and the X-3002 RHW Boiler System operation. These analyses show that there would be no significant impact from accidents involving explosions or fire at the natural gas pipeline on USEC facilities containing or processing NRC regulated materials. While there could be some minor structural damage and injury to personnel, a fire or explosion would not affect the function of any USEC facilities (with the exception of the X-1107BV vehicle portal which could suffer damage and possible irreversible health consequences to personnel in the portal in the event of an explosion). The analyses show that a fire at the fuel oil storage would not impact any USEC facilities containing or processing NRC regulated materials; a large fire could require evacuation of the USEC X-7721 facility, however, it is unlikely that the facility would be damaged.

DOE has installed emergency shutoff valves at the site boundary to stop gas flow on detection of low pressure/high flow rate condition due to a pipeline rupture (these valves also have overpressure protection). The gas pipeline route is clearly identified to minimize the potential for excavation initiated

3.0 FACILITY AND PROCESS DESCRIPTION

The uranium element appears in nature in three isotopes having atomic weights of 238, 235, and 234. All three isotopes are fissionable, but only ^{235}U is capable of sustaining a critical reaction in most practical applications. Natural uranium contains approximately 0.7% ^{235}U isotope. Isotopic separation processes separate uranium (e.g., its compounds) into two fractions, one enriched in the ^{235}U isotope, the other depleted.

In the gaseous diffusion process, isotopic separation is accomplished by diffusing uranium, which has been combined with fluorine to form uranium hexafluoride gas (UF_6), through a porous membrane (barrier). The process utilizes the different velocities of the uranium isotopes to achieve separation. The separation of the lighter ^{235}U isotope from the natural isotopic mixture is small, so the process is repeated many times in various cascade stages to obtain the desired degree of ^{235}U enrichment.

As built, the Portsmouth Gaseous Diffusion Plant comprised 4080 separative stages. UF_6 of any enrichment (i.e., assay) may be fed into the system with current product enrichment limited to less than 10% ^{235}U.

UF_6 is fed from cylinders into the plant in the gaseous state and is withdrawn into cylinders in either the gaseous or liquid state. The withdrawals consist of both the tails (depleted) stream and the enriched stream. The amount of feed and withdrawal depends on the plant power consumption.

The plant has a maximum consumption of 2260 megawatts power. The plant power load is distributed throughout the isotopic and purge stages in operation according to stage size, which is based on the ^{235}U assay and flow of the UF_6 in the stage. Cascade pressures and equipment sizes are tapered from feed to withdrawal points. Natural assay uranium is fed into the largest stage equipment located near the middle part of the cascade, and the high assay is withdrawn from the smaller equipment located at one end of the cascade. The large equipment runs at higher pressures than the small equipment. Compressors are used to move the UF_6 gas streams through the process equipment. The energy introduced into the cascade is removed by heat transfer systems capable of removing the waste energy produced during cascade operations.

Gases lighter in molecular weight than UF_6 that enter the gaseous diffusion cascade are separated from the gaseous UF_6 and discharged through the purge cascades (Top and Side Purges).

The major utility systems and support facilities required to support the uranium enrichment process are identified in the following paragraphs.

A Plant Air System supplies dry air to the cascade for use as instrument air, purge air, and compressor seal air. This air system also serves the plant support and auxiliary systems. A steam plant supplies steam for heating to the cascade and auxiliary and support facilities. A nitrogen system supplies nitrogen to the cascade for use as a purge gas, for compressor seals and cell purging, and to support and auxiliary facilities for specialized operations. The cascade has lube and hydraulic oil systems that maintain a continuous supply of oil to compressor bearings, motors bearings, and hydraulic oil control valves. The cascade also has coolant systems that remove the heat of compression from the process gas and control its temperature. Water systems provide water for use in the cascade recirculating cooling water system, the sanitary water system, and the fire water system.

The plant is supplied electrical power through an extensive electrical supply and distribution system. This electrical power is distributed from the plants electrical switchyards to substations that in turn supply the facilities (e.g., feed facilities, decontamination facility, administrative and support facilities) and processes (e.g., process power systems, process auxiliary power system) on site.

UF_6 feed facilities provide a controlled rate of feed. Facilities are provided to withdraw the depleted gas stream and the product streams. Special equipment is used to move cylinders containing UF_6. The cylinders are stored, shipped, and received with special care to avoid either a criticality or the release of UF_6 to the atmosphere.

Facilities are provided to clean equipment and reclaim uranium. Maintenance facilities are provided for the repair and rebuild of cascade equipment such as converters, compressors, valves and instrumentation. Laboratories provide daily analytical support to cascade operations and develop improved methods and materials.

The plant maintains a fully equipped fire department. Most buildings on plantsite are equipped with automatic water sprinkler systems as required.

Gaseous diffusion plant operations, as well as cascade conditions, are monitored and controlled from Area Control Rooms located in the process buildings and X-300, Plant Control Facility. X-300 has sufficient communications equipment, instrumentation, and control capability to allow personnel to effectively monitor cascade conditions and provide supervision, direction and coordination of overall plant operations during normal and emergency operating conditions.

The PORTS enrichment operations were shutdown by USEC in 2001. Enrichment sufficient to allow for a stand alone enrichment capacity of 3 million SWU per year was placed in a "cold standby" condition. The majority of this equipment has been transitioned to cold shutdown; some chemical treatment for removal of residual deposits and some equipment removal and decontamination is in progress. A small portion of the enrichment cascade is in operation or standby to support deposit removal and Tc Feed Cleanup. A description of the condition of the enrichment equipment and the activities associated with it is provided in SAR Section 3.1.1.1.5. The remainder of the SAR Section 3.1 provides a description of the enrichment operations certified at the time of the shutdown of the uranium enrichment operations at PORTS.

Product withdrawals are typically made at the X-326 ERP Facility and the X-333 Low Assay Withdrawal (LAW) Facility. The Tails Withdrawal Facility, located in X-330, is where the tails stream is normally condensed and withdrawn. The Tails Withdrawal Facility can also be configured as a product withdrawal station. The feed and withdrawal facilities are described in Section 3.2.

Contaminant gases that enter the cascade through leaks or through operations and maintenance activities are removed in the purge cascades. The purge cascades are described in Section 3.1.2.

The cascade is equipped with multiple surge and power control systems that may be used to handle inventory shifts and facilitate efficient operation, including the Intermediate Surge System, the Bottom Surge System, and the F/S Systems.

Process equipment, piping, and instrument lines that contain PG are enclosed in housings to prevent condensation, or freeze-out, of UF_6. The housings retain the heat generated in the enrichment process, or they are provided with supplementary heating to ensure that the UF_6 remains a gas. The housings are described in Section 3.1.1.3.

Auxiliary systems that support the cascade include cascade coolant systems, lube oil systems, buffer systems, and UF_6 leak detection, as well as typical utilities, such as electrical power, compressed air, nitrogen (N_2), and various plant water systems. Fire protection is provided in each process building.

The PORTS enrichment operations have been shutdown and most of the cascade equipment is shutdown. A summary of the status of equipment in each major cascade building is provided in Sections 3.1.1.1.5.

A small portion of the cascade equipment is utilized in transferring Affected Inventory UF_6 (near-normal enriched UF_6 contaminated with Tc-99 above ASTM Specification C-787-90) from DOE Non-DOT Compliant Cylinders to ANSI N14.1 compliant cylinders. The UF_6 is fed as a gas (using both normal and controlled feeding at the X-342 and X-343 autoclaves) to cascade equipment and routed to the X-326 building (specifically cells in Unit X-27-1) and then sent to the ERP Station for withdrawal as liquid UF_6 into ANSI N14.1 compliant cylinders. After the prescribed cooling period, the full cylinders are transferred by a straddle carrier to the X-344 facility for Tc-99 reduction and transfer into shipping cylinders.

3.1.1.1.5 Process Buildings

This section contains general descriptions of the principal facilities and systems located in the three process buildings. The building structures are important to safety as described in Section 3.8.

The buildings are constructed of structural steel framing with reinforced concrete floors. The overall size varies among the three buildings; however, each includes an operating floor at grade, a cell floor above grade, and valve platforms at various levels above the cell floor. The buildings are composed of structural modules that are separated by construction joints (gaps) at the cell floor and the roof. In general, two support columns exist at each column line—one for each adjoining module—though shared columns exist at some column lines. Where separate columns are used for adjacent modules, the columns are not linked structurally, but they share a common foundation. Where shared columns are used, module separation is augmented by slotted connections at the beam-to-column joints. These connections transmit vertical loads, but the slots limit the transmission of lateral loads. The wide-flange columns extend through the grade slab where they are connected to baseplates that are anchored to foundation piers or footers. The ground floor slab is soil-supported and is not tied to the building column footings.

Siding is corrugated cementitious board attached to building girders. The buildings' roofs are composition roofing supported by steel trusses and purlins. The roofs are sloped to facilitate draining. Curbs (parapets) equipped with scuppers surround the roofs.

All three buildings are above the maximum flood elevation for the site, and no damage would be experienced from a flood. Accumulation of rainwater could occur on the roof as a result of heavy rainfall. However, no loss of UF_6 primary system integrity is expected to result from heavy rainfall. The buildings are expected to maintain their structural integrity in the most severe evaluation-basis earthquake event. High winds could cause siding failures at X-326, X-330 and X-333; however, no structural failures are expected to occur.

major equipment on the operating floor includes the air compressors located in the southwest corner of the operating floor that are part of the Plant Air System (Section 3.1.1.6.6) and the building ventilation supply fans (Section 3.1.1.7).

A truck alley and a railroad spur track extend along the east and west sides of X-333 for delivery and pickup of process equipment. The cell floor extends over the truck alley and has hatches located under each crane bay. Heavy process equipment and motors are lifted to the cell floor for installation or storage of spares.

The X-333 Building enrichment equipment is currently in a shutdown condition. The equipment may be restarted for treatment and removal of deposits. Cells have been evacuated of UF_6, a UF_6 negative obtained, and a dry gas buffer applied at slightly above atmospheric pressure. The shutdown cells are isolated from the RCW system. The R-114 coolant is either stored in the cell coolant system, in the coolant storage tanks or is stored in railcars. The seal exhaust system remains operational to the extent required to support shutdown requirements and cell treatment operations. The X-333 Cold Recovery facility is shutdown. Lube oil is drained and isolated from cells in shutdown. The unit lube oil systems are shutdown.

Cell maintenance is performed to maintain the cells in a shutdown condition, to prepare cells for chemical treatment for deposit removal, and to remove equipment for decontamination. Cell treatments, including inverse recycle treatments, are performed to recover deposits. The cell treatment gases are routed to one of the Cold Recovery facilities for recovery of UF_6, or are routed to the X-326 Building for processing in the isotopic/purge cascade cells. Any UF_6 recovered will be withdrawn at ERP or PW or by side withdrawal. The building is equipped with electric heaters, described in SAR Section 3.1.1.7, to assure that the High Pressure Fire Water System (HPFWS) remains above freezing and in service. The TSRs governing the X-333 Building cascade operations do not require the HPFWS to be operable when cells are shutdown and with the lube oil drained to the storage tanks. The CAAS remains operable and the TSRs remain in effect. The TSRs for the building enrichment equipment operation remain in effect for the applicable operating mode. Any cells with deposits are controlled as required by the TSRs and NCSAs.

3.1.1.1.5.2 X-330 Process Building

X-330 is approximately 2176 ft long, 640 ft wide, and 66 ft high. It houses X-29 and X-31-size equipment and the Tails Withdrawal Facility. The functional layout of the process cells in X-330 is shown in Figure 3.1-6. As indicated in the figure, the X-31 units are located between Unit X-29-1 and the remaining X-29 units. This arrangement facilitates cascade operations as described previously in Section 3.1.1.1.4.

An EBS similar to the one in the X-333 Building is located on the east side of the building in front of X-31-5-2 (Section 3.1.1.4.1). The Tails Withdrawal Facility is located in the northeast corner of X-330. The Tails Withdrawal Facility is described in Section 3.2.2. Two interbuilding booster stations are located on the cell floor. The A-booster to X-333 is on the east side of the building east of X-31-2. Its function is to overcome the pressure drop in the tie-line between the top cell of Unit X-31-2 (normally Cell 2) and the bottom cell of X-33-1 (normally Cell 1). A second booster station, located in the southeast corner of X-330 in front of Cell X-29-6-2, is used to boost the A-stream to X-326 (Section 3.1.1.4.2).

An Intermediate Surge Booster compressor, located on the east side near cell X-29-1-2, may be used when needed to pump PG from the B-stream of Unit X-33-1 to the intermediate surge drums (located on the operating floor) for PG inventory control and to minimize the effects of downsurges from the larger X-33 equipment (Section 3.1.1.5).

Two ACRs are provided on the operating floor of X-330 because of the large number of process stages in the building. ACR 2 is located between Units X-31-2 and X-31-3, and ACR 3 is located between Units X-29-3 and X-29-4. ACR 2 has instrumentation for Unit X-29-1 and Units X-31-1 through X-31-5. The area controlled by ACR 2 is referred to as Area 2. The Tails Withdrawal Facility control panels are also located in ACR 2. ACR 3 has the instrumentation for Units X-29-2 through X-29-6. The equipment associated with this control room is referred to as Area 3. See Section 3.1.1.10.2 for a description of the instrumentation in the ACRs.

As in X-333, administrative offices, a kitchen, and restroom facilities are located in rooms adjacent to the ACRs. The basement below the ACRs provides access to instrument cable tunnels that connect X-300 and X-530B, Switch House. Security barriers control ingress in certain tunnels. Communications systems in the ACRs are described in Section 3.1.1.10.2.10.

As in the other process buildings, LCCs for each enrichment cascade cell are located on the operating floor below the associated equipment on the cell floor (Section 3.1.1.10.1).

The X-330 Cold Recovery System is located at the east side of the building between Units X-31-5 and X-29-2 on the operating floor (Section 3.1.4). The surge-drum room for the bottom surge and the intermediate surge is located on the operating floor at the east end of Cell X-29-1-2 (Section 3.1.1.5.1).

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Two coolant drain stations are available—one located at Unit X-31-2, and the other at Unit X-29-3 (Section 3.1.1.6.7). The Interim Purge Facility is located on the ground floor at the east end of Unit X-29-5 (Section 3.1.4.2).

The building also houses multiple electrical substations and distribution panels on the operating floor that supply power to the building's compressor motors and auxiliary systems (Section 3.1.1.8). Three of the five backup diesel generators originally in this building have been removed. The units that were removed are 2-1, 2-2, and 2-3. Other major equipment on the operating floor includes the air compressors, which are a part of the Plant Air System, and a nitrogen plant, which is part of the Plant Nitrogen System, located on the ground floor in the southeast corner of the building (Sections 3.1.1.6.6 and 3.1.1.6.5). The building maintenance shop area is located approximately in the center of the building on the operating floor.

A ventilation system provides the building with effective protection of equipment and with suitable ambient conditions for working personnel. Process heat from the cell floor is used to heat the operating floor during cold weather (Section 3.1.1.7).

A truck alley and a railroad spur track extend along the west side of X-330 for delivery and pickup of process equipment. The cell floor extends over the truck alley and has hatches located under each crane bay. Heavy process equipment and motors are lifted to the cell floor for installation or storage of spares.

The X-330 Building enrichment equipment is currently in a shutdown condition. The equipment may be restarted for treatment and removal of deposits. Cells have been evacuated of UF_6, a UF_6 negative obtained, and a dry gas buffer applied at slightly above atmospheric pressure. The shutdown cells are isolated from the RCW system. The R-114 coolant is either stored in the cell coolant system, in the coolant storage tanks or is stored in railcars. The seal exhaust system remains operational to the extent required to support shutdown requirements and cell treatment operations. The X-330 Cold Recovery facility remains operational to support cell treatment for recovery of deposits and to support processing of vent gases from the X-340 complex. Some equipment (e.g. drums) are used for UF_6 feed repackaging work. Cells in shutdown are isolated from the unit lube oil system and the oil is drained from the cell. The unit lube oil systems remain operable where still required.

Cell maintenance is performed to maintain the cells in a shutdown condition, to prepare cells for chemical treatment for deposit removal, and to remove equipment for decontamination. Cell treatments, including inverse recycle treatments, are performed to recover deposits. The cell treatment gases are routed to the Cold Recovery facility for recovery of UF_6, or are routed to the X-326 Building for processing in the isotopic/purge cascade cells. Any UF_6 recovered will be withdrawn at ERP or PW or by side withdrawal. The building is equipped with electric heaters, described in SAR Section 3.1.1.7, to assure that the High Pressure Fire Water System (HPFWS) remains above freezing and in service. The TSRs governing the X-330 Building cascade operations do not require the HPFWS to be operable when cells are shutdown and with the lube oil drained to the storage tanks. The CAAS remains operable and the TSRs remain in effect. The TSRs for the building enrichment equipment operation remain in effect for the applicable operating mode. Any cells with deposits are controlled as required by the TSRs and NCSAs.

Administrative offices, a kitchen, and restroom facilities are located in rooms adjacent to the control room. The basement below the ACR provides access to an instrument cable tunnel that leads to X-300. Security barriers control ingress in certain tunnels. Communications systems in the ACRs are described in Section 3.1.1.10.2.10.

LCCs for each enrichment cascade cell are located on the operating floor just below the equipment on the cell floor (Section 3.1.1.10.1).

A surge-drum room is located on the east side of the building at the end of Unit X-25-3 (Section 3.1.1.5). Two coolant drain and recovery stations serve the cell Coolant Systems. See Section 3.1.1.6.7 for a description of the Coolant Storage and Transfer Systems.

The Freon degrader, which is used to facilitate purging of Freon coolant contaminants from the light-contaminant upflow, is located near Cell X-25-7-16 (Section 3.1.2). The Product Withdrawal facility is located at the southwest corner of the building (Section 3.2.3). The alumina traps and air jets for the purge cascades are located at the south end of the building (Section 3.1.2). The maintenance shop is located in the center of the building between Units X-25-2 and X-25-3 on the operating floor. This process building also houses multiple electrical substations and distribution panels on the operating floor that supply power to the building's compressor motors and auxiliary systems. Other major equipment on the operating floor includes a diesel-powered backup air compressor, part of the Plant Air System, located in the northeast corner of the building (Section 3.1.1.6.6), and the building ventilation supply fans (Section 3.1.1.7).

A truck alley and a railroad spur track extend along the west side of X-326 for delivery and pickup of process equipment. The cell floor extends over the truck alley and has hatches located under each crane bay. Heavy process equipment and motors are lifted to the cell floor for installation or storage of spares.

The X-326 cascade equipment in Unit X-25-7 and selected cells in Unit 27-1 are in operation or standby as needed to support the deposit recovery operations, the UF_6 material transfer/repackaging, and the venting operations from the X-340 complex. The remaining X-326 Building enrichment equipment is currently in a "shutdown" condition. The equipment may be restarted for treatment and removal of deposits. Shutdown and standby cells have been evacuated of UF_6, a UF_6 negative obtained, and a dry gas buffer applied at slightly above atmospheric pressure. The shutdown cells are isolated from the RCW system and the lube oil has been drained from the system to the storage tanks (or has been removed) and the R-114 coolant has been removed. The standby cells are isolated from the RCW system and the R-114 coolant is either stored in the cell coolant system, in the coolant storage tanks or is stored in railcars. The standby cells are isolated from the unit lube oil system and the lube oil is drained from the cells. The unit lube oil system is operable. The seal exhaust system remains operational to support standby and shutdown requirements and cell treatment operations. The PW withdrawal facility is in standby but ERP is operated to support cell treatment for recovery of deposits, UF_6 transfer/repackaging for Tc Cleanup, and to support processing of vent gases from the X-340 complex.

Cell maintenance is performed to maintain the cells in a shutdown or standby condition, to prepare cells for chemical treatment for deposit removal, and to remove equipment for decontamination. Cell treatments, including inverse recycle treatments, may be performed to recover deposits. Any cell treatment gases generated are routed to one of the Cold Recovery facilities for recovery of UF_6, or are processed in the isotopic/purge cascade cells. Any UF_6 recovered will be withdrawn at ERP or PW or by side withdrawal. The building is equipped with electric heaters, described in SAR Section 3.1.1.7, to assure that the High Pressure Fire Water System (HPFWS) remains above freezing and in service. The TSRs governing the X-326 Building cascade operations do not require the HPFWS to be operable when cells are shutdown and with the lube oil drained to the storage tanks. The CAAS remains operable and the TSRs remain in effect. Any cells with deposits are controlled as required by the TSRs and NCSAs. The TSRs for the building enrichment equipment operation remain in effect for the applicable operating mode.

3.1.1.2 Major Cascade Equipment

The containment function of the UF_6 primary system, including PG piping ≥2 inches in diameter, expansion joints, PG coolers, and associated valves and equipment containing UF_6, is important to safety as described in Section 3.8. The process system consists of an assembly of piping, vessels, compressors, valves, and auxiliary systems designed to circulate PG (primarily UF_6) for separating the uranium isotopes. The motor-driven compressors represent the only major dynamic equipment in the cascade. The compressor drive motors are outside the insulated enclosures. The maximum operating pressures for the cascade system are 25 psia (for uprated cells) and 14.45 psia (for non-uprated cells). Piping and equipment are designed to criteria that assure they meet or exceed the operating conditions they are expected to encounter.

Welds in the UF_6 primary system (converters, compressors, expansion joints, piping, and valves) have been pressure tested. All systems have been vacuum leak tested, and they meet the leakrate criteria specified in plant procedures.

