



PA.45-1
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May 3, 1996

Mr. John J. Matviya
Regional Manager, Environmental Cleanup
Pennsylvania Department of Environmental Protection
Commonwealth of Pennsylvania
400 Waterfront Dr.
Pittsburgh, PA 15222-4745

Subject: Parks Facilities Characterization Report

Dear Mr. Matviya:

Enclosed are four (4) copies of the Parks Facilities Characterization Report. The report presents the results of the comprehensive investigation of the chemical and radiological conditions at the Parks Facilities. The radiological data is the same as that previously submitted in the Decommissioning Plan and its addendum. Copies are also being forwarded to the NRC in support of their review of the Decommissioning Plan.

The characterization work has been completed substantially ahead of schedule, and in order to maintain the balance of our remediation schedule, we are soliciting your comments by June 14, 1996. We would be pleased to meet with you and your staff to review the contents of this submittal.

Please address your comments, questions, or requests to me at (412)842-1412.

Sincerely,
B&W Nuclear Environmental Services, Inc.

Don K. Sgarlata, Mgr. H&S/Licensing
Parks Environmental Restoration Project

Enclosure: Parks Facilities Characterization Report, Rev 0, dated April 30, 1996

cc: M.A. Lamastra - NRC (five copies of enclosure)
Todd Jackson (with enclosure)

