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May 11, 1992

Mr. John W. N. Hickey, Chief
Fuel Cycle Safety Branch
Division of Industrial and
Medical Nuclear Safety
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Reference: Docket No. 70-135/SNM-145
Apollo Decommissioning Plan - Revision 2

Dear Mr. Hickey:

On August 30, 1991, Babcock & Wilcox (B&W) submitted Revision 0 of the Apollo Decommissioning Plan (the Plan) to the NRC. Revision 1 of the Plan was submitted on March 20, 1992 to provide an update of progress and to incorporate changes to the original Plan brought about by improved state-of-the-art technologies and agreements made with owners of the neighboring industrial facility.

On March 24, 1992, B&W received the formal Request for Additional Information (RAI) No. 1 from the NRC. Included in this RAI No. 1 were 130 questions or comments relative to the NRC review of Revision 0 of the Plan. On April 24, 1992, B&W provided responses to RAI No. 1 and indicated that information contained in these responses would be incorporated into the final revision to the Plan, as appropriate. In addition, on April 15, 1992 B&W submitted a conditional request for termination of License No. SNM-145.

Enclosed are the text pages which represent the final revision (Revision 2) to the Plan. For simplification, all text pages, including those previously submitted as Revision 0 and Revision 1, are resubmitted as Revision 2. Changes from earlier submittals, other than those resulting from necessary repagination, are identified with a vertical line in the right hand margin. Please insert these revised pages into your copies of the Plan and remove the superseded pages. The figures provided in Revision 1 are unchanged, except for Figure 2-31. A new Figure 2-31 is included with this submittal of Revision 2. No new figures have been added.

Please note that Revision 2 to Sections 4.0 and 5.0 and Appendix 3 are being provided under separate cover.

If you have any questions or require additional information, please contact me or Mr. Don K. Sgarlata of my staff.

Sincerely,

B L Haertjens

B. L. Haertjens, Manager
Technical Control

120008

BLH15/km

cc: J. Roth - USNRC Region I

Change: LA   Ltr. Encl. 1 0   NF12

Apollo Decommissioning Plan

SNM-145

Babcock & Wilcox Co.
Pennsylvania Nuclear Service Operations

Apollo, Pennsylvania

Revision 2

May, 1992

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ABBREVIATIONS

ABHP	American Board of Health Physics
ADP	Apollo Decommissioning Project
ADU	Ammonium Diuranate
AISC	American Institute of Steel Construction
ALARA	As Low As Reasonably Achievable
ARCO	Atlantic Richfield Company
ASAP	As Soon as Possible
B&W	Babcock & Wilcox
CAA	Controlled Access Area
CAL	Confirmatory Action Letter
CAS	Central Alarm Station
CCT	Clean Change Trailer
CFR	Code of Federal Regulations
CLT	Change Line Trailer
CPM	Counts Per Minute
DAW	Dry Active Waste
D&D	Decontamination and Decommissioning
DOP	Dioctyl Phthalate
DPM	Disintegrations Per Minute
EPA	U.S. Environmental Protection Agency
ER	Engineering Release
HAZWOPER	Hazardous Waste Operations and Emergency Response
HELP	Hydrologic Evaluation of Landfill Performance
HEPA	High Efficiency Particulate Air
HEU	High Enriched Uranium
HPGe	High Purity Germanium
HPP	Health Physics Procedure
H&S	Health and Safety
HSI	Health and Safety Instruction
HST	Health and Safety Trailer
HVAC	Heating, Ventilation, and Air Conditioning
IAEA	International Atomic Energy Authority
IDR	Internal Deficiency Reports
ISI	Industrial Safety Instructions
KVWPCA	Kiski Valley Water Pollution Control Authority
LEU	Low Enriched Uranium
LLD	Lower Level of Detection
LLRW	Low Level Radioactive Waste
LSA	Low Specific Activity
MCL	Maximum Concentration Level
MPAD	Maximum Permissable Annual Dose
MPC	Maximum Permissible Concentration
MPL	Maximum Permissible Level

MPOB	Maximum Permissible Organ Burden
mR	MilliRoentgen
M&TE	Measuring and Test Equipment
NaI	Sodium Iodide
NDA	Nondestructive Assay
NES	Nuclear Environmental Services Division of B&W
NIOSH	National Institute of Occupational Safety and Health
NIST	National Institute of Standards and Technology
NMC	Nuclear Materials Control
NPDES	National Pollution Discharge Elimination System
NRC	U. S. Nuclear Regulatory Commission
NUMEC	Nuclear Materials and Equipment Corporation
OSHA	Occupational Safety and Health Admisistration
PADER	Pennsylvania Department of Environmental Resources
PAH	Polycyclic Aromatic Halogens
PANSO	Pennsylvania Nuclear Service Operations
PCB	Polychlorinated Biphenyls
pCi/g	Picocuries of Total Uranium Per Gram of Material
pCi/l	Picocuries of Total Uranium Per Liter of Material
ppb	Parts per Billion
ppm	Parts per Million
QA	Quality Assurance
QAPP	Quality Assurance Policies and Procedures
QAO	Quality Assurance Outline
QC	Quality Control
QRB	Quality Review Board
R	Roentgen
RCZ	Radiation Control Zone
RFR	Requests for Reply
RWP	Radiation Work Permit
SAB	Safety Advisory Board
SCS	Soil Conservation Service
SNM	Special Nuclear Material
SRD	Self Reading Dosimeter
SRI	Shipping Receiving Instructions
ST	Shower Trailer
TCL	Target Compound List
TCLP	Toxic Characteristic Leaching Procedure
TLD	Thermoluminescent Dosimeter
VOA	Volatile Organic Analytes

DEFINITION OF TERMS

These definitions apply to the terms used in this decommissioning plan.

Apollo Facility: The NRC licensed processing facility, including the Main Building, West Bay, Annex, Box Shop and Compressor Room, on the Apollo site which was used for the manufacturing of high and low enriched uranium fuel.

Apollo Site: The geographic area in Apollo, Pennsylvania on which Babcock and Wilcox (B&W) and other industrial property is located. The Site is bounded by the Kiskiminetas River on the west, Warren Avenue on the east and private property on the north and south.

Area Manager: The Manager responsible for implementation of radiological and non-radiological safety requirements associated with activities and areas of the facility for which he is assigned functional responsibility. The general title "Area Manager" does not necessarily refer to the title of any specific position in the Apollo Decommissioning Project organization and position nomenclature.

Characterization: The ongoing B&W program of sampling and analyzing materials on the Apollo site to determine the nature and extent of radiological and chemical contamination.

Contamination-Free Area: Any unrestricted area, or any area within a restricted area, in which contamination is maintained below administrative and/or regulatory limits.

Controlled Area: An area within a restricted area with special radiological controls over and above the access controls for restricted areas.

Controlled Contamination Area: Any area within a restricted area in which radiological contamination exists at or below administrative and/or regulatory limits. The entry to all such areas is clearly posted.

Deconstruction: The act of dismantling a building under controlled conditions for the purpose of remediating the location.

Diversion Trenches: Lined, excavated channels into the existing soil material which will direct surface water into the Sediment Basin.

Dry Active Waste: Low level radioactive waste consisting of paper, plastic, cloth and other readily compactible materials.

Envirocare Facility: A waste disposal facility operated by Envirocare of Utah, Clive, Utah, which is licensed by the State of Utah to receive and dispose of certain low level radioactive wastes.

Fallout: The descent through the atmosphere of radioactive particles resulting from a nuclear operation.

Final Radiation Survey: A radiation and contamination survey which is performed by a licensee at the conclusion of planned decommissioning work. The purpose of the survey is to verify that the levels of contamination and radiation meet those which are acceptable to the NRC for release for unrestricted use. The survey data are provided to the NRC at the time of request for license termination.

Free Release: Items, facilities, or areas which have been surveyed for radiation and radioactive contamination by a licensee and determined to be acceptable to the NRC for release for unrestricted use. Such items, facilities, or areas are no longer controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials.

Licensed Low Level Radioactive Waste (LLRW) Disposal Site: An NRC or agreement state licensed facility which is authorized to receive and dispose of radioactively contaminated material. The current sites are located at Barnwell, SC, Richland, WA, Beatty, NV, and Clive, Utah.

Licensed Metals Contractor: A licensee of the NRC or an agreement state and authorized to receive, process (e.g. volume reduce, decontaminate, metal melt) and dispose of radioactively contaminated scrap metal resulting from the decommissioning of the Apollo site.

Main Building: A rectangular, high bay building measuring approximately 72 ft. by 452 ft. which is a part of the Apollo Facility that was used for the manufacturing of high and low enriched uranium fuel. This building was originally the shipping portion of the Apollo Steel Company.

Mixed Waste: Waste that contains radioactive material and chemicals above prescribed limits as defined by the NRC and the EPA, respectively.

Mixing Zone: The distance between the point where Apollo site wastes are discharged into the Kiskiminetas River to the point where complete mixing occurs.

Modutank: An approximately 85,000 gallon settling tank which will be used to accept and continuously discharge the water generated by the soil dewatering operation.

Monitoring: The real time measurement of radiological constituents.

Offsite: An area on the Apollo site which is not owned or leased by B&W and which is bounded by the Kiskiminetas River on the west, Warren Avenue on the east, the parking lot on the south and private property on the north.

Onsite Storage: Utilizing B&W owned or leased areas on the Apollo site for the temporary storage of material generated during decommissioning.

Parking Lot: An area on the Apollo site which is approximately 2.5 acres of L-shaped land and is bounded by the Kiskiminetas River on the west, Warren Avenue on the east, private property on the south, and the offsite area on the north.

Parks Township Site: An NRC licensed facility operated by B&W and located approximately 6 miles northwest of the Apollo site.

Processing Plant: The Processing Plant is a HEPA-filtered facility which contains a screener, a crusher and sampling equipment. The equipment will reduce the size of the soil and building rubble to a uniform consistency that facilitates sampling and packaging for disposal.

Radiation Control Zone(RCZ): An isolated controlled contamination area, within a controlled or contamination-free area, which is posted and marked by clearly delineated access control boundaries.

Released for Unrestricted Use : Items, facilities, or areas which have been surveyed for radiation and radioactive contamination by a licensee and determined to be acceptable to the NRC for release for unrestricted use. Such items, facilities, or areas are no longer controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials.

Remediation: The act of decontaminating and/or deconstructing a facility to radiation and contamination levels that are acceptable to the NRC for release for unrestricted use. Remediation allows for releasing the facility for unrestricted use.

Restoration: The final grading and planting of a site following remediation.

Restricted Area: Any area to which access is controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials and industrial safety hazards.

Sampling: The collection of material (solid, liquid, gas) for subsequent analysis.

Sediment Basin: A high density polyethylene (HPDE) or equivalent lined pond for separating sediment from surface water runoff and subsequent sampling prior to discharge to the Kiskiminetas river.

Shoptalk: An informal discussion, normally led by the work group supervisor and including specific job related topics such as safety training, work assignments, schedules and work progress.

Soil: Includes surface and subsurface soil material, concrete slabs and subsurface concrete structures, building material, debris, and rubble, and miscellaneous non-metallic material, which have been processed.

Surge Piles: Interim storage locations for soils and building rubble. Material will be removed from the Surge Piles to feed the Processing Plant.

Task: A specific work assignment or job such as removal of a built-up roof.

Unrestricted Area: Any area to which access is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials.

Utilities: Includes electrical power, gas, water, sewer, telephone, and miscellaneous service related items located on the site.