3.1.1.2.1 Materials of Construction

The cascade materials of construction have good resistance to attack by the three fluorinating agents used in cascade operations—UF_6, fluorine (F_2), and chlorine trifluoride (ClF_3). Nickel plated steel, Monel, and some other alloys with a high nickel content have proven to be the most satisfactory materials, The valving manifold on surge drum banks H, M, J, K, and L allows flexibility in the use of surge drum capacity between the Intermediate and Bottom Surge Control Systems. However, in a typical configuration, drum banks H and M are used for bottom surge control and banks J, K and L are used for intermediate surge control. The drum banks are also used for storage of cascade gases as required to support operations.

The surge drum pressure and room temperature instrumentation is important to safety as described in Section 3.8. The surge drum pressure monitoring instrumentation consists of pressure transmitters/transducers and pressure indicating instruments located at the drum room local panel. In addition, a PR, remote pressure indicating instrument, and alarm indicators are provided in ACR 2 and the PCF. This instrumentation allows operators to verify that surge drum pressures do not exceed the setpoint values and allows drum pressures to be monitored in the ACR and the PCF.

The room temperature instrumentation consists of multiple temperature elements in the surge drum room and the associated TI located on the outside wall of the room. These instruments allow operators to verify that temperatures do not fall below the established setpoint.

The containment function of the UF_6 primary system, including the surge drums, is also important to safety as described in Section 3.8.

The storage drums of the Intermediate and the Bottom Surge Systems are described in this section. The cell service surge drums are described in Section 3.1.1.5.2.

3.1.1.5.1 Intermediate and Bottom Surge Systems

3.1.1.5.1.1 Intermediate Surge Drums

Surge-drum banks J, K, and L (with a total nominal volume of 32,000 ft^3) are used in the Intermediate Surge Control System. These drum banks are located on the operating floor beneath Units X-29-1 and X-31-1. When a downsurge reaches the bottom of the X-333 cascade, the flow increases. This increase is detected by the intermediate surge instrumentation, which diverts the downsurge into the intermediate surge drums. An intermediate surge compressor may be used to boost the pressure and increase the flow rate into the intermediate surge drums when the plant electrical load is low. System controls are located on the Surge and Waste Panel in ACR 2.

When an underload reaches the bottom of the X-333 cascade, the flow decreases. This decrease is detected by the intermediate surge control system, and inventory from the surge drums may be supplied to the A-stream (A-Booster to X-333) to compensate.

Instrument failure could result in the UF_6 inventory in the intermediate drums being dumped on the cascade. However, this would be averted by closing the MOVs on the drums and isolating them from the cascade, or by switching the intermediate surge drums to manual control, depending on which instrument malfunctioned.

3.1.1.5.1.2 Bottom Surge Drums

Surge-drum banks M and H (with a total nominal volume of 22,000 ft^3) are used for the Bottom Surge Drum Control System. These drum banks are located on the X-330 operating floor adjacent to the intermediate surge drum banks. The B-stream flow at the bottom of the X-330 cascade is divided, with part being recycled to the A-stream and the remainder being routed to a compressor at the Tails

Withdrawal Facility. The tails stream is again split, with part going to a compressor and the remainder going to the A-stream at the bottom of the cascade (by automatic operation of the control valves). There, the excess material is stored in M and H surge drum banks. The controls for this system are similar to those described for the Intermediate Surge Control System.

When large downsurges cause overload conditions in X-31-2, X-31-1, or X-29-1, the overload can be reduced by raising the pressure level index (PLI) controller setpoints in those units. This will allow the units to hold the excess inventory until the material can be withdrawn at the Tails Withdrawal Facility.

3.1.1.5.2 Cell Service Surge Drums and Supplemental Surge Volumes

In addition to the Intermediate and the Bottom Surge Control Systems in the preceding sections, additional storage capacity is available for use in controlling cascade surges, including the Cold Recovery System surge drums, the Interim Purge surge drums, the Area 5 surge drums, and three banks of drums located in the X-330 Surge Drum Room.

The Cold Recovery System surge drums are primarily intended to store purge gases and reaction products resulting from cell drying and unplugging treatments until they can be cold trapped or returned to the cascade. However, the drums can also be used for inventory control in a major cascade disturbance. The Cold Recovery System surge drums are described in Section 3.1.4.

The surge drums associated with the Interim Purge located in X-330, the Area 5 surge drums (banks A, B, and C), and three additional banks of surge drums (banks X, Y, and Z) located in the Area 2 Surge Drum Room in X-330 may also be used to store PG and purge gases from the cascade until these gases can be returned to the cascade or transferred to other drums, then bled back to the cascade or cold trapped. The Interim Purge surge drum banks (banks N, P, and R) have a total nominal volume of 20,600 ft^3. Drum banks X, Y, and Z have a total nominal volume of 24,600 ft^3. Drum banks A, B, and C in Area 5 have a total nominal volume of 12,000 ft^3.

Off-stream cells in X-333 and X-330 can also be used as supplemental surge volumes. Conditions for this use, in addition to any criticality safety considerations, include the following: cell pressure must be maintained below atmospheric pressure, the contained UF_6 mass must be no more than 10,000 lb cell coolant must be removed, treatment gas or reaction product concentrations in the cell must be limited to cascade oxidant control bleed-back concentration levels, and potential ignition sources (e.g., compressor motor power supply) must be deenergized and isolated.

The cell volumes and the number of stages per cell are listed, by size of equipment, below.

- X-33 equipment (8 stages, 25,140 to 25,460 ft^3),
- X-31 equipment (10 stages, 11,780 to 11,960 ft^3),
- X-29 equipment (10 stages, 8,900 to 11,100 ft^3),
- X-27 equipment (12 stages, 2,200 to 2,320 ft^3). Note that Cell X-27-1-8 has been modified so that the volume is approximately 3,360 ft^3.
- X-25 equipment (6 or 12 stages, 940 to 1,650 ft^3).

3.1.1.6.8.4 Secondary Confinement System

The drum storage rooms are constructed of noncombustible materials such as concrete block walls, concrete and sheet-metal ceilings. The storage drum rooms are well sealed to prevent any release within the rooms from entering the operating floors. The entrance doors are kept tightly closed, and cracks are sealed to prevent air exchange. Because of these design characteristics, the storage drum rooms are considered secondary confinement systems for the stored gases. The ClF_3 Storage Drum Rooms are heated to prevent liquefaction of the gas in the storage drums during cool weather. Each storage facility has an exhaust duct extending from the roof of the storage drum room through the roof of the process building. The exhaust system is intended primarily for use in case of an accidental release.

3.1.1.6.8.5 Special Gas Treatment

When new equipment is installed or cascade equipment has been opened to atmosphere, a special treatment of F_2 and/or ClF_3 may be used to condition surfaces exposed to wet air while open as well as to remove moisture before exposing the equipment to UF_6. Deposits of UO_2F_2 and other solid compounds may also be removed from equipment by exposure to these gases.

ClF_3 and F_2 are respiratory irritants even in low concentrations and can cause deep irritating burns on contact with the human skin.

Both gases react violently with organic and oxidizing materials and, at elevated temperatures, with most metals. Procedural controls are exercised over the introduction of these gases into the cascade to minimize the risk of an explosive reaction.

Following cell treatment, strict adherence to the administrative controls for the introduction of ClF_3 and F_2 into the cascade and the prohibiting of coolant in a cell during the gas treatment are necessary to protect the equipment.

3.1.1.6.9 Buffer Systems

Buffer systems are used in the process system to prevent PG outleakage or wet-air inleakage. Pressures in the buffer systems are kept higher than the PG pressure to assure that leakage will be inward; provisions are made to purge the PG from the process gas system with nitrogen or dry air.

There are two Buffer Systems in the cascade. One system supplies the compressor flanges, Blowout Preventers (BOPs), control valves, and expansion joints. The other supplies block valves only. The buffering medium, dry air, is supplied from the Plant Air System. Most of the supply tubing runs are outside of the cell housing and enter the housing near the buffered component.

Compressor casing flanges are designed using a double concentric gasket arrangement. When the compressors are in service, the annular spaces between the gaskets are buffered with dry air so that if a leak should develop, dry, rather than atmospheric, air will enter the cascade. Figure 3.1-10 shows a typical gasket arrangement and buffer system connection in an axial compressor. Buffer gas is also provided for the stage control valves and BOP bellows.

3.1.1.7 Heating and Ventilation Systems

3.1.1.7.1 Heating System

Steam, which is produced at X-600, Steam Plant Facility, is distributed to user facilities throughout the plant. In X-330 and X-333, steam is used to heat UF_6 enclosures and storage drums. These enclosures and drums include cell housings, cell by-pass housings, unit by-pass housings, interbuilding tie-line housings, cold recovery piping and holding drums, surge drums, LAW Station piping, freezer/sublimer piping, boosters and Tails Withdrawal Facility piping. In X-326, steam may be supplied to coils in the supply fan ducts for general building heating in case of low ambient temperatures. Cell and unit bypass housings are electrically heated in X-326.

The purpose of the heating system is to prevent freeze-out of UF_6 in the process piping or equipment. As a minimum, the X-326 steam heating system will be operated to maintain temperatures that will prevent the freezing of sprinkler systems as well as other water-containing systems, such as recirculating water lines, sanitary water lines, sewage/drain lines, and equipment that collects water and is not drained (e.g. air receivers, water traps, steam traps, condensate systems, etc.). Portable steam heaters, that are available for supplemental heating, have no automatic control mechanisms installed to control steam usage. Some facilities in X-330 and X-333 have electric heaters or electric and steam heaters combined. Such facilities include the booster systems, cold recovery area, and the LAW Station.

The steam lines are sectioned with manual valves so they can be easily isolated for repair. There is usually ample time for repairs without any danger of UF_6 freeze-out; however, portable electric heaters are available, if needed. The most probable locations for freeze-out are the A-line and B-line drop housings in X-333 that could freeze out in approximately 8 hours under normal conditions, if steam heat is cut off.

The X-330 Tails Withdrawal Facility operation is affected when steam is unavailable for 2 to 3 hours. Temperatures are regularly monitored by operators to reduce the chance of heat loss and freeze-out.

Due to the shutdown of the enrichment process, the process buildings are heated and winterized to provide for personnel needs during the winter months and to provide adequate heat to maintain the HPFWS in service during the winter months. The required heat is supplied by steam and electricity to support required cascade operations using the currently installed heating systems. Portable electric heaters are placed in the process buildings to provide general building area heat during the winter months. The process building areas will be maintained at 40 degrees F or greater at all times. This will assure the functionality of the HPFWS. Most of the building ventilation system, described in the next section, is shutdown to conserve heat during the winter months. Since the enrichment process is no longer operating, there is no need for building ventilation systems to remove process heat or to maintain any specified building differentials; also, the ventilation zone purge systems in the X-330 or X-326 are not operable.

3.1.1.7.2 Ventilation Systems

Ventilation systems are provided in the process buildings primarily for limited control of the operating temperatures for motors and transformers, although other functions may be served. These systems consist of outside air intake dampers, filter rooms, fans, fan discharge dampers, ducts, and supply air grilles. Outside air is drawn in by the fans and delivered to the cell floor through a network of ducts.

The process power system transformers, the major heat source located on the operating floor, are self-ventilated. However, the heated air from the transformers still must be removed from the immediate vicinity by the Process Ventilation System.

3.1.2 Purge Cascade System

3.1.2.1 System Description

The purge cascades are used to separate and remove low and intermediate molecular weight gases ("lights") from the cascade. These "light" gases usually consist of oxygen, nitrogen, cascade coolants, fluorine, and ClF_3 which have either leaked into the enrichment cascade or were introduced into the cascade via operating activities related to cell maintenance. Since these "lights" possess molecular weights lower than that of the UF_6 portion of the PG, they tend to concentrate in the upper stages of the purge and enrichment cascades, until vented, displacing the UF_6 PG to a position downstream of its desired location in the cascade. With the shutdown of enrichment operations, only the Top Purge is in operation supporting Tc Feed Cleanup and Deposit removal cascade activities.

The purge cascade consists of isotopic cells, the Side Purge cells, the Top Purge cells, exhaust (booster) pumps, chemical traps, an atmospheric exhauster, and associated flow instrumentation and controls. The Side Purge is used to vent most of the "lights" introduced into the cascade. The Top Purge, including its associated isotopic cells, operates in conjunction with the Side Purge to separate and vent the heavier "lights" and other contaminants not removed by the Side Purge. Due to its lighter molecular weight with respect to UF_6, the coolant introduced into the PG stream rapidly diffuses to the top of the cascade. However, the molecular weight of the coolant is greater than that of other lower molecular weight gases ("lights") present in the cascade; therefore, the coolant tends to form a "bubble" in the purge and isotopic cells of the Top Purge Cascade. These heavier "lights" include cascade coolants and various fluorinated compounds of metals such as technetium and molybdenum.

The purge cascade, located at the south end of X-326, comprises the top end of the enrichment cascade. The Side Purge cells normally receive flow from the top cell in Unit X-27-1 and return the flow back to the bottom cell in Unit X-27-2. The Side Purge is intended to remove approximately 90% of the "lights" and return the UF_6 and heavier "lights". The Top Purge cells normally receive flow from the top of Unit X-27-2, via the purge cascade isotopic cells, and return the UF_6 to the top cell in Unit X-27-2. The Top Purge is intended to vent the heavier "lights" and any residual "lights" not removed by the Side Purge.

The specially designed Side and Top Purge Cascade cells are the even numbered cells in Unit X-25-7. Each of these purge cells consists of six stages configured as individual Badger stages (Figure 3.1-20), while the isotopic cells have 12 stages configured in Badger clusters. (See Section 3.1.1 for a description of Badger stages and clusters.) The control system and trip features of the lube oil, coolant, and individual stage process pressure systems are similar to those in the enrichment cascade cells (Section 3.1.1). Normally the gas stream is exhausted from the top cell of each purge cascade at less than one ppm UF_6. The Side Purge Cascade A-stream flow normally enters the middle of cell X-25-7-2 (or cell 4 if cell 2 is not on-stream) which creates the Side Purge stripper section, and proceeds through cells X-25-7-2, 4, 6, 8, and 10 (as available) and into the Side Purge Booster station. The Top Purge Cascade A-stream flow enters the odd-numbered isotopic cells of Unit X-25-7, then through purge cells X-25-7-20, 18, 16, 14, and 12 (as available), and into the Top Purge Booster station. Figure 3.1-21 shows the flows within the purge cascade.

The Booster stations are normally used to raise and control the pressure of the vent gas stream before entering a Metering station. The vent gas stream entering the Metering station is either processed through the chemical traps or recycled back to the purge cascade to stabilize the concentration gradient. This "Concentration Recycle" from the Metering station provides a means of maintaining a concentration of approximately 95% "lights" at the inlet to the first high-speed purge cascade cell. The flow that is not used as the Concentration Recycle is measured, and the purge rate to the atmosphere is controlled by other flow loops in the Metering station.

The chemical traps remove most of the residual UF_6 and other radionuclides remaining in the purge gas before it is vented to the atmosphere. The flow exiting the chemical traps is evacuated by the Atmospheric Exhauster station, which includes air ejectors. The combined flow of vent and air ejector gases is monitored by continuous samplers used to establish the environmental discharge values of these vents.

Additional components have been added to the Top Purge Cascade to handle larger accumulations of contaminants in the concentration gradients and the withdrawal of very highly enriched uranium product. These components are the magnesium fluoride (MgF_2) trapping manifold, Product Withdrawal Supply and Return headers, Side Withdrawal (SW) Supply and Return headers, Top Purge Air Bleed station, and the Freon Degrader. The Top Purge Air Bleed station compensates for the reduction of "lights" inleakage previously originating from the HEU cascade and decreases the concentration of oxidant in the Top Purge. The function of a Freon Degrader system (basically, a side-stream reactor) is to react, in a controlled manner, the coolant with fluorine to produce lighter molecular weight gases, which can be more readily purged from the cascade.

The purge cascades use the Nitrogen, Plant Air, Fluorine, and Fire Protection systems in X-326 (Sections 3.4.3, 3.4.4, 3.4.7, and 3.6.1, respectively, for descriptions of these cascade support systems). The power source for the purge cascade stage motors, auxiliary systems, and emergency power are the same as for the enrichment cascade (Section 3.1.1). To assure the operation of the purge cascade cells, power to the high-speed cells is supplied by separate feed lines.

Designated valves and expansion joints and converters in the purge cascades are monitored periodically to detect buildup of UO_2F_2 deposits, indicated by increased gamma/neutron radiation readings. Deposits within compressors are identified by changes in operating characteristics. Buildup of deposits can also be detected by non-destructive analysis methods, including Operational neutron probe readings.

Purge cascade systems, structures, and components identified in Section 3.8 as being important to safety are described in Section 3.1.2.2. General facility safety support systems that are important to safety for X-326 (i.e., the CAAS, the Fire Protection System, and the UF_6 Release Detection System) are described in Section 3.1.1.

3.1.2.2 Equipment

The enrichment cascade description (Section 3.1.1.2) is applicable to similar components in the purge cascade, including: converters, compressors, motors, coolers, valves, piping, and the X-326 process building. Section 3.1.1.6 describes auxiliary cascade systems that support the purge cascade, including: Plant Air, electrical power, nitrogen supply, RCW, and fire protection. The purge cascade equipment descriptions in the following subsections focus on the differences between the purge cascade and enrichment cascade components.

The function of the UF_6 primary system in the purge cascade, which is identified in Section 3.8 as important to safety, is UF_6 containment. (See Section 3.1.1 for a description of the UF_6 primary system.) This function is similar to that of the smaller stages in the enrichment cascade (i.e., converters, compressors, coolers, expansion joints, valves, and piping), and applies to the Booster and Metering Stations, chemical traps, air ejectors, and the Freon Degrader system as well. Since the X-326 cells are concentration of "lights", the line recorder cannot directly measure the actual "lights" concentration within the 6-stage purge cells. However, the flow entering and exiting the Side Purge is monitored for relative changes. The ACR operator monitors the quantity of "lights" entering the Side Purge via a slave line recorder and the flow exiting the Side Purge by a line recorder monitoring an isotopic cell within the Top Purge. Small leaks within the 6-stage purge cells can only be detected by taking the suspect cell off-stream and determining the inleakage rate of "lights" over a given time period. Large leaks within a purge cascade cell can be detected immediately by an increase in purge rate along with little relative change in the "lights" up-flow as seen in the line recorder directly below the purge cascade. The purge cascade can be isolated and the exact location of the leak determined by taking all suspect cells off-stream and detecting the inleakage rate of "lights" over a given time period.

3.1.2.3.2 Space Recorders

A space recorder is a large flow-through ionization chamber used to monitor the vent gases both upstream and downstream from the Top and Side Purge Cascade chemical traps. Under normal operating conditions, continuous samples from the inlet and outlet trap manifold for each vent stream are passed through a space recorder. These recorder readings are recorded and displayed in the ACR. The space recorder readings can be converted into UF_6 concentrations in the vent stream by the ACR operator. The display device also contains an audible and visual alarm, which is set to indicate a large increase in radionuclides in the vent stream.

The space recorder display is monitored by the ACR operator and is used to initiate a predetermined set of actions (e.g., backing of the "lights" front down into the isotopic stage, or switching chemical traps) if the UF_6 concentrations at the trap inlet or vent exceed the preset limits, as confirmed by other operational indicators. This confirmation is needed because the accuracy and on-stream longevity of space recorder operations is affected by the plating of technetium on the wall of the ionization chamber, which reduces the chamber's sensitivity to low UF_6 concentrations in the vent streams. When the trap outlet recorder on the Top Purge or both space recorders on the Side Purge are out of service, laboratory samples are taken in accordance with plant procedures.

3.1.2.3.3 Continuous Samplers

A continuous sampler is an environmental and accountability monitoring device used to accurately determine the quantity of material vented by the Atmospheric Exhauster station. Proportional samples relative to the vent flow are drawn through traps that are analyzed for technetium and uranium. The analytical results are then applied to the actual total vent flow in proportion with the sample flow. The final analysis of these vent samples is reported monthly to Plant environmental, accountability and operational personnel. Significant increases in vent emissions that are identified upon initial evaluation of these results are investigated.

3.1.2.3.4 Oxidant Monitor

A specially modified laboratory Fourier Transform InfraRed analyzer, known as a SPIRA monitor, can be connected to the Top Purge Cascade, at locations prior to the Booster station. To monitor the concentration of oxidant (ClF_3) and coolant in the Top Purge, the SPIRA monitor samples the process gas at the monitoring location and determines the concentration of ClF_3 and coolant. The SPIRA monitor output supplements the operating information obtained from the purge cascade, but does not provide oxidant control.

3.1.2.3.5 Cell Instrumentation

The instrumentation of a purge cascade cell is located in an LCC on the operating floor, directly below the cell it monitors and controls. (A description of LCC instrumentation for the enrichment cascade is in Section 3.1.1.10.) Each stage is equipped with an automatic pressure controller. Each cell cubicle has stage-PICs that indicate and control the high-side pressure and an A-suction PBM to which each stage may be valved individually to read the A-suction pressure. A PIX and a control valve on the RCW supply to the condenser regulate the coolant vapor pressure, which in turn controls the cell temperature. Indicators and controllers are also provided for the seal feed and seal exhaust differential pressures. Each cell cubicle has a temperature-monitoring/control device that monitors, alarms, and trips cell motors based on individual temperatures. Details on the temperature-monitoring/control device are presented below in Section 3.1.2.3.5.1. Each cell cubicle is electrically heated, and the temperature is controlled with a temperature switch. The cubicle temperature is indicated on a TI located on top of the cell cubicle housing.

3.1.2.3.5.1 Temperature Monitoring Device

A temperature-monitoring/control device is provided on each purge cascade cell LCC to monitor, alarm, and trip the cell motors in the event of a high temperature. The Purge Cascade is equipped with stage high-temperature warning and stage high-temperature shutdown alarms.

