APPENDIX B

BUILDING SUMMARIES

BUILDINGS 122 AND 122S

I. Building History

1953 Building constructed. Use designated as medical.

II. Processes Associated with Air Emissions

No Chemicals of Concern listed.

III. Inventory

No Chemicals of Concern listed on the Inventory

BUILDING 218

I. Building History

Building 218 is actually two 10,000 gallon above-ground nitric acid storage tanks.

II. Processes Associated with Air Emissions

Nitric Acid

Acid Tank Farm. Building 218 consists of two stationary, 10,000-gallon HNO_3 storage vessels that have been in operation since 1952. Each tank is equipped with a single uncontrolled vent which protrudes vertically from the roof of each tank. Annual HNO_3 emissions for each tank are determined by summing the breathing and working/filling losses. Emission estimates are reported in tons per year. Annual uncontrolled and controlled air emissions for each tank are:

Uncontrolled and Controlled	8.97×10^{-3} tons/year
Total HNO_3 emissions	1.79×10^{-2} tons/year.

III. Inventory

No listings for this building on the 1988/89 inventory.

BUILDING 371
PLUTONIUM RECOVERY FACILITY

I. Building History

1968	A decision was made to replace the Plutonium Recovery Facility (Building 771) with a new building (Building 371) (ChemRisk, 1991; RE-891[65]).
1972	Construction began on Building 371 (ChemRisk, 1991; RE-891[65]).
1976	B-371 was originally scheduled for start-up (ChemRisk, 1991; RE-891[65]).
1978	Some equipment moved to Building 371 (ChemRisk, 1991; RE-891[65]).
1982	Pilot scale operations conducted. Due to engineering design problems production processes in this building never operated beyond pilot scale. The Plutonium Recovery (Pu electrorefining) operations remained in B-771 (ChemRisk, 1991; RE-891[9,49,65).
1982 - 1989	No accidents of any significance occurred in this building. In addition effluent emissions were most likely of little significance to the off-site population because this building only ran on a pilot scale basis. Monitoring data for radionuclides is available for the life of this building.

II. Processes Associated with Air Emissions

Beryllium

Building 371 does not process Be. However, some materials processed in Building 371 may contain Be. For this reason, Be is monitored at 2 discharge points from Building 371. The monitoring points are identified as 371-NNN and 371-SSS. They correlate respectively with vents #1 and #2.

Vent #1	2.5×10^{-7} tons/yr
Vent #2	1.8×10^{-7} tons/yr

It is believed that non-zero numbers are reported for Be release from these points due to the lack of pre-installation "blank" inspection of the filter (i.e., trace Be exists in new filters), and the magnification of analytical uncertainty, when multiplied by the large volume of air discharged from these vents.

Nitric Acid

The major function of Building 371 is to process and prepare dicesium hexachloroplutonate (DCHP) for use in molten salt extraction (MSE).

Plutonium Analytical Support Laboratory. The laboratory provides analytical support for process control. Processes include radiochemical, calorimetric, and X-ray analyses on feed materials and residues. Sample preparation and analysis can involve the use of HCl, nitric acid (HNO_3), cyclohexane, trioctyl phosphine oxide, and small amounts of HF as a catalyst. Emissions from the Plutonium Analytical Support Laboratory are minimal and would primarily occur from the dissolution processes during sample preparation of liquid and solid samples. Other potential emissions are from custom processes on heating and flaming of planchets containing waste solutions and reagents, such as HNO_3. The pollution control device for this process is a scrubber.

Emission estimates for nitric acid were based on the 10 lb NOx/ton HNO_3 from AP-42. Estimates for the Pu Analytical Support Laboratory Vent #2 are as follows:

Dissolution

Uncontrolled	2.88×10^{-4} tons/yr NOx
Controlled	1.91×10^{-4} tons/yr NOx

Screening

Uncontrolled	3.2×10^{-5} tons/yr NOx
Controlled	2.13×10^{-5} tons/yr NOx

Chemical Standards Laboratory. The Chemical Standards Laboratory is used to prepare standards for various users and to inspect standards that are used throughout the plant site. Emissions from the Chemical Standards Laboratory are negligible, with the exception of HCl and nitric acid used in dissolution. These emissions pass through utility scrubber 131, FP141, to System 1 exhaust (vent #1). Emissions for NOx from nitric acid were based on 11 lb NOx/ton nitric acid (AP-42).

Estimates are as follows:

Uncontrolled	3.38×10^{-5} tons/yr NOx
Controlled	1.11×10^{-5} tons/yr NOx

III. Inventory

Inventory shows quantities of chloroform, nitric acid, and potassium chromate present. See table.

INSERT PAGE

INSERT FIGURE YEARLY EFFLUENT RELEASES FOR BUILDING 371

INSERT FIGURE YEARLY TRITIUM RELEASES FOR BUILDING 371

BUILDING 374
PROCESS WASTE TREATMENT FACILITY

I. Building History

1978	Building brought on-line as the process waste treatment facility for many of the production buildings.
1980	Second stage of HEPA filters added (ChemRisk, 1991; RE-891[44]).
1986 - 1988	An increase in waste load (ChemRisk, 1991; RE-891[13]).
19?? - 1989	The condensate from the evaporator went to the cooling tower and then discharged to Pond B5. In 1989 this discharge was remedied by not allowing the cooling tower to overflow (ChemRisk, 1991; RE-891[44]).
1991	Presently the waste treatment facility is supporting the clean-up of the solar evaporation ponds and processing waste for Buildings 122, 123, 443, 444, 460. 559. 707, 774, 776, 778, 779, 865, 881, 883, and 889.

II. Processes Associated with Air Emissions

Chloroform

Exhausts through vents 7, 8, and 9. These vents serve the main exhaust plenum (2 stage HEPA) which is preceded by a scrubber. There are no controls for chloroform. Estimated emissions for chloroform:

Controlled 0.0014 t/y (almost all from B-778 and B-732)

Note: All VOC emissions are from neutralization processes. All organics are assumed to completely evaporate at some point in the treatment process.

Methylene Chloride

Exhausts through vents 7, 8, and 9. These vents serve the main exhaust plenum (2 stage HEPA) which is preceded by a scrubber. There are no controls for methylene chloride. Estimated emissions for methylene chloride:

Controlled 0.025 tons/yr

Nitric Acid

Exhausts through vents 7, 8, and 9. These vents serve main exhaust plenum (2 stage HEPA) which is preceded by a scrubber. Estimated emissions for nitric acid:

	Uncontrolled	0.46 tons/yr (reaction generates heat, therefore emissions)
	Controlled	1.92×10^{-2} tons/yr

1,1,1-TCA — Exhausts through vents 7, 8, and 9. These vents serve the main exhaust plenum (2 stage HEPA) which is preceded by a scrubber. There are no controls for 1,1,1-TCA. TCA emission estimate:

Uncontrolled	0.0022 t/y

Trichloroethylene — Exhausts through vents 7, 8, and 9. These vents serve the main exhaust plenum (2 stage HEPA) which is preceded by a scrubber. There are no controls for trichloroethylene. Emission estimate for trichloroethylene:

Uncontrolled	0.0015 tons/year

PCE — Exhausts through vents 7, 8, and 9. These vents serve the main exhaust plenum (2 stage HEPA) which is preceded by a scrubber. All VOC emissions are from neutralization. All organics are assumed to completely evaporate at some point in the treatment process. Emission estimate for tetrachloroethylene (PCE):

Uncontrolled	7.14×10^{-5} t/y

III. Inventory

Nitric acid is the only chemical of concern listed on the 1988/89 inventory for Building 374.

INSERT PAGE

INSERT FIGURE YEARLY EFFLUENT RELEASES FOR BUILDING 374

INSERT FIGURE YEARLY TRITIUM RELEASES FOR BUILDING 374

BUILDING 439
MODIFICATION FACILITY

I. Building History

1971	Building constructed. Building 439 houses a machine shop, upholstery shop, battery maintenance, and office space for Building 439/440 support personnel.

II. Processes Associated with Air Emissions

No Chemicals or Radionuclides of Concern listed.

II. Inventory

No Chemicals of Concern were listed on the 1988/89 inventory.

BUILDING 440
FABRICATION FACILITY

I. Building History

1971 — Building constructed. Building 440 is a fabrication facility in which rebuild and rework operations to modify and maintain DOE vehicles, and rail cars are performed. Operations in the building include metalworking, painting, electrical fabrication, and assembly.

II. Processes Associated with Air Emissions

No Chemicals or Radionuclides of Concern listed.

II. Inventory

One 55 gallon drum of methylene chloride was listed on the 1988/89 inventory.