1.0 GENERAL INFORMATION

1.0 GENERAL INFORMATION

1.1 Current Licensee

The name of the licensee is Babcock & Wilcox (B&W), Pennsylvania Nuclear Service Operations (PANSO), an operating unit of the Nuclear Environmental Services Division in the Government Group of Babcock & Wilcox. Babcock & Wilcox is a subsidiary of Babcock & Wilcox Investment Company, a subsidiary of McDermott Inc., which is a subsidiary of McDermott International, Inc., and has its principal offices at 1010 Common Street, New Orleans, LA 70161.

Babcock & Wilcox, PANSO, operates a site in the Borough of Apollo, Armstrong County, Pennsylvania.

The full address is: Babcock & Wilcox, Pennsylvania Nuclear Service Operations, 609 North Warren Avenue, Apollo, PA 15613.

1.2 License Number

The Apollo site operates under Nuclear Regulatory Commission (NRC) License No. SNM-145. Babcock & Wilcox, the current operator of the site, has operated the facility since 1971. From 1967 to 1971, Atlantic Richfield Company (ARCO) was the operator of the Apollo site. The facility was operated by Nuclear Materials and Equipment Corporation (NUMEC) starting in 1957 until 1967.

1.3 Submittal of Apollo Decommissioning Plan

The decommissioning plan for Apollo was originally submitted to the NRC on August 30, 1991 (Rev. 0). Revision 1 was submitted on March 20,1992 and provided an update of progress since the August 30 submittal. The current revision incorporates changes and clarifications resulting from the B&W responses (April 24, 1992) to the NRC formal Request for Additional Information (RAI) No. 1 (March 24, 1992) and from informal discussions held during the NRC review of the Plan and the preparation of the Environmental Assessment.

The scope of the Plan, which generally conforms to the guidance in Regulatory Guide 3.65, is as follows:

1. It briefly describes (Section 2.5) the decommissioning activities that have been conducted at Apollo since 1978 under License No. SNM-145, in order to place in appropriate context the continuing and future decommissioning activities.

2. It describes the decommissioning activities presently underway and which will be completed under present authority (Section 2.6) and activities that will be completed following approval of the Apollo Decommissioning Plan (Section 2.7) if the following conditions are satisfied:

   a. The disposal site operated by Envirocare at Clive, Utah, under a Utah license can receive and dispose of large volumes of low-activity (uranium contamination below 2000 pCi/gm) soil and crushed brick/block from the Apollo plant under terms and conditions acceptable to B&W;

   b. Necessary permits and/or approval for such activities are issued by the appropriate agencies in a timely fashion;

   c. Contaminated materials at the Apollo site continue to be classified as low level radioactive waste, and not as mixed waste; and

   d. B&W continues to have access to adjacent non-B&W owned property to conduct remediation activities.

3. It describes (Section 2.7) the additional decommissioning activities that B&W will undertake once the NRC approves the Plan.

4. Consistent with the letter from the NRC dated July 31, 1991, it specifies (Section 4.0) the residual contamination limits for release of the Apollo site for unrestricted use; namely, those specified in Option I of the October 1981 NRC Branch Technical Position "Disposal or Onsite Storage of Residual Thorium or Uranium from Past Operations."

5. A groundwater pathway analysis (Appendix 3) was prepared and submitted on October 10, 1991.

The status of the uncertainties listed in Item 2 above has been sufficiently resolved that B&W submitted a conditional request for termination of License No. SNM-145 to the NRC on April 15, 1992. Termination of the license and authorized activities will occur when:

1. The NRC approves this Plan, and

2. The Apollo site is remediated to the criteria described in this Plan, and

3. The NRC concurs that the site meets the free release limits specified in this Plan.

If issues beyond B&W's control result in the inability to complete the planned decommissioning and disposal of LLRW prior to December 31, 1992, a viable burial alternative may not exist. In this case, B&W will promptly notify the NRC of changes in decommissioning activities and schedules and may need to have License No. SNM-145 amended to a possession-only status.

In the meantime B&W intends to proceed with the ongoing activities described in Section 2.6 of this Plan in accordance with the approximate schedules contained in Appendix 2 and discussed in Section 2.8. Similarly, B&W will conduct the activities described in Section 2.7 upon approval by the NRC.

1.4 Apollo Decommissioning Activities

For B&W's Apollo site, decommissioning was initiated in 1978 when production ceased in a portion of the facility. Decommissioning has been an on-going activity since then, with an increase in activity in 1983 when another area ceased production, and a further increase in decommissioning activity in 1990, when B&W elected to proceed more rapidly. These decommissioning activities have been performed under the authority of B&W's NRC License No. SNM-145.

Among the major Apollo site decommissioning milestones achieved to date by B&W are:

- Completed disposal at a licensed site of high-enriched uranium (HEU) processing equipment in June 1980.
- Completed disposal at a licensed site of low-enriched uranium (LEU) processing equipment in October 1984.

- Completed deconstruction of small structures (i.e. box shop and annex) that abutted two sides of the Apollo Plant and the neighboring facility in October 1990.

- Completed approximately 95% of the radiological characterization of the site in March 1991.

- Completed removal of a portion of the second floor (i.e., HEU area) of the plant July 1991.

- Completed deconstruction of the laundry building in August 1991.

- Removal and disposal of all materials, including soil, contaminated above 2000 picocuries of total uranium per gram by December 1991.

Other decommissioning activities are also continuing under the authority of NRC License No. SNM-145 as indicated in Section 2.6.

The deconstruction of the external walls of the Main Building, extensive soil excavation (i.e., sewer line and riverbank excavation) and operation of the crushing plant will commence after NRC approval of this Decommissioning Plan.

1.5 B&W's Decommissioning Tasks

The tasks required for decommissioning a nuclear fuel cycle facility, such as the Apollo site, include:

- Implementation of proceduralized selected tasks in a manner that protects the health and safety of the workers and the public and that precludes the inadvertent spread of contamination. All operations are implemented in a manner consistent with the ALARA concept. (See Sections 2.4.1, 2.4.3, 3.2, and 3.3)

- Removal and recovery of the SNM inventory and converting it to a form suitable for transfer to an authorized receiver. This generally includes equipment clean out, scrap recovery, and similar operations. (See Sections 2.5.1, 2.5.2, 2.5.3, and 2.5.6)

- Disposition of process equipment. All nuclear materials chemical processing equipment (HEU, LEU, and laundry equipment) was removed from the site and sent to a licensed LLRW disposal facility by the end of 1984. Presently, decommissioning equipment (cranes, excavators, backhoes, etc.) that enter the site or the Main Building, are surveyed and, if necessary, decontaminated to Annex C levels of License SNM-145 prior to removal from the Main Building, or the Apollo site. (See Sections 2.4.1, 2.4.2, 2.4.3, 2.4.5, and 3.3.3 A4-6)

- Site characterization to determine the extent and levels of residual radioactive contamination. This includes sampling and analysis of soils, structural materials, and groundwater, as well as the performance of calculational analyses of radiation dose rates. (See Section 2.3)

- Selection and implementation of methods for reducing the residual radioactive contamination to levels acceptable for the NRC to release the property for unrestricted use. These methods include removal of the surfaces of building materials by one or more of several processes; physical processing of soil; deconstruction of structures and their disposal at an authorized site; and other operations. (See Sections 1.5 and 2.4.2)

- Final radiation survey of the property to verify that the residual radioactivity is below the level acceptable for the NRC to release it for unrestricted use. (See Sections 2.7.3 and 4.0)

- Preparation of detailed plans, schedules, budgets and other information to ensure the work is managed effectively. Many support activities, such as training, purchasing, and accounting, are also required. (See Sections 2.4.1, 2.8, 2.9, and 2.10)

During planning for the decommissioning of the Apollo facility and site, alternative decontamination and decommissioning methods were evaluated. The decontamination and decommissioning methods described in the Apollo Decommissioning Plan are the result of several years of intense evaluation. Thousands of man-hours were invested in the characterization of the Apollo facilities and site, researching alternative decontamination techniques, and evaluating alternative decontamination and decommissioning approaches. Some of the decontamination and decommissioning alternatives evaluated included:

- acidic and basic soil leaching

- soil washing
- soil screening
- concrete block/brick decontamination by means of scabbling, needle scaling, grit blasting, CO_2 blasting, etc.
- metallic decontamination by grit blasting, chemical dipping, etc.
- crushing versus non-crushing of contaminated soil

In addition to these evaluations conducted for the Apollo facility, Babcock & Wilcox has extensive decontamination and decommissioning experience at their other NRC licensed facilities. This experience base includes early work at the Apollo Facility, the Parks Township Plutonium Fuel Manufacturing Facility, the Lynchburg, VA Commercial Nuclear Fuel Plant, the Lynchburg, VA Naval Nuclear Fuel Facility, and the decommissioning of the Lynchburg, VA Plutonium Development Laboratory. The "lessons learned" from these prior decontamination and decommissioning activities were evaluated and results incorporated into the Apollo Decommissioning Plan. This extensive prior experience base and skilled work force enabled Babcock & Wilcox to develop a highly competent decommissioning approach and plan.

Based upon the characterization data, the research and development program results, the prior decontamination experience, and engineering cost analyses, the decision was made to remove and dispose of all said contaminated above regulatory limits and to completely deconstruct and dispose of the site buildings. This decision was predicated on the following facts:

- Soil leaching, washing, and screening tests did not decontaminate the soil below regulatory limits
- Surface scabbling of building concrete block and brick was not a viable alternative based upon the penetration of contamination into the porous matrix.
- Surface decontamination, including scabbling of concrete floors, was not a viable alternative because of the penetration of contamination into the concrete. The decontamination of plant floors was further complicated by the presence of multiple floors; one on top of the other. Each floor was contaminated.

- Soils inside of the Main Building were contaminated to a depth that precluded removal while the buildings remained standing. Temporary support of the Main Building foundation and walls were prohibitively expensive (several million dollars for temporary foundation support).

The selected decontamination and decommissioning option became particularly viable with the licensing of the Envirocare disposal site for the large volumes of soil and building rubble generated by the Apollo decontamination and decommissioning project.

The alternative treatment option to crush and process soil was selected because:

- the ability to obtain representative samples from a heterogenous material

- an increase in shipping packed densities

- a resulting reduction in transportation costs to licensed LLRW disposal facilities

This Decommissioning Plan addresses all phases of the decommissioning work performed since 1978. Completed work is discussed in summary form; on-going activities are discussed in detail; anticipated activities are discussed either conceptually or to a level of detail consistent with current planning. If necessary, further detail on the latter will be provided when detailed planning is complete. Site characterization data are provided in summary form; details are available in the project files. The existing site health and safety programs, which for years have been effectively providing for protection of occupational and public health and safety in a manner consistent with ALARA, remain in place with changes only in a few operational details. These programs are summarized in this plan.

1.6 Categorical Exclusion

Pursuant to 10 CFR § 51.22(c)(11), approval of the Apollo Decommissioning Plan is eligible for a categorical exclusion from the review requirements of 10 CFR Part 51. Appendix 1 to this Plan provides an evaluation of the basis for a categorical exclusion.

2.0 DECOMMISSIONING OBJECTIVES, ACTIVITIES, AND SCHEDULE

2.0 DECOMMISSIONING OBJECTIVES, ACTIVITIES, AND SCHEDULE

2.1 OVERVIEW: Description of Facility and Operation

2.1.1 Apollo Site Operations

The Apollo site is located in an industrial complex in the Borough of Apollo, Pennsylvania. The principal NRC licensed activities conducted by Babcock & Wilcox (B&W) at this site were housed in two areas, the Apollo Facility and the laundry building. The main business conducted at this site was manufacturing uranium oxide fuels for the government and the commercial nuclear power industry. During these plant operations, there were no known waste burials on the Apollo site resulting from past licensed operations. Further, there has been no evidence of waste burial found during site characterization efforts or during the soil remediation activities completed to date.