The temperatures monitored in the Purge Cascade (Top and Side non-isotopic) cells include cell coolant, each stage A-suction, Stage 1 compressor internal, and selected compressor discharges. Cell Recycle valves automatically open and alarm in the ACR if a high temperature occurs within the Stage 1 compressor (low and high-speed cells) and/or Stage 6 (high-speed cells) compressor discharge temperatures. Opening the cell recycle valves will prevent Stage 1 or Stage 6 compressors from overheating.

The temperatures monitored in the isotopic Top Purge Cascade cells include each coverter B-outlet, Stage 12 compressor discharge, and Stage 11 compressor B-suction. The Stage 12 discharge temperature is monitored to initiate the opening of the cell's top recycle valve.

3.1.2.3.5.2 Power Monitors

The power drawn by individual stages of the purge cascade is monitored in the ACR on the cell panel. Load alarms and indicators are also associated with each stage motor. A significant increase or decrease in any stage motor load will actuate an audible and visual alarm on the respective stage/cell. The operating band varies from a nominal 30-40 percent of the ammeter scale for those cells operating in a steady state condition, up to a band width of 10% to 90% ammeter range. The 10% to 90% band width is used on cells near the UF_6 front location due to the frequent fluctuations seen in the cell UF_6 concentration. When any one of these load indicators is tripped, a horn will continue to sound until the cell alarm silence button is pushed. This alarm is slaved to the Plant Control Facility. The major interlocks associated with purge cell power operations are described below.

The total power drawn by designated high-speed purge cells is monitored by relays in the ACR. The signal from the total motor load relay can be tied into an interlock that isolates the vent flow downstream from the chemical traps. The interlock, which can be manually overridden in the ACR, is engaged when the total motor load of the high-speed cell exceeds the cell normal motor load by a preset limit.

3.2 UF_6 FEED, WITHDRAWAL, SAMPLING, HANDLING, AND CYLINDER STORAGE FACILITIES AND SYSTEMS

The various UF_6 feed, withdrawal, and sampling systems and UF_6 cylinder operations occur in a variety of facilities throughout the gaseous diffusion plant. These facilities and their related processes are identified in the following descriptions.

Facilities are provided for the feeding and withdrawing of UF_6 at various points along the enrichment cascade. The facilities are necessary to obtain material of the desired assays to fill customer orders and to prevent mixing of assays when introducing miscellaneous assays of UF_6 feed material into the cascade. All cascade feeding, whether from the X-342A, Feed, Vaporization & Fluorine Generation Building, the X-343, Feed, Vaporization & Sampling Building, or from any of the various side feed locations, is performed by transferring UF_6 gas from a cylinder through heated line(s) into the appropriate point in the cascade, which contains similar assay material as the material being fed. Regardless of the location of the feeding operation, feed headers are available for distribution of the UF_6 to the appropriate location in the cascade.

Cascade UF_6 withdrawals are also performed at various locations. As with feed operations, there are both fixed and portable withdrawal facilities; however, some withdrawals involve liquid UF_6 transfers. These UF_6 liquid phase withdrawals are performed at three fixed facilities: the Tails Withdrawal Station in X-330, the Low Assay Withdrawal Station in X-333 and the Extended Range Product Station in X-326. These withdrawals involve the compression and condensation of UF_6. Gas phase withdrawals may be performed at the Product Withdrawal facility in the X-326, Process Building, or at any local cell control panel in the isotopic cascade, using portable equipment, and at X-326 line recorder sampling lines in the Area Control Rooms.

Assay control for all enriched products withdrawn from the cascade is verified by samples taken at the withdrawal station and/or the withdrawal point. To ensure that the product material meets the customers' requirements for both assay and purity, additional sampling is required.

Pre-sampling operations, as required, are performed at X-343. The sample/transfer operation is performed at X-344A, UF_6 Sampling Facility. The shipping and receiving activities for large cylinder (2½, 10- and 14-ton cylinders) toll enrichment orders are normally performed at the X-344A facility. Shipping and receiving activities for large cylinder toll normal and Paducah product feed is normally performed at X-343. Shipping and receiving of sample containers is normally performed at X-344A.

A cylinder containing solid UF_6 can be transported along any plant-site street and can typically be found in any of the process buildings; X-344A; X-343; X-342A; X-710, Technical Services Building; X-760, Chemical Engineering Building; X-705, Decontamination Building; in addition to X-745 outside UF_6 cylinder storage.

The uranium enrichment operations at PORTS have been shutdown and the majority of the enrichment cascade equipment placed in a shutdown condition (See Section 3.1 for more detail).

The uranium feed and withdrawal operations have been drastically curtailed due to the shutdown of enrichment operations. The X-343 and X-344A facilities are primarily utilized for the receipt, sampling, Tc reduction, transfer and shipping of uranium material. Both the X-343 and the X-342A may be used for material transfer and venting to the cascade equipment. The withdrawal facilities at Tails and LAW are in a shutdown condition. The ERP and PW facilities may be used for side feed and withdrawal operations to support cascade equipment deposit removal activities and X-340 operations (including UF_6 material transfer for repackaging).

USEC has contracted with DOE to process near-normal enriched UF_6 contaminated with Tc-99 above ASTM Specification C-787-90 (Affected Inventory) contained in cylinders that, based on initial inspections, are not compliant with DOT shipping requirements and are designated "Non-Compliant Cylinders." These cylinders are shipped to PORTS under a DOT exemption. USEC has contracted with DOE to remove the UF_6 from the cylinders, process this material for reduction of Tc-99 to acceptable levels and to package the material in ANSI N14.1 compliant cylinders.

Since the enrichment process is shutdown, USEC will use existing cascade equipment and processes at the Portsmouth GDP (PORTS) to perform the required activities. Many of these cylinders meet PORTS inspection requirements (based on ANSI N14.1 and USEC-651) and are liquid-transferred and processed in X-344. For the majority of these cylinders, PORTS will use autoclaves in the X-342 and X-343 autoclaves to heat the impaired cylinders using both the normal and "controlled feed" mode of heating, as described in the TSRs, and feed the material to cascade equipment for withdrawal at the ERP Station into 10-ton ANSI N14.1 compliant cylinders.

The autoclaves in X-342 and X-343 that will be utilized for this process had been in service prior to shutdown of the enrichment process. The X-342 and X-343 autoclaves were utilized for providing feed to the cascade and will be used in the same manner for this project activity. However, the autoclaves to be used in X-342 and X-343 in the "Controlled Feed" mode for these cylinders in transferring the material to the cascade equipment are modified. The steam control system (a Non-Safety, NS, system) is modified to employ a new control system utilizing the cylinder surface temperature measurement as the control parameter. The new steam control system will replace one of the existing steam control systems and is designed to provide steam at a rate of approximately 10% of the existing steam control systems. The feed will be transferred using existing transfer lines (e.g., tie-lines) to the cascade equipment. In addition, these autoclaves will be used for heel evacuation and feed of some cylinders using normal heating settings.

The cascade will receive the feed into either drums or directly to operating cascade equipment. The overall feed rate will be approximately 1000 lb/hr (or less); this feed rate is 20% of the feed rate at PORTS GDP rated capacity.

The following sections describe in more detail the operations identified above.

The United States government intends to ship four cylinders of UF_6 to USEC for processing. These cylinders cannot be shown to meet the specifications required by the SAR and TSRs and the contents cannot be verified to meet the SAR requirements nor can the normal receipt verifications be performed as described in the FNMCP.

The methodology for handling these cylinders is as follows:

- Receive cylinders, inspect for obvious defects, weigh cylinders and compare with shipping weights from an Oak Ridge facility
- Perform NDA measurements to identify uranium isotopes and any significant quantities of other isotopes
- Perform initial inspection of cylinders and valves including radiography and ultrasonic thickness testing, as required, to provide information on the structural characteristics of the cylinders
- Perform Engineering Evaluation to determine ability of cylinders to withstand process temperatures and pressures
- Perform gas over solid sampling of the cylinder contents prior to processing
- Set up autoclave for the 30-inch nominal diameter cylinder for sampling and transfer by controlled heating (this process prevents liquefaction of cylinder contents) to a standard (ANSI N14.1) cylinder
- Set up transfer equipment in X-710 for sampling and vapor transfer of small cylinder contents to standard (ANSI N14.1) 5" cylinders
- Transport 5" cylinders to X-344 for transfer to final cylinder
- Sample final cylinder contents for accountability and make available for use as feed to enrichment process
- Clean empty cylinders and return cylinders to U.S. government for disposition

As noted above, the off-specification cylinder contents will be processed for transfer into cylinders meeting the SAR/TSR requirements. The SAR compliant cylinder contents will be measured as required by the FNMCP for uranium materials and will be available for processing in the enrichment process in the same manner as other feed materials. From this point on, the recovered UF_6 will be stored, handled and processed in compliance with the NRC Certificate. The emptied U.S. government cylinders will be cleaned and returned to the U.S. government.

3.2.1 Cascade UF_6 Feed and Sampling Systems

The following facilities/locations perform feed and sampling functions:

- X-343, Feed, Vaporization & Sampling Building,
- X-342A, Feed, Vaporization & Fluorine Generation Building,
- X-344A, UF_6 Sampling Facility, and
- Side Feed at X-326, X-330, & X-333.

3.2.1.1 X-343 Feed Vaporization & Sampling Building

The X-343 facility is the usual receiving point for all inbound uranium hexafluoride (UF_6) natural assay (0.7% ^{235}U) and Paducah product feed material. This feed material is received in large cylinders (10-ton and 14-ton). The X-343 facility is the usual shipping point for the empty cylinders after they are fed to the cascade.

The X-343 building consists of a high bay area, an adjoining west service area (low bay) and an adjacent open crane runway area on both the north and south ends. The building is constructed of braced structural steel with insulated metal siding on the high bay and service areas. The building floors are reinforced concrete slabs on fill and the roofs are insulated steel rib decking with built up roofing. The building structures are important to safety as described in Section 3.8.

The X-343 facility is equipped with seven steam-heated autoclaves. All seven units are designed for feed or vapor-phase sampling operations and are connected to the cascade feed headers. Three of the seven autoclaves have seven-foot diameters and are equipped with cylinder rollers to allow the cylinder valve to be positioned below the UF_6 liquid/gas phase boundary for liquid phase sampling. The remaining four autoclaves have six-foot diameters and are not equipped for cylinder rotation; two of these autoclaves (positions three and four) are no longer used for heating cylinders since they were not upgraded and the steam supply lines are cut and capped. The six-foot autoclave positions can be used for cylinders to collect sample flushes, residual UF_6 from spent Tc traps, from dumping 5- and 12-inch cylinders or from evacuation for pressure control in the event of a pressure excursion during initial cylinder heating as well as other material that may not be sent to the cascade as discussed below. The autoclaves and related important to safety systems are described in Section 3.2.1.1.1. There are two oil interceptors in the X-343. The first oil interceptor, located in the X-343 basement contains borosilicate-glass raschig rings as a nuclear criticality safety control. The second oil interceptor, located on the first floor of X-343, does not contain raschig rings.

If a cylinder requires liquid phase sampling it is picked up with the overhead crane and placed into a feed and sampling (seven-foot) autoclave. The cylinder is then heated, sampled, weighed, and returned to storage with the overhead crane. The sample container is taken to the X-710, Technical Services Building for chemical and isotopic analyses. The sample flush is either sent to the cascade or to the dump cylinder described in more detail in Section 3.2.1.1.1.

As a general administrative control, cylinders containing liquid UF_6 are moved only by overhead cranes. After a cool down period at ambient temperature, as specified in plant administrative controls, mobile equipment, such as straddle carriers and forklifts, may be used. Criteria for UF_6 cylinder cooling and transport are discussed in Section 3.2.4.5. After analytical results of feed cylinder samples are available, the cylinders may be scheduled for feeding. The cylinders can be fed from any of the operating autoclaves where they are heated, the cylinder contents are vaporized, and transferred to the cascade through a manifold system of three feed headers, metering stations, and cascade feed piping. During the cylinder feed cycle, feed operations controls the feed rate and setpoints are established by personnel in the X-300, Plant Control Facility (PCF). When a cylinder has fed out to the point where the desired feed rate cannot be maintained, the cylinder is valved off and a full preheated cylinder in another autoclave is valved on to maintain the feed rate. The feed plant personnel will then evacuate the residual contents of the cylinder to the cascade through an available feed header. The noncondensible gases are also evacuated to the cascade through an available feed header. This evacuation of residual material is to assure the net weight (heel) is within shipping limits (50 lb UF_6 or less) for "empty" cylinders. Once evacuated, the autoclave cylinder pigtail is purged, evacuated, and disconnected. The emptied cylinder is then placed on a scale, weighed for accountability, and then moved to the X-343 outside storage lot or an adjacent lot east of X-343.

The feed and sample system in the X-343 Building is equipped with dump cylinder and surge volume cylinder capability. These dump/surge volume cylinders are large UF_6 cylinders installed on the cylinder supports of shell open autoclaves. The operation is discussed in more detail below.

The X-343 facility is equipped with cold trap banks to support operation when the cascade is not used. Each cold trap bank is a metal enclosure that provides housing for three refrigeration chambers, the refrigeration equipment for each chamber, and the associated controls. Each refrigeration chamber provides housing for a 12-inch cylinder (cold trap cylinder). The refrigeration chambers are designed to operate in series or individually as needed. The cold trap refrigeration chambers have weighing systems to monitor cold trap cylinder weight and temperature controllers to maintain the temperatures necessary to freeze UF_6 in the cold trap cylinders. Gas concentrations sent to the cold traps are diluted as necessary to prevent the accumulation of explosive gases in the cold trap cylinders. The cold trap operation is discussed in more detail in Section 3.2.1.1.5.

Downstream of the cold traps are chemical traps used to trap UF_6 that might pass through the cold traps. Flow through these chemical traps is maintained by the use of air ejectors. These ejectors exhaust to the vent stack. A continuous/real time vent monitor, located prior to the gases leaving the building, will monitor the evacuation vent line. The continuous portion of the monitor provides integrated release information to demonstrate compliance with OEPA emission limits. The real time portion of the monitor provides operations with an alarm to investigate the evacuation system for chemical trap break through or system off-normal operation.

3.2.1.1.1 Autoclaves

There are seven autoclaves in the X-343 facility designed to heat UF_6 cylinders containing material enriched to 5 weight percent ^{235}U or less. At present, five autoclaves can be used to heat cylinders for cascade feeding and/or sampling. Three of the five are equipped with the roll mechanisms for liquid phase UF_6 sampling.

The X-343 facility contains seven autoclave positions with feed capability. The autoclaves are also used for dumping 5- and 12-inch cylinders. Dumping consists of installing the cylinder in the autoclave. The contents are then heated, liquefied and flashed to a designated dump cylinder. Three of these positions (five, six and seven) have the capability to liquid sample UF_6 cylinders. As a part o the cold trap evacuation process, autoclave positions one, two, three and four have the capability to be used as dump/surge volume cylinder locations when they are not functioning as autoclaves. Autoclave positions one and two (six-foot autoclaves) can be used as autoclaves for preheating and special cylinder burping, and feed to the cascade, but can be converted for use as dump/surge volume cylinder locations when necessary. Positions three and four are used as dump/surge cylinder locations only.

The dump cylinder is used to receive residual UF_6 remaining in the autoclave sample loops following sampling operations and residual UF_6 from spent Tc traps. The dump cylinder is also used to evacuate material for dumping 5- and 12-inch cylinders or for pressure control in the event of a pressure excursion during initial cylinder heating. The UF_6 is flashed from the liquid phase, transferred in the vapor phase, and solidified in the dump cylinder. The surge volume cylinder receives the gas impurities from the product cylinders and autoclave sample loops. If the gas composition is such that explosive mixtures (>11 mole percent ClF_3, >10 mole percent R-114) could be produced or liquefaction could occur in the cold traps, the surge volume cylinder contents are diluted with an appropriate gas, e.g., dry air, as necessary. If the surge volume cylinder contents are not sampled to determine dilution, the contents are diluted with at least 50 psia of an appropriate gas. The dump cylinder and surge volume pressures are monitored to verify a dump or transfer of material has occurred and to verify the flow path from the autoclave is closed.

The Autoclave Nuclear Safety Upgrades (NSU) Project results in different system descriptions applying to certain autoclave systems and components depending on whether it pertains to an "upgraded autoclave" or to a "non-upgraded autoclave" (only applies to autoclaves 3 & 4, which are no longer used as autoclaves for heating cylinders). The following discussions indicate which configuration is being described when such clarification is required.

The autoclave heads have penetrations for the following UF_6 piping and utility services:

- UF_6 line,
- Steam inlet,
- Steam control valves pressure tap (upgraded autoclaves only),
- Condensate drain,
- Blowdown exhaust line,
- Shell vent,
- Roll motor buffer air inlet and outlet (seven-foot autoclaves only),
- Electrical power cable (seven-foot autoclaves only),
- Air supply line for back-up safety valve,
- Steam sample tubes (2),
- Internal pressure tap,
- Thermocouple leads,
- Pressure relief line, and
- Vacuum relief line.

The electric motor which drives the cylinder rollers inside a seven-foot feed/sampling autoclave is encased in a buffered enclosure. The buffer is dry air at a pressure greater than or equal to the maximum normal operating pressure of the autoclave and is provided to protect the motor from steam inleakage during normal operation. Figure 3.2-1 shows a diagram of a six-foot feed autoclave; the X-343 seven-foot feed and sample autoclaves are diagrammed in Figure 3.2-2.

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Differences between upgraded and non-upgraded autoclaves involve the programmable logic controller (PLC) configurations and the containment valve configurations for the various shell penetrations. The discussion below describes these differences.

Non-Upgraded Autoclaves (only Autoclaves 3 & 4)

All lines except the shell vent, feed header, vacuum relief, and pressure relief lines have two automatic containment valves. The shell vent line has a manual valve, in addition to the automatic containment valve, that is closed during autoclave operation except when steam is being released at the end of a feeding cycle. The feed header line can be double isolated by closing one of the main feed header lines downstream of the autoclave feed valve. Even if this fails to isolate the autoclave during an upset event, there would be no release of UF_6 to the atmosphere. The vacuum relief line has a relief valve that is maintained in the closed position by autoclave pressure. The pressure relief line is equipped with a rupture disc and a relief valve.

Each non-upgraded autoclave includes a single PLC that monitors field devices (pressure switches, temperature switches, condensate level switches, conductivity switches, etc.) to provide appropriate signals to the solenoids that operate containment valves. Loss of signal from the PLC will result in closure of all automatic containment valves.

Upgraded Autoclaves

The upgraded autoclaves are modified so that, except for the shell vent line, each autoclave head penetration that is protected by automatic containment valves has two such containment valves. The containment configurations of the shell vent line and the high pressure relief line are unchanged from those of the non-upgraded autoclaves. The vacuum relief line and the roll motor buffer air supply line each have been modified to include an additional automatic containment valve. The UF_6 feed line has been modified to include a new containment valve just upstream of the existing "F" valve. The "F" valve remains as a feed control valve that is not credited nor tested as a containment valve. The steam inlet line is modified to include an additional steam control valve in parallel with the existing control valve. Actuators for both of these control valves are connected to a new autoclave internal pressure tap. This steam control valve pressure tap is protected by two automatic containment valves.

The upgraded autoclaves also include two PLCs that are configured to provide limited backup capability. Each PLC receives inputs from the field devices and provides output to one of the two containment valves on each shell penetration that is protected by two automatic containment valves. One PLC provides output to one valve on each line, and the other PLC provides output to the other valve on each line. Each PLC monitors the containment signal from the other PLC so that a containment output from either PLC to its set of containment valves will result in a containment output from the other PLC to its set of containment valves.

3.2.1.1.1.1 Autoclave Operations

The feed-only autoclaves are six feet in diameter and are American Society of Mechanical Engineers (ASME) code-rated for a maximum allowable working pressure (MAWP) of 163 psig. The roller-equipped feed/sampling autoclaves are seven feet in diameter and are rated for 165 psig. Each autoclave is approximately 23 feet long with one end (the head) being fixed in position and the remainder placed in each cell. The fill is constructed so that the water falling through it breaks into small droplets, enhancing heat transfer.

3.4.2.2.3.3 Recirculating Cooling Water Distribution Piping

RCW distribution piping consists of supply and return headers, bypass and blend lines, and blowdown lines.

Recirculating Cooling Water Supply and Return Headers

Two headers from each pumphouse supply water to opposite sides of their respective process building. At X-630-1 and X-633-1, there is a crossover line between the supply headers just outside each pumphouse. At X-626-1 and X-6000, the supply headers are tied together inside the pumphouse. There are also two return headers from the process building to the cooling tower(s). The X-630 and X-633 headers are tied together before reaching the cooling towers, while the X-626 and X-6000 headers are tied together at the cooling tower. The crossover piping allows any part of the building supply line or return line to be shut down for cleaning or repairs. All outside piping is underground, except for the risers on the return line to the cooling towers and the blend lines.

Recirculating Cooling Water Bypass and Blend Lines

The function of the RCW (hot water) bypass is to help control the temperature of the RCW supplied to the process buildings. This is done by allowing a portion of the hot return water to flow directly into the mixing flume from the return headers, bypassing the cooling tower(s). The bypass is used as needed to aid in keeping the supply water at the desired temperature for process cooling.

To prevent damage to the cooling towers, the blend lines are used to mix cool water with hot return water from X-330 and X-333 to control the temperature of the return water.