INSERT PAGE

BUILDINGS 444, 445, 450 and 455
DEPLETED URANIUM AND BERYLLIUM METALLURGY

I. Building History

1953	Building 444 came on line in August.
1957	Building 445 added.
1958	Be operations began in Building 444. Blanks received from commercial supplier were machined.
1968	Buildings 444 and 445 connected.
1968 - 1972	Tetrabromoethylene was used as a float-sink separation process media in conjunction with beryllium work (ChemRisk, 1991; RE-891[56]).
1980	Beryllium casting ceased (ChemRisk, 1991; RE-891[56]).
1981	Production plating lab began operations (ChemRisk, 1991; RE-891[56])
1983	Construction of new filter system for B-444.
1984/85	New filter system came on-line.
1987	Titanium Stripping began (ChemRisk, 1991; RE-891[56]).
1989	Uranium foundry shut-down (ChemRisk, 1991; RE-891[56]).
1990	Production plating lab shut down after a fire (ChemRisk, 1991; RE-891[56]).
B-450	Date of construction Unknown. Building 450 houses the exhaust filter plenum and exhaust fans that handle a major portion of the air exhausted from Building 444. The plenum is comprised of a demister section and two stages of HEPA filters. Each stage contains 192 HEPA filter units mounted 32 units wide by 6 units high. Three exhaust fans pull the exhaust air through the filter plenum and discharge the air through vent #200 to the atmosphere (EG&G Rocky Flats, 1991).

B-455

Date of construction unknown. This building is an exterior exhaust filter plenum consisting of a demister section and two stages of HEPA filtration. The plenum serves the production plating laboratory in Building 444. Each stage contains 16 HEPA filter units mounted 4 units high by 4 units wide. The exhaust fan for the plenum exhaust system is mounted on the roof of Building 444. The fan discharges through vent #82 to the atmosphere (EG&G Rocky Flats, 1991).

II. Processes Associated with Air Emissions

Beryllium

Beryllium Machining. Beryllium machining operations in Building 444 include sawing, milling, drilling, and lathe operations followed, if necessary, by polishing and abrading operations. Machining includes work on Be castings, rough pressings, sintered forms, and bar stock. Beryllium chips and dust are generated during dry Be machining operations. Chips and dust generated are collected from the immediate work area by two systems: 1) a low vacuum system consisting of hoods/plenums located above the machine that removes fine dust and small metal particles; and 2) a high vacuum system consisting of flexible hoses with suction heads located within a few inches of the cutting tools. This material is removed from the exhausted air stream by cyclone separators (one for the low vacuum system and one for the high vacuum system) followed by two stages of HEPA filtration. Beryllium chips and dust collect in 55-gallon drums located under each cyclone. Filled drums are sealed, inspected, and transported to Building 991 Waste Operations. For emission estimates an overall cyclone separator efficiency of 85 percent is assumed. Filtered air exits to the atmosphere through vent #122.

Be particulate air emissions are as follows:

Uncontrolled	1.88 tons/yr
Controlled	5.65×10^{-7} tons/yr

Nitric Acid

Production Plating. Building 444 production plating etches and plates War Reserve (WR) and special order parts fabricated from Cu, steel, and stainless steel. These processes are similar to standard industry plating processes, and are performed on a bench-scale basis. Air emissions from the production plating operations area discharge through the Building 445 exhaust filter plenum to vent #82. There are no air emission controls.

Emission estimates from the oxidation of HNO_3 to NOx (vent #86):

Uncontrolled NOx	7.02×10^{-2} tons/yr

Assembly Welding, Brazing, Etching, and Coating. In assembly welding, special order and WR parts fabricated from stainless steel are welded using a tungsten inert gas (TIG) welding process. In assembly brazing operations, Be and stainless steel parts are brazed in a vacuum furnace. Assembly etching is performed prior to assembly coating. Uranium parts are acid etched using an ultrasonic etching bath with a solution of HNO_3, hydrogen peroxide, and DI water. Air emissions from welding, brazing, etching, and coating operations discharge through the Building 450 exhaust filter plenum to vent #200. There are no emission controls.

Emission estimates from the oxidation of HNO_3 to NOx (vent #86):

Uncontrolled NOx 8.60×10^{-2} tons/yr

Titanium Stripping. WR products are coated with Ti in another process area. Stainless steel and ceramic fixtures used to hold WR parts during Ti coating also become coated with Ti. The build-up of Ti eventually makes the fixture unusable. Stripping restores the fixtures so that they can be reused. The Ti is removed by immersing the coated fixture in an acid solution from ten minutes to five hours. Air emissions from the Ti stripping discharge through the Building 450 exhaust plenum to vent #200. Fumes from the Ti stripping operations pass through a fume scrubber. The efficiency of this scrubber for removing NOx could not be determined. For this reason no reduction in NOx emissions was considered for this process. The reaction of HNO_3 with Ti generates NO_2.

Emission estimates of NO_2 are as follows:

Uncontrolled 7.93×10^{-2} tons/yr

Radionuclides

Foundry. Eight vacuum induction furnaces are used to produce ingots from scrap depleted U, depleted U alloys, Ag, Al, and Cu. Casting processes produce small quantities of particulates from mold coating compounds and metal oxidation reactions. All off-gases discharge through the Building 444 exhaust system to the Building 450 exhaust filter plenum vent #200 (Figure 2). Particulate emission control consists of two stages of HEPA filtration. Particulate (including depleted U, depleted U alloys, Ag, Al, and Cu). Emission Estimates:

Uncontrolled 4.92×10^{-2} tons/yr
Controlled 9.84×10^{-8} tons/yr

Mold Cleaning. Graphite molds used in the foundry area in Building 444 for casting ingots are manually cleaned using wire brushes and other hand tools. The molds are recycled for reuse. Residual material in the mold after ingot removal includes Y_2O_3, depleted U oxide, graphite, and trace quantities of iron, silica, and other cast metals. This material is collected and transferred by house vacuum to a cyclone collector located in the Building 444 Utilities Area. The cyclone is 85 percent efficient in removing particles greater than 15 microns. According to plant personnel, approximately 5 percent of the material is less than 15 microns. Particulates from mold cleaning discharge through vent #200 after passing through a vacuum cyclone separator and two stages of HEPA filtration.

Particulate (including Y_2O_3, depleted U oxide, graphite, and trace quantities of iron, silica, and other cast metals) air emission estimates are as follows:

Uncontrolled	1.06 tons/yr
Controlled	4.06×10^{-7} tons/yr

Robot Crucible Cleaning. A robot device in Building 444 cleans the graphite crucibles used for heating and melting metals in foundry furnaces. The removed residue contains depleted U oxide with trace amounts of iron, silica, Y_2O_3, graphite, and other cast metals from the crucible. Controls consist of the cyclone separator and two stages of HEPA filtration.

Particulate (including depleted U oxide with trace amounts of iron, silica, Y_2O_3, graphite, and other cast metals) air emission estimates are as follows:

Uncontrolled	0.56 tons/yr
Controlled	2.16×10^{-7} tons/yr

Depleted Uranium Machining. Depleted uranium machining operations in Building 444 include turning, facing, boring, milling, and sawing using numerically controlled lathes and conventional machine tools. Parts are fabricated from depleted U, depleted U alloy, depleted U with trace amounts of iron, silica, Ti, Al, and stainless steel. Air emission controls consist of two stages of HEPA filtration. Particulate air emission estimates are as follow:

Uncontrolled	1.38×10^{-3} tons/yr
Controlled	2.76×10^{-9} tons/yr

II. Inventory

Buildings 444/445 are listed as having some quantities of cadmium, chloroform, chromium, lead, mercury, and nickel. See table.

INSERT FIGURE YEARLY EFFLUENT RELEASES FOR BUILDING 444

BUILDINGS 447, 448, and 451

I. Building History

1956	Building 447 constructed. Manufacturing building
1962	Building 448 constructed. Shipping, receiving, and storage building
1983	Construction of a new filter system for Building 447.
B-451	Exhaust Filter Plenum Building which serves processes and facilities in Buildings 447 and 448. The exhaust plenum provides a demister and two stages of HEPA filtration. Three exhaust fans pull the air through the plenum and building exhaust ducts and discharge into a header that exhausts to the atmosphere through horizontal vent #201.

II. Processes Associated with Air Emissions

Beryllium

Electron Beam Welding. An electron beam welder is used for welding V, Be, Al, depleted U, and stainless steel. Welding operations are performed inside a vacuum chamber. The welding chamber vacuum pump connects to the Building 451 exhaust filter plenum. Exhaust from electron beam welding operations exits to vent #201 from the Building 451 exhaust filter plume, except during special cleanup operations after Be welding, when the chamber is vented to the Be exhaust plenum in Building 444. The calculated Be emissions from EB welding operations are 1.54×10^{-7} tons/yr.

Electrochemical Milling Operations (ECM). The ECM machine is used for a variety of production and special order jobs. Some work involves milling tungsten, brass, Cu, Al, Be, and depleted U.

ECM machining operations are performed in an enclosed chamber using aqueous electrochemical processing. Therefore, the process is not a significant source of air emissions.

Beryllium

Heat Treatment Operations. Some WR and special order depleted U, Be, and V parts produced in Manufacturing Buildings 444, 447, 883, and 460 require vacuum heat treatment to relieve internal stresses and "work hardening" induced by machining processes.