Nuclear fuel manufacturing operations commenced in the Apollo Facility in 1957 and were terminated in 1983. The primary operation was the chemical conversion of both low enriched uranium (LEU) and high enriched uranium (HEU) hexafluoride gas into uranium dioxide powder. HEU processing began in 1958 on the first floor of the Main Building. In 1963 this operation was relocated to the second floor and continued until it was terminated in 1978.

Small scale LEU production also began on the first floor in 1958. These facilities were moved to the second floor in 1960. A second small scale production line was established on the second floor later in 1960 and discontinued in 1962. The original small scale production line was replaced by a large scale, continuous production line in 1963. This line was terminated in early 1983.

The laundry building was constructed in 1959 and began operations in late 1960. Initial activities consisted of decontaminating protective apparel for both B&W and outside customers including the government. In March 1965 an amendment to the laundry facility license was issued to allow decontaminating submarine control rod drive mechanisms for the United States Navy. These activities continued until they were terminated in February 1984.

During these operations, there was no known history of leaks or spills that caused extensive contamination of the site or buildings that could adversely affect the health and safety of the decontamination and decommissioning work force or the general public during these decommissioning operations. A more detailed discussion of historical incidents is contained in Section 3.1.3.4.

In late 1978, B&W began decommissioning work on a limited basis. The decommissioning work continued and its scope increased over the last several years. A discussion of decommissioning work performed from 1978 to August 1991 is included in Section 2.5 of this plan. A more detailed discussion of site activities and operations during the life cycle of the Apollo Facility is contained in Section 3.1.

2.1.2 Apollo Site

To organize, manage, and control decommissioning activities, the Apollo Project Site has been divided into three key areas: the Apollo Facility, the parking lot, and an offsite area on land owned and occupied by another industrial facility. (Figure 2-1)

The B&W Apollo Facility situated on B&W property is on the east side of the site. It consists of approximately one acre of roofed area bounded by the offsite area on the north, west, and south, and by the parking lot on the east. The Apollo Facility is a two story structure that previously contained uranium processing and manufacturing facilities and the associated building services.

The parking lot, an approximately 2 1/2 acre L-shaped area, is situated on the south and east portions of the Apollo site. Approximately one acre of the total 2 1/2 acres is owned by B&W, one acre is leased by B&W, and the remaining 1/2 acre is offsite. The parking lot is bounded by the Kiskiminetas River on the west, Warren Avenue on the east, private property on the south, and the offsite area occupied by the neighboring industrial facility on the north. The laundry building, the small block building, and several utility services were located in the parking lot.

The offsite area, which is not owned by B&W, is on the west and north sides of the site. It consists of approximately three acres of land bounded by the Kiskiminetas River on the west, B&W property on the east, the parking lot on the south, and private property on the north. The industrial facility's previous neighboring main buildings, office building, south bay, paint shed, breezeway, and alcove were located in the offsite area. This area also contains the north, middle, and south sewer outfalls, several utility services, and a portion of the riverbank.

2.2 OVERVIEW: Decommissioning Objectives and Approach

2.2.1 Objectives

Babcock and Wilcox (B&W) decommissioning objectives for the Apollo, Pennsylvania uranium fuel plant are to:

A. Perform decommissioning activities and tasks leading to the termination of NRC License No. SNM-145 and release of the remediated site for unrestricted use, and

B. Perform the decommissioning activities and tasks in a controlled manner, consistent with applicable federal, state, and local regulations for maintaining the health and safety for workers, other onsite personnel, and the general public.

2.2.2 Approach

The remaining remediation activities are being completed in two phases:

Ongoing Decommissioning Activities - These activities, as discussed in Section 2.6, continue the decommissioning work associated with the site and building. These activities, are being conducted under the existing B&W NRC License No. SNM-145, and include the following tasks:

- The deconstruction of the Apollo Facility interior walls, floors, and mezzanines. Upon completion of these activities, the Apollo Facility will be reduced to the Main Building which consists of four exterior walls, a roof and the necessary utilities.

- Processing of concrete block, brick and soils in preparation for disposal.

- Disposal of contaminated building material and soil containing more than 2000 pCi/g in a licensed LLRW disposal facility was completed in December 1991.

- Limited remediation of soils containing less than 2000 pCiU/g and more than 30 pCiU/g and disposal of that soil at a licensed LLRW disposal facility. In general, these efforts will not involve extensive excavations (i.e. the sewer lines and the riverbank).

Ongoing decommissioning activities will be conducted in accordance with ALARA principles to minimize the potential safety risks associated with the activities.

<u>Completion of Decommissioning Activities</u> - These activities, discussed in further detail in Section 2.7, will commence after the Decommissioning Plan has been approved by the NRC, and will involve:

- The extensive remediation of site soils containing less than 2000 pCiU/g and more than 30 pCiU/g and the disposal of that soil at a licensed LLRW disposal facilities (Figure 2-4).

- Deconstruction of the Main Building (Figure 1.1). This activity will include the removal of the exterior building walls and roof.

- The remediation of contaminated site sewers (north sewer, middle sewer and south sewer (Figure 2-1).

- The operation of the soil, concrete and block rubble processing plant (Figure 2-24).

- Conduct a final radiation survey of the site and preparation of a final survey report by B&W and confirmatory survey by the NRC.

2.3 Site Characterization

Characterization and sampling has been an ongoing program at the Apollo site. The goals of the characterization program are to determine and quantify the nature and extent of contamination. Characterization includes both radiological and chemical.

Sampling techniques include motorized core soil drilling using continuous split spoon sampling, hand digging and sampling, wall scabbling, floor scabbling, grab sampling, and monitoring wells. Sampling is performed according to procedures and engineering releases approved by the Pennsylvania Nuclear Services Operations (PANSO).

The protocol for the (systematic) collection of soil samples is based on the guidance in NUREG/CR-2082, "Monitoring for Compliance with Decommissioning Termination Survey Criteria." It is the same protocol described in Section 4.0 of the Decommissioning Plan. Additionally, the radiological history of the site, summarized in Section 3.1, was used to determine where to take additional biased samples. All suspect areas of the Apollo site and the neighboring site where access has been allowed will have been sampled as part of the characterization program.

2.3.1 Radiological Characterization

Radiological characterization is approximately 99 percent complete. Figure 2-2 identifies the locations where radiological samples have been taken. The balance of radiological characterization will determine the absence or presence of radiological contamination along the near shore of the riverbank, from the Apollo bridge to the Vandergrift bridge (Figure 2-18).

Recent radiological characterization activities completed since the submission of the Apollo Decommissioning Plan (Revision 0) have included:

- An evaluation of approaches to bound the extent of contaminated areas such as the north and south sewer. It has been concluded that precise determination of the contamination boundaries through site characterization is not practical because of the heterogeneous distribution of contamination. As a result, a decision has been made to use in-process soil sampling and analyses with a sodium iodide counting system to determine the extent of contamination in such areas. Current soil excavation plans are to excavate each contaminated area until the in-process sampling data indicate that regulatory limits have been reached. This in-process survey system will not be used to establish the free release of an area. This free release will be accomplished using the sampling methods and survey protocols described in Section 4.0. As a result, further site characterization to bound the areas of uranium contamination in the north and south sewers, etc. have been terminated.

- The completion of the characterization of the concrete floor in the south end of the Main Building. The results indicated that this floor area contained <2000 pCiU/g. Characterization results have been incorporated into remediation plans for this floor area.

- Sampling of the south sewer for Technetium-99 contamination is continuing. Initial results have indicated that low levels of Tc^{99} exist in several isolated areas. The results have been confirmed by a second laboratory. Soil with Tc^{99} contamination, which exceed the regulatory limit for free release, will be shipped to a licensed LLRW disposal facility. In addition, soil samples will be taken in the vicinity of the Laundry Building and analyzed for Tc^{99}. The results of the Tc^{99} investigation, including the nature of the occupational and public population dose, will be included in the final Pathway Analysis (Appendix 3).

Environmental radiological monitoring is ongoing and contributes to the overall characterization effort, particularly in the riverbank area.

Samples are analyzed by gamma spectroscopy. A total of 52 fission product, activation product, byproduct, and natural product isotopes are analyzed for including ^{235}U; ^{238}U; ^{232}Th; ^{60}Co; ^{137}Cs; and ^{241}Am. The characterization program has assumed the uranium is not soluble. Solubility studies have been conducted to confirm this assumption. PANSO approved procedures are used for analysis for radionuclides in various matrices or geometric forms.

Prior to 1985, characterization efforts focused on the Main Building interior in support of the decontamination and removal of HEU and LEU processing equipment. Since 1985, a comprehensive radiological characterization program has been ongoing throughout the Apollo site in support of all other decommissioning efforts of the Apollo Decommissioning Project. Characterization efforts were directed at soils, walls, floors, roofs, groundwater, river water, and runoff water. Table 2-1 provides a radiological characterization summary for the Apollo Site.

Due to the historical knowledge available and the completeness of the site radiological characterization, all possible areas of contamination that could affect the decommissioning activities have been characterized and are understood.

A. Soil Characterization. Approximately 7,000 soil samples have been taken throughout the Apollo site. Figure 2-4 indicates the extent of radiological contamination >30 pCi/g, to depth, across the site. Figures 2-5 and 2-7 indicates the extent of radiological contamination >2000 pCi/g, to depth, across the site. The samples were collected on a systematic basis using a 25 ft. x 25 ft. grid system.

B. Wall Characterization. Approximately 700 wall samples have been taken from the Apollo Facility to determine the nature and extent of the wall contamination. A study was conducted to determine how contamination levels varied within concrete block. The study determined that over 66% of the contamination is in the first half inch of the block. Figures 2-8 and 2-9 delineate the contamination levels of the walls.

C. Floor Characterization. Over 300 floor samples have been taken from the two floors of the Apollo Facility to determine the nature and extent of the contamination. Figures 2-10 and 2-11 indicate the contamination levels of the floors.

D. Roof Characterization. Over 100 roof samples from the Apollo Facility roof have been collected and analyzed. Uranium contamination ranged from 11.27 pCi/g to 5600 pCi/g, indicating the need for disposal of the built up roof at a LLRW burial site.

E. Water Characterization. Groundwater characterization data were collected during a hydrogeological assessment performed during November and December of 1990. Groundwater was characterized for radiological contamination, chemical contamination, and physical properties. A total of 22 monitoring wells were installed at 15 different locations (Figure 2-12).

The monitoring wells were sampled and analyzed using gamma spectrographic, alpha and beta analysis, and analyzed for the U.S. Environmental Protection Agency (EPA) Target Compound List (TCL). Discussions of the chemical results are found in Section 2.3.2. Roof runoff water and surface water have also been characterized. None of the water samples exceeds the NRC limit for unrestricted release of water to the environment.

F. River Water and Sediment Characterization. A river water and sedimentation sampling plan was developed by reviewing records of plant activities to assess potential discharges of contaminated water and sediment to the river and flow and sediment transport conditions. River water and sediment sampling in the Kiskiminentas River has been conducted at 13 permanent sampling points located upstream, beside, and downstream of the Apollo site. None of the river water sample results exceed the NRC limit for unrestricted release of water to the environment. Uranium contamination in the sediment along the near shore ranged from 4.6 pCi/g to 57 pCi/g, indicating the need to remediate a small amount of the sediment. Supplemental sampling and characterization of the riverbed was performed (Figures 2-17 and 2-18). The data indicate that contamination is not a problem in the river sediment. The sampling points at the river's edge indicate a potential for contamination along the riverbank, especially in the previously mentioned areas requiring remediation. A characterization program is underway to determine the presence or absence of radiological contamination along the near shore.