Recirculating Cooling Water Blowdown Lines

The function of the blowdown lines is to provide a means of lowering the dissolved and suspended solids concentrations in the systems. The blowdown from the X-626 system is used as partial makeup for the X-630 system. The blowdown from the X-6000 system is used as a partial makeup for the X-626 system. Likewise, blowdown from the X-630 system is used as partial makeup for the X-633 system. A blowdown line runs from the X-633 supply header to the Scioto River. Blowdown may be routed to bypass the X-633 before it is discharged to the Scioto River.

3.4.2.2.3.4 Protection Systems (Recirculating Cooling Water Facilities)

Due to the large quantity of water flowing through the RCW Systems, the equipment must be protected from pressure changes which result from the starting or stopping of a pump or the sudden closing of a valve. Surge protection is provided by surge relief valves or cone valves, which will open and allow water to return to the wetwell if high pressure occurs in the system. Check valves or cone valves on the pump discharge lines protect from backflow through the pumps.

The cooling tower fans are equipped with vibration switches, which will shut down the fan if excessive vibration occurs.

Fire protection in the RCW pumphouses is provided by Sanitary and Fire Water System sprinklers and fire hydrants, except in X-6000, which is protected by the HPFW System. The fire protection for the RCW cooling towers is provided by HPFW System sprinklers. All four RCW pumphouses are protected by the plant fire protection and evacuation alarm system.

3.4.2.2.3.5 Control Systems (Recirculating Cooling Water Facilities)

RCW pumps in three of the RCW Systems (X-626, X-630, and X-633) can be started and stopped locally or remotely. Local controls are positioned on control panels in each respective pumphouse. Remote controls are located in X-300. The X-6000 RCW pumps are started and stopped from X-6000.

Similarly, the RCW cooling tower fans in the X-626, X-630, X-633, and X-6000 RCW Systems can be started or stopped locally or remotely. Local controls are mounted on the cooling towers next to each cooling tower cell. Remote controls are located on the control panels in each respective pumphouse.

3.4.2.2.4 Recirculating Heating Water System

The RHW System consists of the necessary piping and equipment to circulate hot RCW return water from X-330 to the X-700, Converter Shop & Cleaning Building, X-705, the X-720, Maintenance & Stores Building, the X-623, North Groundwater Treatment Building, and the Gas Centrifuge Enrichment Plant (GCEP). The system provides a source of building heat. The RHW system is currently in a shutdown condition; the buildings listed above are heated by other means when the RHW system is shutdown.

The primary pumping station in X-330 is equipped with pumps, filters, flow controls and piping. RCW return water is taken from one or more of four return headers and is pumped into the distribution piping to flow to the various building heating systems. Each building serviced by the system has a pumping system to circulate water through the building heat exchange units and into the RHW return line.

3.4.3 Plant Nitrogen System

3.4.3.1 System Description

The Plant Nitrogen System consists of a nitrogen plant, nitrogen storage facilities, vaporization facilities and a distribution system. The system is designed to generate and distribute nitrogen gas used in the cascade for seal feed, buffer systems, and servicing equipment when dry gas is required. Nitrogen gas is also distributed to various process auxiliary buildings. The principal nitrogen production and storage equipment is located in X-330 and just south of X-330.

The nitrogen plant consists primarily of a separation column in which the nitrogen is produced. From the separation column, the nitrogen can be routed as a gas to a distribution header or a bank of storage cylinders. It can also be supplied as a liquid to a low-pressure liquid nitrogen storage tank. The tank is normally filled from a truck. Additional liquid nitrogen storage capacity is provided by a high-pressure storage tank that is filled from a tank truck.

When needed, liquid nitrogen from the low pressure storage tank or the high pressure storage tank may be transferred to a cold converter and vaporizing unit where it is converted to gaseous nitrogen. Gas from the cylinder storage bank can be transferred to the distribution header as a supplementary source of nitrogen.

3.4.3.2 Nitrogen Distribution System

A distribution header that typically operates at approximately 55 psig furnishes nitrogen to various plant buildings. Nitrogen is provided to the distribution header from three main sources:

- Nitrogen from the air separation column is furnished directly to the distribution header at a rate of up to 100 scfm.

- Nitrogen is supplied from the liquid storage tanks through the cold converter and vaporizing unit at the rate of up to 7,100 scfm. (Nitrogen is also vented from the high-pressure gas storage tank into the distribution header. However, this is not considered a major source of nitrogen.)

- If the nitrogen demand exceeds column production and cold converter capacity, the high-pressure storage cylinders are used to meet the demand. Nitrogen can be transferred at the rate of up to 1,000 scfm from that source.

Pressure reducing stations in each process building are located on the operating floor beneath the X-25-7, X-31-5, and X-33-1 units. These stations reduce nitrogen pressure for building needs. A vent line from the low-pressure liquid storage tank furnishes additional flow to the header in X-326 and can supplement the header in X-330. The distribution systems in the process buildings are protected by pressure relief valves.

The plant distribution header supplies nitrogen to auxiliary and service buildings where maintenance, testing, or plant service activities are conducted. Each of these buildings contains a station where nitrogen pressure is reduced to operating pressure.

X-333 and X-330 are interconnected by a nitrogen line to ensure a nitrogen supply in the event of a process building pressure reducing station failure. In addition, an automatic air-to-nitrogen crossover is provided in each process building for emergency use of dry air in place of nitrogen.

3.4.3.3 Protection Systems

The nitrogen system contains multiple relief valves and rupture discs, which are provided to prevent over-pressurization of various components of the system. These are designed and sized to comply with ASME standards for the pressure vessels on which they are placed.

In addition to internal safety devices, the area around the generation facility is protected by the building fire protection and evacuation alarm systems.

3.4.4 Plant Air System

3.4.4.1 General Description

The Plant Air System supplies dry compressed air to the process buildings and the auxiliary buildings, except some buildings outside the perimeter fence. The Plant Air System consists of equipment to compress, dry, and distribute air to the use points. System design capacity is more than 47,000 scfm. Typical uses for Plant Air include purging process equipment; as a backup for the nitrogen system; to operate instruments, controls, air ejectors, and alarms; to provide air for the plant datum systems; to provide process system buffers; to provide air for compressor seal operation; and to provide air for general maintenance and laboratory operations. The principal system components are located in

X-326, X-330, X-333 and X-6000. Dry air is produced with a dew point of at least -25 °F, measured at atmospheric pressure.

3.4.4.2 Description of the Air Plants

The dry air plants are typical industrial units consisting of compressors, receivers, oil adsorbers and dryers. Multiple compressors, including diesel-powered backup units, are available to meet varying site air demands. Typical site usage is approximately 15,000 scfm. Normally, four compressors can meet the demand. However, additional compressors will start automatically to augment system capacity, as needed. The diesel-driven units are normally in standby. They automatically start when the air pressure drops to a predetermined level. Package air compressor units can be installed to augment the capability of the equipment installed in the air plants.

Sanitary water and RCW are used for cooling the equipment at the X-326, X-330 and X-333 air stations.

Controls are built into air plant equipment to improve the overall safety of the system. All compressors have shutdown interlocks for low lube oil pressure and high air temperature. The centrifugal compressors also have vibration monitors. The diesel-driven compressors have overspeed cutoffs. Instrumentation is provided to monitor and record the moisture content of the air in the system. Alarms are provided to alert operators to conditions of low pressure or high moisture content.

3.4.4.3 Air Distribution System

The main air distribution line for the GDP is arranged as a loop. The cascade portion of the loop can be isolated from the auxiliary portion in the event of air pressure reduction, thereby maintaining the air for the enrichment cascade. The auxiliary portion of the distribution loop supplies those facilities where continuous air service is not required. Such facilities include those involved in maintenance, testing, administration and storage. The distribution system also provides the means for isolating portions of the system for maintenance or operational reasons, while maintaining service to unaffected areas.

Dry air also serves as a backup to Plant Nitrogen Systems. In the event of a nitrogen system failure, dry air is automatically supplied to each process building nitrogen system through crossover connections.

3.4.4.4 Air System Safety Systems, Design Features, and Administrative Controls

Plant Air System instruments, fixed or portable, that are relied upon to monitor the dew point temperature are nuclear criticality safety features (Section 5.2, Appendix A)—however, they are not active engineered features (Section 3.8.10).

3.4.5 Plant Steam and Condensate Systems

3.4.5.1 General Description

X-600 is a standard industrial facility with typical systems such as water treatment, steam generation, coal and ash handling, steam distribution, and condensate return. Radioactive materials are not routinely handled in this facility, although the boilers are radiologically controlled due to contamination.

X-600 is located near the south end of PORTS, east of X-326. The Steam Plant produces saturated steam that is used for general plant heating and to provide heat for process operations. Three

3.5 GENERAL SUPPORT FACILITIES AND SYSTEMS

The Portsmouth Gaseous Diffusion Plant (PORTS) site has a variety of facilities that provide for maintenance services, laboratories, materials receiving and storage, communications and data processing, administrative services, and health protection services.

3.5.1 Maintenance Facilities

The PORTS maintenance facilities consist of sections of the X-700, Converter Shop & Cleaning Building, the X-720, Maintenance & Stores Building, all of the X-750, Mobile Equipment Maintenance Garage, and some of the X-7721, Maintenance, Stores & Training Building. In addition, maintenance shops are found in the X-333, X-330, X-326 Process Buildings, X-600B (Steam Plant Shop), and the X-342A, Feed, Vaporization & Fluorine Generation Building, / X-344A, UF_6 Sampling Facility, building complex. The locations of these maintenance facilities are shown in the plantsite map, Figure 2.1-4.

3.5.1.1 X-700 Maintenance Facility

X-700 is a permanent structure located north of X-720 and east of the X-705, Decontamination Building. The building is divided into two main sections. The east section is an equipment and parts cleaning area, and also contains the Biodenitrification facilities described in Section 3.3.1.4.5. The west section houses shop areas, DOE contractor maintenance shops, and the X-721, Radiation Instrument Calibration (RADCAL) Facility.

The work activities involved within this facility have the potential to deal with radioactive contaminated materials and process related equipment. The requirements for working with radioactive contaminated material in all facilities are established in Section 5.3.

The Cleaning Area in X-700 is used for cleaning parts in support of maintenance activities. Cleaning activities, such as rust removal and removing hard water deposits, are performed on parts and equipment requiring maintenance. The facility contains cleaning tanks (normally not all are in service and one is designated for converter flushing only), and a sandblast cabinet. The cleaning tanks in service contain vent exhausts at the tank top lip. The exhaust system has motorized exhaust fans that discharge through a common stack. The cleaning tanks are serviced by overhead cranes. Equipment cleaning may be facilitated by dipping the equipment into the cleaning tanks.

The X-700 Barrier Shop Area is used for general maintenance activities such as cooler repair. The X-700 Converter Furnace Stand is no longer in service.

The former X-700 (Converter/Weld Shop) is used for DOE contractor maintenance shops and offices.

X-700 is provided fire protection by fire alarm systems and automatic wet pipe sprinkler systems. The facility is also equipped with a Criticality Accident Alarm System (CAAS). CAAS details are contained in Section 3.6.2. Compressed gas cylinders are stored in accordance with site industrial safety requirements and have protective valve caps.

3.5.1.1.1 Radiation Instrument Calibration (RADCAL) Facility

The RADCAL Facility is used to test and evaluate radiation instruments and equipment and to certify plant radiation standards.

The north and west walls of the RADCAL Facility are concrete and are shared in common with X-700. The remaining walls are stud walls and the roof is made of steel decking. A portion of the facility is located outside X-700 and has a beam room. Walls and others features of the beam room are discussed in Section 3.5.1.1.1.2. The laboratory and training room walls are steel-reinforced block with all voids filled with concrete grout. The control room and the storage room share walls in common with other rooms. These walls either are made of concrete block or are solid concrete.

The Cleaning Room located inside X-700 is used to disassemble and clean incoming instruments. The low level contamination from the cleaning solutions presents no safety hazard. Protective equipment, approved operating procedures, and adequate ventilation mitigate any toxic hazards of the chemicals used.

A radiation hazard does exist in the beam room. As such, each RADCAL area has written procedures that govern the safe operation of that area. All personnel assigned to the RADCAL Facility are required to wear personnel dosimeters as required by the radiation protection program. Supplemental instrumentation is employed for non-routine or special work as defined in the applicable work requirements document. All personnel assigned to the facility are trained in accordance with approved training materials.

The utilities furnished to the RADCAL Facility are supplied from X-700 and the X-700A, Air Conditioning Equipment Building. Fire protection is provided by an extension of the sprinkler system used in X-700.

3.5.1.1.1.1. RADCAL Facility Radiation Shielding Assessment

The RADCAL Facility houses several high intensity radiation sources which are either intrinsically safe or are used remotely inside a shielded irradiation room. This facility has been designed to meet the calibration requirements given in the American National Standards Institute (ANSI) standard N323-1978, Radiation Protection Instrumentation Test and Calibration. In addition, the beam room has been designed to meet safety requirements stated in the following documents:

- DOE/EV 1830-T5, "Guide to Reducing Radiation Exposure to As Low As Reasonably Achievable," April, 1980,
- ANSI/ANS 6.4-1977, "Nuclear Analysis and Design of Concrete Radiation Shielding for Nuclear Power Plants," 1977,
- GAT-T-3193, "Proposed Corporate Radiation Instrument Maintenance and Calibration Facility," May 5, 1983,
- Y-1754, "X-ray and Nuclear Radiation Facility, Personnel Safety Features," October 1986.

A gamma irradiator (Unit 1) and one filtered 320 kV constant potential (CP) X-ray unit are located in the "beam room" at fixed positions. The multiple source gamma irradiator focuses its radiation field through a 20 degree beam port against the North wall of the beam room 48 ft. away. The unit is pneumatically controlled with additional passive mechanical fail-safe source storage control devices. Dose rates from the irradiator are less than 5 mRad/hr at 1 ft. (30 cm) from the shield surface when each unit is deactivated (i.e. lowered into its storage position).

A neutron irradiator is also located in this facility. The source is positioned pneumatically with mechanical or gravity-based fail-safe storage mechanisms. Neutron dose rates are below 5 mRem/hr at 1 ft. (30 cm) from shield surfaces when these devices are deactivated. Dose rates from the largest gamma irradiator will produce maximum radiation fields of less than 500 Rad/hr at 1 meter. Maximum dose rates for neutrons occur with unmoderated ^{252}Cf. This area can also be used for irradiations with low intensity gamma ray standards such as ^{226}Ra and ^{241}Am.

Distance and shielding are employed to assure that external exposures to personnel outside of the beam room are kept below plant limits. For all irradiators, their position is fixed either by size and weight constraints or by their physical installation. Both computer analysis and actual field results verify gamma exposure rates outside of the beam room are less than 0.1 mRad/hr at 1 ft. (30 cm) for measurements in the direct path of the radiation. Scattered radiation levels on the roof will be less than 4 mRad/hr at 1 ft. (30 cm) from either gamma irradiator. Scattered and penetrating neutron radiation fields on the roof will be less than 100 mRem/hr. Therefore, access to this area is physically restricted and is governed by radiological work limits. Appropriate radiological posting and boundary markers are in place should personnel require access to this area. Sky-shine effects in uncontrolled laboratory and outside areas are less than those that would require controlled access to these areas due to radiation levels.

The source storage room is located inside X-700 in the northeast corner of the RADCAL Facility. This area is used both for storage of tertiary and working level alpha and beta particle emission sources as well as a box-type irradiator and other small gamma or neutron sources used in the bench-top calibration or response checks of radiological survey instruments. All radioactive materials stored in this area are kept in special containers provided by the source manufacturer or are kept in lockable storage cabinets. Access to this room is controlled and all activities are controlled by active radiological work controls or direct surveillance.

The radiation protection development laboratory area, which is an integral part of the RADCAL Facility, is located in the southwest corner of this facility outside of the X-700 high-bay area. This laboratory can contain additional alpha and beta particle emission reference standards and miscellaneous low level standard reference materials provided by the National Institute of Standards and Technology. All radioactive materials stored in this area will be kept in special containers provided by the source manufacturer or are kept in lockable storage cabinets. Access to this room is controlled.

3.5.1.1.2 Monitoring and Protection Systems in the RADCAL Facility

The design of the facility, the safety devices, and the procedures meet the applicable ANSI and PORTS requirements. The RADCAL Facility is equipped with a number of operational alarms and interlocks that provide protection from the radiation hazard that exists. These include the following features that are part of the RADCAL Facility interlocks, which are important to safety as discussed in Section 3.8:

- Closure switches on the entrance doors and the beam room sliding radiation shielding doors. These composite lead, steel, and concrete doors are normally opened by key access. All irradiators must be de-energized for a door to open without generating a source scram alarm and an immediate return of the source to its storage position.
- Interior motion detectors. No source can be energized if motion is detected in the beam room.
- Neutron and gamma detectors. Separate detectors are interlocked so that no source can be energized if an area monitor is in a high alarm state. All sources will retract if a high alarm

state is actuated after a source is energized. Alert alarm states do not control source operations.

- Manual scram pushbuttons. Scram pushbuttons are located in the control room, beam room, and other convenient locations. Exposure will immediately terminate when the pushbuttons are actuated.
- Source rod assembly. The assembly requires electrical power to position the source during exposure.
- Control relays and solenoid valves for the above listed components.

A horn alarm is located on the control room operator's console that sounds if a scram pushbutton or a detector alarm is actuated.

Electrical power is supplied to the switches, control relays, solenoid valves, and control circuits for the above listed components. The electrical control components are configured such that any open circuit, switch failure, or interruption of power de-energizes the source rod assembly. The source rod assembly is a spring-loaded component that retracts the radiation source if power is interrupted. Therefore, the RADCAL Facility interlocks are fail-safe upon a loss of electrical power.

In addition to the above, the beam room walls and sliding radiation shielding doors are also important to safety as described in Section 3.8. The beam room north, east, and west walls are made of reinforced concrete. The south wall is made of reinforced concrete and contains two equivalent composite shield doors. Each shield door contains steel, boron loaded polyethylene, and lead in equivalent proportions to equal the concrete walls on the south side. No support systems are applicable to the beam room walls and sliding radiation shielding doors.

Although not classified as important to safety, the floor in the beam room has a special covering of concrete mixed with boron frits. Part of the floor in the beam room is below the main floor level.

Fire protection for the RADCAL Facility is provided by an extension of the sprinkler system used in the X-700 Building. The system was installed in accordance with the National Fire Protection Association Standard 13 (NFPA-13).

3.5.1.2 X-720 Maintenance and Stores Building

X-720 contains several types of maintenance shops. The south side of the building contains the Main Stores Area, and a Toxic Materials Storage Area. The building and its facilities are necessary to provide services for maintenance of the plant.

Several office areas, locker rooms, former Instrument Shop areas and a portion of the Stores area have been de-leased and returned to DOE. DOE contractors will utilize the space for administrative work, shipping and receiving activities and radiation protection program activities. USEC will provide emergency response, fire protection response services, and some maintenance support to the DOE contractor(s) activities in these areas. USEC retains responsibility for equipment important to safety in these areas, specifically, the fire alarm systems, automatic sprinkler systems and the "AQ" structural components of the building. The DOE contractor activities do not involve fissile material operations, significant quantities of radioactive materials, or large quantities of hazardous or flammable materials.

Hazardous materials and spills in the building are handled in accordance with the requirements of Section 5.6.

Specially constructed storage lockers to house toxic materials are located at the east end of the Stores Area. These lockers are equipped with diked doorways and are locked to minimize access to the material.

The work activities involved within this facility have the potential of dealing with radioactive contaminated materials and process related equipment. The requirements for working with radioactive

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contaminated material are established by the plant's radiation protection procedures, as described in Section 5.3.

The X-720 maintenance facility is equipped with fire alarm systems and automatic sprinkler systems. Various portable fire extinguishers are located throughout the building. Ventilation in the shops is provided by large ceiling exhaust fans.

The facility is equipped with a CAAS. CAAS details are contained in Section 3.6.2.

The X-720 building structure is important to safety (Section 3.8) and performs the function of withstanding natural phenomena hazards such as high winds and seismic events. As described in Section 3.8, the X-720 building is capable of withstanding the evaluated events.

3.5.1.2.1 X-720 Shop Areas

The X-720 Machine Shop contains tools capable of performing drilling, turning, broaching, grinding, threading, boring, shaping, milling, and sawing on metal parts or stock. The shop balances assembled compressor rotors. The shop also operates a tool room for sharpening drills, reamers, cutting dies, taps, etc. The Machine Shop is also equipped with a brush plating system (Section 3.5.1.2.2). Small quantities of non-hazardous cutting oil and cleaning fluids are used throughout the shop.

The X-720 Compressor Shop reblades and assembles component parts of axial compressors. Centrifugal compressors are also assembled and tested in this area. All compressor assembly is under stringent cleanliness conditions. This shop utilizes many fixtures and jigs in the assembly of compressors. All compressor parts are checked per radiation protection requirements before entering the X-720 Shop.

The X-720 Sheet Metal Shop is equipped for repair and fabrication of metal parts from metal stock. The shop is also equipped for the layout and fabrication of small models of new or experimental machinery.

The X-720 Weld Shop is capable of various welding techniques and cutting of metals. The Weld Shop works on materials such as tool steel, stainless steel, monel, inconel, aluminum, and nickel.

The X-720 Carpenter Shop is equipped for various types of carpentry work. In addition to wood, the shop is able to work with such materials as masonite, and plastics. The hazardous and volatile materials stored in the Carpenter Shop include items such as paints, thinners, glues, wood preservatives, and solvents.

The X-720 Paint Shop is located adjacent to the Carpenter Shop. The Paint Shop is equipped to apply paints, varnish, and other coatings required on plantsite. This shop includes a spray booth equipped with filtered ventilation, storage space for paints and lacquers, and a drying oven that has its own exhaust system.