Heat treatment operations are performed inside vacuum furnaces where parts and assemblies are heated to a specified temperature under a vacuum. Therefore, there are no air emissions except ethyl alcohol used for cleaning the sealing surfaces on the vacuum chamber doors.

Methylene Chloride

Maintenance operations in B-447, B-448, B-451. Methylene chloride emitted during painting, paint stripping. Estimated air emission thru vent #201 in B-451:

Uncontrolled 5.31×10^{-4} tons/year

Radionuclides

Vacuum Arc Melt Furnace. The vacuum arc melt furnace is used to melt material for casting consumable electrodes in 6-inch and 8-inch diameter copper molds. The metals melted include depleted U, and depleted U alloy with six percent Nb. The molds may be up to 5 feet long. Off-gases from the furnace vacuum pump discharge to the 447 exhaust system, which vents to the Building 451 exhaust filter plenum. Metal melting operations are performed inside a vacuum chamber. Metal particulates may be exhausted from the chamber to the Building 451 exhaust plenum. These particulates would be collected on the vacuum pump filter. A combined emission factor of 5.7 pounds of particulate per ton of material processed is used from AP-42, Section 7.10, "Gray Iron Foundries". Actual vacuum arc melt furnace emissions are much lower than those presented below.

Emission estimates are:

Depleted U and U alloy part.	Uncont. 1.07×10^{-1} tns/yr
Depleted U and U alloy part.	Cont. 2.14×10^{-7} tns/yr

Controls: Particulate controls consist of two stages of HEPA filtration.

Chip Roaster. The chip roaster is used to oxidize depleted U scrap metal. The chip roaster is a 4-tier, single chamber, vertical roaster. Particulates and NOx gases are formed during the oxidation process. Particulate emission controls consist of two cyclone separators, a sintered metal filter, and two stages of HEPA filtration:. Air emissions from the chip roaster discharge to Building 451 exhaust filter plenum through vent #201.

Emission estimates:

Depleted U and U alloy part.	Uncont. 2.98 tns/yr
Depleted U and U alloy part.	Cont. 8.5×10^{-7} tns/yr

III. Inventory

No Chemicals of Concern were listed on the 1988/89 inventory

INSERT FIGURE YEARLY TRITIUM RELEASES FOR BUILDING 447

BUILDING 460
CONSOLIDATED MANUFACTURING FACILITY

I. Building History

1984	Building constructed. This building is a non-nuclear facility for war reserve and special order parts and assemblies. The stainless steel operations in this building were transferred from B-881 (ChemRisk, 1991; RE-891[35]).
1990	Eliminated the use of all chlorinated solvents (ChemRisk, 1991; RE-891[35]).

II. Processes Associated with Air Emissions

Carbon Tetrachloride

Materials Development Lab. Eight gals/yr carbon tetrachloride is used to clean metal parts and is sent to B-881, distilled and returned to 460 for reuse. There are no emission controls, therefore uncontrolled and controlled emissions are the same. It is estimated that approximately 5% of the carbon tetrachloride evaporates and exhausted through vent #14.

Uncontrolled 0.00266 tons/year

Chloroform

Ten vents are associated with the high bay (central manufacturing area). Chloroform emission estimates for vent #'s 2, 4, 5, 6, 35, 36, 38, 39, 40, 43 are:

Uncontrolled 0.00625 tons/year

Lead

Used in non destructive testing. Radiographic testing (500 lb/yr no air emissions; lead is recycled or sent to an off-site metal processor)

Methylene Chloride

Aqueous cleaning. Estimated methylene chloride air emissions through vent #23:

Uncontrolled 0.00162 tons/year
Controlled 0.00137 tons/year

Nitric Acid

Parts cleaning. Acid wastewater goes to wastewater collection system. Spent acid is sent to waste treatment for disposal. Emissions go to an <u>inactive</u> fume scrubber and out vent #30.

Estimated NOx air emissions from nitric acid:

Uncontrolled 0.0119 tons/yr

1,1,1-TCA

Non-destructive testing (ultrasonic). Radiographic SKC developer/cleaner is 95% TCA. There are no emission controls. Estimated emissions through vent #54 are:

Uncontrolled 0.000241 tons/year

Aqueous cleaning. Ninety-five percent of 1,1,1-TCA is recovered as waste and 5% evaporates. Emissions are exhausted through an activated carbon filter to vent #23. Estimated emissions of 1,1,1-TCA:

Uncontrolled 0.00335 tons/year
Controlled 0.00285 tons/year

High Bay. Ten vents are associated with the high bay (central manufacturing area). 1,1,1-TCA emissions for vent numbers 2, 4, 5, 6, 35, 36, 38, 39, 40, 43 are:

Uncontrolled 0.00399 tons/year
Controlled 0.00399 tons/year

Inspection. 1,1,1-TCA is used to clean parts. There are no emission controls. 1,1,1-TCA emissions exhaust out the high bay vent group

Uncontrolled 0.15 tons/yr

III. Inventory

Chloroform and nitric acid were both listed on the 1988/89 inventory.

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BUILDING 549

I. Building History

1957	Building constructed. This building contains the alarm systems.
1991	This building is used exclusively as an electrical maintenance shop and general staging support.

II. Processes Associated with Emissions

There are no processes associated with emissions of Chemicals of Concern from Building 549.

III. Inventory

No Chemicals of Concern were listed on the 1988/89 Inventory.

BUILDING 559 and 561
PLUTONIUM ANALYTICAL LABORATORY

I. Building History

1968 — Building Constructed. Plutonium Analytical Lab. The building contains laboratory facilities for conducting spectrochemical, chemical, and mass spectrometric analyses.

1973 — Building 561 constructed. This building houses the exhaust plenums for Building 559. Building 561 contains four separate filter plenums. Three of the plenums filter exhaust air from Building 559 and 561; the fourth plenum filters supply air for Building 561.

II. Processes Associated with Air Emissions

Beryllium — Building 559 does not process beryllium (Be). However, some materials processed in Building 559 may contain, or be contaminated with Be. For this reason, Be is monitored at Building 561 (the Building 559 glove box exhaust vent). The Be release data for 1988, is:

Controlled 1.45×10^{-7} tons/yr.

Chloroform — **Gallium Determination**. For the analysis of Pu metal samples for gallium content; Pu metal and turnings from the foundry in Building 707 foundry and the molten salt extraction in Building 776 are submitted for gallium determination. Chloroform is used to extract the gallium oxide complex. Emission estimates for vent #36 are:

Uncontrolled 0.74 tons/yr VOC

Nitric Acid — **Emissions Spectroscopy**. Emission spectroscopy analyses are performed on a variety of metal samples. Both direct reading spectrographs and Inductively Coupled Plasma are used. Acid emissions will result from the dissolution and evaporation of metal samples in acid. The acid fumes are passed through a bubbler -type scrubber before being exhausted to the filter plenum. Emission estimates (through vent #36) for the NOx generated from HNO_3 are:

Uncontrolled NOx 7.27×10^{-3} ton/yr
Controlled NOx 4.55×10^{-4} ton/yr

Uranium Analysis. Metals, liquids, oxides, oils, and sludges are analyzed for U content. Nitric acid is used during sample preparation for dissolution purposes. This results in a usage of 300 ml HNO_3/yr.

The NOx emission estimates from the evaporation of HNO_3 are:

Uncontrolled 4.97×10^{-4} ton/yr to vent #36.

Radionuclides **Plutonium Oxidation**. Plutonium scraps and oxides remaining after sample analyses are oxidized in one of two glove boxes prior to shipping the PuO_2 to another process on the plant site. Scrap and oxide from all the processes are collected in these two glove boxes, and the oxidation process is run as needed (about once a month).

Emissions from Pu oxidation can be estimated by material balance. The HEPA filters on the glove box exhausts are changed approximately once every six months. These are assayed to determine Pu content. Typically each filter collects about 10 grams of particulate. The filters are more than 99% efficient. Therefore, it is assumed that all of the particulate generated during the oxidation process is collected on the prefilter. Controls include four stages of HEPA filtration in the filter plenum, the emissions vent to vent #36. The emission estimate for plutonium particulates follows:

Uncontrolled (On HEPA filters)	4.41×10^{-5} tons/yr
Controlled	3.53×10^{-16} tons/yr

1,1,1-TCA **Infrared Analysis (Infrared Spectroscopy Laboratory)**. 1,1,1-TCA may comprise some of the production samples undergoing acceptance testing by infrared analysis. However, no emissions are expected from this process, since the majority of organic compounds used are nonvolatile and collected in waste bottle.