2.3.2 Chemical Characterization

Currently planned chemical characterization is approximately 90 percent complete. The balance of chemical characterization is being performed to determine if chemicals are present in radiologically contaminated soil that would prevent disposal at a licensed LLRW disposal site.

In June and July of 1989, soils from the parking lot were analyzed for EP toxicity testing of metals, beryllium, reactive cyanide, reactive sulfide, polychlorinated biphenyls (PCBs), and soil gas evaluations. Figure 2-13 shows the sample locations for the 1989 toxicity characterization program. Table 2-2 summarizes the data. Reactive cyanide levels of 15 to 330 ppm were detected at six of the locations. To further evaluate the cyanide concentrations, the samples were analyzed using a more extensive analytical approach to verify the concentrations, presence, or absence of the cyanide. These results ranged from 1 to 8 ppm, which are below the EP toxicity levels.

Because of environmental regulatory changes, an additional chemical characterization program was initiated in June 1991 and completed in August 1991. The locations of the additional sampling points are shown in Figure 2-3. The samples were taken and analyzed for VOAs, PCBs, polycyclic aromatic hydrocarbons (PAHs), metals, reactive cyanide, and reactive sulfide. Analysis indicates that the soils are not a RCRA characteristic waste. (40 CFR 261).

In November and December of 1990, a comprehensive groundwater survey was conducted to determine if chemicals were present in the groundwater. (See Figure 2-12 for the locations of the monitoring wells.) Both groundwater and soils from several of the wells were analyzed for volatile organic analytes (VOAs/VOCs), PCBs, pesticides, semi-VOAs, and metals. Tables 2-3 and 2-4 summarize the chemical portion of the groundwater assessment. Results indicate that VOA concentrations in water were elevated above Maximum Contaminant Levels (MCLs) in monitoring wells 3A, 5A, and 15A. Metal concentrations in water were elevated above MCLs at wells 1A, 1B, 10A, and 15A. High metals values are suspect due to the high turbidity values. Upgradient wells (above the Apollo site) also contain some metals and commercial solvents of uncorrelated origin. Results showing exceedences of chemical constituents above MCL's were reported to the Pennsylvania Department of Environmental Resources (PADER). Monitoring wells 1A, 1B, 10A, and 15A were redeveloped and resampled in November of 1991. Some exceedences of chemical constituents still existed and were provided to PADER in March 1992.

2.4 Management of Apollo Site Decommissioning

Significant progress has been made in the decommissioning of the Apollo site. This section describes the procedures and technical controls that have been used for many years at PANSO to manage operations, including decommissioning activities; the control mechanisms used during decommissioning activities to protect the health and safety of the general public and the decommissioning work force; the site support services associated with decommissioning; and the methods for treatment and disposal of contaminated material.

2.4.1 Procedures and Management Controls

As has been the case for over 30 years, operations with nuclear materials, including decommissioning activities, at the Apollo site are performed in accordance with written instructions. These written instructions have been utilized in the successful completion of previous decommissioning activities and will continue to be used for ongoing and future decommissioning activities.

There are five types of written instructions: procedures, workplans, engineering releases, Radiation Work Permits (RWP's) and work requests. These documents are reviewed and approved by individuals who perform key management functions in the PANSO organization.

A. Procedures

In addition to meeting the requirements of NRC License No. SNM-145, all operations comply with two PANSO documents:

- the Radiological and Industrial Safety Manual; and
- the Quality Assurance Policy and Procedure Manual.

Procedures are reviewed and approved by the appropriate technical disciplines within PANSO, such as Operations, Engineering, Quality Assurance, Health and Safety, Nuclear Safety and Regulatory Compliance, and Nuclear Materials Control.

B. Work Plan

The final decommissioning activities described in Section 2.7 are organized into three major efforts defined in work plans: the Soil Remediation Plan, the Water Control Plan, and Apollo Facility Deconstruction Plan.

Approved work plans define the remediation work to be done, list the permits required to perform remediation work, estimate the volumes and weights of material that will be produced during remediation, and identify the specific engineering releases (i.e., detailed work instructions) that will be required to define the deconstruction work in more detail.

Each work plan is subject to an internal review and approval in accordance with applicable PANSO procedures. These procedures provide a disciplined mechanism for completing appropriate review for assuring compliance with applicable regulations, codes, permits, licenses, and other similar requirements. Included in the review process are key PANSO management and technically qualified personnel. The result of each review is formally recorded.

C. Engineering Release

Decommissioning work within the Apollo Decommissioning Project is conducted using approved detailed work instructions called engineering releases (ERs).

Each ER is associated with an approved work plan, which establishes the technical parameters (applicable regulations, codes, permits, licenses, and other similar requirements) of an ER. Using these technical parameters, work instructions are written to define the scope of work in sufficient detail to reflect sequential and logical progression of work operations and to ensure that health and safety requirements are met. A checklist is used to provide general guidance for preparing an ER.

The review, approval, and implementation of an ER are completed according to applicable PANSO procedures.

The PANSO technical disciplines involved in the review and/or approval of ERs are Engineering, Quality Assurance, Health and Safety, Environmental and Regulatory Affairs, and Nuclear Materials Control.

D. Radiation Work Permit (RWP)

RWPs specify the necessary radiation safety controls, including personnel monitoring, monitoring devices, protective clothing, respiratory protection equipment, special air sampling, and additional precautionary measures to be taken. Radiation Work Permits are issued for nonroutine activities where there is a need to prescribe the conditions under which the work may be done in order to assure adequate protection of workers and the public from the potential radiological hazards that may be encountered.

The area manager is responsible for ensuring that an RWP is obtained from Health and Safety and for ensuring that only personnel who have completed the necessary training are assigned to work under the RWP. Health and Safety personnel evaluate and approve the RWP request and determine the necessary radiation safety controls. The radiological safety evaluation of the RWP triggers use of the ALARA Plan when the appropriate criteria are met. Information taken into account in issuing the RWP includes: type and location of work to be performed, radiation and contamination types and levels, and effects on work being performed simultaneously in other areas, as well as on the environment.

All RWPs have expiration dates, and the status of issued RWPs is reviewed on a routine basis by Health and Safety personnel. Upon completion of the work under the RWP, the requestor is responsible for ensuring that the RWP is terminated and that the work area is returned to acceptable conditions, as determined by Health and Safety personnel.

E. Work Requests

Work requests are detailed work instructions that are used to perform work of a non-radiological nature. Examples of the types of work which would be controlled by a work request are: plumbing repairs/installation, electrical repairs/installation, HVAC repairs/installation, installation of haul roads, etc. The work requests are written to define the scope of work in sufficient detail to reflect sequential and logical progression of work operations and to ensure that health and safety requirements are met.

The technical disciplines involved in the review and approval of work requests are Engineering and Health and Safety.

2.4.2 Potential Safety Hazards

For each of the methods planned to accomplish the activities at the Apollo site, potential safety hazards must be controlled to minimize the risk to both onsite personnel and the general public. An analysis of the previously completed decommissioning activities, the ongoing decommissioning activities, and the planned decommissioning activities was performed to determine required safety control methods and procedures. The results of the analysis indicate that the safety methods and procedures necessary for ongoing and completion of decommissioning activities are nearly identical to those of the completed decommissioning activities. Thus, all safety measures used in the successful completion of past activities that are consistent with existing site requirements and practices will be continued during the ongoing and future decommissioning activities.

The following sections describe potential hazards and the respective safety precautions used to minimize them:

A. Dismantling Contaminated Components

Dismantling contaminated components involves such potential hazards as burns from hot material or torches, the spread of contamination, electrical shock, eye flash, and smoke from torch operations. Standard industrial safety equipment and clothing are used to protect personnel against these potential hazards.

To protect personnel, the public, and the environment from potential radiological hazards associated with dismantling activities, the following safety precautions are put in place:

- a radiation work permit (RWP) is issued, as required by Health and Safety personnel;
- temporary exhausted and HEPA-filtered enclosures are erected around dismantling areas that may generate contaminated dust, as required by Health and Safety personnel;
- airborne contamination samplers and surface contamination radiation monitors are utilized, as required by Health and Safety personnel, so that operations can be suspended promptly, if required, and evaluated for additional preventive actions;
- respiratory protective equipment is used, when required by Health and Safety personnel;
- the building air exhaust system keeps the building at a negative

pressure relative to the outside and uses HEPA-filters to contain potential airborne contamination;
- continuous sampling of the building air exhaust system is conducted to verify that all emissions are within NRC limits.

Potential radiological hazards due to waste generation during dismantling activities are expected to be minor. Liquid effluent is not anticipated from these planned decommissioning activities. Solid wastes generated by deconstruction activities are packaged as dry waste for shipment and disposal.

B. Decontamination

Decontamination methods may produce solid waste streams, including particulate contaminated air. The building air may contain uranium contaminated dust, which is cleaned by HEPA-filters before being recycled within the facility or discharged to the outside. Waste shipments are made in compliance with regulatory requirements.

1. Manual scrubbing and abrasive cleaning methods have limited application at the Apollo site. The potential hazards encountered during manual scrubbing are contamination of operations personnel and cuts from burrs or sharp objects.

The safety precautions employed during manual scrubbing are:

- the use of protective equipment such as gloves, goggles, face shields, and respiratory protection, as required by Health and Safety personnel;
- the use of a radiation work permit with prompt evaluation of any suspected exposures;
- the use of airborne contamination samplers and surface radiation and contamination monitors, as required by Health and Safety personnel, so that operations can be suspended promptly, if necessary, and evaluated for additional necessary preventive actions.

Manual scrubbing produces only very small quantities of dry active waste that are packaged for disposal. No gaseous wastes and no liquid wastes are anticipated from these activities.

2. The potential hazards encountered during decontamination by abrasive cleaning are airborne contamination, flying objects dislodged by spray, and puncture wounds or bruises.

The major safety precautions employed during abrasive cleaning include:

- erecting temporary exhausted and HEPA-filtered enclosures (See Section 2.4.3.A) around cleaning operations that may generate contaminated dust;
- isolating operators from the process environment;
- using misting sprays, as necessary, to control airborne contamination;
- using airborne contamination samplers and surface radiation and contamination monitors so that operations can be suspended promptly, if required, and evaluated for additional necessary preventive actions.

There are no significant hazards identified that result from contaminated material generated during abrasive cleaning.

C. Concrete Removal

The removal of the concrete floors is accomplished using methods, such as sawing and grinding, and equipment, such as jackhammers, bulldozers and the excavators. These methods and equipment may produce airborne contamination.

The potential industrial safety hazards associated with these methods, and the precautions for ensuring safety, include:

- Jackhammer operations may cause heat stress to operating personnel and produce excessive noise levels. Further, improper usage may cause puncture wounds. Precautions include wearing ear protection and encouraging workers to drink high levels of fluids. Only trained personnel operate jackhammers.

- Sawing hazards include excessive noise levels and personal injury. Control measures include ear protection, equipment guards, and the use of trained personnel.

- Grinding and excavating hazards include excessive noise levels, injury from rotating equipment, and equipment exhaust. Precautions include the use of ear protection and equipment guards to protect against personal injury, the use of trained personnel, and catalytic converters with proper ventilation for equipment exhaust.