Parks Facilities Characterization Report

Revision 0

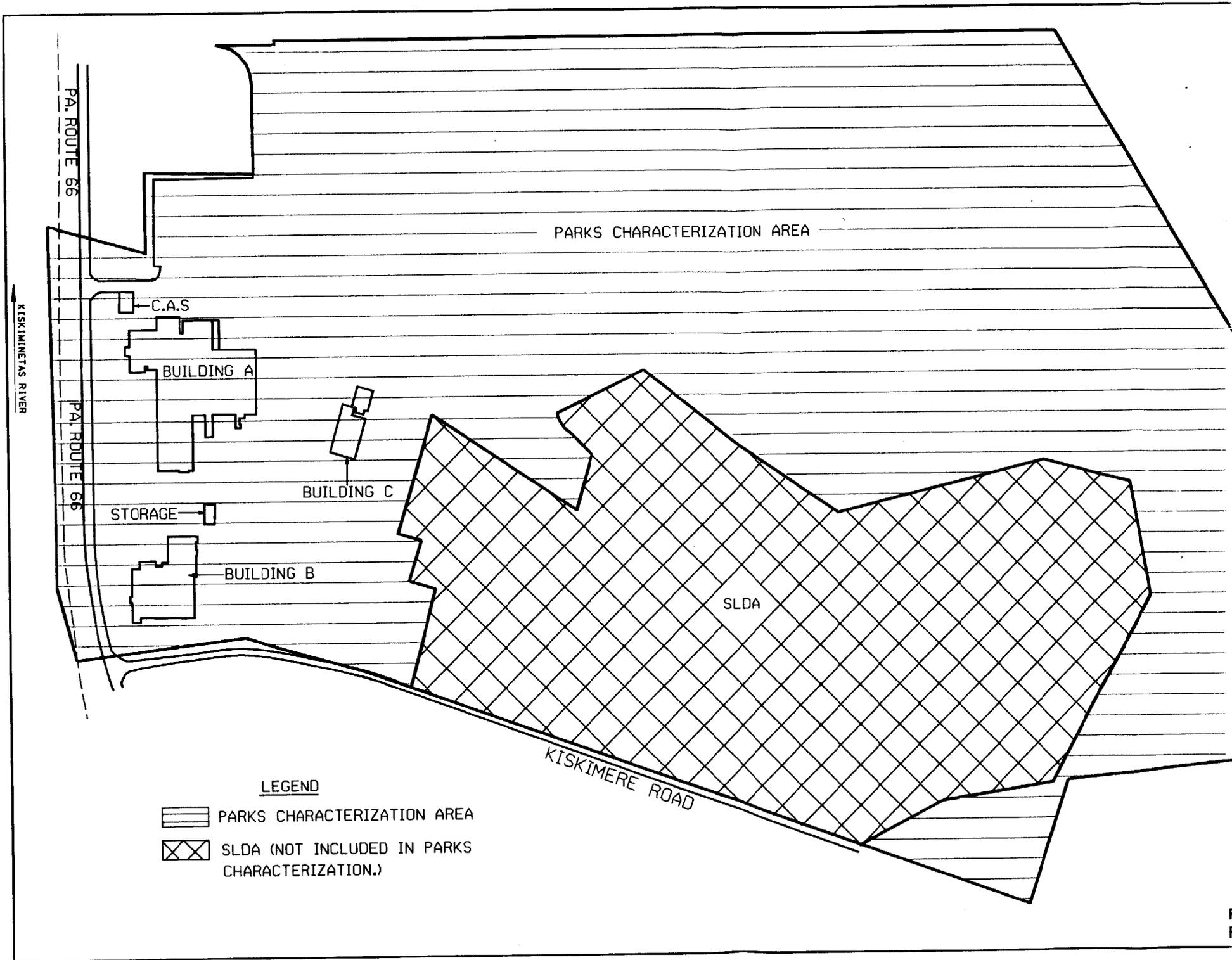
April 30, 1996

EXTRACT

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EXTRACT



PA. ROUTE 66

KISKIMINETAS RIVER

PA. ROUTE 66

PARKS CHARACTERIZATION AREA

C.A.S.

BUILDING A

BUILDING C

STORAGE

BUILDING B

SLDA

KISKIMERE ROAD

LEGEND

-  PARKS CHARACTERIZATION AREA
-  SLDA (NOT INCLUDED IN PARKS CHARACTERIZATION.)

EXTRACT

2.0 SITE HISTORY

This section traces the ownership of the Parks Facilities, and presents a brief history of building construction and operational control. The processing of radioactive materials from 1960 to 1980 is discussed briefly, as is the production of specialty metals and alloys. Finally, the commercial nuclear service business activities which began in the mid-1980s and continue to the present day are discussed.

2.1 OWNERSHIP

Nuclear Materials and Equipment Corporation (NUMEC) was the initial owner of the Parks Facilities. NUMEC leased the land from Kiski Valley Enterprises, Inc. in 1959, but eventually bought the land portion of the Parks Facilities in the early 1970s. Prior to 1959, the area currently known as the B&W Property was utilized for agricultural purposes.

The stock of NUMEC was sold in 1967 to the Atlantic Richfield Company. NUMEC, as a wholly-owned subsidiary of ARCO, operated the Parks Facilities until late 1971. B&W purchased the stock of NUMEC in November 1971 and NUMEC operated as a wholly-owned subsidiary until 1974, when the operations were consolidated into a B&W operating division. B&W NESI, an affiliate of B&W, has been responsible to B&W for operation of the Parks Facilities since April 1, 1992.

2.2 BUILDING HISTORY

Construction of the first phase of Building A began in 1959. Initial operations in Building A were licensed by the Atomic Energy Commission (AEC) in 1960 under license SNM-414 Docket 70-364. From 1961 to 1967, Building A was expanded and Building B was constructed. Construction of Building C was started in 1970.

The major buildings within the Parks Facilities include a former plutonium processing facility (Building A; Figure 2-1); a multi-purpose building currently housing a machine shop, administrative offices, and a radiological laboratory (Building B; Figure 2-2); and, a former high-enriched uranium processing facility (Building C; Figure 2-3).

At various times in the past, Building A has been known as the Plutonium Lab; Building B as the Metals Plant, Hafnium Facility, and the Machine Shop; and Building C as the Type II or T-2 Facility. What is now known as the Parks Facilities was known as the NUMEC Advanced Materials Center in the 1960s and early 1970s.

2.3 MATERIALS PROCESSING HISTORY

Radioactive materials were processed and handled in designated areas of Buildings A, B, and C. The work which was performed in each Building is discussed separately below.

2.3.1 Building A

Building A was constructed in five major phases, beginning in 1959 and continuing until 1970. The original portion of Building A was designed as a plutonium laboratory to perform R&D leading to plutonium-based products for emerging nuclear businesses. Initial operations in Building A were authorized by the Atomic Energy Commission (AEC) in 1960. Many experimental fuel forms and compositions were produced in the 1960s, including oxides, carbides and metal alloys in the form of plates, powder, pellets and special shapes. Work with nuclear materials in Building A was conducted in fabrication areas designated as Fab 1 through 7 and Fab 9, and in several small laboratories adjacent to the Fab areas. The current layout of the Fab areas is shown in Figure 2-1. All significant work on nuclear fuel materials was done within containment systems such as radiochemical hoods and gloveboxes.