III. Inventory

The 1988/89 inventory places a number of the Chemicals of Concern in this building. A complete list can be found on the attached table. The following is an abbreviated list:

Beryllium (oxide, sulfate)
Cadmium (acetate, chloride, iodide, nitrate, oxide, sulfate, and metal)
Carbon Tetrachloride
Chloroform
Chromium (chloride, nitrate, oxide, potassium sulfate, sulfate, trioxide)
Formaldehyde

Lead (acetate, chloride, metal, nitrate, oxide, powder)
Mercury (nitrate)
Methylene Chloride
Nickel (powder, nickelous chloride, nitrate, oxide, sulfate)
Nitric Acid
Tetrachloroethylene
Trichloroethylene

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INSERT FIGURE YEARLY EFFLUENT RELEASES FOR BUILDING 559

INSERT FIGURE YEARLY TRITIUM RELEASES FOR BUILDING 559

BUILDING 566
LAUNDRY FACILITY

I. Building History

Construction date unknown. This building was designed as a laundry facility for clothing and respirators contaminated with radioactive materials; the present plan is that it will be used only for non-contaminated items.

II. Processes Associated with Air Emissions

Beryllium	No emissions listed. Asbestos and beryllium laundry, Room 127, has a supply air plenum and the dryers vent to an exhaust plenum then to the atmosphere.

No other chemicals of concern listed.

III. Inventory

No Chemicals of Concern were listed on the 1988/89 inventory.

BUILDING 701
WASTE TREATMENT RESEARCH AND DEVELOPMENT FACILITY

I. Building History

1965 — Building constructed. Pilot Plant Development. Building 701 is a research and development facility that is used to design, build, and evaluate bench-scale and pilot-scale waste handling and treatment processes. Because this building is a Research and Development facility emissions of significant quantities of hazardous, toxic, or criteria air pollutants are not expected (EG&G Rocky Flats, 1991).

II. Processes Associated with Air Emissions

No Chemicals of Concern listed.

III. Inventory

The 1988/89 inventory places a number of the Chemicals of Concern in this building. A complete list can be found on the attached table. The following is an abbreviated list:

Benzene
Carbon Tetrachloride
Chloroform
Chromium (compounds)
Formaldehyde
Lead compounds
Nitric Acid

INSERT PAGE

BUILDING 705
COATINGS LABORATORY

I. Building History

1966 — Building Constructed. Coatings Laboratory. This building consists of coatings laboratories and associated offices. Currently, the following processes are conducted in Building 705 at a reduced rate as compared to previous years of operation:

Vapor Deposition
Be Vapor Deposition
Parts Cleaning
Be Parts Cleaning
Polishing
Sand Blasting
Water Cooling

The primary operations in Building 705 involve vapor deposition. In the past, metallography was also performed in Building 705, but this process is no longer conducted.

II. Processes Associated with Air Emissions

Beryllium — Beryllium Vapor Deposition, Room 100A-- Be is vaporized and used to coat metal parts. The Be particulate emission through Vent #11 is:

Uncontrolled	6.61E-08 tons/yr
Controlled	1.32E-13 tons/yr

III. Inventory

No Chemicals of Concern were listed on the 1988/89 inventory.

BUILDING 707
PLUTONIUM FABRICATION/PYROCHEMICAL OPERATIONS

I. Building History

1972 — Construction completed. This building provides metallurgical support in the form of foundry and casting operations, as well as product assembly. The machining and foundry operations of Plutonium came from 776 after the 1969 fire. The buildings main ventilation system consists of seven separate exhaust plenums.

1972-1989 — Building 707 was the major user of carbon tetrachloride and 1,1,1-TCA at Rocky Flats.

II. Processes Associated with Air Emissions

Beryllium — Building 707 does not process beryllium (Be). However, some materials processed in Building 707 may contain Be. For this reason Be is monitored at 15 discharge points from Building 707. The monitoring points are identified as 707-101, 707-102, 707-105, 707-106, 707-1072, 707-108, 707-R21, 707-R22, 707-R23, 707-R25, 707-R26, 707-R27, 707-R45, and 707-R46. They correlate respectively with vents #36, #9/10, #28, #55, #65, #75, #38/39, #40/41, #42/43, #44/45, #76/77, #78/79, #80/81, #1/2, and #3/4. The controlled release data for the entire building is 1.9×10^{-7} tons/yr. Individual vent information is as follows:

Vent #9/10	6.9×10^{-9}
Vent #28	2.5×10^{-8}
Vent #36	1.9×10^{-9}
Vent #44/45	7.2×10^{-9}
Vent #55	1.7×10^{-8}
Vent #65	2.6×10^{-8}
Vent #75	4.1×10^{-8}
Vent #78/79	8.8×10^{-9}
Vent #80/81	9.0×10^{-9}
Vents #1/2, #3/4, #38/39, #40/41, #42/43, #76/77	4.4×10^{-8}

Carbon Tetrachloride

Plutonium Fabrication/Pyrochemical Operations. This building contains foundry and casting operations and products assembly. carbon tetrachloride is used as a cleaning agent. Waste carbon tetrachloride is drained to tanks located in the basement of the building. Carbon tetrachloride exhausts thru vents #9/10, #28, and #36. Total carbon tetrachloride emission estimates for each vent are:

Vents #9/10	3.36 tons/yr
Vent #28	0.11 tons/yr
Vent #36	28.83 tons/yr
TOTAL	32.30 tons/yr

Module A - Casting Operations. Carbon tetrachloride is used to clean interior glove box walls where casting furnaces are located in which Pu ingots are made. Carbon tetrachloride is also used to clean the furnaces. Carbon tetrachloride emissions estimate through vent #36:

Uncontrolled 1.68 tons/yr

Module J - Casting Operations. Pu ingots are made. Carbon tetrachloride is used to clean the glove boxes. Carbon tetrachloride emission estimate through vents #9/10:

Uncontrolled 1.68 tons/yr

Module K - Casting Operations and Stacker Retriever. This operation stores and retrieves Pu metal for distribution to other processes. Metal is weighed, melted in furnace, formed into ingots. Carbon tetrachloride is used for cleaning inside of glove boxes. Carbon tetrachloride emission estimates through vents #9/10:

Uncontrolled 1.68 tons/yr

Module B - Rolling and Forming. This process involves the forming and thermal treatment of Pu metal ingots. Carbon tetrachloride is used to clean the rollers. Carbon tetrachloride emission estimates through vent #36:

Uncontrolled 4.39 tons/yr

Module C - Briquetting. Metal turnings from Module C machining process and Module B scrap cutters are put in metal baskets and dipped in five carbon tetrachloride baths. Filtered carbon tetrachloride is piped directly to pencil tanks in the C-pit. Carbon tetrachloride emission estimates to vent #36:

Uncontrolled 0.10 tons/yr

Module C - Machining Operations. Pu parts are machined. After machining, parts are weighed and cleaned with carbon tetrachloride, which is pumped to the C-pit. Carbon tetrachloride emission estimates to vent #36:

Uncontrolled	22.62 tons/yr

Modules C and D - Inspection. Parts are cleaned with carbon tetrachloride. Emission estimates:

Uncontrolled	0.11 tons/yr thru vent #28
Uncontrolled	4.2×10^{-02} tons/yr thru vent #36.

Radionuclides

Casting Operations - Module A. Plutonium ingots are cast into feed or production ingots in Casting Operations. Ingots are transported by enclosed, interconnected chain conveyors from storage to the foundry glove boxes. The ingots are placed in crucibles and melted in electric induction furnaces, which operate under vacuum. Metal is poured through a funnel into the molds which are then allowed to cool. Crucibles and funnels are scraped clean and reused until worn. Emissions from this process exhaust through vent #36 and include carbon tetrachloride and particulates. While details of certain process emissions are classified, the total radionuclide emissions for the building are reflected in the graphs that follow.

Casting Operations - Module J. Emissions from this process exhaust through vents #9/10. Two types of particulate emissions result from operations in this module. The first is from Pu oxidation and the second is from casting operations. Uncontrolled emissions of 8.0×10^{-3} tons/yr of Pu particulate from Pu oxidation operations were estimated. Particulate emissions from both of these sources pass through five stages of HEPA filters. For Pu oxidation particulates, this results in a controlled emission of 1.3×10^{-16} tons/yr. Controlled emission estimates for casting operations are classified, but the total radionuclide emission for the building are reflected in the graphs that follow.

Casting Operations and Stacker Retriever - Module K. Module K contains the stacker retriever also known as the X-Y retriever, and casting furnaces. These operations are performed in an inert nitrogen atmosphere. The stacker retriever is used to store and retrieve Pu metal for distribution to other processes in Building 707. Particulate emissions are those resulting from casting. While details of certain process emissions are classified, the total radionuclide emissions for the building are reflected in the graphs that follow.

1,1,1-TCA

B-707 is the **Plutonium Fabrication/Pyrochemical Operations** building, which has foundry and casting operations and product assembly. TCA is used as a cleaning and degreasing agent. TCA is gravity drained to tanks in the

basement of the building. All emissions are uncontrolled. 1,1,1-TCA exhausts thru vents #28 (1.48 tons/yr), #36 (8.5×10^{-3} tons/yr), #44/45 (7.4×10^{-3} tons/yr), #55 (6.7×10^{-2} tons/yr), #65 (2.11 tons/yr), #80/81 (0.13 tons/yr). The total emission estimate for B-707 is:

Uncontrolled 3.80 tons/yr

Module E, Assembly Operations. TCA is component of ultrasonic cleaner used to clean Pu parts. When the TCA reaches a designated level of impurities, it is pumped into tank V100 in the C-pit; from C-pit, the TCA waste is piped to B-777 then to B-774 for treatment. TCA emissions from the 3 ultrasonic cleaners exhaust to vent #28. The emission estimates are included in the above total.