- To protect personnel, the public, and the environment from potential radiological hazards associated with removal of concrete floors, the safety features listed in Section 2.4.2.A are in place.

D. Soil Excavation, Handling, and Backfilling

Soil remediation is accomplished using standard construction equipment and tools, such as excavators, bulldozers, front end loaders, dump trucks, compactors, dredging equipment, water trucks for wetting haul roads, and skid loaders. The associated potential hazards include equipment exhaust gas emissions and excavation cave-ins, as well as injury from equipment tipping or rolling, rotating machinery, flying objects, and accidents due to improper equipment operation and airborne contamination.

The primary safety precautions to address these potential hazards are:

- using catalytic converters with proper ventilation for exhaust gas emissions;
- implementing proper slope management, soil stabilization, and shoring techniques;
- maintaining equipment guards, rollover cages, and other safety features in good repair;
- training personnel in the proper use of equipment;
- using standard industrial safety equipment and clothing for personnel protection;
- restricting access to excavation areas to minimize the number of personnel exposed to risk.

To protect personnel, the public, and the environment from potential radiological hazards associated with soil remediation activities, the following safety precautions are put in place:

- implementing a dust control program that is standard for a construction site (see Section 2.4.3.C below for additional details)
- implementing an erosion control program that is standard for a construction site (see Section 2.4.3.B below for additional details)
- using portable airborne contamination samples so that operations can be suspended promptly, if necessary, and evaluated for additional necessary preventive actions.

E. Soil Processing

Soil and nonmetallic building rubble are planned to be reduced in size to decrease the volume and to facilitate sampling, packaging, shipment, and/or disposal. This will be accomplished using standard bulk materials handling equipment, such as conveyors, crushers, and storage bins (See Section 2.4.4.D for further description.) The associated potential hazards include excessive noise level, injury from rotating equipment, and airborne contamination.

The safety precautions employed during soil processing are:

- use of standard industrial safety equipment for personnel protection, such as ear protection, safety glasses, and hard hats, as required by Health and Safety personnel;
- maintaining equipment guards and other safety features in good repair;
- operation of the facility at a negative pressure relative to the surrounding area and with a HEPA-filtered and exhausted ventilation system;
- covering the material during transport and storage to control the potential for dust generation;
- using the airborne contamination sampling program described in Section 3.3.5 so that operations can be suspended promptly, if necessary, and evaluated for additional preventive action;
- restricting access to the facility to minimize the number of personnel exposed to potential risk as described in Section 3.3.4.

F. Volume Reduction of Equipment, Building Services, Utility Services, and Other Building Materials

Equipment and building materials are dismantled to minimize the volume of contaminated material resulting from decommissioning. Where possible, equipment is simply disassembled using hand tools. Some large components are reduced in size by means of cutting torches, shears, cement saws, or other tools. See Section 2.4.2.A for description of the potential hazards associated with these operations and the respective safety precautions used to minimize them.

Contaminated solid waste is packaged for shipment and disposal at a licensed LLRW site.

G. Onsite Material Handling and Shipment

The potential hazards encountered in onsite material handling and shipment are equipment accidents and airborne contamination during transport and loading for shipment.

The major safety precautions for the material shipment and in-plant handling activities include:

- equipment operator training, testing, and certifications;
- use of protective clothing, such as gloves and safety shoes, as required by Health and Safety;
- radiation work permits, as required by Health and Safety, for handling contaminated or potentially contaminated materials;
- comprehensive radiation surveys;
- issuance of cutting and welding permits when required by Health and Safety:
- respiratory protection when required by Health and Safety.

2.4.3 Control Mechanisms

A number of engineered control mechanisms are used to manage the potential hazards discussed in the preceding section.

A. Airborne Contamination Control

The Apollo Facility had an extensive airborne contamination control system that was used during uranium processing operations. Parts of this system have also been used for contamination control during the decommissioning operations performed to date. This ventilation system consisted of a large number of small fans and HEPA-filter systems (1,000 to 5,000 cfm capacity) which were distributed throughout the facility. These systems were removed to gain access to building walls and mezzanines as part of the deconstruction of the interior of the Main Building. In addition, these individual small systems did not have the capacity and flexibility to support future building decommissioning operations. To support decommissioning of the Apollo Facility, new HEPA-filtered ventilation equipment was installed in the Main Building (Figure 2-16). This section describes the equipment.

The fixed HEPA-filtered ventilation equipment exhausts the Apollo Facility air through a series of roughing filters, prefilters, and HEPA-filters and discharges this filtered air to the outside atmosphere through a stack, which is continuously sampled. This ventilation system maintains the inside of the Apollo Facility at a negative pressure with respect to the outside air.

As described in Sections 2.6.1 and 2.7.1, deconstruction operations will occur in discrete remediation areas (contamination containment zones). During internal building deconstruction, ten such remediation areas will be established (Figure 2-14). While Apollo Facility external deconstruction is occurring, nine remediation areas will be established (Figure 2-15).

A contamination containment zone is established by erecting walls of plastic, cloth, or other material around the remediation area. Portable HEPA-filtered ventilation equipment is used in a remediation area undergoing deconstruction. Exhaust air is filtered through roughing filters, prefilters, and HEPA-filters, and discharged into the Main Building. This equipment maintains a negative pressure in the remediation area with respect to the rest of the Apollo Facility. This pressure differential is verified through the use of smoke testing, which determines the direction of airflow. The equipment removes contamination and dust from the air at the generation source and does not permit the dust to migrate through the Apollo Facility.

The performance of the airborne contamination control system is indicated in Figure 2-16. The fixed equipment exhausts the Apollo Facility and maintains a negative pressure within the total building with respect to the outside. The portable and fixed equipment work together to maintain building airborne radiological contamination control. Both the portable equipment and fixed equipment have horizontally mounted centrifugal fans in series with the filter systems. The filter systems include, in the order of air flow, a bank of roughing filter and prefilters; and a bank of HEPA-filters. Instrumentation across each filter bank measures filter pressure drop. In addition, the HEPA-filter bank measurement system has audible and visual alarms for high and low differential pressure. The portable fans have a capacity of 6,500 cfm; the fixed fans have a capacity of 22,000 cfm.

B. Water Control

The term "water" as used in the Decommissioning Plan includes surface water, groundwater, river water/sediments, and roof runoff water. Water control is needed to meet Commonwealth of Pennsylvania and EPA regulatory requirements to control erosion, sedimentation and storm water; to institute a surface and roof runoff water flow during remediation activities that will result in permanent flow paths at project completion; to minimize the effects of water flow and accumulation during soil and building remediation activities; and to assure that radiological contamination is not transferred by water flow during remediation.

1. Surface Water

Surface water flow is affected by soil, precipitation and topography. Various classifications of soil cover this site; however, the majority of the soil can be considered as unclassified fill, based on the U.S. Soil Conservation Service (SCS) Soil Survey of Armstrong County, Pennsylvania. Surface water runoff travels toward the Kiskiminetas River on the western edge of the site. The source of surface water is precipitation either through direct contact or through direct roof runoff discharge.

During the hydrogeological assessment, the Hydrologic Evaluation of Landfill Performance (HELP) model was used to estimate the rate of water infiltration across the site. The HELP model used five years of data (1974 to 1978) to project runoff and evapotransportation values. The average annual precipitation of the five year period was found to be 38.09 inches, of which 36.6 percent evaporated and the remaining 63.4 percent (24.05 inches) infiltrated into the subsurface and, presumably, to groundwater.

The existing topography and changes to that topography resulting from remediation activities provide the basis for engineering control of the temporary and permanent water flow paths. Before leaving the site, surface water will flow into a sediment basin designed in accordance with the Pennsylvania Department of Environmental Resources (PADER) erosion and sedimentation control requirements (Figures 2-19 and 20). The sediment basin is designed to store 5,500 cubic feet of runoff per acre of the site. The basin will be cleaned out when sediment levels reach a predetermined elevation. At project completion, the sediment basin will be removed and appropriately disposed of. Final grade and vegetation will be established to allow runoff to flow toward the river.

2. Groundwater and River Water/Sediments

In some of the remediation areas, contamination may extend below the water table. If so, groundwater will be controlled during excavation by drilling a series of approximately 50 wells five feet into bed rock. These dewatering well locations will be established based upon the site hydrogeologic report and the contaminated soil areas to be remediated. Each well is designed with a sediment filter and screen to remove silt while pumping operations are occurring. Removing groundwater through these dewatering wells will lower the water table below excavation depths effectively dewatering the soil. The groundwater will be pumped through a network of pipes to an 85,000 gallon Modutank or equivalent, where sediment and solids will settle prior to being pumped through a filtration system for final water clarification. Water will be continuously pumped to the Kiskiminetas River through a PADER approved outfall. Discharge rates may vary from 200 to 1,750 GPM depending upon the season, groundwater pumping rate, and the site area being remediated. Discharged water will be sampled once per working shift, the samples composited and analyzed weekly to demonstrate compliance with the release criteria specified in the discharge permit issued by PADER and the limits specified in 10 CFR 20. Discharged water will be analyzed for total suspended solids, iron, pH, total metals, VOCs and radiological contamination per the temporary discharge of groundwater approval granted by PADER. This permit specifies weekly monitoring and monthly reporting of results.

During the earthmoving and deconstruction work, temporary diversion ditches and silt curtain barriers will be installed in excavation areas to divert runoff to the sediment basin and to prevent possible siltation of the Kiskiminetas River. Any appreciable accumulations of surface water in the remediation areas will be collected in the sediment basin, sampled, and analyzed for total suspended solids and radioactive contamination prior to discharge through an approved outfall to the Kiskiminetas River.

3. Building Roof Run Off

Building roof runoff from the Apollo Facility will be discharged through the onsite surface water drainage system. (Figure 2-19)

C. Dust Control

The primary potential radiological hazard created by remediation and deconstruction activities at this site is airborne contamination. To ensure that exposures of general public and the project personnel to airborne radiological contamination are maintained within approved limits, the following control measures have been implemented for ongoing decommissioning activities and will continue for the completion of decommissioning activities:

- Deconstruction and remediation activities and tasks performed in the Apollo Facility are conducted, as necessary, in contained remediation areas consisting of a framework supporting a soft-sided enclosure. A negative pressure, HEPA-filtered environment is maintained in each contained area when such tasks are being conducted.

- Visible cracks and openings in the Apollo Facility are sealed with foam prior to the beginning of deconstruction activities.

- The Apollo Facility shell is used for added containment during remediation of interior walls, soils, slabs, buried utilities, and foundations.

- Wetting agents, including water mists and spray foams, are used as dust control measures for remediation activities conducted outside the Apollo Facility. Choice of any of these agents will be dependent on the absence of a hazardous material in the residuals. Some remediation efforts may be conducted in areas below the water table and, therefore, the inherent soil moisture acts as an effective agent for dust control.

- Materials stored outside are covered as necessary.

- Haul roads are wet down, as necessary, during working hours and vehicle speeds are restricted to less than 5 mph.

2.4.4 Site Support

Security fences and personnel access gates, change room and sanitary facilities, haul roads, a Processing Plant and adjacent temporary storage areas, and construction and emergency power ensure the performance of Apollo decommissioning activities in a safe and orderly manner.

A. Security Fence and Personnel Access

A security fence with controlled personnel access gates encloses the Apollo site (Figure 2-21).