The two largest production runs of fuel were Zero Power Plutonium Reactor (ZPPR) fuel plates in the late 1960s, and Fast Flux Test Facility (FFTF) fuel rods in the 1970s and early 1980. More than 12,200 ZPPR fuel elements were produced under contract to Argonne National Laboratory using plutonium-uranium-molybdenum ternary alloy plates encapsulated in stainless steel. The plutonium content was primarily Pu-239, with 11,500 of the plates having 11.5% Pu-240 and the balance of the plates having 27% Pu-240. The uranium was depleted.

FFTF (the DOE's Fast Flux Test Facility) fuel was the largest order of fuel processed in Building A. More than 50,000 FFTF pins were made; portions of Cores 1 and 2, and the entire Cores 3 & 4. The FFTF fuel was a mixed oxide based on a 20:80 ratio by mass of plutonium dioxide (PuO_2) and uranium dioxide (UO_2). The plutonium isotopic content was approximately 86% Pu-239, 12% Pu-240, and 2% Pu-241 with trace amounts of Pu-242 and Pu-238. The uranium was either natural or depleted, depending on the customer's specifications.

Plutonium scrap recovery was an integral part of Building A operations. Scrap recovery operations were conducted in Fab 5 until August 1, 1967. They were moved in 1968 to a much larger and improved operation in Fab 6, which operated throughout the 1970s and into 1980. The scrap was dissolved in concentrated nitric acid to which a small amount of hydrofluoric acid had been added. The valence of the plutonium ion in the impure nitrate solution was adjusted by the addition of small quantities of ferrous sulfamate and sodium nitrite. The plutonium nitrate solution was purified by passing through ion exchange columns. The purified solution was then concentrated by evaporation, put into bottles and stored for shipment to the customer or for conversion into plutonium oxide.

Conversion of plutonium nitrate to plutonium oxide was performed at the north end of Fab 1 inside HEPA filtered gloveboxes. The conversion process started with small batches of plutonium nitrate to which either oxalic acid or hydrogen peroxide was added. The same equipment could be used for either precipitation process. The filter cake from the precipitation and filtration steps was transferred to a muffle furnace for calcining to PuO₂. The PuO₂ was placed into metal cans and stored for shipment back to the customer or for use in the Building A fuel fabrication.

The chemical, physical, mechanical, and radiochemical properties of in-process fuel, finished fuel forms, and radiation sources were determined on small samples in several small laboratory rooms adjacent to the west side of Fabs 1, 2, 3, and 4. Separate laboratories existed for wet chemistry, metallography and mechanical properties, and radiochemistry. An analytical chemistry laboratory was also installed in Fab 5, after removal of the scrap recovery process equipment, but the Fab 5 lab only operated for about 6 months during 1979-1980. Only laboratory size quantities of reagent grade chemicals were used in these laboratories.

Alpha, neutron and thermal sources were also produced in Building A. The two most common neutron sources were double-encapsulated plutonium-beryllium metallic sources and compacted mixtures of americium oxide and beryllium metal powders. These neutron sources were made in the Fab-4 area. A standard alpha source was made which consisted of a plutonium oxide film deposited on one or both sides of a flat metal backing plate. Limited quantities of various other neutron, beta, and gamma sources were also made to specific customer specifications. Materials used in these specialty sources included polonium, plutonium, americium, iridium, cesium, cobalt, and beryllium. Source manufacturing always took place inside HEPA filtered gloveboxes, except for high activity sources which were fabricated in the Building A Hot Cell.

The north end of Building A was divided into two large rooms (see Figure 2-1). The Hot Cell and the Cell Control Area occupied the east room, and the Hot Handling Facilities occupied the west room. The Hot Cell was a reinforced, high density concrete structure designed for shielding personnel from gamma radiation. The Cell Control Area contained a fumehood for mixing chemicals prior to inserting them into the cell, and a second fumehood over the fission gas analysis equipment. A metallographic cell was abutted to the west side of the Hot Cell, just north of the sliding doors. Two small, steel-walled hot cells were also located in the Hot Handling Facilities room. One cell was used as a dissolving cell and the other for storage of radioactive specimens.