The paint mixing and cleaning room is used for storage of small amounts of paint. This cleaning area contains solvent and is ventilated by a hood and exhaust fan. The doorways are diked to contain spills. A locker approved for storage of toxic and flammable materials is used to store thinners and toxic paints and is equipped with a ventilation system, diked doorway, and an eye bath. A vent system is provided for a darkroom that is located in this area.

The X-720 mechanical maintenance area is separated into several small shops. The equipment available in these shops may include items such as hand chain hoists, an oil recovery unit, an oil filter unit, assorted carts, winches, sewer pipe cleaners, telescoping platforms, electric agitators, portable generators, centrifugal pumps, and air compressors.

Shop facilities for repair of electrical equipment and instruments are provided in X-720. The X-720 Electrical Maintenance Shop contains equipment such as volt-ohmmeters, oscillographs, oscilloscopes, and electronic amplifiers.

Instruments are repaired or rebuilt in the X-720 Instrument Shop. The following hazards and hazardous materials can exist in these areas:

- Storage of flammable and toxic chemical cleaning materials,
- Mercury exposure resulting from small mercury spills,
- Plating solution spills,
- Leaks from Nuclear Criticality Safety (NCS)-approved containers containing contaminated cleaning solutions.

These hazards are minimized by the following safeguards:

- Automatic sprinkler systems and fire extinguishers at strategic locations,
- Approved and separate storage containers for toxic chemicals and flammable materials,
- Availability of mercury control kits designed to contain mercury spills,
- Plating solutions spills are cleaned up and the collected liquid is placed in approved containers for disposal,
- Varying assays of ^{235}U can be found on contaminated instruments; therefore, all contents of NCS-approved containers are handled in accordance with applicable NCS requirements.

Several hazardous materials such as acids and nickel plating solutions are used for cleaning and plating instrument parts. These chemicals are stored and used in accordance with Section 5.6.

3.5.1.2.2 X-720 Metal Spray and Plating Areas

Several areas in X-720 are involved with metal plating.

The Metal Spray Facility provides an area for the restoration of worn parts and for the application of protective coatings. The hazardous materials encountered at the Metal Spray Facility include airborne metal dusts (principally steel, iron, and nickel), cylinders of oxygen (under pressure), and acetylene (explosive/flammable).

Brush plating (or selective plating) is the electrodeposition of plating metal upon selected areas of a work piece. The Brush Plating System is used in an open shop area; industrial safety and building protective systems for this area are the same as those that protect the Machine Shop area (Section 3.5.1.2.1).

The Cleaning and Plating Facility is located in the northeast section of X-720. Electroless nickel metal plating is performed in this facility. Some low level decontamination occurs at this facility and is done in accordance with applicable NCS Approvals (NCSAs). Several acid and detergent solutions are

Source terms for these release scenarios were calculated. Dispersion analyses were performed to estimate the duration of an unmitigated release necessary to exceed EGs. The resulting release durations from the threshold analysis are summarized in Table 4.2-12.

4.2.6.3.3 Preventive/Mitigative Controls

The PrHA also identified the facility controls (procedural and equipment) that can be used to prevent and/or mitigate the initiating events or minimize the consequences of the resulting accidents. The only safety classification that could be made as a result of the PrHA is AQ. The remaining classifications are based on the results of the accident analysis described in Section 4.3. Detailed technical bases for the safety classifications are presented in Section 3.8. In addition to process-specific controls, programs and plans are identified in the PrHA and play an important role in providing worker safety for many of the events evaluated. These programs and plans are described in SAR Chapters 5 and 6 and Volume 3 of the Application.

4.2.6.3.4 Accident Selection

Accidents selected for the accident analysis are defined by the set of limiting initiating events determined in the hazard evaluation. The limiting initiating events were selected from the events that exceed the PSOA threshold as indicated in Table 4.2-11. The process for selecting the limiting initiating events is described in Section 4.2.5.3.

Operating modes. A review of operations identified normal operating modes for the various processes that had events exceeding the PSOA threshold. These operating modes, described in the TSRs, are used to address potential operations for the defined processes and to develop the limiting initiating events. The modes are not mutually exclusive; operations within a facility may simultaneously involve more than one mode. For example, when one cell is in the *operating* mode, another cell may be in the *standby* mode.

Hazard states. The analysis of normal operation and initiating events must include evaluation of each mode of operation in combination with the hazard states that may be present during that mode. Hazard states for all hazards were identified as solid, liquid, and gas. Where one hazard state is present with another (e.g., gaseous UF_6 is always present with both liquid and solid UF_6), only one of the hazard states is associated with the analysis, but both conditions are considered in establishing the consequences.

Operating mode-initiating event-hazard state matrix. The consequences of unmitigated initiating events were compared with the PSOA screening thresholds to determine whether an event is carried forward to the PSOA. The comparison of the consequences with the PSOA screening thresholds (Table 4.2-3) is provided in the PrHA reports. The evaluation resulted in the set of initiating events indicated in Table 4.2-11.

Limiting initiating events. The set of the initiating events in Table 4.2-11 that were carried forward to the PSOA were evaluated to determine which of these events place the most demand on an essential mitigative system in each initiating event frequency category. Table 4.2-11 indicates the limiting initiating events that are evaluated in detail in Section 4.3.2. The evaluation resulted in a set of limiting events, denoted by a "Yes" under "Limiting event?" in Table 4.2-11.

Detailed descriptions of the accident scenarios associated with these limiting initiating events are presented in Section 4.3.2. Sections 4.2.6.4 through 4.2.6.8 present an overall summary and characterization of the hazard evaluation results for the facility groupings given in Table 4.2-9.

4.2.6.4 Cascade Facilities Group

The Cascade Facilities Group consists of the process buildings (X-326, X-330, and X-333) and the associated tie lines (X-232C1, C2, C3, C4, and C5). The principal hazards identified for this group are UF_6 and its reaction products, toxic gases (ClF_3 and F_2), light cascade gases (e.g., combinations of coolant, ClF_3, F_2), and miscellaneous waste storage areas. The miscellaneous waste storage areas are addressed in the group for waste storage (Section 4.2.6.7). Because these are complex facilities that contain a significant hazard, the principle hazard evaluation performed for the cascade facilities involved a more detailed analysis method. This hazard evaluation combined an operational review, the What If method, and the PSOA approach to evaluate potential initiating events and consequences. A separate hazard evaluation was performed for the cascade facilities to focus on shutdown scenarios. This hazard evaluation combined a failure modes and effects analysis and event tree sequence analysis to identify potential accident sequences and consequences. The PORTS enrichment operations were shutdown by USEC in 2001. Equipment sufficient to allow for a stand alone enrichment capability of 3 million SWU per year was placed in a "cold standby" condition; this equipment was transitioned to shutdown in 2006. This equipment is currently being treated for removal of residual deposits and some equipment removal and decontamination is in progress. The cascade equipment is being maintained in a shutdown condition. A description of the condition of the enrichment equipment and the activities associated with it is provided in SAR Section 3.1.1.1.5. The remainder of the SAR Section 3.1 provides a description of the enrichment operations certified at the time of the shutdown of the uranium enrichment operations at PORTS.

Some cascade equipment is being used for transfer of DOE Affected Inventory UF_6 from Non-DOT Compliant Cylinders to cylinders meeting ANSI N14.1 requirements. A small portion of the cascade equipment is utilized in transferring Affected Inventory UF_6 from DOE Non-Compliant Cylinders to ANSI N14.1 compliant cylinders. Many of the cylinders meet PORTS inspection requirements and are liquid-transferred and processed in X-344. For the majority of these cylinders, the UF_6 is fed as a gas (using both normal and controlled feeding at the X-342 and X-343 autoclaves) to cascade equipment and routed to the X-326 building (specifically cells in Unit X-27-1) and then sent to the ERP Station for withdrawal as liquid UF_6 into ANSI N14.1 compliant cylinders. After the prescribed cooling period, the full cylinders are transferred by a straddle carrier to the X-344 facility for Tc-99 reduction and transfer into shipping cylinders. The operations to be employed in transferring the UF_6 into ANSI N14.1 compliant cylinders are within those utilized in the feed, material transfer and withdrawal of UF_6 from the cascade during enrichment operations. The amount of material to be fed and withdrawn is a small fraction (approximately 20%) of the operations evaluated at the PORTS plant capacity in the SAR accident analyses. The amount of inventory in the cascade is a very small fraction (less than 1%) of the analyzed plant capacity.

The risk of all accidents described in this accident analysis of the enrichment cascade operations is lower for the shutdown condition. The accident scenarios postulating the release of toxic materials have lower probability and lower consequences than stated since the remaining inventory of UF_6 is much less than the analyzed condition and the process pressures of cascade systems containing UF_6 are all below atmospheric pressure. The potential risk of a criticality accident is also lower due to the greatly reduced inventory of uranium and the reduction of the potential sources of moderation associated with the RCW and lube oil systems. The risk from a fire is also lower due to removal of the lube oil from the shutdown process equipment, the shutdown of the compressors and the reduction in energized electrical equipment. While the additional space heaters introduce some potential fire risk, there is little combustible loading associated with the heaters themselves and the overall risk of fire is much lower than is the case for an operating enrichment cascade. The risk of an exothermic reaction or explosion is also greatly reduced due to the reduction in the amount of operating equipment, coolant and oxidant that could be present. The following discussion summarizes the results of these hazard evaluations for UF_6 in these facilities.

4.2.6.4.1 Process Definitions

The enrichment and purge cascades include the cascade auxiliary equipment (e.g., booster systems, surge systems, coolant systems, seal systems, seal exhaust systems, wet air evacuation systems, datum systems) that supports the operation of the cascades. In addition to the cascades, the enrichment and purge cascade facilities also include the following processes that provide support for the operation of the main cascades:

- Freezer/Sublimer (F/S) Process.
- Cold Recovery Process.
- Freon Degrader Process.
- Side Feed Process.
- Toxic Gas Storage and Distribution Process.

The F/S Process consists of F/S vessels and associated support equipment. These vessels are installed in various locations within X-333 to allow excess UF_6 inventory to be rapidly removed from the cascade by freezing it in storage vessels and then returning it to the cascade by sublimation when required. Cascade inventory adjustments may periodically be required to accommodate changes in the available power. F/Ss are strategically located where they can be independently or jointly operated to remove excess UF_6 inventory, to conduct emergency power drops, or to adjust the power load to maximize production.

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The Cold Recovery process in X-330 and X-333 removes UF_6 from process gas that has been contaminated with coolant. The gas is evacuated from the cascade to the surge drums. The UF_6 is then separated out in a cold trap and in chemical traps (sodium fluoride and alumina) while the coolant is vented to the atmosphere. The UF_6 is then sublimed to surge drums and returned to the cascade.

The Freon Degrader Process located in X-326 removes coolant that collects in the Purge Cascade and the top process cells. Coolant in a process gas side stream is decomposed by reaction with F_2 in the Freon degrader vessel to produce low molecular weight gases which are returned to the purge cascade where the lighter products are purged out.

The Side Feed Process is primarily located in the X-326 Product Withdrawal area. This process involves the connection of small cylinders containing LEU material being connected to a manifold and limited heat being applied to cause sublimation of the material into the process piping. The material is fed through piping to the cascade for blending with the main process stream. The process was evaluated and considered to be another location for controlled feeding of UF_6 cylinders. This process is evaluated in the UF_6 Cylinder Handling and Storage Group.

The Toxic Gas Distribution Process includes the storage and distribution of ClF_3 and F_2 within the process buildings.

4.2.6.4.2 Hazards

The hazardous materials in the Cascade Facilities Group were reviewed to determine which needed to be evaluated in the PrHA and PSOA. The results of this review are indicated in Table 4.2-9. All the hazardous materials, except those indicated in the table, were characterized as being standard industrial hazards that are commonly found in industrial facilities. These were screened out from further analysis in the PrHA because the amounts of the material are insufficient to cause any significant local health effects. These hazards are adequately controlled by site administrative programs and plans, and no additional analysis was required.

The energy sources identified in the hazards analysis that have the potential for causing releases of hazardous materials are (1) steam energy used to heat the building, (2) electrical energy, (3) chemical energy from the reaction between UF_6 and a coolant/oxidant, (4) potential energy associated with the process building cranes and the lifting of heavy equipment, (5) kinetic energy associated with the process gas compressors and the various types of vehicles, (6) flammable materials (7) combustible materials (e.g., lube, hydraulic oil), and (8) compressed gases (e.g., coolant, nitrogen).

The Enrichment and Purge Cascade Facilities were categorized as Hazard Category 2 nuclear facilities because they contain quantities of the ^{235}U component of the UF_6 sufficient to exceed the threshold quantity for Hazard Category 2 in Table A.1 of DOE-STD-1027-92.

4.2.6.4.3 Parameters of Concern

The first step of the principle hazard evaluation was to identify potential initiating events associated with the Cascade Facilities Group to identify the process parameters that, if changed, could result in a release of the hazard that could exceed the screening thresholds for either PrHA or PSOA. The process parameter changes that could lead to a release of the hazards are (1) a temperature change in the primary system that exceeds the primary system temperature limits, (2) a pressure change in the primary system that exceeds the primary system pressure limits, (3) a failure in the primary system integrity, and (4) a loss of criticality safety controls.

Based on the groupings described, four process parameters should be addressed for each operating condition to ensure that potential types of events are considered in the hazard analysis. The potential ways of releasing hazardous materials that are caused by things such as energy sources and natural phenomena were evaluated for each operating mode to determine whether they might cause a change in one of the four process parameters. Table 4.2-11 summarizes the different initiating events by parameter. These events were developed by considering operational history, operator input, and systematic evaluations.

The first step of the hazard evaluation associated with the shutdown scenarios was to identify the specific scenarios to be evaluated. The scenarios chosen for the evaluation included:

- Prompt total shutdown of a cell or multiple cells, a unit or multiple units, a partial building or complete building or multiple buildings with UF_6 inventory.
- Controlled shutdown of multiple cells, a unit or multiple units, a partial building or complete building or multiple buildings with UF_6 inventory.
- Controlled shutdown of multiple cells, a unit or multiple units, a partial building or complete building or multiple buildings following UF_6 evacuation.
- Shutdown of a purge cascade

The evaluation developed failure modes and effects analyses to identify failures that could initiate these scenarios and then analyzed the bounding initiating events via event trees to identify the range of potential scenario outcomes.

As noted earlier, the enrichment operations have been shutdown and the majority of the cascade equipment has the UF_6 inventory removed and a dry gas buffer applied. While some equipment is undergoing treatment for deposit removal and maintenance for equipment removal or for maintaining the shutdown requirements, the shutdown condition will have a lower risk than was present for an operating enrichment cascade.

4.2.6.4.4 Summary of Results

As indicated in Table 4.2-11, the events considered for the Cascade Facilities Group included a wide range of process-related events, external events, shutdown scenarios, and controls for minimizing the potential risks. A brief summary of the hazard analyses are presented below for each process.

4.2.6.4.4.1 Enrichment Cascade

Table 4.2-11 identifies all of the events associated with the Enrichment Cascade Process that were considered in the hazard analyses. Twelve of these events were identified as having the potential to exceed the PSOA threshold, with only one of these (stage control valve closure) not being a limiting event (Table 4.2-11). The controls identified as being AQ are described in Section 3.8. These controls were identified as playing an important role in minimizing potential exposure for on-site personnel, but none were identified as being required to protect the off-site public (Section 4.3.2). The primary administrative control identified for this process is to limit operating pressures for the cascade auxiliary equipment that processes UF_6. This equipment is maintained below atmospheric pressure to minimize releases of UF_6

should a failure in the primary system occur. In addition to the auxiliary equipment, a large portion of the Enrichment Cascade Process is also operated below atmospheric pressure. These portions of the cascade were not considered to have the potential to exceed the PSOA threshold except where the stage control valve closure event or the B-stream block valve closure event could still cause the pressures to increase above atmospheric pressure. In these cases, the PrHA does not postulate that a catastrophic rupture will occur due to the extended period of time to detect and mitigate the event. However, limited UF_6 releases (see Section 4.3.2.1.4) are possible during the transient due to the pressure increase. The remaining controls identified for the enrichment cascade process are adequately addressed by the programs and plans described in SAR Chapters 5 and 6 and Volume 3 of the Application.

4.2.6.4.4.2 Purge Cascade

The Purge Cascade Process is similar to the Enrichment Cascade Process (i.e., same type of equipment and initiators) but does not have any significant inventory of hazardous material that could exceed the PSOA threshold except for criticality. Therefore, the analyses were very similar to that for the Enrichment Cascade Process where pressures remain below atmosphere.

4.2.6.4.4.3 Freezer/Sublimers

Table 4.2-11 identifies all of the events associated with the Freezer/Sublimer (F/S) Process that were considered in the hazard analyses. Seven were identified as having the potential to exceed the PSOA threshold, and all seven events were limiting events (Table 4.2-11). The controls identified as being AQ are described in Section 3.8. These controls were identified as playing an important role in minimizing the potential exposure for on-site personnel, but none were identified as being required to protect the off-site public (Section 4.3.2). The only significant energy source associated with this process is the coolant used to heat and cool the UF_6 during operations. During the freeze mode of operation, the primary concern is to prevent overfilling the vessel with UF_6 (overfilling could result in failure of the primary system during a subsequent sublime mode). Expansion of UF_6 from a solid to gas in the sublime mode could result in stress failure of the coolant tubes. This event was evaluated in the hazard analysis and was determined to cause only local effects because the F/S is connected to the A-line during the sublime mode, which is at extremely low pressures. The remaining controls identified for this process are adequately addressed by the programs and plans described in SAR Chapters 5 and 6 and Volume 3 of the Application.

4.2.6.4.4.4 Cold Recovery

Table 4.2-11 identifies all of the events associated with the Cold Recovery Process that were considered in the hazard analyses. Only two of these events (criticality and evacuation) were identified as having the potential to exceed the PSOA threshold (Table 4.2-11). The controls identified as being AQ are described in Section 3.8. These controls were identified as playing an important role in minimizing the potential exposure for on-site personnel, but none were identified as being required to protect the off-site public (Section 4.3.2). The primary administrative control identified for this process is to limit operating pressures to below atmospheric pressure to minimize releases of UF_6 should a failure in the primary system occur. The remaining controls identified for this process are adequately addressed by the programs and plans described in SAR Chapters 5 and 6 and Volume 3 of the Application.

4.2.6.4.4.5 Freon Degrader

Table 4.2-11 identifies all of the events associated with the Freon Degrader Process that were considered in the hazard analyses. Only two of these events (i.e., criticality and evacuation) were identified as having the potential to exceed the PSOA threshold (Table 4.2-11). The controls identified as being AQ are described in Section 3.8. These controls were identified as playing an important role in minimizing the potential exposure for on-site personnel, but none were identified as being required to protect the off-site public (Section 4.3.2). The primary administrative control identified for this process is to limit operating pressures below atmospheric pressures to minimize releases of UF_6 should a failure in the primary system occur. The remaining controls identified for this process are adequately addressed by the programs and plans described in SAR Chapters 5 and 6 and Volume 3 of the Application.

4.2.6.4.4.6 Toxic Gas Distribution

Table 4.2-11 identifies all of the events associated with the Toxic Gas Distribution Process that were considered in the hazard analyses. Only one of these events (evacuation) was identified as having the potential to exceed the PSOA threshold (Table 4.2-11). The controls identified as being AQ are described in Section 3.8. These controls were identified as playing an important role in minimizing the potential exposure for on-site personnel, but none were identified as being required to protect the off-site public (Section 4.3.2). The remaining controls identified for this process are adequately addressed by the programs and plans described in SAR Chapters 5 and 6 and Volume 3 of the Application.

4.2.6.5 UF_6 Handling and Storage Facilities Group

The UF_6 Handling and Storage Facilities Group consists of the feed vaporization buildings [X-342A (UF_6 portion only), X-343], the toll enrichment services facility (X-344A), the withdrawal facilities (located in X-326, X-330, and X-333), and the cylinder storage yards (X-745B, D, F, and G). The principal hazard identified for this group is UF_6 and its reaction products. Because these are complex facilities that contain a significant hazard, the principle hazard evaluation performed for the liquid UF_6 facilities (i.e., X-342A, X-343, withdrawal, X-344A) involved a more detailed analysis method. This hazard evaluation combined an operational review, the What If method, and the PSOA approach to evaluate potential initiating events and consequences. A separate hazard evaluation was performed for the withdrawal facilities to focus on shutdown scenarios. This hazard evaluation combined a failure modes and effects analysis and event tree sequence analysis to identify potential accident sequences and consequences. The shutdown of uranium enrichment operations has reduced the overall risk associated with these facilities since the cascade feed is greatly reduced and the Tails and LAW withdrawal facilities have been placed in a shutdown condition. Also, the amount of product withdrawn from the enrichment cascade at ERP is a fraction of the withdrawal rates initially evaluated. The overall level of cylinder handling and processing activity at the X-344A, X-342A, and X-343 buildings remains bounded by the operations as originally analyzed. The mission of the X-343 has changed to primarily receipt, processing and sampling of cylinders for Tc-reduction with some feeding and venting to the cascade equipment; X-342 performs some feeding to cascade equipment for Tc-reduction; feed operations in support of the enrichment operations at PORTS have been terminated.

USEC has contracted with DOE to process near-normal enriched UF_6 contaminated with Tc-99 above ASTM Specification C-787-90 (Affected Inventory) contained in cylinders that, based on initial inspections, are not compliant with DOT shipping requirements and are designated "Non-Compliant Cylinders." USEC has contracted with DOE to remove the UF_6 from the cylinders, process this material for reduction of Tc-99 to acceptable levels and to package the material in ANSI N14.1 compliant cylinders.