Module F, Assembly-Superdry. TCA is used to clean Pu parts before they are assembled and welded into a weapons product. Emissions exhaust through vent #55 and are uncontrolled. The emission estimate is included in the above total.

Module G, Assembly-Welding and Cleaning. TCA is a component of the ultrasonic cleaner used to clean Pu parts following welding. TCA emissions from the 2 ultrasonic cleaners pass thru vent #65 and are included in the above total.

Module G, Assembly-Electron Bombardment Brazing/ Scanning. TCA 2 is a used (1) to clean waste materials deposited on the walls of a bell jar during brazing of metals in the jar, and (2) during fluorescent dye penetration (quality control to detect surface flaws in Pu parts -- fluorescent dye is applied to a part, then the part is cleaned with TCA and viewed under black light). Emission estimate (through vent #80/81) is included in the above total.

Module H, Assembly Testing. TCA is used to clean parts prior to testing. The emission estimate (through vents 65 and 80/81) is included in the above total.

Modules D, E, and G, Assembly Ultrasonic Cleaners. Tanks containing the ultrasonic cleaners used in B-707 and B-777 and described above. Emission estimates through vents 28 and 65 are included in the above total.

Room 173, Radiography. TCA is used to clean Pu parts prior to radiography (X-ray examination of parts). The emission estimate through vent 44/45 is included in the above total.

Module D, Weighing. TCA is used for cleaning prior to weighing of parts. The emission estimate through vent 28 is included in the above total.

Module E, Eddy Current Testing. To check the depth of weld penetration on Pu parts which are moved to and from glove boxes; TCA is used to clean glove boxes. The emission estimate through vent 28 is included in the above total.

Weld Scanners and Fluorescent Penetrant Operations. Area used to qualify welds on Pu parts. TCA is used to clean off fluorescent dye. The emission estimate through vent 65 is included in the above total.

Module D, Production Control Operations. TCA is used to clean parts following grit blasting. The emission estimate through vent 28 is included in the above total.

Modules D and G, Calibration Laboratory. TCA is used to clean gauges before precision measurements. The quantity of TCA used is so small it does not add appreciably to the total emissions from the associated vents and therefore was not calculated.

Carbon Tetrachloride, TCA, and Freon Systems. TCA feed tanks (V-36A, B, C) located in B-707, room 200, provide solvents to Buildings 707 and 777. Working losses for all three tanks were calculated:

Uncontrolled 7.6×10^{-3} tons/yr thru vent #36

Working loss from waste tank throughput was calculated to be:

Uncontrolled 9.0×10^{-4} tons/yr thru vent #36

Both of these estimates are included in the above total.

III. Inventory

Building 707 is listed on the 1988/89 inventory as having some quantities of lead, chromium, 1,1,1-TCA, TCE, and mercury. See table.

INSERT PAGE

INSERT FIGURE YEARLY EFFLUENT RELEASES FOR BUILDING 707

INSERT FIGURE YEARLY TRITIUM RELEASES FOR BUILDING 707

BUILDING 771
PLUTONIUM RECOVERY OPERATIONS

I. Building History

1953	Building constructed. The principal operation of Building 771 is the recovery of plutonium from plutonium bearing residues.
1957	Americium line started.
1958	Carbon tetrachloride distilled out of the cutting oil and Pu recovered from the solids. The cutting oil, carbon tetrachloride mixture came from the Pu machining in B-776.
1958 - 1988	Incinerator used for the recovery of fissile material (ChemRisk, 1991; RE-891).
1953 - 1959	Purex process used for Pu purification (ChemRisk, 1991; RE-891).
1959	Began using ion exchange for Pu purification (ChemRisk, 1991; RE-891).
1968	Caustic scrubber installed (ChemRisk, 1991; RE-891).
1963-1975	Ammonium thiocyanate used for recovery of americium (ChemRisk, 1991; RE-891).
1975 - 1980's	Oxalate precipitation process used for recovery of americium (ChemRisk, 1991; RE-891).
Early 1980's	Discontinued americium purification but not recovery (ChemRisk, 1991; RE-891).

II. Processes Associated with Air Emissions

Beryllium	Building 771 does not process Be. However some materials processed in Building 771 may contain, or be contaminated with Be. For this reason, Be is monitored at four air discharge points from Building 771. Three of these monitored discharge points are from Building 771C (vents 2, 8 and 9). Vents 2 and 8 are combined and designated as discharge point 771-CRM. Vent 9 is designated discharge point 771-CMA. Vent #86, the main exhaust stack for Building 771, is designated as 771-MAI. The Be release data from these vents for 1988, the last year of nearly full-time operation for Building 771 are given below:

771-CRM	2.74×10^{-9} tons/yr
771-CMA	2.90×10^{-9} tons/yr
771-MAI	2.46×10^{-9} tons/yr

Methylene Chloride

Maintenance Operations. Methylene chloride is present in paints, paint strippers (e.g. methylene chloride is an ingredient of KS-3 paint remover at 85 % wt). Estimated air emissions through vent #86 (main B-771 exhaust stack).

Controlled 0.70 tons/year

Nitric Acid

Dissolution. Dissolution processes are all similar in concept. The equipment consists of a series of cascade dissolver vessels. Plutonium- bearing material is fed into the first dissolver at a controlled rate by a special screw feeder. Nitric acid (12N), aluminum nitrate, calcium fluoride, and water are fed into the first dissolver, also at a controlled rate. Nitric acid is the primary chemical used in dissolution. Solids are kept in suspension in the dissolvers by the agitation provided by an air lift. Vapors from the dissolvers are collected by an off-gas system. A portion of the gases are condensed and returned to the process. The remaining vapors are drawn to the Building 771 large fume scrubber, which removes any acids from the air stream. The Building 771 large fume scrubber consists of two packed tower scrubbers in series.

Emissions Estimate:

Uncontrolled NOx	0.33 tons/yr
Controlled NOx	1.69×10^{-2} tons/yr

Note: These emission estimates include the NOx released from the oxidation of both aluminum nitrate and nitric acid.

Feed Evaporation. Feed evaporation is used to concentrate some solutions coming from previous operations. Concentration of these solutions is necessary in order to yield precipitation feed of an acceptable Pu concentration. The off-gas from the evaporation step is collected and routed through a moisture condenser and large fume scrubber.

Emission estimates from the oxidation of HNO_3 to NOx (vent #86):

Uncontrolled NOx	8.23×10^{-2} tons/yr
Controlled NOx	4.21×10^{-3} tons/yr

Peroxide Precipitation. The peroxide precipitation process converts the Pu in solution to a solid form. The precipitation process itself should not contribute significantly to air emissions. However, some emissions will be

associated with the evaporation of the filtrate from the precipitation step. The off-gases are passed through a condenser and then through the Building 772 large fume scrubber.

Emissions Estimate from oxidation of HNO_3 to NOx (vent #86):

Controlled NOx emissions 1.68×10^{-2} tons/yr

Chemical Technology. Plutonium chemistry technology in Building 771 supports and develops improved methods for recovering, separating, and purifying actinides from acidic streams. Off-gases from this operation are passed through a bubble-type acid scrubber that is assumed to be 50% efficient. The controlled emissions are released into booster plenum FU-2C, which discharges to the main filter plenum.

Emission Estimate from oxidation of HNO_3 to NOx (vent #86)

Uncontrolled	2.54×10^{-3} tons/yr
Controlled	1.27×10^{-3} tons/yr

Radionuclides

Calcination. The calcination process converts PuO_4 to PuO_2 and drives out residual water and HNO_3, leaving a dry, powdered product. The primary contaminant released from calcination is PuO_2 particulates. The off-gas from this operation is passed through a HNO_3 scrubber (50% efficient for PuO_2 removal) and six HEPA filters in series.

Pu particulate Emission Estimates (vent #86):

Uncontrolled	4.21×10^{-2} tons/yr PuO_2 particulate
Controlled	6.74×10^{-19} tons/yr PuO_2 particulate

Hydrofluorination. Plutonium oxide is converted to plutonium tetrafluoride (PuF_4) in a continuous rotary-tube hydrofluorinator. The off-gas from the hydrofluorination process is routed through an emissions control system consisting of a venturi-type KOH scrubber. The off-gas is then routed through six stages of HEPA filtration.

Pu particulate Emission Estimates:

Uncontrolled	4.30×10^{-2} tons/yr
Controlled	2.06×10^{-19} tons/yr

Plutonium Oxidation. Plutonium oxidation converts pure Pu metal, which is pyrophoric, to a more stable PuO_2. The PuO_2 is then used as a feed to the

dissolution operation. The off-gases are passed through six HEPA filter stages.