The interior of the Hot Cell was at a lower pressure than the exterior to prevent radioactive materials from reaching the workers or the environment. Air from the Hot Cell passed through a HEPA filter prior to reaching the stack. Two liner boxes were used in the cell for performing work on materials containing alpha emitters. Each box had inlet and output filters and the air exiting the boxes passed into the main cell exhaust system which was HEPA filtered. Two other ventilation systems served hot cell operations. One system

exhausted the metallograph and dissolver cell in the Hot Handling Facilities room, and the fission gas fumehood in the Cell Control Area. The other system exhausted the chemical fumehood in the Cell Control Area.

Gamma sources of Ir-192 and Co-60, which required extensive shielding (i.e., a hot cell), and high yield neutron sources of Po-210/beryllium were fabricated in the Hot Cell, but the primary work performed in the Hot Cell was destructive post-irradiation examination of test capsules and fuel pins irradiated in research reactors.

Significant quantities of chemicals were not used in hot cell operations, although varied reagents were used for metallography and cleaning of sealed sources. Solid waste from inside the Hot Cell was packaged and disposed of at AEC/NRC-approved disposal sites. High activity liquid waste was solidified for disposal as solid radioactive waste. Low activity liquid waste, such as from washing the cell walls prior to a manned entry, was sent to an outside, underground tank. This tank was fed by two floor drains inside the Hot Cell and one floor drain in the Hot Handling Facilities room. The tank liquid was periodically pumped back into the Building A low level liquid waste discharge system. Eighteen dry storage units (five inch diameter aluminum pipes set in concrete) are located outside the north end of the building just west of the former Hot Cell underground tank. The dry storage units were used to temporarily store containers of radioactive material going into or out of the hot cells.

Fuel processing and source manufacturing in Building A required support from other systems such as: water heaters; HVAC; natural gas fired boiler; air compressor; emergency generator; and a cooling tower. A small supply room for chemicals was originally located near the metallographic room west of Fab 1, but was moved later to Fab 8. Large containers of chemicals (bulk chemicals) were stored in several locations including outside the building. Building A also housed a repair shop for non-contaminated equipment, a shipping and receiving area, administrative offices, and lunch room areas. Special Nuclear Material (SNM) was neither processed nor stored in these support areas. Routine repair and maintenance of contaminated equipment was performed in the glovebox or radiochemical fumehood where the equipment was located. More extensive repairs were performed in the Warm Maintenance Area which contained a series of ventilated, HEPA filtered gloveboxes containing a lathe, drill press and other required equipment. The Warm Maintenance Area was located near the east side of Fab 1. Most of the equipment committed to the gloveboxes and radiochemical fumehoods was modified prior to use to facilitate both maintenance and repair within the containments.

Waste management was particularly important during the days of fuel fabrication. Recoverable amounts of plutonium and uranium were returned to customers, the fuel plant in Apollo (uranium only), or to another AEC-approved site. Trace quantities of plutonium and other radioactive materials, in the form of equipment or material contamination, were not recoverable and were sent for disposal as radioactive solid waste. Acidic waste streams were neutralized, solidified and sent off-site for disposal.

Liquid wastes such as sink and shower water and water used to cool the process equipment were discharged into holding tanks for sampling and monitoring to assure compliance with Pennsylvania and AEC/NRC limits prior to discharge to the Kiskiminetas River. In 1977, these discharges were rerouted to the Kiski Valley Water Pollution Control Authority (KVVWPCA) sanitary sewer. Stormwater was also discharged to the river and since 1994 has been discharged under a NPDES permit. Sanitary wastes from six of the Building A rest rooms were originally discharged into three septic tanks and one septic field located between the building and Route 66. Sanitary wastes from a seventh rest room in Fab 9 discharged to a separate tank and septic field located to the rear of the building. All connections to the Building A septic systems were rerouted to the KVVWPCA sanitary sewer in 1977, thereby eliminating use of the septic tanks and drain fields.