With the enrichment process shutdown, USEC will utilize existing cascade equipment and processes at the Portsmouth GDP (PORTS) to perform the required activities. Many of the cylinders meet PORTS inspection requirements and are liquid-transferred and processed in X-344. For the majority of these cylinders, the UF_6 is fed as a gas using both normal and controlled feeding. PORTS will use autoclaves in the X-342 (Autoclaves 1 and 2) and X-343 (Autoclaves 1, 2, and 6) to heat the impaired cylinders that do not have the ability to withstand a normal heating cycle using the "controlled feed" mode of heating, as described in the TSRs, and feed the material to cascade equipment for withdrawal at the ERP Station into 10-ton cylinders.

The autoclaves in X-342 and X-343 that will be utilized for this process had been in service prior to shutdown of the enrichment process. The X-343 and X-342A were utilized for providing feed to the cascade and will be used in the same manner for this project activity. However, the autoclaves to be used will be operated both in the normal and "Controlled Feed" mode in transferring the material to the cascade equipment. In order to reduce the need for frequent operator adjustment of the steam supply to the autoclaves during controlled feeding, the steam control system (a Non-Safety, NS, system) is modified to employ a new control system utilizing the cylinder surface temperature measurement as the control parameter. The new steam control system will replace one of the existing steam control systems and is designed to provide steam at a rate of approximately 10% of the existing steam control systems. The feed will be transferred using existing transfer lines (e.g., tie-lines) to the cascade equipment. The feed rate will be a small fraction of that utilized during enrichment operations; the rate is about 20% of that analyzed in the accident analyses. Additionally, since any of the Non-Compliant Cylinders that do not have the ability to withstand a normal heating cycle will be processed using the Controlled Feeding Mode of Operation, the potential for an accident affecting plant workers or the offsite public is not increased since any of these cylinders processed in the autoclaves will not contain liquid UF_6. No cylinders containing liquid UF_6 will be handled in the X-342 and X-343 facility above what was previously evaluated in the SAR. The sampling and processing of UF_6 in ANSI N14.1 compliant cylinders, in X-342, X-343 and X-344 for the Tc-99 reduction activity will be within the limitations established for the Tc Cleanup Project and thus are within the previous analyses.

The following discussion summarizes the results of these hazard evaluations for UF_6 in these facilities.

4.2.6.5.1 Process Definitions

The UF_6 Handling and Storage Facilities Group consists of liquid UF_6 handling facilities and large UF_6 cylinder storage and handling operations. These operations consist of equipment such as autoclaves, cranes, UF_6 compression equipment, condensers, piping, and other support equipment.

The X-344A toll enrichment services facility provides systems for the receiving, sampling, transferring, and shipping of cylinders containing UF_6. This facility provides all operations necessary

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Table 4.2-9. Hazards in Facilities Exceeding PrHA Thresholds.

Facility group/processes evaluated/hazards/facilities

All processes for the X-710 technical services building

Hazards exceeding the PrHA threshold

UF_6 - Uranium hexafluoride
Hydrofluoric acid
Chlorine
Chlorine trifluoride (ClF_3)
Fluorine (F_2)
Various analytical chemicals
Uranium-bearing solutions

Facilities associated with process

X-710	Technical Services Building

All processes for the X-720 maintenance and stores building

Hazards exceeding the PrHA threshold

UF_6 - Uranium hexafluoride
Sulfuric acid
Uranium oxide
Flammable liquids (e.g., varnish)
Phosphoric acid

Facilities associated with process

X-720	Maintenance and Stores Building

Table 4.2-10. Hazard Categorization of Facilities.

Facility	Name
Radiological	
X-103	Auxiliary Office Building
X-342-B	Fluorine Storage Building
X-747-C	Material Storage Yard
X-747-D	Material Storage Yard
Category 2	
X-232-C1	Tie Line No. 1; X-342 to X-330
X-232-C2	Tie Line No. 2; X-330 to X-326
X-232-C3	Tie Line No. 3; X-330 too X-333
X-232-C4	Tie Line No. 4; X-326 to X-770
X-232-C5	Tie Line No. 5; X-343 to X-333
X-326	Process Building
X-330	Process Building
X-333	Process Building
X-342-A	Feed Vaporization and Fluorine Generation Building
X-343	Feed Vaporization and Sampling Facility
X-344-A	Toll Enrichment Services Facility
X-700	Converter Shop and Cleaning Building
X-705	Decontamination Building
X-710	Technical Services Building
X-720	Maintenance and Stores Building
X-745-B	Toll Enrichment Process Gas Yard - UEA
X-745-D	Feed Storage Yard
X-745-F	North Process Gas Stockpile Yard - UEA
X-745-G	Cylinder Storage Yard
XT-847	Waste Management Staging Facility

requirements is discussed in Section 3.8. Operating limits for the essential controls are presented in the TSRs.

4.3.2.1 Cascade Facilities

Table 4.2-11 documents the results of the hazard analysis for each of the cascade facility processes. In addition to the processes that were evaluated directly inside the cascade facilities, various waste storage/handling operations may also be present inside the facilities. These operations and their analyses are addressed in Section 4.3.2.3.

As noted earlier in Chapter 4, the shutdown of enrichment operations has reduced the probability and consequences of accidents described in this section. While the various accident initiators discussed could be present on cells running for deposit removal treatments or to support Tc Cleanup, the inventory of uranium and other hazardous materials in the cell would not pose a threat to public health and safety. The protection of onsite worker from releases of toxic materials is accomplished by evacuation according to site "see and flee" procedures.

4.3.2.1.1 Compressor Failure-UF_6 /Hot Metal Reaction (Temperature Increase)

a. Scenario Description

UF_6 oxidizes most metals producing a metal fluoride and solid uranium compounds, but at moderate temperatures the reaction is mild and the reaction rate is inhibited by the layer of reaction products formed on the surface of the metal. However, if aluminum is heated above the solidus temperature [about 1100°F (593°C)], the protective metal fluoride layer is disturbed and a more vigorous exothermic reaction can occur. The reaction will continue as long as UF_6 and aluminum are available, and the heat generated by this reaction is sufficient to maintain the aluminum above the solidus temperature.

Any mechanism capable of heating the aluminum to temperatures above the solidus temperature when UF_6 is present can initiate the UF_6/aluminum reaction. However, the most probable and most historically common initiating mechanism is friction associated with component rubbing after axial compressor failure/deblade which generates sufficient heat to raise aluminum temperatures above the solidus temperature. While all axial compressors have aluminum blades, the "00" compressors have the greatest potential for UF_6/hot metal reactions because they have aluminum rotors that tend to expand more than the "000" compressor steel rotor. This expansion results in decreased rotor blade tip clearances and a greater probability of blade rubbing and deblade. Friction or rubbing of aluminum components or fragments after a deblade has the potential to provide sufficient heat to reach the solidus temperature of the aluminum and create an exothermic UF_6/hot metal reaction. The reaction will result in increased temperatures and decreased pressures locally as the UF_6 is reacted to produce solid compounds. If the reaction occurs in a vulnerable location and is not mitigated, it can damage the pressure boundary and cause a breach of the primary system. A breach would result in a release of UF_6 if the process pressure were above atmospheric pressure. In addition, under certain conditions, the heat from an exothermic reaction in the compressor can be transmitted to the cooler. If this occurs, and sufficient heat is provided to melt the aluminum components in the stage cooler, the R-114 coolant would leak into and pressurize the process system. If the R-114 coolant system is breached in a cell that is isolated from the cascade, this could result in overpressure and breach of the primary system due to the limited expansion volume available. Coolant system ruptures into the primary system are addressed in Section 4.3.2.1.6.

During the modes of operation for the enrichment cascade where the compressors are running, a number of causal factors may result in compressor failure in a cell or booster station operating either on-stream or off-stream including (1) compressor flow starvation or compressor overload, (2) catastrophic seal or bearing failure that results in wet air inleakage and subsequent rotor imbalance (excessive vibration) due to uranium deposition, (3) enrichment cascade disturbances which result in compressor surging, and (4) overheating the process gas stream due to coolant system malfunctions. These factors can cause the progressive effects of (1) compressor surging or overload, (2) overheating, and (3) if unmitigated, a compressor deblade. Direct compressor failure can also be caused by (1) a foreign object in the compressor suction or (2) blade fatigue. When a compressor deblades, the possibility of heat build up exists due to rubbing/friction of aluminum components or fragments sufficient to initiate a UF_6/hot metal exothermic reaction, and burn a hole in the primary system boundary and/or the R-114 coolant system boundary.

This event is an AE because a single active failure of a compressor, left unmitigated, could result in a UF_6/hot metal reaction that could lead to a breach in the process system and a release. Operational history indicates that only a small percentage of compressor failure events result in a UF_6/hot metal reaction.

A UF_6/hot metal reaction event was evaluated in the PrHA, and it was determined that the consequences could include significant on-site impact while operating above atmosphere if no mitigation were provided.

The primary concerns associated with this event are (1) the primary system temperature increase, and (2) controlling the UF_6 release if the primary system should fail. The applicable EGs (see Table 4.2-2) associated with this event are all the EGs for the AE frequency range. EG 4 is addressed by the NCS Program (see Section 5.2). The first safety action required to meet the other EGs would be to maintain the primary system temperature within EG 3. This action will prevent primary system failure, protect on-site personnel, and maintain habitability of the required control area by preventing a release of UF_6. If primary system temperature cannot be maintained within EG 3, a breach of the primary system could conceivably occur. The safety actions for above atmospheric systems of (1) primary system leakage detection, (2) primary system pressure control (to reduce the primary system pressure and minimize the UF_6 release), (3) building holdup, and (4) emergency response by on-site personnel would be required to maintain the effects of a UF_6 release within EGs 1, 2, and 6. These actions protect on-site personnel and will maintain habitability of the required control area in accordance with EG 6 as well.

Primary system temperature control is required to meet EG 3. The primary means of accomplishing this safety action is to minimize the potential for the event to occur. Typically, when one of the causal factors that could lead to a compressor deblade is identified by an abnormal motor load and confirmed by examining other process parameters, operators will initiate appropriate actions (e.g., reduce the operating pressure, take the cell off-stream, or trip the cell(s) and take off-stream) to prevent a deblade. However, once a deblade is confirmed the essential method for preventing the reaction is to trip the cell(s) from the area control room (ACR) to shut down the motors to eliminate any heat generation due to rubbing parts. If this control fails to stop the transient in sufficient time to prevent the failure of the primary system, a release is assumed to occur if the system is above atmospheric pressure. The release of UF_6 to the atmosphere could exceed EGs 1, 2, and 6 if no mitigation is accomplished. The compressor failure-UF_6/hot metal reaction produces the most limiting temperature transient event in the AE category for the operating and standby operating modes.

necessary. However, none of these actions are considered essential because in the event that the fire directly results in a primary system failure, none of these actions would significantly effect the quantity of UF_6 ultimately released. This is because of the extensive time required to reduce building inventory. The main concern is for operational personnel in the ACR to evacuate the facility when that decision is made.

Workers outside the process buildings — The essential controls for protecting on-site personnel outside the process buildings are (1) elevated dispersion of any release by the existing process building structure, and (2) training of on-site personnel to evacuate areas upon detection of a release by sight or by odor. The process building is expected to cause most of the UF_6 that escapes the building to be released at an elevated point. If workers outside of the process building have received no other instructions for action to be taken (i.e., shelter in place or take cover), then the essential control for these receptors is to evacuate their areas if a release is detected by sight or by odor.

Off-site public — As indicated in the source term discussion, this event is not likely to cause any off-site impact because of the extreme high temperatures generated from the fire and the rise of the plume from the heat of the fire that would occur. Therefore no off-site exposures exceeding the EGs are expected. However, the fire protection system and the fire protection program described in Section 5.4 are extremely important in preventing a small fire from becoming the large fire that could initiate this event.

d. **Comparison With Guidelines**

As indicated in the consequence analysis, no direct calculations of consequences were performed to provide a comparison to the EGs. However, the controls provided in the consequence analysis are expected to maintain the effects of the event within the applicable EGs.

e. **Summary of SSCs and TSR Controls**

Based on the results of this analysis, the essential controls for the large fire event are summarized as follows:

- Visual/odor detection of release, worker training, and evacuation of affected area—all on-site workers (EGs 1 and 2);
- Process building structure providing elevated dispersion—on-site workers outside process building and the off-site public (EGs 1 and 2);
- Process building fixed fire protection system—minimize potential and mitigation of a large fire (EG 5); and
- Fire Protection Program—minimize potential for a large fire (normal operation, EG 5 only)

Based on the above essential controls, the resulting important to safety SSCs and TSRs are as follows:

- The process buildings, and process building fixed fire suppression systems are identified as important to safety SSCs. See Section 3.8 for details including safety classification.

- TSRs are provided for the fire protection system and its associated water supply from the HPFWS, and administrative requirements for the Fire Protection Program, and for procedures and training of workers for evacuation actions.

4.3.2.2 UF_6 Handling and Storage Facilities

Table 4.2-11 documents the results of the hazards analysis for each of the UF_6 handling and storage facilities processes. The UF_6 handling and storage processes consist of feed vaporization, toll transfer and sampling, product and tails withdrawal, and cylinder storage. The principal hazard evaluated for this group is UF_6 and its reaction products. As noted earlier in Chapter 4, the shutdown of enrichment operations has reduced the probability and consequences of accidents described in this section related to the cascade product withdrawal systems and autoclave cascade feed related accidents. The following summarizes the hazards and results of the accident analysis involving these facilities.

4.3.2.2.1 Compressor Failure-UF_6/Hot Metal Reaction (Temperature Increase)

a. <u>Scenario Description</u>

UF_6 reacts with most metals. Typically the reaction between UF_6 and the metals used to fabricate gaseous diffusion process equipment is relatively mild due to: (1) the relatively moderate temperatures associated with the gaseous diffusion processes, and (2) a reaction-inhibiting layer of reaction products that is formed on the metal surfaces. However, if the metal is heated above its solidus temperature (about 1100°F for aluminum) in the presence of UF_6, then the exothermic reaction is not inhibited and can become self-sustaining. Once the reaction becomes self-sustaining, it can continue as long as UF_6 and exposed metal are available for the reaction. Due to the localized nature of the event, there is no direct indication that a self-sustaining UF_6/hot metal reaction is occurring in the process. Therefore, a self-sustaining UF_6/hot metal reaction can cause a primary system failure that would result in a loss of primary system failure.

An event involving a UF_6/hot metal reaction is applicable for the centrifugal compressors used in the ERP, LAW and Tails withdrawal facilities.

The excessive heating required to start a UF_6/hot metal reaction can be generated in the centrifugal compressors due to various initiators such as frictional heating generated by misaligned compressor parts rubbing together, foreign objects in the compressor's suction, etc. A loss of physical integrity associated with a UF_6/hot metal reaction in the first stage centrifugal compressors would result in an air leakage into the withdrawal process since both the inlet and outlet sides of the first stage centrifugal compressors operate at sub-atmospheric pressures. However, should the second stage centrifugal compressors suffer a similar type of failure, a UF_6 gas release could be expected since the second stage compressors operate with discharge pressures that are above atmospheric pressure.

The UF_6/hot metal reaction event is classified in the AE frequency range because a single active failure or operator error could cause the event. The bounding compressor failure involves the UF_6/hot metal reaction. Past operating experience indicates that many compressor failures have occurred with a few resulting in a UF_6/hot metal reaction. This was typically discovered only when the compressor was removed and opened up for repair. Therefore, failure of the primary system is rarely experienced for

- 300-600 rem—as above, plus hemorrhaging, infection, diarrhea, epilation, and temporary sterility, with guarded recovery prognosis; exposure of about 400 rem is fatal to 50 percent of individuals without medical treatment.
- 600 rem—above symptoms plus impairment of central nervous system and incapacitation for doses above 1000 rem, with death expected.

The preceding list of ranges and thresholds, as stated, is derived from data on gamma radiation. However, the results can be extended to mixtures of gamma and neutron exposure because the limits are given in units of rem, which take into account the relatively higher biological efficiency of neutron irradiation (i.e., neutron radiation is generally more harmful than gamma radiation per unit of absorbed energy). In high doses and high dose rate situations, the determination of a "quality factor" is very difficult because of complex dosimetry and radiation biology interactions. Quality factors for neutron exposure also vary significantly based on the energy of the interacting neutrons. As a result, estimation of neutron radiation dose is usually done using units of "rad". However, in this analysis, the formulas from Reg. Guide 3.34 were used to provide estimates of neutron exposure and these are reported in the Reg. Guide in rem. In the consequence evaluations below, a mixed (gamma plus neutron) exposure of 400 rem is taken conservatively to define the zone of potential lethality.

b. **<u>Historical Record of Accidental Criticality Events</u>**

Accidental criticality, with uncontrolled power level, has occurred on 37 known occasions (according to data available up to 1988) (References 79 and 80). All but eight of these have occurred in facilities such as critical experiments facilities or reactor facilities and are thus of some interest but of limited applicability to the industrial processing activities that go on at a gaseous diffusion plant. The total yields for these events ranged from 3×10^{15} to 1.2×10^{20} fissions, with a median of about 1.3×10^{17} fissions. For the 27 events that were not terminated by automatic shutdown systems, the criticality was terminated by the negative reactivity effects of the energy released by the unintended fissions. The shutdown mechanisms can be summarized as follows:

- Density reduction, either via microbubble formation or thermal expansion.
- Loss of water moderation by boiling.
- Expulsion of part of the mass.
- Mixing of light and dense layers (dilution).
- Geometry change.

In the history of fissile material processing, eight accidental criticality events have occurred in processing plants and are therefore relevant to the industrial setting of a gaseous diffusion plant. Table 4.3-11, taken from References 80 and 81, summarizes important facts about these events. Most of the events can be characterized by an initial main pulse followed by other, smaller pulses and, in some cases, featuring a plateau of apparently steady criticality at a low level for an extended period. The magnitude of these accidents has ranged from about 10^{15} to about 6×10^{17} fissions in the initial pulse. The largest total yield is estimated to have been about 4×10^{19} fissions accumulated as a result of an extended period of small pulses. The likelihood of an extended period of criticality provides a firm basis for prompt evacuation of process areas to minimize the radiation exposure of workers. Another significant lesson is that all eight of the processing plant criticality accidents involved solutions rather than solids.

This is not surprising when it is considered that solution systems can have much smaller critical masses and are quite mobile, thus inviting criticality in unexpected locations. By contrast, solids typically are nonmobile or at least do not generally move except by deliberate action of operational personnel, and the masses required for undermoderated solids are large compared with those of well-moderated solution systems.

c. **Possible Criticality Events at PORTS**

Criticality accidents that may be possible at a gaseous diffusion plant are either similar to or not worse than those that might be encountered at a fuel fabrication plant. A gaseous diffusion plant and a fuel fabrication plant share many qualitatively similar operations involving analogous forms of fissile material:

- Gaseous and solid UF_6.
- Uranium solutions.
- Slurries of low-density uranium compounds.
- Low-density dry forms of uranium compounds, with and without moderation control for criticality safety purposes.

A gaseous diffusion plant lacks the high-density forms of uranium, such as pressed and sintered UO_2, that must be handled at a fuel fabrication plant to manufacture reactor fuel.

Considering the range of activities at PORTS, as well as industry experience, it is reasonable to conclude that the most likely type of criticality would be one involving uranium solution. Solution processing is most common in the Decontamination and Uranium Recovery Facility (Building X-705); however, solutions are routinely handled in several other facilities (e.g., the X-710 laboratory), and accidents could theoretically occur (e.g., in conjunction with a nonroutine cleanup or maintenance operation) in any facility on-site where significant quantities of fissile material are being processed.

In defining a second-most-likely type of criticality event, one would have to look to the sheer size of the cascade operations (> 50 acres under roof) and the large number of UF_6 gas processing units. UF_6 gas is inherently safe against criticality for conditions possible in the cascade. The possibility of criticality is introduced by the chance that a buildup of solid uranium compound in large-diameter pipes or other large equipment (i.e., equipment for which size exceeds geometrically favorable dimensions) could become sufficiently moderated to go critical. It should be pointed out that inherent as well as intentionally maintained safety features make such an event a very unlikely and hypothetical postulate. In the cascade, the UF_6 must be kept in gaseous form, and except in the freezer/sublimer vessels, any buildup of solid forms must be avoided for the gaseous diffusion process to work properly. The deposits surveillance program (described in Section 5.2) is performed in addition to the normal cascade controls to detect buildup within the cascade. Nevertheless, buildup of solids does occur, and the buildup must be periodically cleaned out via chemical treatment or by equipment removal and decontamination.

Enrichment operations were terminated in 2001 by USEC. Enrichment cascade equipment is in a shutdown condition, except when undergoing chemical treatments for removal of deposits or operating to support Tc Feed Cleanup and/or Deposit Removal. For shutdown cells, the RCW has been isolated from the cell cooling systems; the lube oil has been drained from the cells; the cells are buffered with dry gas at slightly above atmospheric pressure. With these conditions, the probability of a criticality is lower for the enrichment cascade when in a shutdown condition than for an operating enrichment cascade. Uranium deposits have been identified and quantified and are handled based on the deposit size according to TSRs and NCS requirements.

Defining whether a solids-buildup-related criticality event warrants consideration in addition to that to be given to solution criticality requires consideration of the rate at which the hypothetical, potentially critical mass becomes moderated. If the rate of moderation were rapid (e.g., through actuation

- Outfall 002 (X-230K South Holding Pond)
- Outfall 003 (X-6619 Sewage Treatment Facility)
- Outfall 004 (Headhouse #3)
- Outfall 005 (X-611B Lime Sludge Lagoon)
- Outfall 009 (X-230L North Holding Pond)
- Outfall 010 (X-230J-5 Northwest Holding Pond)
- Outfall 011 (X-230J-6 Northeast Holding Pond)

The X-230J-7 East Holding Pond (Outfall 001) provides a quiescent zone for settling of suspended solids, dissipation of chlorine, and oil diversion and containment. Influent to the East Holding Pond consists primarily of once-through cooling water and rainfall runoff. Figure 5.1-4 provides a flow diagram for the influent to the X-230J-7 East Holding Pond. The pond is approximately 100 ft wide by 375 ft long by 4 to 5 ft deep, and discharges to Little Beaver Creek.