Emission Estimates for Pu particulates (vent #86):

Uncontrolled	3.47×10^{-5} tons/yr
Controlled	1.11×10^{-21} tons/yr

Plutonium Metallurgy and Research and Air Emissions. The Pu metallurgy group assists the design agency and plant production in the development of processes that require metallurgical production of materials and related manufacturing techniques. All Pu metallurgy operations are conducted in glove boxes. Off-gases from these operations are passed through an exhaust filter plenum (FU-1 and main plenum) consisting of six HEPA filters.

Pu particulate Emission estimates:

Uncontrolled	4.83×10^{-3} tons/yr
Controlled	1.55×10^{-19} tons/yr

III. Inventory

The 1988/89 inventory places a number of the Chemicals of Concern in this building. A complete list can be found on the attached table. The following is an abbreviated list:

Beryllium Compounds	Formaldehyde	Nitric Acid
Cadmium Compounds	Lead Compounds	
Carbon Tetrachloride	Mercury	
Chloroform	Methylene Chloride	
Chromium Compounds	Nickel Compounds	

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INSERT FIGURE YEARLY EFFLUENT RELEASES FOR BUILDING 771

INSERT FIGURE YEARLY TRITIUM RELEASES FOR BUILDING 771

BUILDING 774
PROCESS WASTE TREATMENT FACILITY

I. Building History

1953	Building constructed to support B-771. Originally designed as a nuclear waste packaging facility. Modifications and additions in 1963, 1965, 1966, 1967, 1970, and 1974.
1981	Converted to storage for Building 771 (Drums).

II. Processes Associated with Air Emissions

Nitric Acid	**Radioactive Decontamination Treatment**. Nitric Acid is used in the first stage of this process. This caustic precipitation process reduces the plutonium and americium concentrations. The acidic distillate waste is neutralized and transferred to caustic system. There are no air emissions of NOx because no heat is applied to the solution.
Radionuclides	**Caustic Precipitation**. This process is the first stage in radioactive decontamination treatment it is designed to reduce the Pu and Am concentrations. Pressure control zones 1,2 and 3; 1 has three stages HEPA, 2 and 3 have two stages HEPA; all 3 go to main exhaust plenum, which has two more stages of HEPA.
1,1,1-TCA	**OASIS (organic and sludge immobilization system)**. TRU waste from 707 and 776/777. TCA, oils mixed with carbon tetrachloride are solidified with gypsum cement in a glove box. Process and tanks all vent to #4. There are no Air Pollution Control Devices, therefore estimated emissions:
	Uncontrolled 8.26 tons/yr

III. Inventory

No chemicals of concern listed on 1988/89 inventory.

INSERT FIGURE YEARLY AIRBORNE EFFLUENT RELEASES FOR BUILDING 774

INSERT FIGURE YEARLY AIRBORNE TRITIUM RELEASES FOR BUILDING 774

BUILDINGS 776 AND 777
ASSEMBLY AND MANUFACTURING BUILDINGS

I. Building History

1957	Buildings 776 and 777 constructed. B-776: Manufacturing building; B-777: Assembly Building. Assembly operations transferred from B-991.
1958	First significant machining of Pu begins using cutting oil, followed by a washing with carbon tetrachloride.
1969	Fire in B-776 on May 11, 1969.
1972	Operations in B-776 transferred to B-707. B-776 converted to waste storage and waste size reduction.
1957-1969	B-776 was the major user of carbon tetrachloride and TCE at Rocky Flats

Buildings 776 and 777 are connected by a common wall and share building ventilation systems.

II. Processes Associated with Air Emissions

Beryllium

Buildings 776/777 do not process Be. However, some materials processed in these buildings may contain Be. For this reason Be is monitored at nine plenum discharge points from Buildings 776/777, which exhaust to the atmosphere through five vents. The monitoring points are identified as plenums 201, 202, 204, 205, 206, 207, 250, 251, and 252. Plenum 202 exhausts through vent #17. Plenums 201, 204, and 250 exhaust through vent #24. Plenums 205, 206, and 207 exhaust through vent #32, Plenums 251 and 252 exhaust through vents #45 and #44, respectively. The Be releases for Buildings 776/777 from these vents are given below:

#17	1.9×10^{-8} tons/yr
#24	2.0×10^{-7} tons/yr
#32	1.6×10^{-7} tons/yr
#44	1.1×10^{-8} tons/yr
#45	1.5×10^{-8} tons/yr
TOTAL	4.0×10^{-7}

Carbon Tet.

B-776

CCl4 emitted from vents #24, #32, and #45. These vents serve the main building HEPA filter plenums.

Uncontrolled	8.10 tons/yr through vent #24
TOTAL	8.10 tons/yr (All three vents).

Baler. The baler is used to reduce volume of low-level combustible waste. CCl4 is solvent present in wet low-level waste at 750 lb CCl4/10E+06 lb waste; Emissions estimate for vent #24:

Uncontrolled	2.32 tons/yr (This is included in the above total)

B-777

Briquetting. The pressing of Pu metal machine turnings into pucks using hydraulic press. Turnings are cleaned in metal baskets that are dipped into four CCl4 baths. Emissions estimate for vent #24:

Uncontrolled	8.0×10^{-2} tons/yr (This is included in the above total)

Machining, Rooms 131 and 134A. Parts are cleaned with CCl4 on towels prior to machining.

Uncontrolled	5.65 tons/yr through vent #24 (This is included in the above total).

Inspection, Rooms 130 and 430. Parts are cleaned with CCl4.

Uncontrolled	5.5×10^{-2} tons/yr thru vent #24 (This is included in the above total).

Carbon Tetrachloride System. Waste CCl4 from briquetting and machining operations in B-777 are collected in 5 pencil tanks. When full, the CCl4 is pumped through filtration system to larger storage tank. When full, this tank is filtered and tested and transferred to B-774 for waste treatment. Emissions are calculated with other outdoor tanks in a separate APEN.

Methylene Chloride

Baler, Room 144. The baler is used to reduce volume of low-level combustible waste. Methylene chloride is present in wet low-level waste at 750 lb/10E+06 lb waste this is equal to an air emissions estimate (through vent #24) of:

Uncontrolled	2.32 tons/year

Radionuclides

Disassembly Operations. Disassembly occurs in room 430 and involves the disassembling of Pu parts for further processing in the Molten Salt Extraction (MSE) Operation. No controls are listed in the APEN document. While details of certain process emissions are classified, the total radionuclide emissions for the building are reflected in the graphs that follow.

Special Weapons Projects. Special weapons projects perform R&D for fabricating classified parts and fitting specialty parts and materials. Plutonium oxidation is conducted to convert pyrophoric Pu residues to non-pyrophoric PuO_2. The particulate passes through four stages of HEPA filters.

Pu particulate emission estimates (vent #32):

Uncontrolled	2.7×10^{-6} tons/yr
Controlled	2.2×10^{-17} tons/yr

Tritium Environmental Control. Tritium is generated from the disassembly of some types of contaminated parts. The tritium environmental control system removes tritium from gas sampling and glove box exhausts by converting it to tritiated water and desiccating the air stream. Tritium contaminated water is collected in special containers for further processing. The gettering process has not been used for over two years. If this process becomes operational, particulate emissions will be generated from the disassembly of parts by standard machining operations. While details of certain process emissions are classified, the total radionuclide emissions for the building are reflected in the graphs that follow.

1,1,1-TCA

B-776

Baler, Room 144. The baler is used to reduce volume of low-level combustible waste. TCA is present in wet low-level waste. TCA is assumed to evaporate 100%. All emissions are uncontrolled. Emission estimate:

Uncontrolled 6.19 tons/yr thru vent #24

B-777

Foundry Operations, Coatings. TCA is used in coatings facility in Rooms 437 and 463 to remove oils from substrates to be coated with U or Pu. Waste TCA is piped directly to Building 777 waste TCA collection system. Emission estimate:

Uncontrolled 0.20 tons/yr thru vent #32

Disassembly Operations, Room 430. Pu parts are disassembled for further processing. Following disassembly, TCA is used to clean parts. Emission estimate:

Uncontrolled 5.6×10^{-3} tons/yr thru vent #24

Assembly Superdry, TCA Wash, Room 430, Glove box 465 Process Description. Parts are cleaned in a 10-gallon TCA bath prior to ultrasonic cleaning. Emission estimate:

Uncontrolled 0.18 tons/yr thru vent #24

Ultrasonic Cleaning System, Room 430. Ultrasonic vapor degreaser containing TCA is used to clean parts from various modules in B-707. Emission estimate:

Uncontrolled 0.69 tons/yr thru vent #24

Ultrasonic Cleaning System, Room 440. Ultrasonic vapor degreaser containing TCA used to clean metal filters from module H in B-707. Emission estimate:

Uncontrolled 0.46 tons/yr thru vent #32

Downdraft Rooms 430, 432, 432B, 433, and 440 Assembly and Cleaning Process Description. TCA is used to assemble parts in a moisture-free airlock chamber. Emissions estimate:

Uncontrolled 1.1×10^{-2} tons/yr thru vent #32

Radiography. TCA used for general cleaning of radiography instrument. Emission estimate:

Uncontrolled 7.4×10^{-3} tons/yr thru vent #24

Weighing. Prior to weighing, parts are cleaned with TCA = 3.0×10^{-3} tons/yr thru vent #24

Plutonium Metallography Laboratory. TCA is used as a cutting agent for grinding with carbide grit to cut Pu. Emissions estimate

Uncontrolled 0.13 tons/yr thru vent #32

Special Weapons Projects. R&D for fabricating classified parts and fitting specialty parts and materials. Parts are immersed in ultrasonic cleaner which contains TCA. Emission estimates for the three different cleaners are:

Uncontrolled	0.14 tons/yr vent #32
Uncontrolled	0.25 tons/yr vent #32
Uncontrolled	8.4×10^{-2} tons/yr vent #32

TCA Collection and Filtration System. Collects TCA from storage systems in B-707 and B-776/777 and pumps the TCA to tank V-100 in B-707 C-pit and then to tank T-1 in B-777. Waste TCA from B-776/777 ultrasonic cleaners and vapor degreasers is pumped to tank T-1. If Pu, Am, and U are below the transfer limit is pumped to T-2; if not, is circulated through a filter system and sent back to Tank T-1. Emission estimates:

Uncontrolled	4.94×10^{-3} tons/yr thru vent #32 from T-1
Uncontrolled	4.94×10^{-3} tons/yr thru vent #32 from T-2

III. Inventory

Buildings 776/777 are listed as having some quantities of chromium and nitric acid. See table.

INSERT PAGE

INSERT FIGURE YEARLY EFFLUENT RELEASES FOR BUILDING 776

INSERT FIGURE YEARLY TRITIUM RELEASES FOR BUILDING 776

BUILDING 779
PLUTONIUM DEVELOPMENT BUILDING

I. Building History

1965	Building constructed. Building 779 is a research and development facility that supports production.

II. Processes Associated with Emissions

Although there are no specific processes associated with emissions of Chemicals of Concern from Building 779, some radonuclides are emitted from the research and development operations in the building. The following graphs reflect the radionuclide emissions from the building.

III. Inventory

The 1988/89 inventory of the chemicals and radionuclides of concern is provided in the following table.

INSERT PAGE

INSERT FIGURE YEARLY EFFLUENT RELEASES FOR BUILDING 779

INSERT FIGURE YEARLY TRITIUM RELEASES FOR BUILDING 779

BUILDING 865, 867, AND 868
RESEARCH AND DEVELOPMENT OF URANIUM AND BERYLLIUM

I. Building History

1972	Building Constructed. Material and Process Development Lab.
B-867	Date of construction unknown. Contains filter plenums for process exhaust routed from Building 865.
B-868	Date of construction unknown. Contains filter plenums for process exhaust routed from Building 865.

Process exhausts are routed through an exhaust plenum to the dedicated filter plenums located in filter plenum Buildings 867 and 868. There are no raw chemical storage tanks or process waste storage tanks located in Building 865.

II. Processes Associated With Emissions

Beryllium

Beryllium Powder Work. Rooms 144, 148, 153. Be powder is mixed with other metals, placed in molds, and compressed into shapes. Be emissions are from powder pressing, drying operations, and spills in glove boxes. Be particulate emissions for vents #58/59 and 63/64:

Uncontrolled	2.50×10^{-3} tons/vent pair
Controlled	6.12×10^{-10} tons/vent pair

High Bay. Production through R&D of metalworking processes. Be particulate emissions from casting and heat treating furnaces. Be particulate emissions for vents #58/59 and 63/64:

Uncontrolled	4.88×10^{-5} tons/vent pair/year
Controlled	9.76×10^{-11} tons/vent pair/year.

Beryllium Electrorefining. Production of ultra-pure Be metal electrolytically. In operation from 1983 through 1986; exhausts were routed through scrubber, then through B-865 plenum system. Process discontinued in 1986. Currently no emissions.

Nitric Acid

High Bay. The High Bay area of Building 865 supports production through the research and development of metalworking processes. Most work is done with depleted U, Be, copper, tungsten, stainless steel and other steel alloys. Processes include metal casting, machining, rolling, heat-treating, and isostatic pressing. Chemical etching and cleaning are also performed to prepare the part for inspection and to remove oily residues, respectively. Nitric acid is used in the etching process. The air emission controls in the Building 865 complex do not reduce the uncontrolled emissions of nitric acid. Therefore, emission estimates for nitric acid assume that 100 percent evaporation occurs. Reported uncontrolled emissions for vent pairs #58/#59 and #63/#64 follow:

Uncontrolled 1.62×10^{-3} tons/vent pair/year

Metallography Laboratory. The Metallography Laboratory, located in Rooms 102, 106, and 108, conducts quality control analyses on metal samples. Nitric acid is used in the etching step of the quality control process. Nitric acid air emissions are based on the annual usage. It is assumed that 100 percent of the nitric acid evaporates during use. The emissions are directed into the building ventilation system where flow is assumed to be split evenly between vent pairs #58/#59 and #63/#64. Uncontrolled nitric acid emissions are not reduced by building control equipment; therefore, reported uncontrolled and controlled emissions are identical.

Uncontrolled 6.50×10^{-4} tons/vent pair/year

Radionuclides

High Bay. Production through R&D of metalworking processes. Uranium particulate emissions from casting and heat treating furnaces. Emission estimates for vents #58/59 and 63/64

Uncontrolled 9.52×10^{-4} tons/vent pair/year
Controlled 1.90×10^{-9} tons/vent pair/year.

Grit Blasters, Room 172. Surface cleaning of parts containing depleted U. Air emission estimates for all particulates including various metals are (for vent pairs #58/59 and #63/64):

Uncontrolled emissions 6.25×10^{-3} tons/pair/year
Controlled emissions 5.00×10^{-10} tons/pair/year

III. Inventory

The 1988/89 inventory places a number of the Chemicals of Concern in this building. A complete list can be found on the attached table. The following is an abbreviated list:

Chromium compounds
Lead compounds
Nickel compounds
Nitric Acid

INSERT PAGE

INSERT FIGURE YEARLY URANIUM EFFLUENT RELEASES FOR BUILDING 865

BUILDING 866

I. Building History

Date of construction unknown.

Building 866 is a transfer station. It receives wastes from Building 865 and 889 and transfers them to Building 374.

II. Processes Associated with Air Emissions

Beryllium	No emissions listed. No quantities are provided because emissions that occur during waste transfer in 866 are included in the B-374 APEN emissions.
Radionuclides	Two of the four vents are sealed (physically capped) and two have 2 stages of HEPA filters. Waste from B-865 includes 3 1200-gal tanks containing metals, acids, bases, uranium 238, beryllium. Wastes from B-889 include two 400-gal tanks containing detergent, U238, and Be. No emission estimates were derived because emissions that occur during waste transfer in 866 are in B-374 APEN.

III. Inventory

No Chemicals of Concern were listed on the 1988/89 inventory for Building 866.

BUILDING 881

I. Building History

1953 — Building constructed. Building 881 contains laboratories, maintenance shops, and plant support facilities. The original building was designed and built for processing uranium 235. Small quantities of other radioactive materials such as uranium 233 and plutonium (Pu) were also historically handled in the building.

II. Processes Associated with Air Emissions

Benzene

No information on the use of benzene was provided in the APENS.

Controlled	3.87×10^{-3} tons/yr

Beryllium

Beryllium is not processed in B-881. However, some materials processed in the building may contain beryllium. The following emission estimate is based on stack effluent monitoring data for 1990.

Controlled	7.32×10^{-8} tons/yr

Carbon Tet.

Carbon tetrachloride is used in small quantities in several laboratories and processes it is most commonly used at room temperature as a rinse. The liquid waste is transferred to a satellite collection container. The emission estimate is based on an assumption that five percent of the carbon tetrachloride will volatilize.

Controlled	8.92×10^{-4} tons/yr

Chloroform

No information on the use of chloroform was provided in the APENS.

Controlled	9.68×10^{-2} tons/yr

Methylene Chloride

Methylene chloride is used in several laboratories and process areas for sample preparation and analysis. The emission estimate is based on the assumption that 50 percent of the methylene chloride evaporates in the hood.

Controlled	0.28 tons/yr

Nitric Acid	Per building personnel approximately 5 gallons/yr of HNO_3 is used in the laboratories. Eighty percent of the laboratory acid is used at room temperature in various baths, rinses, and sample preparation, and approximately five percent of this evaporates. The remaining 20 percent of the nitric acid is boiled to dryness under acid scrubber hoods. All of this acid evaporates and 90 percent is recovered by the acid scrubbers.	
	Uncontrolled	0.16 tons/yr
	Controlled	4.16×10^{-2} tons/yr
1,1,1-TCA	No information on the use of 1,1,1-TCA was provided in the APENS.	
	Controlled	6.16×10^{-2} tons/yr

II. Inventory

The 1988/89 inventory of the chemicals and radionuclides of concern is provided in the following table.