Air from the process areas of Building A was discharged via a system of roof stacks using one, two or three stages of HEPA filtration. The majority of the stacks vented the HEPA filtered gloveboxes and radiochemical fumehoods, while the balance vented the flue gases from the natural gas fired heating units or general area exhaust. Exhaust air was not HEPA filtered if it came from the office areas, the Fab 4 change room, and other areas of the plant where radioactive material was not handled.

All the plutonium glove boxes and fumehoods were removed from Building A during a 1981-1983 deactivation program. Most of the effluent streams which existed during the years of plutonium fuel production were thus eliminated. The workload in Building A then shifted to repair and refurbishment of contaminated equipment used at reactor sites, building decontamination, and Low Level Radioactive Waste volume reduction services for commercial customers. Although involving much smaller quantities of radioactive isotopes, these activities still generated radioactive contamination, so the building exhaust air continued to require HEPA filtration before exiting through roof stacks. This exhaust was monitored to assure compliance with existing regulations. As commercial work slowed in the mid-1990s, the pace of building decontamination increased.

Additional details of the processing history in the Fab areas of Building A can be found in the Parks Facilities Characterization Plan which was submitted to the NRC on March 13, 1995.

2.3.2 Building B

Building B was constructed in three stages, beginning in 1961 when the Hafnium Facility was built to produce crystal-bar hafnium. The second stage of construction occurred in 1963 when the Metals Plant was built to the east of the Hafnium Facility. The third and final stage of construction occurred in 1964, when the space between the Hafnium Facility and the Metals Plant was closed in to create the Machine Shop. Later in its life, the combined facility became known as the Metals Building, and then Building B. The layout of Building B is shown in Figure 2-2.

Depleted uranium was the primary radioactive material processed in Building B, although smaller quantities of natural uranium, thorium, and Pu-238 were also processed. The depleted uranium was primarily in the form of metal or metal alloy, and the processing consisted mostly of forming (rolling, etc.) and machining operations which do not generate significant airborne emissions. A limited amount of U_3O_8 powder products were produced at the northeast end of Building B. Pu-238 was processed in a room in the northwest corner of Building B. All Pu-238 work was performed within interconnected gloveboxes. Receiving and shipping operations were conducted in a chemical fumehood. Non-radioactive metals and alloys were also processed in significant quantities in Building B. The majority of the work was production of crystal bar zirconium and hafnium, and zirconium-beryllium alloys.

The chemicals used in Building B were those required to support the radioactive materials and specialty metals processing and manufacturing. This included the use of nitric and oxalic acids in Pu-238 processing, use of materials such as trichlorethylene (TCE), and use of iodine in crystal-bar production.

The Hafnium Facility

The original product from the Hafnium Facility was crystal-bar hafnium. Crystal-bar hafnium was produced by reacting hafnium sponge with iodine (non-radioactive) to form hafnium-iodide gas. The gas was introduced into a vessel containing a high purity hafnium wire. A reaction between the gas and the heated wire dissociated the gas and deposited the hafnium on the wire forming crystal-bar hafnium. After reaction, the iodine gas was condensed and cycled back through the operation. The hafnium bar was packaged and shipped to customers. Crystal-bar zirconium was also produced in the Hafnium Facility using a process similar to the crystal-bar hafnium process.

A specialty zirconium alloy product was produced by hydriding ingots of beryllium and zirconium with hydrogen gas in a furnace. The resulting hydride was ground into powder, heated under vacuum to dissociate the hydride, milled, and sieved. The dehydrided powder was blended with titanium powder to produce homogeneous lots of zirconium-beryllium-titanium alloy powder. The blended powder was pressed into solid rings, packaged and shipped. Metal powders of other alloys were also produced in the Metals Plant using an identical hydride-dehydride process.