All working personnel enter and exit the Apollo site through a controlled access gate past the Central Alarm Station (CAS) trailer. They then proceed to the Clean Change Trailer (CCT) to check in and to put on their industrial protective equipment. Any personnel not assigned to the work force (i.e., management, engineering, visitors and clerical support) leave their emergency ID badge in the receptacle inside the CCT before crossing the site perimeter.

For entrance into the plant, all workers will normally proceed to the Change Line Trailer (CLT) and prepare for work.

Existing security fences will be extended as necessary to control access to remediation areas (Figure 2-22). In addition, temporary fencing may be added for personnel safety. The temporary fences will be joined to existing fences on the site. The temporary fences can be moved easily as remediation progresses. Temporary fences will remain in place until remediation activities are completed and the area is surveyed and backfilled.

B. Change Rooms and Sanitary Facilities

Several trailers are on site to be used by plant personnel as temporary working quarters. The three trailers have been designated Change Line Trailer (CLT), Men's Shower Trailer (MST), and Health and Safety Trailer (HST).

The CLT, MST and HST trailers have been fitted with a HEPA-filtered exhaust system to maintain possible radioactive releases below acceptable limits. An enclosure is maintained between the CLT and Main Building for contamination control.

All three trailers contain drinking water dispensers. The CLT and MST also have fresh water supplied for use in the respirator washer, sink, and shower areas. Both the CLT and MST feed a wastewater holding tank via a pumping system. These waste systems automatically pump the water into a large holding tank where it is mixed, sampled, and analyzed prior to being removed by a licensed waste handler. If wastewater is contaminated above applicable NRC limits, it is disposed of as described in Section 3.5. Portable toilets have also been provided and are serviced as needed.

C. Haul Roads

Movement of materials to the soil processing area is accomplished on the existing site road network (Figure 2-23). This network is being improved so that equipment and material can be moved more efficiently and generation of dust can be minimized. Movement from the north end of the Main Building is by way of a roll-up door and south to the Processing Plant area. Movement from the west, south and east sides of the Main Building are by a gravel and asphalt road proceeding south to the Processing Plant area. Movement from the west side of the site is by an existing road that is adjacent to the riverbank. Additional temporary haul roads may be constructed in excavation areas to allow access to the existing haul road network. Haul road integrity will be maintained with gravel as necessary.

D. Processing Plant and Temporary Storage

The processing plant is designed to screen and volume-reduce all soil and building rubble for two primary functions: to reduce all material to a uniform matrix that can be accurately sampled using automated equipment and to allow maximum day bin and rail car loading efficiency.

The processing plant is comprised of the following major components:

1. 2 covered feed material piles (soil & rubble)
2. a building enclosed Telsmith HSI 5246 impact crusher with a grizzly feeder
3. a Tenkay HEPA filtration system
4. a Denver belt sampler
5. a covered Telsmith radial stacker
6. 4 covered approximately 150-ton day bins
7. a covered underbin loadout conveyor emptying into gondola rail cars lined with a "LOADWRAPPER" packaging system
8. a fabric covered temporary structure in which railcars are loaded

All plant systems will be electrically operated. The processing plant will be fed from either of the staging piles (Figure 2-24) by way of a curtained window in the crusher enclosure. Material passes through the curtain into the grizzly feeder/screener. All material less than 1 inch will pass through to the under crusher conveyor while larger material will discharge into the crusher for volume reduction. Material entering the crusher at approximately 14" minus will be reduced to approximately 1" minus before discharging to the undercrusher conveyor. The material will be sampled, as required by the sampling plan, using a Denver H2H sampler before passing onto the radial stacker which fills the covered and ventilated approximately 150-ton day bins (Figure 2-38).

The crusher enclosure contains a Tenkay HEPA filtration system which will incorporate dust pick-up points at critical locations. Dust will be pulled through duct work from these points into a cartridge type bag house and then to a filter bank of pre and final filters before being exhausted out of the building via a 21,000 cfm fan. The bag house will be self cleaning using air pulses to remove dust from the filters automatically at a predetermined differential pressure. The dust will be directed back to the under crusher conveyor in front of the belt sampler. The HEPA filters will be monitored by a photohelic gauge which will actuate an alarm and shut down the system automatically if a predetermined differential pressure is detected. Calculated values indicate the system will control radiological effluent to more than 8 orders of magnitude below NRC established MPC limits for U 235 (Figure 2-37).

The processed material exits the under-crusher conveyor onto a covered 90 ft. radial stacker that empties into an approximately 150-ton day bin by way of an enclosed chute. Day bins will be controlled by a scale system which will alarm and shut down the processing plant when a predetermined weight is achieved. This will then permit the radial stacker to be detached and attached to one of the other three day bins for further processing to continue. The scale system will also record input and output weights of the material in the day bins for activity calculations and shipping form preparation. The day bins will also have interconnecting ductwork and a trunkline back to the ventilation system.

The gondola railcars will be loaded from the day bins by an enclosed under-bin conveyor which will pass into a "Rubb" fabric covered building. Material exiting the day bins will be controlled by a clamshell type chute and the weight of the material loaded into each railcar will be recorded and controlled by the scale system. Misting of crushed material will be done as necessary for dust control while loading the railcars.

The material will be packaged in a "LOADWRAPPER" manufactured by Transport Plastics of Denver, Colorado. These wrappers will function as an integral railcar liner and a bulk shipment package. The "LOADWRAPPER" is a single piece woven plastic wrapper coated on both sides with polyethylene. The reinforced woven material is made of 1,200 denier, 14 x 14 weave, polyethylene with a 40 micron polyethylene surface coating on each side and an overall thickness of approximately 15-18 mils. All tie ropes and elastic ropes are attached securely to the liner fabric for a one piece system. The elastic tie ropes are designed to allow for weight shifts in transit without rupturing the liner. The full overlapping top flaps of 11 feet by 55 feet each will provide secure multiple layered protection during transport to Envirocare of Utah, Inc.

Some material will be packaged in one to three cubic yard "Baggies". These bags will be made of an ultra-violet treated woven polypropylene material of varying weight per square yard depending on the weight capacity of the bag. The bags may be coated with polyethylene for waterproofing and if additional waterproofing is required, a polyethylene liner can be sewn inside the bag. The bags may be loaded off the end of the underbin conveyor inside the loadout building through a chute or they may be loaded using pre-manufactured bagging machines installed underneath the daybins with the conveyor removed. The material will be transported by railcar or truck, or combination of the two, to a licensed LLRW disposal facility.

The chosen bag manufacturer will be required to be a member of the Flexible Intermediate Bulk Container Association (FIBCA). This association has set performance standards for bags including a drop test, jerk/shock test, topple test, topple/drag test, filling and discharge test and various handling tests to ensure that the bags are manufactured to meet quality standards.

E. Construction and Emergency Power

In 1991, at the start of decommissioning activities, the Main Building electrical power service consisted of a 480 volt, 1200 amp service which was used for full plant operation. Electrical power entered the site through a transformer bank located on the east side of the site, adjacent to Warren Avenue. Power was then distributed to the building through transformers located on the mezzanine. The mezzanine area had to be removed during the ongoing internal building deconstruction. Thus, a new source of power was installed to support decommissioning.

During this period, the building was also serviced by a 480 volt, 40 amp diesel powered emergency generator providing backup power for HVAC fans and air sampling systems. The diesel generator was located outside the Main Building in an enclosed shed. The addition of new nuclear air cleaning systems to the Main Building and ongoing decommissioning activities required additional emergency power, and the relocation of this diesel generator system.

A new construction power and emergency power system was installed to provide electrical power service to the Main Building during its decommissioning. This service consists of a 480 volt, 665 amp service that will be utilized for building deconstruction; and a 480 volt, 180 amp emergency generator power service that supplies backup power for the nuclear air cleaning systems (ref. Fig. 2-16) and the air sampling system.

The new construction power system is distributed along the outside of the east, north, and west walls of the Main Building. At appropriate locations, power drops enter the building supplying four portable 50 KVA (480 volt, 60 amp) power stations. Each station contains transformers to supply 110 volt power as well as 480 volt power for construction equipment and the small nuclear air cleaning systems used in deconstruction operations. Power for the large building nuclear air cleaning systems (Figure 2-16) is also fed from outside the building to minimize impacts on the internal building deconstruction activities. Battery powered emergency lighting for exit routes will continue to service the Main Building.

F. Fire Protection

Fire protection is provided by adequate numbers of fire extinguishers designed for specific fire control utilization as the primary fire containment, and a fire hose reel located outside the east wall of the Main Building. PANSO maintains its high state of emergency preparedness by a continuing program of emergency training. Training includes, but is not limited to:

- conducting of drills,
- review of specific drills,
- review of the Emergency Organization checklist, and
- review of the Emergency Organization Chart and an updated phone list.

Routine inspection and testing of the fire protection equipment is conducted by PANSO personnel under the direction of Health and Safety supervision. Maintenance and operation of the fire protection equipment is the responsibility of the engineering and maintenance functions.

Emergency Response Team personnel receive advanced training to develop a high level of preparedness. Subjects emphasized include, but are not limited to:

- first aid;
- emergency response to general emergencies;
- response to contamination incidents;
- general fire fighting.

Non-PANSO emergency support personnel receive periodic instruction to cover basic procedures pertaining to their role in the event their services are requested by the company.

2.4.5 Treatment and Disposal of Contaminated Material

The decommissioning activities at the Apollo site are directed toward safe disposal of all material contaminated above 30 pCi/g, on average, and restoration of the site so that it is suitable for release for unrestricted use.

These materials include soils, structural steel, miscellaneous metallic materials, concrete, block, brick, roofing materials, miscellaneous construction and building materials, and miscellaneous trash. Tables 2-5 through 2-10 shows the volumes of materials estimated to be generated.

During decommissioning operations, use of acids or other liquid materials requiring treatment and disposal is not planned. Minor use of water is anticipated for dust control during soil remediation and wall deconstruction, but the volumes generated are not projected to require disposal. This section describes the solid materials resulting from decommissioning activities and the methods to be used in disposal of materials contaminated above 30 pCi/g, and in site restoration.

A. Soil (Table 2-10)

Contaminated soils will be excavated as part of the remediation of the Apollo site. Soils are planned to be processed as discussed in Section 2.4.4.

Soil with an average activity concentration less than 30 pCi/g will be used for backfill in site excavations. Disposal of soil with average contamination above 30 pCi/g will occur according to the following guidelines:

- Soil with an average activity concentration level greater than 2000 pCi/g is being shipped to a licensed LLRW disposal site;
- Soil with an average activity concentration level between 30 pCi/g and 2000 pCi/g will be shipped to Envirocare, an agreement state licensed LLRW disposal facility.

B. Structural Steel (Table 2-5)

The structural steel components (support columns, beams, etc.) are being sent to a licensed metals contractor for processing and disposal or directly to a licensed LLRW disposal site.

C. Miscellaneous Metallic Materials (Table 2-6)

This category includes the wide variety of metallic materials used in an industrial plant, such as process and utility piping, HVAC duct work, conduit, and cable trays. In addition, a large volume of utility support and building services equipment will be scrapped during deconstruction, including fans, air sampling systems, the criticality alarm system, liquid storage tanks and pumps, etc. These materials will be volume-reduced and either shipped directly to a licensed LLRW disposal site or to a licensed metals contractor for processing and disposal.

D. Concrete (Table 2-7), Block, and Brick (Table 2-8)

This category principally includes the concrete present in the Apollo Facility floor, elevated mezzanines, and building foundations, as well as some material from completed decommissioning activities, discussed in Section 2.5. Concrete, block, and brick are planned to be processed as described in Section 2.4.4. This material will then be disposed of as in paragraph A above.