INSERT PAGE

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INSERT FIGURE YEARLY EFFLUENT RELEASES FOR BUILDING 881

INSERT FIGURE YEARLY TRITIUM RELEASES FOR BUILDING 881

BUILDINGS 883 and 879
BERYLLIUM AND URANIUM MACHINING FACILITY

I. Building History

1957	Building constructed as a rolling and forming (more commonly referred to as machining) facility for both enriched and depleted uranium. The building was divided into two sides: A side and B side. The A side rolled enriched uranium while the B side rolled depleted uranium (ChemRisk, 1991; RE-891[36]).
1966	Enriched uranium operations curtailed at Rocky Flats. The A side of Building 883 was converted to beryllium rolling (this process was not enclosed). Depleted uranium rolling continued on the B side (ChemRisk, 1991; RE-891[36]).
Mid-1970s	Beryllium machining stopped (ChemRisk, 1991; RE-891[36]).
1957-1988	Perchloroethylene, trichloroethylene and freon commonly used solvents (Quantity used is unknown). In November of 1988 the use of chlorofluorocarbons in B-883 was curtailed (ChemRisk, 1991; RE-891[36]).
Late 1970s or Early 1980s	Nitric acid fume scrubber added (ChemRisk, 1991; RE-891[36]).
1957-1989	Nitric acid commonly used in a 50:50 water/nitric acid mixture for pickling uranium (No estimate of quantity given) (ChemRisk, 1991; RE-891[36]).
1980-1985	Increased processing of depleted uranium. See graphs indicating missing monitoring data during this time period (ChemRisk, 1991; RE-891[36]).
Early 1980s	Modification of the ventilation system (ChemRisk, 1991; RE-891[36]).
B-879	Date of construction unknown. Building 879 houses the exhaust plenums and particulate emission controls for the Building 883 heating, ventilation, and air conditioning (HVAC) system.

II. Processes Associated with Air Emissions

Beryllium

Beryllium has not been fabricated in these buildings since late 1970s. The building has undergone decontamination since the discontinuation of Be processing. However, Be is still monitored at 3 plenum discharge points from the building. These are vents #34, 44, 45 (883-AAA, 883-BBB, 883-CCC).

Controlled emissions 2.02×10^{-4} lb/yr

Radionuclides

Vents #34, Room 139 plenum exhaust
Vents #44 and #45, Building 879 plenum exhaust

Rolling. Metal ingots, including uranium, are rolled in a rolling mill to reduce thickness and establish desirable grain structures. No emissions.

Shearing. Uranium plates are mechanically cut into smaller pieces before being shaped in other mechanical processes. Uranium scrap is recycled by sending it to B-444 for recasting.

Blanking/Trepanning. Uranium is cut from a sheet with a press and die, and desired shapes are cut with trepanning tool. Uranium turnings are placed in a drum and sent to B-444 for U chip roasting.

Forming. Uranium parts are formed into useful shapes. No emissions.

Heat Treating. Process used to anneal uranium parts-- are heated to high temp in a salt bath or furnaces; oxidation of uranium to uranium oxide may occur in furnaces. Amount of U accumulating in furnaces = 6 lb/yr Amount of U in uncontrolled and controlled release of U particulates are:

Uncontrolled	6 lb/yr
Controlled	1.20×10^{-5} lb part/yr

III. Inventory

The 1988/89 inventory places two 500 gallon storage tanks of nitric acid outside of B-883. See table.

INSERT PAGE

INSERT FIGURE YEARLY URANIUM EFFLUENT RELEASES FOR BUILDING 883

BUILDINGS 886 AND 875
NUCLEAR SAFETY FACILITY

I. Building History

1965	Building 886 constructed. This building contains 13 interior storage tanks. Nine tanks contain uranyl nitrate in dilute nitric acid and four of the tanks are utility tanks and are empty. The function of the operations in this building was to perform safety experiments for equipment design.
1965-Present	Over 1600 criticality experiments have been performed. The materials used in the experiments (uranyl nitrate metal powder) are re-used. Very little waste fission products are produced and none are released. The products decay rapidly and are contained until stable (ChemRisk, 1991; RE-891[53]).
B-875	Date of construction unknown. B-875 Contains two filter plenums for air exhaust from three vents in B-886, an air supply fan and two tanks (one tank is empty, it is used to collect fire water, and one is an insulated steam condensate tank).

Building 886 is connected to B-875 by an underground passageway. The interior of the building is divided into offices, an electronics/machine shop, and laboratory spaces.

II. Processes Associate with Air Emissions

Nitric Acid	Nine storage tanks of uranyl nitrate in 0.5 N and 0.16 N nitric acid (approx. 4000 liters) are located in Rooms 103 and 101. Because the solution is not heated, no emissions of NOx from the oxidation of nitric acid are expected to occur.

III. Inventory

One pound of mercury in storage is listed on the 1988/89 inventory. See table.

INSERT PAGE

INSERT FIGURE YEARLY EFFLUENT RELEASES FOR BUILDING 886

BUILDING 910 AND SOLAR PONDS 207A, B, AND C

I. Building History

1957	Solar evaporation pond 207A put into use (asphalt-planked pond).
1960	Solar Evaporation Ponds 207B and C put into service (asphalt-planked).
1961	Pond 207B relined with asphalt concrete over the planking.
1963	Pond 207A relined with asphalt concrete over planking.
1967	Pond 207B receives several treatments to repair cracks.
1968	Nigrosine dye used in solar evaporation ponds. Pond 207B cracked side walls repaired with burlap and asphalt.
1977	Building 910 (Reverse Osmosis facility) constructed. This building originally contained the equipment required for a reverse osmosis (RO) operation to treat effluent from the sanitary wastewater treatment plant. The RO units separated dissolved solids from the wastewater streams. This process has not been in operation for about the last five years. Building 910 is presently used to house portable evaporator units and support services for the evaporation of liquids from the solar ponds.

II. Processes Associated with Emissions

Methylene Chloride	Ponds 207A and the three 207B ponds detected methylene chloride at levels above zero but below the specified detection limit. Methylene chloride was also detected in the blank sample and the results are, therefore suspect. Therefore no emissions were calculated.
Nickel	In Ponds 207A and the three 207B ponds, **nickel** was above the detection limit in June 1990, but will remain with the sludge and not contribute to air emissions

III. Inventory

The 1988/89 inventory places formaldehyde in this building. See table.

INSERT PAGE

BUILDING 985
AIR HANDLING SYSTEM

I. Building History

1974 — Building constructed. Building 985 houses the air handling system that supports the underground storage vaults 996, 997, and 999. These underground storage vaults are tunnels that extend out from Building 991. Air is supplied to the underground storage vaults by Building 985 via the supply air intake vent. The exhaust air leaving the underground storage vaults 996, 997, and 999 is drawn into the filter plenum in Building 985. The exhaust passes through a metal mesh demister screen and two stages of high efficiency particulate air (HEPA) filters before exiting through the exhaust vent.

II. Processes Associated with Air Emissions

Beryllium — Beryllium is not processed in Building 985 or in the underground storage vaults. However, some materials in the vaults may contain beryllium. For this reason beryllium is monitored at the plenum discharge point.

Controlled 3.15×10^{-8} tons/yr (particulates)

The above emission estimate is the value for beryllium releases from B-985 during 1990. It is believed that the non-zero number reported for beryllium releases is a combination of the lack of pre-installation "blank" assays of the filters (i.e., trace beryllium exists in new filters) and the magnification of analytical uncertainty when multiplied by the large volume of air discharged from these points.

II. Inventory

No Chemicals of Concern were listed on the 1988/89 inventory.

BUILDINGS 990, 990A, 995, 988, 228A, 228B

I. Building History

1953 — Buildings 990, 995, and 988 constructed. B-990 - Pre-Aeration Building; B-995 - Sewage Treatment Facility; B-988 - Tertiary Treatment Pump House.

Buildings 228A and 228B are sludge drying beds located east of B-995. Date of construction is unknown. When the reverse osmosis (RO) process was in operation, these drying beds were used to dry sludge from the precoat filters. The drying beds are presently used to dry sludge from the sanitary waste treatment plant.

II. Processes Associated with Emissions

Methylene Chloride — In sludge drying beds, B-228A and B-228B, methylene chloride was detected in one bed at a level of 160 µg/kg and was not detected in the other bed. The emissions estimate was based upon 80 µg/kg in the drying bed and 100% volatilization.

Uncontrolled	0.00014 tons/yr

III. Inventory

No chemicals of concern were listed on the 1988/89 inventory.

GRAPHS FOR BUILDINGS WITHOUT APENS
(Data from the EIS)

INSERT FIGURE YEARLY EFFLUENT RELEASES FOR BUILDING 778

INSERT FIGURE YEARLY EFFLUENT RELEASES FOR BUILDING 889

INSERT FIGURE YEARLY EFFLUENT RELEASES FOR BUILDING 991

BUILDINGS WITHOUT APENS BUT CONTAINING CHEMICALS OF CONCERN ON THE 1988/89 CHEMICAL INVENTORY

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