Under contract with the Atomic Energy Commission, Pu-238 nitrate was converted into an oxide product in a room in the northwest corner of the Hafnium Facility known as the Plutonium Annex. The conversion process for the Pu-238 nitrate was very similar to the process used for converting Pu-239 nitrate into fuel products in Building A, except that only oxalate precipitation was used. The conversion was performed in eight HEPA-filtered gloveboxes. Both product and waste were shipped to government sites. Sink and shower water and waste water from the janitor sink were discharged into one of two interconnected 1,000 gallon underground concrete tanks. The tanks were sampled to verify the water met

AEC and Pennsylvania discharge criteria prior to release to the Kiskiminetas River. After production was completed, the equipment was removed and boxed. The gloveboxes were partially decontaminated and the glove ports sealed. The boxes were filled with a fire retardant foam, placed in large diameter corrugated steel pipe and the pipe was filled with foam. The boxes and pipes were shipped to a licensed radioactive waste disposal site in New York. Following equipment and glovebox removal, the floor covering was removed and the room decontaminated. The underground tanks and associated piping which supported the work in the Plutonium Annex were not removed at the time the equipment was dismantled. The two concrete tanks and the piping from the building to the tanks and several feet of outlet pipe were removed in a remediation project in 1991 which will be discussed later in Section 3.

B&W NESI's Nuclear Environmental Laboratories - Parks Township Laboratory is currently operational along the west side of the Hafnium Facility. The lab was opened in 1991 and will continue operation in Building B until the building is ready for final decontamination. At that point in time, the lab equipment will be moved to on-site trailers and will continue operation for the remainder of the remediation effort.

The Machine Shop

The Machine Shop, connecting the Hafnium Facility to the Metals Plant, was used to fabricate equipment and machine metals in support of the production lines at the Apollo and Parks Township sites. The equipment in the Machine Shop included drill presses, lathes, shears, formers, grinders, polishers, welders, sandblasting, degreasing and other associated metal working machinery. Machining of depleted uranium was performed in the Machine Shop. Additionally, the repair/refurbishment of equipment from the Apollo and Parks facilities was performed. Some of this equipment contained levels of radioactivity that exceeded the then existing criteria for release for unrestricted use.

The machining operations all took place on the ground floor. The second floor contained primarily offices and a training room, although a small environmental laboratory was in use at the south end of the second floor until 1991. Today, most of the second floor is office space, and will remain so until decontamination operations are started in Building B.

The Metals Plant

The Metals Plant was built in 1963. The original layout of the first floor of the Metals Plant included a variety of equipment to: melt zirconium-beryllium rods; heat treat tantalum and zirconium billets or plates for drawing or rolling; extrude copper-clad zirconium and uranium billets; forge uranium and zirconium products; hot roll tantalum and boron containing stainless steels; cold roll magnesium, tantalum and zirconium; vacuum annealing of metals; drawing and rotary swaging zirconium and uranium products; blending zirconium-beryllium

powders and pressing into rods for later electric arc melting; air induction melting of stainless steel billets containing boron; vacuum induction melting of depleted uranium-molybdenum ingots which were sent to Building A for remelting into Pu-U-Mo alloy fuel plates; centerless grinding of uranium and zirconium products; powder processing of depleted U_3O_8 compacts; electroplating copper, nickel or cadmium cladding onto depleted uranium products; manufacturing and encapsulating sodium carbonate wafers, and hafnium or boron containing stainless steel control rods; pickling metal products after vapor (TCE) degreasing, cleaning with nitric acid (occasionally with HNO_3 -HF) and/or a caustic solution, and deionized water rinsing.

Metals production from the Metals Plant was small scale and intermittent. Most of the processing equipment was removed for resale or disposal in 1973-1974. During the mid-1970s, a portion of the high bay area was used to machine non-radioactive fan components.

The second floor of the Metals Plant initially contained only one office, but over the years other offices were added along with two physical and mechanical testing laboratories for quality control testing, and an Energy Conversion Lab (also called the R&D Lab) where R&D projects were performed such as the development of Pu-238 fueled heart pacemakers, under an AEC sealed source license.

Shower and sink water was sent to one of two 500-gallon tanks on the east side of the Metals Plant and sampled prior to release to the Kiskiminetas River through the Metals Plant sewer. The condensed steam from the cooling tower was discharged directly to the Kiskiminetas River through the Metals Plant sewer. The sanitary waste was sent to one of two septic tanks and distributed to a leach field located between Building B and Route 66. In 1977, the sanitary waste from Building B was connected to the KVVPCA sewage system.

As the original equipment in the Metals Plant was discarded, much of the building was converted to office space which will remain in use until decontamination activities begin in Building B.