E. Roofing Materials (Table 2-9)

Roofing materials consist of steel decking, sheeting, purlins, trusses, tar, and composite materials. Disposal of these materials is as follows:

- Roof sheeting and built-up materials are packaged and sent to a licensed LLRW site;
- Structural steel roof components are packaged and shipped to a licensed metals contractor for processing and disposal or directly to a LLRW disposal site.

F. Miscellaneous Construction Materials and Trash

A wide variety of miscellaneous construction materials are produced during decommissioning. These include plastic pipe, wood, office furniture, laboratory furniture, etc. If these materials are contaminated above free-release criteria, as set forth in Annex C of NRC License No. SNM-145, they will be packaged and shipped to a licensed LLRW disposal site. If the contamination is below acceptable levels, these materials will be removed from the site for reuse or disposal.

2.5 Completed Decommissioning Activities

Decommissioning activities have been ongoing at the Apollo site since 1978. These activities have been completed under NRC License No. SNM-145 and have primarily been associated with the decontamination of plant facilities, areas and equipment that were no longer required for ongoing or planned site operations.

All materials generated during these decommissioning activities have been or are in the process of being disposed of. A brief discussion outlining these decommissioning efforts is presented below. See Figures 2-1, 25, and 26 for specific locations of these activities.

2.5.1 High Enriched Uranium Processing Area [1978 to July 1991]

The second floor of the Main Building was constructed in the early 1960s for HEU processing. Production continued until 1978, when HEU operations were terminated and decommissioning was initiated. All process equipment was dismantled and disposed of by June 1980. The volume was approximately 660 cubic feet.

Following equipment removal, the amount of ^{235}U contamination contained in the walls and floors was determined. The HEU area was gridded into 2-foot by 2-foot sections, and *in situ*, nondestructive assays [NDA] were performed. In May 1981 B&W issued a report to the NRC that estimated that 30,512 grams of ^{235}U were embedded in the concrete floor. In May 1982, an independent assessment by the NRC estimated that 23,743 grams of ^{235}U were present in the concrete floor.

The NRC report implied that uranium embedded in the concrete floor from spills and processing could be economically extracted. Feasibility studies confirmed this, and a uranium recovery program was begun in 1985. In May 1985 deconstruction activities were initiated to remove sections of the HEU floor where the dissolver and scrap recovery equipment had been located. The floor was broken up with jackhammers, the pieces were placed in 5-gallon buckets, and NDAs were performed.

In June 1985 approximately four cubic feet of concrete were processed to recover embedded uranium. The recovered amount of ^{235}U present in this section was found to be only about 20 percent of the estimated values. NDA values for the remainder of the floor confirmed the lower value. In November 1985, the recovery project was terminated because the concentration of ^{235}U in the concrete was too low for recovery to be cost effective. Consequently, the 358 cubic feet of removed floor were sent for disposal at a licensed LLRW disposal site.

Work in the HEU area resumed in August 1990. This work, which was completed in January 1991, entailed stripping all remaining equipment, ventilation systems, and other installations, such as piping and power lines, from the area to prepare for floor removal. The stripping operations produced approximately 900 cubic feet of material of which 595 cubic feet was metallic. Removal of the remaining approximately 2000 cubic feet of concrete from the floor began in May 1991 and was completed in July 1991.

The deconstruction methodology for the remaining HEU floor consisted of breaking up the floor within a ventilated, temporary enclosure using jackhammers, chisels, and sledge hammers. The concrete was broken into chunks approximately four inches in maximum diameter. Access to the work area was controlled.

Containment was accomplished by installing portable plastic tents exhausted with portable 1,000 cfm HEPA-filtered nuclear air cleaning systems which maintained a negative pressure inside of the plastic tents. Operators working inside the tent wore full-face respirators. As each section of concrete was removed, a vacuum cleanup was performed prior to moving the tent. The corrugated metal decking was then removed.

As the concrete was broken, it was collected in 5-gallon pails for transportation and storage prior to assay. The pails were staged in a designated area with a configuration to assure nuclear criticality safety. The vacuuming operation was performed using an approved, critically safe vacuum cleaner with a critically safe vacuum receiver. All critically safe configurations were approved by qualified B&W licensing personnel. Each pail was assayed and accountability records completed for uranium content. Approved Nuclear Materials Control (NMC) standards were in place for measuring the uranium content in 5-gallon pails.

After assay, released pails were marked and taken to a designated staging area. Their contents were dumped directly into a steel burial box, maintaining the nuclear safety limits established by B&W, and the pails reused. A record of the amount of uranium in each burial box was maintained. These burial boxes have been shipped to a licensed LLRW disposal facility.

This activity yielded approximately 2000 cubic feet (293,000 pounds) of concrete and 32,000 pounds of structural steel material for disposal.

2.5.2 Low Enriched Uranium Processing Area [1983 to 1984]

The LEU processing area consisted of four separate production lines. The major production line filled most of the 220-foot by 50-foot east bay. This uranium processing area was divided into three distinct areas:

- chemical processing line,
- chemical recovery processing line, and
- ceramic fabrication line.

A preliminary radiological characterization of the floor and sub-surface soil was initiated prior to the termination of production. A total of 72 core samples was taken within the east bay and outside the Main Building. Analysis results indicated that the chemical processing line and chemical recovery processing line areas were contaminated above free-release limits at depths in excess of three feet. A more extensive characterization program, which included numerous surface surveys, smears, scabble samples, and core samples, began in 1989. Contamination levels above acceptable limits were found embedded in the floor and, in one area, up to 14 feet below the surface.

East bay decommissioning activities began in 1983 and consisted of removal of all LEU production and processing equipment and support systems. The removal, volume reduction, and burial of all LEU processing equipment was concluded by October 1984. All of the approximately 65,000 cubic feet of material removed from the LEU area was shipped to a licensed LLRW disposal site.

2.5.3 Laundry Building [1984 to 1991]

The laundry building, which was located in the parking lot, was a single-story, corrugated sheet metal and steel structure with an adjoining concrete block wing. All operations within the laundry building were terminated in 1984. Activities were then begun to remove all processing equipment, nonessential utilities, and miscellaneous support systems. This material was volume reduced, packaged, and sent to a licensed LLRW disposal site.

The next phase of the laundry building deconstruction, concrete trench removal, began in April 1989 and was completed in July 1989. This activity involved the removal of a concrete trench that served as a sump drain for washing machine waste water. This sump was contaminated with low levels of beta-gamma fission product activity. Approximately 292 pounds of sludge (30 cubic feet) and approximately 347 cubic feet of concrete were removed from the process waste trench.

Stripping operations, which began in August 1990 and ended in March 1991, were accompanied by characterization activities. Characterization included the collection of data from 251 soil samples, 9 floor core samples, and 66 scabble samples. In addition, numerous smear and exposed surface surveys were taken. Sample results indicated that remediation was required for several areas of elevated contamination on the main floor before deconstruction activities could begin. These areas were removed by concrete scabbling.

The corrugated sheeting, roofing, and structural steel were dismantled in June 1991 using small hand tools and standard construction equipment. Approximately 2,400 cubic feet of roofing and sheeting material were removed for disposal.

The concrete block walls were deconstructed in August 1991 using an excavator with a LaBounty Universal processor, described in Section 2.6.1., and generated approximately 3,300 cubic feet of material. The block wall material is covered and stored in the parking lot for future disposal.

2.5.4 Alcove [1988]

The alcove is a strip of ground north of the Apollo Facility. It surrounded three sides of the neighboring industrial facility's previous office building and extends nearly 300 feet along the east wall of the previous neighboring industrial facility.

Prior to deconstruction activities, 427 soil samples were taken at 116 locations at depths varying from 6 to 24 inches. The average uranium activity concentration was determined to be 44 pCi/g, and a maximum concentration of 629 pCi/g was found. Decommissioning activities commenced in March 1988 and lasted through May 1988. The activities involved the use of such basic excavation equipment as a backhoe, picks and shovels, and dump trucks. Approximately 11,540 cubic feet of soil were excavated, transported to the parking lot, and are stored under cover for future disposal.

Soil excavation was terminated when samples indicated residual contamination levels averaged less than 30 pCi/g. The results of the final survey were verified by the NRC prior to backfilling with clean fill, and the entire alcove area was free-released by the NRC. Concrete rain troughs and pads were then installed followed by placement of 1,000 square feet of blacktop.

2.5.5 South Bay Area [1989 to 1990]

The south bay is located offsite and is on the southern end of the previous neighboring industrial facility and is divided into Bays 1 through 4. Decommissioning activities were confined to Bays 1 through 3. The south bay measures 360 feet on the northern side and 236 feet on the eastern side.

Prior to the beginning of decommissioning activities, approximately 700 soil samples were taken at depths ranging from 6 to 96 inches. The average uranium activity level was 24 pCi/g with a maximum concentration of 324 pCi/g. The major south bay decommissioning tasks consisted of removing approximately 42,000 cubic feet of soil, pin piling the footings of seven support columns common to the box shop and Bay 3 (to allow safe excavation of soil around and under the footings), and constructing a barrier wall in the north end of Bay 3 to act as a barrier for backfill material. The deepest excavations were approximately eight feet deep. The excavated soil was transported to the parking lot in covered trucks, mounded, and covered while awaiting future disposal. Soil excavation was terminated when samples taken at the bottom of all excavated areas indicated average activity levels of less than 30 pCi/g. A final radiation survey was performed in the manner described below in Section 4. The results of the final survey were verified by the NRC prior to backfilling with clean fill, and the entire south bay area was free-released by the NRC.

2.5.6 Box Shop [1989 to 1990]

The box shop was a two-story, corrugated sheet metal building approximately 115 feet long, 38 feet wide, and 34 feet high with concrete block walls and a concrete floor. It was attached to the south wall of the Main Building for use as a low-enriched fuel processing area. In 1976, all processing equipment was removed and this area was decontaminated. The first floor was remodeled to house an instrument shop, a box fabrication area, and a waste storage area. It also contained the steam boilers and emergency generator for the plant. The second floor was converted into an engineering and drafting office. All areas were maintained as contamination free areas.

Prior to the start of deconstruction, a radiological characterization survey, which lasted from April 1990 through July 1990, was completed using exposed surface surveys, surface smears, and scabble samples. Deconstruction activities started in September 1990. Approximately 6,400 concrete blocks were removed. The dismantling of the generator room and its contents, two steam boilers, and the second floor office partitions resulted in removal of approximately 2,000 cubic feet of material which met the free-release criteria.

All concrete blocks and the concrete slabs of the second floor were removed from the structure (approximately 5,000 cubic feet and 2,300 cubic feet, respectively), palletized, shrink-wrapped, and stored in the parking lot. The rubble generated by wall removal was placed in drums and also stored in the parking lot. Approximately 820 cubic feet of corrugated sheet metal and 460 cubic feet of structural steel were removed and sent to a licensed LLRW disposal site. The foundation slab of the box shop, which is currently in place, will be removed as part of the soil remediation described in Section 2.7.2.

2.5.7 Annex [1989 to 1990]

The annex was a corrugated sheet metal and concrete block building attached to the west wall of the Main Building, which was approximately 225 feet long, 15 feet wide, and 18 feet high, and was used as a storage area for HEU materials.

Prior to the start of deconstruction activities, the radiological characterization of the annex was accomplished using direct readings, surface smears, and scabble samples. Deconstruction activities commenced in July 1990 and lasted through October 1990. All concrete blocks removed from the structure (approximately 3,550 cubic feet) were palletized, shrink-wrapped, and stored in the parking lot. The rubble generated from wall deconstruction was placed in drums and also stored in the parking lot. Approximately 350 cubic feet of corrugated sheet metal and 150 cubic feet of structural steel were sent to a licensed low-level radioactive waste disposal site.