The X-230K South Holding Pond (Outfall 002) provides a quiescent zone for settling of suspended solids, dissipation of chlorine, oil containment, and pH adjustment prior to discharge. Influent to this pond consists primarily of once-through cooling water, rainfall runoff, and treated coal pile runoff (Internal Outfall 602, X-621 Coal Pile Treatment Facility). Figure 5.1-5 provides a flow diagram for the influent to the X-230K South Holding Pond. As depicted in this diagram, Internal Outfall 602 (X-621 Coal Pile Treatment Facility) discharges into the pond. The pond is approximately 1,000 ft long, irregular in shape, averaging 250 ft in width and is approximately 12 to 15 ft deep, and discharges to Big Run Creek.

The X-6619 Sewage Treatment Plant (Outfall 003) uses screening and a grit chamber as preliminary treatment followed by an activated sludge treatment system. Mixed liquor from the aeration basins is clarified, filtered using multimedia sand filters, and then chlorinated/dechlorinated. Sludge is aerobically digested and dried on sludge drying beds. Influent to the Sewage Treatment Plant consists primarily of domestic sewage, biodenitrification effluent from Internal Outfall 604 (X-700 Biodenitrification Facility), microfiltration effluent from Internal Outfall 605 (X-705 Microfiltration Facility), treated groundwater and surface water from Internal Outfall 610 (X-623 North Groundwater Treatment Building), effluent from Internal Outfall 607 (X-700 Air Stripper, which is presently not in operation), treated groundwater from Internal Outfall 608 (X-622 Carbon Filtration Facility), effluent from X-627 (Groundwater Treatment Facility), miscellaneous wastestreams (X-710 laboratory waste, cafeteria food wastes, hospital medicinal wastes, office chemicals, miscellaneous chemicals, laundry wastewater, and floor washwater), and infiltration/inflow of groundwater. Included in these wastestreams are contributions from both USEC and DOE facilities as well as from leased plantsite facilities (the Ohio National Guard). Figure 5.1-6 provides a flow diagram for the influent to the X-6619 Sewage Treatment Plant. Sludge produced by the facility is drummed and stored pending future disposal, and the effluent discharges to the Scioto River.

Figure 5.1-7 schematically shows the configuration of all PORTS recirculating cooling water systems and the cascading arrangement of the X-626 and X-6000 into the X-630, and the X-630 into the

X-633. It is only the blowdown from X-633 that is sent directly to the Scioto River. Blowdown may be routed to bypass the X-633 before it is discharged to the Scioto River.

The X-611B Lime Sludge Lagoon (Outfall 005) provides a quiescent zone for settling lime sludge used in the water softening process. X-611B also receives some water from rainfall runoff; supernatant is returned to the X-611 Water Treatment Plant. Figure 5.1-8 schematically shows the X-611B Lagoon and the three inactive X-611A Lagoons (DOE Outfalls 006, 007, and 008). Discharges are extremely rare and occur only during periods of excessive rainfall. Discharge is to Little Beaver Creek.

The X-230L North Holding Pond (Outfall 009) provides a quiescent zone for settling of suspended solids and dissipation of chlorine. The pond can also be closed for emergency containment of unpermitted discharges or spills. Influent to the North Holding Pond is depicted in Figure 5.1-9. The pond is approximately 200 ft long, averages 50 ft wide by 10 to 15 ft deep, and discharges to an unnamed tributary of Little Beaver Creek.

The X-230J-5 Northwest Holding Pond (Outfall 010) provides a quiescent zone for settling suspended solids, dissipation of chlorine, and oil diversion and containment. A unique feature of this drainage sector is the ability to manually control/contain all water upstream of the X-230J-5 at the X-230J-3 Impoundment Facility. Influent to the Northwest Holding Pond is described in Figure 5.1-10. The pond is approximately 100 ft long, averages 50 ft wide by 4 to 5 ft deep, and discharges to an unnamed tributary of the Scioto River.

The X-230J-6 Northeast Holding Pond (Outfall 011) provides a quiescent zone for settling suspended solids, dissipation of chlorine, and oil diversion and containment. Influent to the Northeast Holding Pond is described in Figure 5.1-11. The pond is approximately 75 ft long, averages 40 ft wide by 4 to 5 ft deep, and discharges to Little Beaver Creek.

5.1.2 Environmental Monitoring Description

PORTS conducts routine environmental surveillances in relation to the operation of the facility. Environmental monitoring locations are chosen to provide a comprehensive measurement of environmental dispersion of plant emissions and effluents, including upwind and downwind locations for airborne emissions and upstream and downstream locations for waterborne effluents.

PORTS radiological monitoring, as described in this document, is summarized in Table 5.1-5. This table provides a list of the radionuclides analyzed for each particular medium and the frequency of analysis. Effluent data are provided in the Portsmouth Environmental Compliance Status Report and the report's attachment. Environmental compliance management is responsible for the environmental monitoring program. Details concerning analytical techniques at PORTS are provided in Section 5.7.

within certain distances from the fixed equipment. This operation meets the double contingency principle.

There are no AEFs for this system other than the condensate flow diversion system discussed in the next section.

3.20 B-Area Condensate Drain System

The B-Area condensate drain system serves all process systems in B-Area. The system can be functionally divided into two systems: the process condensate drain system (P-201 collection system) and the cooling water and steam condensate drain system (storm sewer). All floor drains in the B-Area that originally went to the X-701B holding pond have been grouted over.

Nuclear criticality safety of the B-Area condensate drain system is assured by a combination of administrative controls, passive barriers, and an AEF. The AEF is a flow diversion system consisting of conductivity cells and flow diversion valves that divert flow from the cooling water and steam condensate drain system to the favorable geometry storage tanks when the uranium concentration exceeds a specified value. The administrative controls require spacing between uranium-bearing equipment and all portable containers of uranium-bearing material allowed in the area, and they also specify requirements for the calibration and operation of the flow diversion system. The passive barriers include fixed equipment spacing and the physical integrity of tubing inside the evaporators from which steam condensate is collected.

In order for a criticality to be possible, multiple contingency events would need to occur. For instance, an evaporator tube would need to fail during operation (passive barrier failure), and the conductivity monitoring (flow diversion) system would need to fail to perform its function (AEF failure). Therefore, the double contingency principle is met.

The flow diversion system described above is an AEF identified for the B-Area condensate drain system. See SAR Section 3.8 for further details including safety classification.

3.21 F-Area Oxide Glove Box

The F-Area Oxide Glovebox is utilized primarily for sampling of uranium oxide and other solid uranium materials associated with the calciner process; the glovebox and associated processes are described in SAR Section 3.3.

The primary NCS administrative controls are on the type and number of containers allowed in the glovebox.

The glovebox operation meets the double contingency principle through the use of administrative controls on the type and number of containers allowed in the glovebox at one time. There are no AEFs associated with the glovebox.

4.0 Maintenance and Support Facilities

Nuclear criticality safety controls associated with fissile material operations conducted in the X-700 and X-720 maintenance and support facilities are summarized in this section.

4.1 X-700 Converter Disassembly and Repair Area

A shop area in the West High Bay of Building X-700 may be used for disassembly and repair of leaking converters and coolers from the process buildings.

Administrative controls are in place to prevent a criticality in the X-700 converter disassembly and repair area by limiting both the mass of fissile material and the quantity of moderator available. Mass is controlled by requiring that deposits of uranium-bearing materials in equipment be within safe mass limits. Moderators are excluded from the converters and coolers by requiring process gas openings to be covered except when converters are actually being worked on, and by limiting moderating materials in the equipment to small quantities such as a damp cloth or spray bottle for cleaning if necessary.

In order for a criticality to be possible, multiple contingency events would need to occur simultaneously. For instance, a converter would need to be sent to the disassembly and repair area without first having a significant (greater than safe mass) uranium-bearing deposit removed (first administrative control failure), and an unsafe quantity of moderator would need to be allowed to enter the converter (second administrative control failure). Therefore, the double contingency principle is met and there are no AEFs identified for the X-700 converter disassembly and repair operations.

4.2 Maintenance Shop Fissile Operations

The Maintenance Shops that handle fissile operations do not handle large quantities of fissile material. Normally, equipment has either been decontaminated prior to being brought to the Maintenance shops or there is little likelihood of significant contamination.

The controls are a combination of passive engineered features controlling geometry and spacing of solution handling equipment and administrative controls on the type of equipment to be cleaned or handled by the shop.

All of these operations meet the double contingency principle with a combination of passive engineered and administrative controls and there are no AEFs identified for the maintenance shop fissile operations.

5.0 X-710 Laboratory Facility

Nuclear criticality accident scenarios associated with fissile material operations conducted in the X-710 laboratory facility are summarized in this section.

The third process is associated with contractors on site. When work is to be performed by contractors, a review of the contractors' safety and health program is conducted to identify the presence of hazardous and toxic materials to be brought onsite by the contractor. MSDS for these chemicals are provided by the contractor, and the chemical is entered into the plant centralized listing.

The three processes described above identify chemicals to be evaluated and controlled at PORTS.

5.6.13.2 Chemicals Addressed By Accident Analysis

The Chapter 4 accident analyses address risks associated with UF_6 and HF. The analyses identify engineered and administrative controls required for safety.

Uranium hexafluoride (UF_6) is the most abundant hazardous material on site. Chapter 4 provides an evaluation of accidents that involve the release of UF_6. The accident analysis considers both radiological and toxicological hazards from the UF_6 releases. The HF which evolves from a UF_6 release is considered as one of the effects of a UF_6 release and as such is addressed in Chapter 4.

5.6.13.3 Chemicals Addressed by Process Safety Management

A number of chemicals are used at PORTS that are managed in accordance with the requirements of 29 CFR 1910.119. The PSM Program manages these hazardous chemicals in a manner that prevents impact to workers or the public. When the enrichment process is shutdown, the inventories of the highly hazardous chemicals are often reduced to below the threshold levels where the requirements of 29CFR1910.119 are applicable.

In addition to the chemical process hazard analyses described in Chapter 4, the PSM Process Hazard Analyses (PHA) are used to identify and manage chemical risks and impacts to plant systems or operations, workers, and to the public. Specific job-related risks and the technical and administrative controls used for risk management are addressed in the PHAs.

The chemicals used at PORTS that are in excess of the threshold limits identified in 29 CFR 1910.119 are chlorine, chlorine trifluoride, hydrogen fluoride, and fluorine. The chemicals and locations of use are described in Chapter 3 and summarized in this section. As noted above, during enrichment process shutdown, the inventories of these chemicals are often reduced below the threshold limits for chlorine trifluoride, fluorine, and hydrogen fluoride. However, when the systems are in operation, the systems and processes are operated and maintained in accordance with the PHAs and associated procedural requirements. When the operations are shutdown and the inventories in storage are below the OSHA PSM threshold limits, the OSHA PSM and PHA requirements are not applicable.

The 29 CFR 1910.119 covered uses, locations, typical working inventory and storage quantities at PORTS during enrichment operations are:

- Chlorine

X-611E Water Treatment Plant Chlorination Upgrade	6000 pounds

- Hydrogen Fluoride/Fluorine

X-342 Fluorine Generation Complex (2)	16,100 pounds

- Chlorine Trifluoride

X-330/X-333 Feed Station	3,400 pounds
X-742 Storage Facility	3,750 pounds

PORTS is in compliance with 29 CFR 1910.119 for completion of the Process Hazard Analysis (PHA). As noted above, the current safety requirements for these systems are discussed in Chapters 3 and 4.

Previously undisclosed or newly revealed chemical safety concerns identified by the PHA preparation process are processed through a 10 CFR 76.68 review for disposition of the concern. This 10 CFR 76.68 review will determine if new TSRs need to be developed.

5.6.13.4 Industrial Hygiene Program Managed Chemicals

Hazardous and toxic chemicals, not covered by the programs discussed above, are effectively managed using industrial hygiene programs. For industrial hygiene program managed chemicals, there is not a "threshold quantity" qualifier. To address these chemicals, the industrial hygiene programs provide the necessary protective barriers and controls enabling safe use of these chemicals.

Commercial chemicals have varying toxicity and hazardous ranges and categories. Because chemicals can be used across the site in various manners, the industrial hygiene program applications to chemical safety are general in nature and based on industry accepted standards and regulatory requirements for controlling occupational exposures. To address the potential exposure risks associated with industrial hygiene program managed chemicals, PORTS uses chemical review programs, program procedures, and Material Safety Data Sheets (MSDSs). Implementation of these industrial hygiene and equipment. Radiation Work Permits, lockout/tagout, and various safety and health permits establish conditions to ensure personnel and equipment protection.

When entry into a closed system is necessary, the foreign material exclusion (FME) control process is utilized in accordance with procedures to prevent entry of extraneous material and to ensure that foreign material is removed before the system is closed.

SSCs that are replaced during maintenance are compared to the installed part and verified to be approved for installation. Temporary modifications, such as temporary bypass lines, electrical jumpers, lifted electrical leads, and temporary trip settings, are governed by approved administrative procedures.

When equipment is returned to service, equipment owners will verify and document the satisfactory completion of post-maintenance testing and place the equipment in operation.

6.4.9 Post Maintenance Testing

PMT requirements are approved by and may be developed by Engineering. As needed, special PMT requirements are requested on a case-by-case basis. Performance of PMT is documented in the work package.

6.4.10 Procurement, Receipt Inspection, Control, and Issuance of Repair Parts, Materials and Services

The Quality Assurance Program describes the requirements for procurement control, and the control of purchased material, equipment, and services. Procurement of items is performed in accordance with corporation and plant procedures.

Repair parts, components and material requirements for Important-to-Safety SSCs are listed on the engineering approved specifications. The engineering approved specifications and associated inspection plans provide the design criteria and inspection requirements needed when procuring SSCs.

The buyer obtains the latest engineering approved specifications and inspection requirements and reviews them for changes. Commercial grade items are procured according to catalog specifications from the manufacturer or factory authorized dealer or distributor. A computer-based procurement system identifies materials which require inspection upon arrival at the plant. Upon receipt, the item is placed in a segregated area for inspection and acceptance. Quality Control is provided an inspection package by the Buyer to determine acceptability of the item. A unique identification number is placed on the item for traceability. If the item is rejected by Quality Control, it is placed in a segregated area or tagged until the nonconformance is dispositioned by the appropriate Responsible Disposition Authority.

Traceability of Important-to-Safety SSCs is maintained when they are received and placed in stores for use. Configuration management provides for parts traceability after they are installed in the plant.

6.4.11 Control of Measuring and Test Equipment

To maintain accuracy within specified limits, the maintenance program requires that M&TE be properly controlled, calibrated, and adjusted at specified periods in accordance with program procedures.

The following items are included in PORTS procedures:

- A unique identifier
- Calibration intervals defined and entered into a recall system
- A label to indicate calibration status
- An inventory listing of controlled M&TE
- Evaluation of calibrations using M&TE that is subsequently found out of tolerance
- Preparation and maintenance of calibration records
- Measures for the storage and control of M&TE.

M&TE is calibrated in accordance with procedures. Standards used to calibrate devices have the required accuracy, stability, and range for the intended use and are certified and traceable to the National Institute of Standards and Technology. If no national standards exist, the basis for calibration is documented. The M&TE program will apply to all M&TE at PORTS.

6.4.12 Maintenance History

CMMS and completed work packages are used to capture maintenance history for Important-to-Safety SSCs. The maintenance history includes the items discussed below.

6.4.12.1 Component Identification and Description

Components are identified by name, number and component identification. Where available, the description includes the manufacturer's name, model, serial number, and quality classification. Additional reference may be made to purchase order number, vendor manuals, drawings, system logic and/or flow diagrams, and applicable maintenance procedures. Engineering procedures specify control of modification documents.

6.4.12.2 Maintenance Record

A work in progress log provides equipment history information and a record of significant work performed on the component and is included as part of the work package as appropriate.

6.4.13 Section Deleted

Each shift organization is composed of a PSS and an assistant PSS; a cascade control (CC) operator; first-line managers for the cascade buildings, power operations, chemical operations, and utility operations, shift engineer, health physics technicians, security shift commander, fire services shift commander, operators, security patrol officers, and firefighters. Less than this normal shift staffing is permitted for short periods with the concurrence of the PSS to allow for call-ins or other compensatory actions.

The PSS provides a direct chain of command from the Shift Operations Manager, Director, Infrastructure Operations, and General Manager to the shift operating staff, and serves as the senior shift manager in directing activities and personnel. The operations line organizations are accountable to the PSS for reporting plant status.

Under the direction of the PSS managerial guidance, operations coordination, and assurance of adequate staffing for all cascade operations on a 24-hour basis is provided.

The remaining members of the shift organization perform the needed functions for round-the-clock operations. The assistant PSS supports the PSS in management during shift operations. The first-line managers provide management for, coordination of, and assurance of proper execution of assigned tasks. The shift engineer provides engineering support for technical issues involving operations. Health physics technicians provide support for 24-hour shift operations. The security shift commander supervises the activities necessary to ensure the protection of plant facilities, government property, and classified information. The fire shift commander supervises shift fire services work activities and responds to plant emergency events.

There are many diverse systems for operational communications. Commercial telephones, an internal plant telephone system, radio networks, a plant public address (PA) system, emergency signals, and a pager system are available to provide necessary communications in operating the plant. The PCF is the focal point for all emergency reporting and initiating of all emergency responses. A special emergency telephone network is available in the PCF. Fire alarm and sprinkler indicator systems, and criticality alarm panel, as well as numerous operational alarms are monitored. As described in the Emergency Plan, the PSS will initiate offsite notifications and plant personnel call-ins when required.

In accordance with the corrective action program, plant personnel are required to report abnormal events or conditions that may have the potential to harm the safety, health, or security of on-site personnel, the general public, or the environment. Plant personnel are also required to immediately report conditions which may require emergency response. The PSS reviews potentially reportable or inoperable safety system equipment reports and determines proper disposition.

6.5.2 Operations

The cascade is the UF_6 enrichment portion of the plant. The cascade is composed of three major process buildings which house two parallel enrichment cascades that share common product and tails withdrawal facilities. There are auxiliary facilities such as the recirculating water pump houses which are also under the direct control of cascade operations.

The Directors of Infrastructure Operations and Program Management and Strategic Planning are responsible for overall operations. This includes operation of cascade equipment, planning for power usage, control of feeds, product and tails material including sampling, operating plant utilities, radiological decontamination, equipment cleaning, uranium recovery, and operation of plant laundry. These managers are supported by managers in the following functions:

Chemical, Utilities and Power; X-326, X-330/333, and X-340s operating groups; and Shift Operations. These managers have subordinate managers assigned to functional areas to provide oversight of the day shift operations.

The optimum cascade arrangement for specific power levels, product and tails assay levels, and feed availabilities is determined by operations staff. The rotating shift organizations follow daily instructions and work plans developed and communicated by management. The PSS has the responsibility to change cascade related priorities should the need arise. Changes to plant priorities for activities on shift require the approval of the PSS.

The Director, Program Management and Strategic Planning, is responsible for overall operation and maintenance of the cascade including deposit remediation activities, and for ensuring the available staff is adequately trained to perform all related tasks.

The Chemical, Utilities and Power Manager, in conjunction with key building managers, provides the plant with sanitary water, chilled water, steam, air, nitrogen, and sewer services. These must be supplied on a continuous basis to meet the cascade requirements. Any outage is coordinated with customers to assure proper planning to provide temporary services as necessary.

The Power/Utilities Section Manager is responsible for managing the power supply system as well as being involved in the activities associated with power contract and power scheduling. Power systems rely on scheduled preventive maintenance activities to ensure a dependable supply. The power facilities are operated and monitored 24-hours per day and, therefore, have a shift organization which interfaces directly with the PSS.

Chemical operations management is responsible for operation of the plant laundry, nonradiological and radiological decontamination, cleaning of respiratory protection equipment, and uranium recovery.

The X-340s management is responsible for UF_6 cylinder handling within the plant including product cylinder shipment, and operating the plant fluorine facility.

Other organizations within the plant provide support such as supply of spare parts and equipment, handling of scrap and waste, provisions for employee safety, necessary analysis to control operation and protect the environment, provide status of equipment design, systems engineering support and design change, and administrative support. Chapter 3 provides additional detail on specific cascade equipment and support systems.

6.5.3 Section Deleted

6.5.4 Section Deleted

6.5.5 Operator Responsibility, Authority and Shift Routines

Plant operations, shift routines, and operator responsibilities are activities that are governed by procedures at PORTS.