Additional details of the processing history in each of the three building complexes can be found in the Parks Facilities Characterization Plan which was submitted to the NRC on March 13, 1995.

2.3.3 Building C

Combined with the general expansion of Building A in the 1969-1970 time period, a new building was erected to the east of Building A. The building sat unused until 1973 when B&W received a contract to fabricate a high-enriched uranium fuel called Type II fuel. The building became known as the Type II Plant or T-2 Plant, and processing of SNM in the building was authorized by the AEC as Amendment No. 83 to SNM-414. The layout of Building C when it was in a production mode is shown in Figure 2-3.

The processing of Type II fuel involved dissolving high enriched U_3O_8 in a solution of hydrochloric acid and hydrogen peroxide, then diluting with demineralized water. The diluted uranium solution was fed through dialysis columns and an electrolysis cell. The uranium solution was then passed through forming columns to create a solid fuel form. The solid fuel was rinsed, dried, and sintered in a furnace. The sintered fuel was placed into containers and stored prior to being shipped to another licensed site for finishing operations. The majority of the processing operations were conducted in gloveboxes, radiochemical fumehoods, or other ventilated, HEPA filtered enclosures. In addition, the room air from the building was exhausted through HEPA filters.

Type-II fuel processing produced several types of liquid wastes: process wastes, laboratory wastes, hexanol wastes, utilities and blow-down wastes, and sanitary wastes. Uranium-rich liquid process waste was concentrated in a boil-down unit and transported, along with solid waste containing recoverable amounts of uranium, to the Apollo facility for recovery.

Laboratory waste, primarily from sampling operations to determine the uranium concentration of solutions, was pumped to the evaporator-concentrator for boil-down.

Hexanol from the forming columns was recycled through both continuous and batch recovery systems. The continuous recovery system combined spent hexanol and a small amount of fresh hexanol from the storage tank, and then added small quantities of ammonia gas. The solution was fed to a wash column where contact with water removed the impurities in the hexanol. The hexanol was distilled to remove absorbed water before being returned to the forming columns. The water was sent to a 15,000 gallon holding tank for monitoring prior to pumping to the evaporator-concentrator. The bottoms from the evaporator-concentrator were pumped to one of two asphalt-lined holding ponds on the east side of Building C and the vapors passed through a scrubber where volatile chlorides were removed using a sodium hydroxide solution. The spent scrubber solution was also discharged to the holding ponds.

The batch recovery system was used to concentrate three hexanol-lean waste streams: small amounts generated when removing fuel from the forming columns; separation of fuel from hexanol in the collection vessel during the first step in the wash cycle; and, a side stream from the main hexanol stream going from the forming columns to the wash columns. Water from the batch process went to the 15,000 gallon holding tank for monitoring. Recovered hexanol was sent to the hexanol storage tank, and the bottoms were used to supplement the natural gas as fuel for the evaporator-concentrator.

Liquid from backwashing the deionizer units and blow-down from the boiler and cooling systems were sent to a lime treatment sump to neutralize the waste effluent, then were transferred to a sewer line which discharged into the Kiskiminetas River under a provisional permit from the Pennsylvania Bureau of Water Quality Management.

Shower and sink waste was piped to a holding tank for monitoring. The waste was piped to the septic tank if it was less than 1% of the uranium limits set in the then applicable 10 CFR

20 for liquid effluents to unrestricted areas. Waste which exceeded the administrative limit was pumped to an evaporator-concentrator for boil-down prior to recovery at the Apollo facility. Sanitary waste from commodes and urinals was piped to a septic tank which fed a 1,600 ft² leach field.

Gaseous effluent from the evaporator-concentrator was sent to a scrubber for treatment prior to release to the atmosphere. The gaseous effluent from the evaporator-concentrator consisted of air, carbon dioxide, nitrogen, and water vapor that was scrubbed with sodium hydroxide before being discharged to the environment. Flue gases were discharged directly to the atmosphere.

High enriched fuel was fabricated in Building C from 1973 until March 1978. Deactivation of Building C is discussed later in Section 3. Additional details of the SNM processing in Building C can be found in the Parks Facilities Characterization Plan which was submitted to the NRC on March 13, 1995.