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PORTSMOUTH GASEOUS DIFFUSION PLANT EMERGENCY PLAN MAP

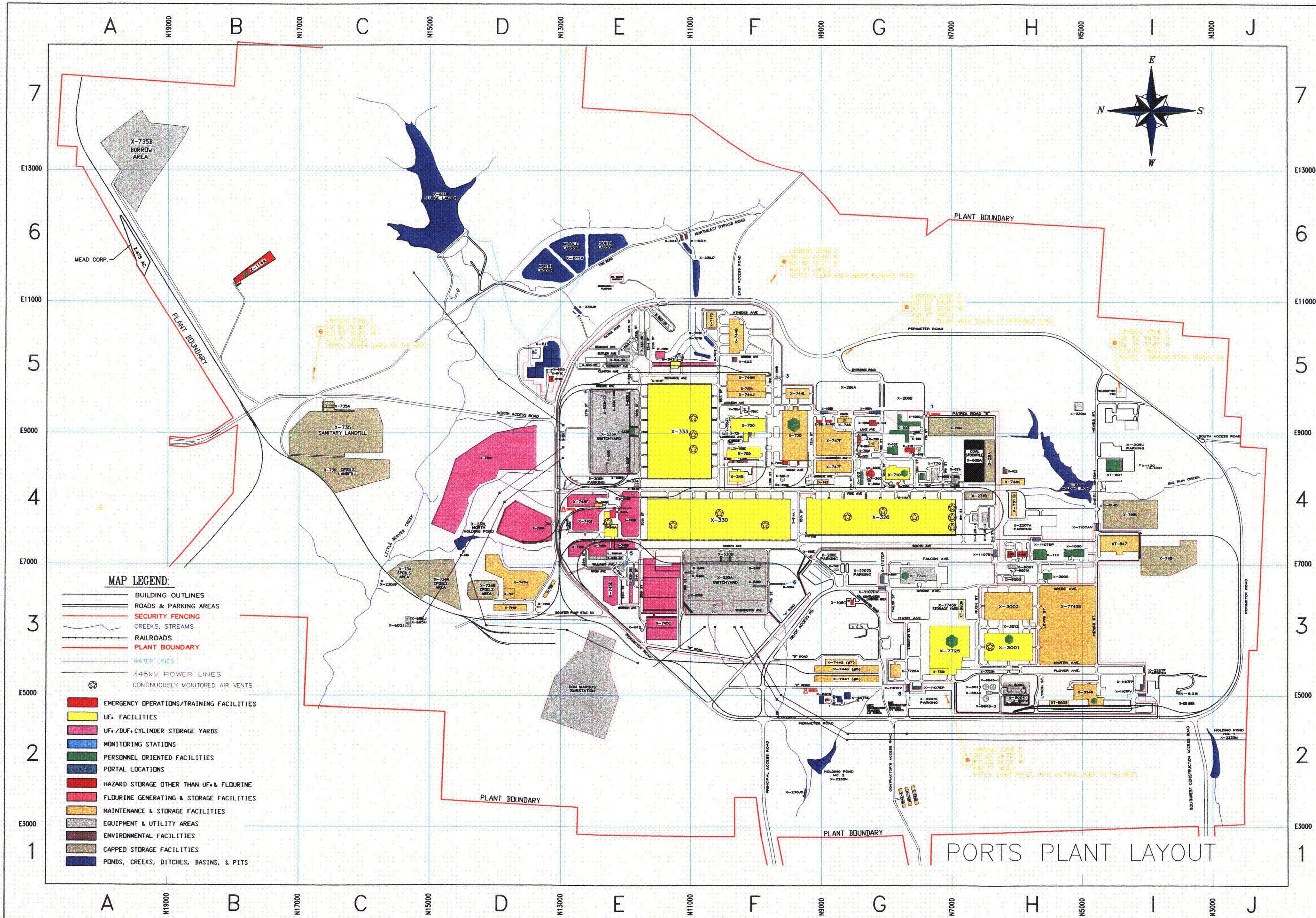

FIGURE 1–2

PORTSMOUTH GASEOUS DIFFUSION PLANT EMERGENCY PLAN MAP INDEX

FAC #	FAC DESCRIPTION	NT	GL	LS
X-100	ADMINISTRATION BLDG		G5	L
X-100B	AIR CONDITIONING EQUIP BLDG		G4	L
X-101	HEALTH SERVICES		G4	L
X-102	CAFETERIA		G4	L
X-103	AUX OFFICE BLDG		G4	L
X-104	GUARD HEADQUARTERS		G5	L
X-104A	INDOOR FIRING RANGE		G5	L
X-106	TACTICAL RESPONSE BLDG		G4	L
X-106C	NEW FIRE TRAINING BLDG		G3	L
X-108A	S PORTAL & SHELTER		G5	L
X-108B	N PORTAL & SHELTER		G5	L
X-108E	CONSTRUCTION PORTAL		F4	L
X-108H	PIKE AVE PORTAL		E4	L
X-109A	PERSONNEL MONITORING STA		F3	L
X-109B	PERSONNEL MONITORING STA		F5	L
X-109C	PERSONNEL MONITORING STA		G5	L
X-111A	SNM MONITORING PORTAL (X-326)		G4	L
X-111B	SNM MONITORING PORTAL (NW X-326)		F4	L
X-112	DATA PROCESSING BLDG		H4	L
X-114A	OUTDOOR FIRING RANGE		B6	L
X-120	OLD WEATHER STA		I4	R
X-120H	NEW WEATHER STA		I4	L
X-206A	N MAIN PARKING LOT		G5	L
X-206B	S MAIN PARKING LOT		G5	L
X-206E	CONSTRUCTION PARKING LOT		G4	L
X-206H	PIKE AVE PARKING LOT		E4	L
X-206J	S OFFICE PARKING LOT		I4	L
X-230J-2	S HOLDING POND EFFLUENT MONITORING STA		I4	L
X-230J-3	W ENVIR MONITORING STA		F2	L
X-230J-5	W HOLDING POND & ENVIR SAMPLING BLDG		F2	L
X-230J-6	NE HOLDING POND & MONITORING STA		E6	L
X-230J-7	E HOLDING POND & MONITORING STA		F6	L
X-230J-9	N ENVIR SAMPLING STA		C3	L
X-230K	S HOLDING POND		H4	L
X-230L	N HOLDING POND		D4	L
X-230M	CLEAN SITE NE OF XT-801		H5	R
X-231A	SE OIL BIODEGRADATION PLOT		H4	R
X-231B	SW OIL BIODEGRADATION PLOT		H4	R
X-300	PLANT CONTROL FAC		G4	L
X-300A	PROCESS MONITORING BLDG		G4	L
X-300B	PLANT CONTROL FAC CARPORT		G4	L
X-326	PROCESS BLDG		G4	L
X-326L	L-CAGE, L-CAGE GLOVE BOX & STORAGE AREA		G4	R
X-330	PROCESS BLDG		F4	L
X-333	PROCESS BLDG		E5	L
X-334	TRANSFORMER CLEANING BLDG		E4	L
X-342A	FEED, VAPORIZATION & FLUORINE GENERATION BLDG		E4	L
X-342B	FLUORINE STORAGE BLDG		E4	L
X-343	FEED, VAPORIZATION & SAMPLING BLDG		E5	L
X-344A	UF_6 SAMPLING FAC		E4	L
X-344B	MAINTENANCE STORAGE BLDG		E4	L
X-344D	HF NEUTRALIZATION PIT		E4	R
X-345	SNM STORAGE BLDG		F4	R
X-501	SUBSTATION		G4	L
X-501A	SUBSTATION		G4	L
X-502	SUBSTATION		G4	L
X-530A	SWITCH YARD		F3	L
X-530B	SWITCH HOUSE		F4	L
X-530C	TEST & REPAIR BLDG		F3	L
X-530D	OIL HOUSE		F3	L
X-530E	VALVE HOUSE		F3	L
X-530F	VALVE HOUSE		F3	L
X-530G	GCEP OIL PUMPING STA		F3	L
X-533	TRANSFORMER STORAGE PAD		E4	L
X-533A	SWITCH YARD		E4	L
X-533B	SWITCH HOUSE		E5	L
X-533C	TEST & REPAIR BLDG		E5	L
X-533D	OIL HOUSE		E4	L
X-533E	VALVE HOUSE		E5	L
X-533F	VALVE HOUSE		E4	L
X-533H	GAS RECLAIMING CART GARAGE		E5	L
X-540	TELEPHONE BLDG		G4	L
X-600	STEAM PLANT FAC		H4	L
X-600A	COAL PILE YARD		H4	L
X-600B	STEAM PLANT SHOP		G4	L
X-600C	ASH WASH TREATMENT BLDG		H4	L
X-605H	BOOSTER PUMP HOUSE & FAC		C3	L
X-605I	CHLORINATOR BLDG		C3	L
X-605J	DIESEL GENERATOR BLDG		C3	L
X-611	WATER TREATMENT PLANT		D5	L
X-611A	OLD LIME SLUDGE LAGOONS AREA		E6	R
X-611B	SLUDGE LAGOON		D6	L
X-611C	FILTER BLDG		D5	L
X-611D	RECARBONIZATION INSTRUMENT BLDG		D5	L
X-611E	CLEARWELL & CHLORINE BLDG		D5	L
X-612	ELEVATED WATER TANK		E3	L
X-614A	SEWAGE PUMPING STA		F4	L
X-614B	SEWAGE LIFT STA		E4	L
X-614D	S SEWAGE LIFT STA		I4	L
X-614P	NE SEWAGE LIFT STA		E5	L
X-617	S HOLDING POND & PH CONTROL FAC		I4	L
X-618	N HOLDING POND STORAGE BLDG		D4	L
X-621	COAL PILE RUNOFF TREATMENT FAC		H4	L
X-622	S GROUNDWATER TREATMENT BLDG		H4	R
X-622T	CARBON FILTRATION (X-705 SUMP WATER)		F4	R
X-623	N GROUNDWATER TREATMENT BLDG		F5	R
X-624	LITTLE BEAVER GROUNDWATER TREATMENT FAC		E6	R
X-624-1	LITTLE BEAVER GROUNDWATER TREATMENT DECONTAMINIATION PAD		E6	R
X-625	PILOT SCALE TREATMENT FAC		I3	R
X-626-1	RECIRCULATING WATER PUMP HOUSE		H4	L
X-626-2	COOLING TOWER		H4	L
X-630-1	RECIRCULATING WATER PUMP HOUSE		E3	L
X-630-2A	COOLING TOWER		E4	L
X-630-2B	COOLING TOWER		E3	L
X-633-1	RECIRCULATING WATER PUMP HOUSE		E5	L
X-633-2A	COOLING TOWER		E5	L
X-633-2B	COOLING TOWER		E5	L
X-633-2C	COOLING TOWER		E5	L
X-633-2D	COOLING TOWER		E5	L
X-640-1	FIRE WATER PUMP HOUSE		E5	L
X-640-2	ELEVATED WATER TANK		F4	L
X-700	CONVERTER SHOP & CLEANING BLDG		F5	L
X-700A	AIR CONDITIONING EQUIP BLDG		F5	L
X-701A	LIME HOUSE		F5	L
X-701B	HOLDING POND (DRAINED)		F5	R
X-701C	NEUTRALIZATION PIT & TANK		F5	R
X-701E	NEUTRALIZATION BLDG		F5	R
X-705	DECONTAMINATION BLDG		F4	L
X-705A	INCINERATOR AREA		F4	R
X-705B	CONTAMINATED BURNABLE STORAGE AREA		F4	R
X-705D	HEATING BOOSTER PUMP BLDG		F4	L
X-705E	OXIDE CONVERSION AREA		E4	R
X-710	TECHNICAL SERVICES BLDG		G4	L
X-710A	TECHNICAL SERVICES GAS MANIFOLD SHED		G4	L
X-710B	EXPLOSION TEST FAC		G4	L
X-720	MAINTENANCE & STORES BLDG		F4	L
X-720B	RADIO BASE STA BLDG		F4	L
X-720C	PAINT & OIL STORAGE BLDG		F4	L
X-721	RADIATION INSTRUMENT CALIBRATION FAC		F4	L
X-734	OLD SANITARY LANDFILL		B4	R
X-734A	CONSTRUCTION SPOILS DISPOSAL AREA		C3	R
X-734B	CONSTRUCTION SPOILS DISPOSAL AREA		D3	R
X-735	SANITARY LANDFILL		C5	R
X-735A	LANDFILL UTILITY BLDG		C5	R
X-735B	BORROW AREA		A7	R
X-736	W CONSTRUCTION SPOILS LANDFILL		C4	R
X-741	OIL DRUM STORAGE FAC		F5	L
X-742	GAS CYLINDER STORAGE FAC		G5	L
X-743	LUMBER STORAGE SHED		G4	L
X-744B	SALT STORAGE SHED		D3	L
X-744G	BULK STORAGE BLDG		F5	R
X-744H	BULK STORAGE BLDG		F5	L
X-744J	BULK STORAGE BLDG		F5	L
X-744K	WAREHOUSE K		H4	R
X-744L	STORES & MAINTENANCE BLDG		F5	L
X-744N	WAREHOUSE N NON UEA		G2	R
X-744P	WAREHOUSE P NON UEA		G2	R
X-744Q	WAREHOUSE Q NON UEA		G2	R
X-744S	WAREHOUSE S NON UEA		G3	R
X-744T	WAREHOUSE T NON UEA		G3	R
X-744U	WAREHOUSE U NON UEA		G3	R
X-744W	SURPLUS & SALVAGE BLDG		D3	L
X-744Y	WASTE STORAGE YARD		E3	R
X-745B	TOLL ENRICHMENT PROCESS GAS YARD		E4	L
X-745C	W DUF_6 STORAGE YARD		E3	R
X-745D	CYLINDER STORAGE YARD		E5	L
X-745E	NW DUF_6 STORAGE YARD		E3	R
X-745F	N PROCESS GAS STOCKPILE YARD		E4	L
X-745G	CYLINDER STORAGE YARD		D4	L
X-745H	CYLINDER STORAGE YARD		D4	L
X-746	MATERIALS RECEIVING & INSPECTION BLDG		G5	L
X-747	CLEAN SCRAP YARD		D3	L
X-747A	MATERIAL STORAGE YARD		G4	L
X-747B	MATERIAL STORAGE YARD		G4	L
X-747C	MATERIAL STORAGE YARD		E5	L
X-747D	MATERIAL STORAGE YARD		E5	L
X-747E	MATERIAL STORAGE YARD		E5	L
X-747F	MISCELLANEOUS MATERIAL STORAGE YARD		F5	L
X-747G	PRECIOUS METAL SCRAP YARD		F5	R
X-747H	NW CONTAMINATED SCRAP YARD		D3	R
X-747J	DECONTAMINATION STORAGE YARD		F4	L
X-748	TRUCK SCALE FAC		G3	L
X-749	S CONTAMINATED MATERIAL STORAGE YARD (CAPPED)		I4	R
X-749A	S CLASSIFIED BURIAL YARD (CAPPED)		H5	R
X-749B	PETER KIEWIT LANDFILL (CAPPED)		I4	R
X-750	MOBILE EQUIP MAINTENANCE GARAGE		G4	L
X-750A	GARAGE STORAGE BLDG		G4	L
X-751	GCEP MOBILE EQUIP GARAGE		F3	R
X-752	WAREHOUSE		D3	R
X-760	CHEMICAL ENGINEERING BLDG		G4	L
X-770	MECHANICAL TEST BLDG		G4	R
X-1000	ADMINISTRATION BLDG		H4	L
X-1007	FIRE STA		H4	L
X-1020	EMERGENCY OPERATIONS CENTER (EOC)		H4	L
X-1107AV	ADMINISTRATIVE VEHICLE PORTAL		I4	L
X-1107BP	ADMINISTRATIVE PEDESTRIAN PORTAL		H4	L
X-1107BV	INTERPLANT VEHICLE PORTAL		H4	L
X-1107DP	ADMINISTRATIVE PEDESTRIAN PORTAL		G3	L
X-1107DV	ADMINISTRATIVE VEHICLE PORTAL		G3	L
X-1107EP	NW PEDESTRIAN PORTAL		G3	R
X-1107EV	NW VEHICLE PORTAL		G3	R
X-1107FP	S PEDESTRIAN PORTAL		I3	R
X-1107FV	S VEHICLE PORTAL		I3	R
X-2207A	PARKING LOT		H4	L
X-2207D	PARKING LOT		G3	L
X-2207E	NW PARKING LOT		G2	R
X-2207F	S PARKING LOT		I3	R
X-2230M	HOLDING POND #1		J2	R
X-2230N	HOLDING POND #2		G2	R
X-3000	ENVIR COMPLIANCE BLDG		H3	L
X-3001	GCEP PROCESS BLDG #1		H3	R
X-3000T1	IAEA TRAILER		G3	L
X-3002	GCEP PROCESS BLDG #2		H3	R
X-3012	GCEP PROCESS SUPPORT BLDG		H3	R
X-3346	GCEP FEED & WITHDRAWAL FAC		I3	R
X-5000	GCEP SWITCH HOUSE		H3	L
X-5001	SUBSTATION		H2	L
X-5001A	VALVE HOUSE		H3	L
X-5001B	OIL PUMPING STA		H3	L
X-6000	GCEP COOLING TOWER PUMP HOUSE		H3	L
X-6001	COOLING TOWER		H3	L
X-6001A	VALVE HOUSE		H3	L
X-6613	SANITARY WATER STORAGE TANK		H3	L
X-6614E	SEWAGE LIFT STA		G2	L
X-6614G	SEWAGE LIFT STA	3		L
X-6614H	SEWAGE LIFT STA	3		L
X-6614J	SEWAGE LIFT STA	3		L
X-6619	SEWAGE TREATMENT PLANT		G2	L
X-6643-1	FIRE WATER STORAGE TANK #1		H3	L
X-6643-2	FIRE WATER STORAGE TANK #2		H2	L
X-6644	FIRE WATER PUMP HOUSE		H3	L
X-7721	MAINTENANCE, STORES & TRAINING BLDG		G3	L
X-7725	RECYCLE/ASSEMBLY BLDG		G3	R
X-7725A	WASTE ACCOUNTABILITY FAC		G3	R
X-7726	CENTRIFUGE TRAINING & TEST FAC		G3	R
X-7727H	INTERPLANT TRANSFER CORRIDOR		H3	R
X-7745R	RECYCLE/ASSEMBLY STORAGE YARD		G3	R
X-7745S	FENCED AREA S OF X-3012		H3	R
XT-801	S OFFICE BLDG		I4	L
XT-847	WAREHOUSE		I4	L
XT-860A	RUBB BLDG AT X-7725		H3	R
XT-860B	RUBB BLDG AT X-3346		H2	R
DOE'S CONTRACTOR TRAILER AREA			G2	R
USEC CONTRACTOR TRAILER AREA			G2	L
CONTRACTOR LAYDOWN AREA			G3	R
X-120 AREA			I2	R

Z-SWMU-QUAD-IV	SOUTHERN END OF RAILROAD SPUR WHICH IS USED AS DRUM STORAGE AREA
Z-SWMU-QUAD-IV	CHEMICAL & PETROLEUM CONTAINMENT TANKS E OF X-533C
Z-SWMU-X-701	NE OIL BIODEGRADATION PLOT AREA WHICH WAS FORMERLY USED FOR THE DISPOSAL OF X-615 SLUDGE
Z-SWMU-X-710	INACTIVE 'HOT PIT' IN THE AREA OF X-710 THAT WAS ONCE USED FOR THE STORAGE OF RADIOACTIVE WASTEWATER
Z-SWMU-X-744	RETRIEVABLE WASTE STORAGE AREA
Z-SWMU-XXXX	SOLID WASTE MANAGEMENT UNITS AS IDENTIFIED ON PORTSMOUTH ENVIR INFORMATION MANAGEMENT SYSTEM DRAWING, PRINTED 2/9/93

GENERAL NOTES

1. THE COMMON AREA LEASED BOUNDARY ASSOCIATED WITH DITCHES, CREEKS, AND WATERWAYS (EXCEPT PONDS) IS DEFINED AS 100 FOOT PARALLEL TO THE CENTERLINE OF THE WATER EACH DIRECTION, EXCEPT WHERE THE BOUNDARY HAS BEEN DEFINED BY A ROADWAY OR OTHER PHYSICAL BOUNDARY.
2. THE COMMON AREA LEASED BOUNDARY ASSOCIATED WITH PONDS IS DEFINED 100 FOOT PARALLEL FROM TOP OF POND BANK, EXCEPT WHERE THE BOUNDARY HAS BEEN DEFINED BY A ROADWAY OR OTHER PHYSICAL BOUNDARY.
3. THIS FACILITY SHOWN IN EXHIBIT A, NOT SHOWN ON THIS REVISION OF OF LEASE MAP.
4. THE MAP FACILITY INDEX FIELDS ARE DEFINED AS FOLLOWS BELOW:

1 C4 L

- L = LEASED TO USEC
- U = OWNED BY USEC
- R = RETAINED BY DOE
- GL = GRID LOCATION WHERE LOCATED
- NT = REFERENCE TO GENERAL NOTES

ABBREVIATION LEGEND

AOC = AREA OF CONTAMINATION	GL = GRID LOCATION
AUX = AUXILIARY	LS = LEASE STATUS
AVE = AVENUE	N = NORTH
BLDG = BUILDING	NT = NOTE
E = EAST	S = SOUTH
ENVIR = ENVIRONMENTAL	STA = STATION
EQUIP = EQUIPMENT	SWMU = SOLID WASTE MANAGEMENT UNIT
FAC = FACILITY	W = WEST

◇ MONITORING STATIONS

NO.	LOCATION	PHONE
1.	X-109C TRAILER SOUTHEAST OF X-100	2238
2.	X-106 TRT STATION	5956
3.	X-109B FRAME BUILDING EAST OF X-106	2535
4.	X-533 SWITCHYARD – EAST SIDE	4183
5.	X-630 PUMPHOUSE – INSIDE NORTH END	4185
6.	X-109A SOUTH OF X-530 SWITCHYARD	4122
7.	X-1007 FIRE STATION	5611
8.	X-1107EV PORTAL	3352

PA/SIREN LOCATIONS

NO.	LOCATION
1.	SOUTH OF X-100
2.	NORTH SIDE OF X-745F
3.	NORTH EAST OF X-6619

PORTS PLANT LAYOUT INDEX
FIGURE 1–2A