At present all that remains of the annex is the foundation slab, which is currently in place next to the Main Building, and the palletized block and rubble in the parking lot. These materials will be excavated (for those materials still in place), processed and disposed of during soil remediation, described in Section 2.7.2.

2.5.8 Asbestos Remediation [1989 to 1991]

Prior to the decontamination and dismantling of systems, components, and structures at the Apollo site, the insulating materials were sampled and analyzed for the presence of asbestos. Materials sampled included thermal insulation on piping, gasketing material on boilers, water tank wrappings, ceiling insulation, spray-on insulation, ceiling tile, floor tile, and wall insulation.

The sampling program, conducted by an independent consultant, included 27 grab samples from the affected components that were also analyzed to determine their radiological contamination levels. Of these 27 samples, four did not meet the radiological free-release criteria.

A licensed asbestos abatement contractor was employed to remove 4,500 square feet of spray-on insulation, 1,300 square feet of ceiling fiber, thermal insulation on 95 fittings, gaskets from two boilers, and 194 linear feet of ductwork. The major areas affected by the asbestos removal were the box shop, annex, and boiler room. All asbestos containing materials were double bagged, placed in containers and shipped to a licensed LLRW disposal site.

In April 1991, an additional 12 samples were taken from the Main Building roof, west bay roof, and laundry building. The results of these sample analyses confirmed the absence of asbestos fibers at these locations.

2.5.9 Small Block Building [1990 to 1991]

The small block building was a single-story, corrugated sheet metal and concrete block structure located in the parking lot. The building, which was approximately 19 feet long, 13 feet wide, and 11 feet high, was used to store pumps, motors, filters, and other equipment.

Prior to deconstruction, a radiological characterization study of the interior and exterior of the building was performed using exposed surface direct readings, surface smears, and concrete scabble samples. These data, collected during October 1990, showed that 90 percent of the concrete block met the free release criteria.

Deconstruction activities commenced in January 1991 and were concluded in February 1991. Approximately 400 cubic feet of clean block and 50 cubic feet of contaminated block were removed separately, shrink wrapped, palletized, and stored in the parking lot. The rubble generated from wall deconstruction was placed in drums and also stored in the parking lot. Approximately 125 cubic feet of corrugated sheet metal and 65 cubic feet of remaining metal items and materials were sent to a licensed LLRW disposal site. The floor slab, the palletized concrete block, and drummed wall rubble remain covered and stored in the parking lot for future disposal.

2.5.10 Miscellaneous Activities (1991 to Present)

Additional activities that have been completed since Revision 0 of the Apollo Decommissioning Plan include:

1. Approximately 12,000 cubic feet of the Main Building concrete floor containing >2000 pCiU/g were removed and shipped to a licensed LLRW facility for disposal.

2. Main Building soils containing >2000 pCiU/g were removed. Approximately 4,600 cubic feet of soil were shipped to a licensed LLRW facility for disposal.

3. The compressor/gas storage shed attached to the east side of the Main Building was deconstructed. Block rubble from this shed has been stored for subsequent processing in the crushing plant. Structural steel and steel roof decking has been cut to size and stored for disposal at a licensed LLRW facility.

4. The parking lot was graded for installation of the Modutank, sediment pond, and the crushing plant.

5. The crushing plant building, the Modutank and the sediment pond have been installed. Erection of the crushing plant (daybins, crusher, etc.) has been initiated and is ongoing.

6. All characterization work has been completed with the exception of the riverbank and that necessary to further evaluate south sewer soils for Tc^{99} contamination.

7. The contaminated built up roofing material on the Main Building and the West Bay was removed and shipped to a LLRW facility for disposal. A non-hazardous rubber type mastic was applied to the exposed metal decking as a temporary roof. This roofing material will be removed as part of the Main Building deconstruction described in Section 2.7.

2.6 Ongoing Decommissioning Activities

The following activities either have been or are being conducted under existing NRC License No. SNM-145. Appendix 2 provides the schedules for these activities, indicating their start dates and estimated dates for completion.

NOTE: The activities discussed in this section represent the status and plans for decommissioning activities as of the time of the submittal of Revision 0 of the Apollo Decommissioning Plan in August 1991. Since that submittal, most of the ongoing decommissioning activities described in this section have been completed. In order to maintain continuity for the review of the Apollo Decommissioning Plan, this section in general, has not been rewritten to reflect completion of these activities, nor has description of these completed activities been moved to Section 2.5 (Completed Decommissioning Activities). Those ongoing decommissioning activities that have been completed since the initial issue of this Plan are identified by a notation placed next to the section heading. With the exception of 2.6.2 West Bay, none of the text has been rewritten (i.e. the activities are discussed in the future tense as activities that will be completed). The owner of the neighboring industrial facility decided to terminate his operation and raze his facilities, and thus greatly simplified the deconstruction of the West Bay. Section 2.6.2 has been rewritten to describe how West Bay deconstruction happened.

Figures 1-1 and 1-2 provide a site and building layout as these areas exist as of March 1992.

2.6.1 Main Building - Internal Deconstruction

During the internal deconstruction of the Main Building, all building services, interior walls, floors, and the built-up roof will be removed. At the completion of these activities, the Main Building will consist of four walls and a roof. Support systems and services (e.g., HEPA-filtered ventilation, air monitoring, fire protection, and temporary and emergency power) will be maintained until the Main Building deconstruction is complete.

A. Removal of Building Services

The removal of all building services is being performed using standard deconstruction methods to reduce the volume of these systems into segments of manageable size for remediation and disposal. Standard equipment that is being used includes metal shears, cutting torches, saws, bolt cutters, and wire snips.

1. Fire Sprinkler System **(Activity Completed)**

The piping for the fire sprinkler enters the building on the east side and runs vertically to the roof of the building. The system currently encompasses a header above the mezzanine. The fire hose hook-up extending outside the building's east wall will be maintained until the Main Building is removed. The remaining sections of the original system have already been removed and sent to a licensed contractor for disposal. After the flammable materials are stripped, and personnel and equipment are relocated, the fire sprinkler will be dismantled for disposal.

2. Criticality Alarms **(NRC Approval Received and Activity Completed)**

The criticality alarm sensors are mounted halfway up the high bay wall in the middle of the plant, above the truck dock in the northeast corner, and above the mezzanine on the east side of the plant. A series of conduits carry the signal to a panel in the main hallway near the former guard station. This signal is also transmitted to the security system and into a series of alarms outside the southeast wall. The current license requires that this system be functional. A 10 CFR § 70.24 exemption request has been submitted to the NRC. When approved, the system will be dismantled for disposal.

3. Waste System **(Activity Completed)**

- M & T Waste System

During plant operation, treated process wastes were pumped to the M&T tanks which were located outside of the east wall of the Main Building. These tanks were also used to collect sink and shower water from the change rooms and the Main Building sump. Following monitoring, these liquid wastes were pumped to the overflow weir pit for discharge to the south sewer. These tanks are fabricated from 300 series stainless steel.

The M&T tanks system is no longer used for process wastes and will be removed. Standard deconstruction techniques using cutting torches will be used to remove the vessels. Following removal, the vessels will be moved inside the Main Building where they will be cut up and reduced in size for disposal at a licensed LLRW facility.

- C & D Waste Holding System

Water generated from several sumps located throughout the Apollo Facility is pumped to the C & D waste holding system for verification that discharge limits are not exceeded before discharge to the south sewer. Water collected in the shipping and receiving loading dock sump is also pumped to the C & D waste holding system. The C & D waste holding system will be removed and dismantled for disposal.

4. Apollo Facility HVAC Make-Up Air System **(Activity Completed)**

The Apollo Facility make-up air system consists of two independent ventilation systems. The first system is located above the former security area. The duct exits the south end of the building, runs above the cafeteria, and terminates in the HEU area. The remaining sections of the original duct system have been removed and sent to a licensed metals contractor for processing and disposal.

The sheeting on the walls and the roof will be removed, allowing access to the HVAC unit. The filter bank will be surveyed to identify any parts meeting the free-release criteria, and the remaining material will be volume reduced and sent to a licensed contractor for disposal.

The second system, located adjacent to the former waste volume reduction calciner, is currently used in a recirculation mode to cool the Apollo Facility. The 52 inch ductwork for the make-up unit travels on trusses above the LEU area and terminates near the center of the Main Building. The remaining original ductwork located above the HEU area has been removed, volume reduced, and sent to a licensed metals contractor. At the completion of service, the blower will be dismantled and removed.

5. Air Sampling System

The permanent plant air sampling vacuum pumps are located in the LEU area along the west wall. The piping system travels throughout the facility and on the roof. As the areas within the plant are stripped, the piping system will also be removed. This process will continue until the piping system is removed to the pump locations. During this process, portable air sampling systems will supplement or replace the permanent plant system. All piping, valves, fittings, and pumps will be removed for disposal.

6. HVAC Exhaust Fan-2 System **(Activity Completed)**

The blower and 90 percent of the exhaust fan-2 system have been removed and sent for disposal. The remaining section of duct is located above the 52 inch make-up duct at the peak of the roof in the LEU area. This remaining section will be removed for disposal.

7. Compressed Air System **(Activity Completed)**

The compressed air system consisted of an air compressor and a series of piping and valves supplying compressed air throughout the plant. The air compressor has been relocated to the north end of the building. Once the compressor is no longer required, the compressor and associated piping will be removed for disposal.

8. Emergency Power System

The emergency power system supplies electricity to a power distribution panel on the east wall. The distribution panel feeds the air sampling pumps, the security system, the criticality alarms, the existing plant ventilation, and some lighting fixtures. A diesel generator supplies the emergency power. The emergency lighting system is supplemented by battery-powered units positioned to illuminate the exit routes, so that personnel can travel from work areas to the lighted hallways. As decommissioning proceeds, the permanent units will be replaced with the portable units to ensure a lighted exit pathway, and to maintain building ventilation.

9. Existing Ventilation Systems **(Activity Completed)**

A 2,000 cfm blower serves the drum compactor and the two decontamination tents in the LEU area. At the end of decommissioning, the system will be dismantled for disposal. A portable HEPA-filtration unit will replace the existing unit and discharge into the LEU area.

A 6,000 cfm blower and its associated duct work provided proper air flow patterns in the change rooms. This system was shut down when the CLT was installed, and will be removed and volume reduced for disposal.

The Apollo Facility ventilation system is located on the second floor in the HEU access hallway. When new airborne contamination control equipment is installed and operational, this unit will be dismantled to facilitate the removal of the elevated floors.

10. Natural Gas System and Piping **(Activity Completed)**

The natural gas system fed the hot water heaters, the make-up air system, and the small room heaters. Gas service has been terminated. Natural gas was fed from a regulator system at the southeast corner of the Main Building. The main gas header runs on the outside of the east wall of the building and connects to the make-up air system. Removal of the system will consist of removing the regulator system and associated piping and disconnecting and capping the gas service source at the gas shed located at the southeast edge of the B&W property outside of the security fence (see Figure 2-30 for the location of the gas shed).

11. City Water System **(Disconnection of the Building Water Supply at the Underground Pit Completed)**

All of the city water lines within the building will be removed during removal of building services and the Main Building water terminated at the underground pit located at the east side of the B&W property inside of the security fence (reference Figure 2-30). An external 1½ inch underground line will remain active for use in fire suppression. An additional 1 inch line will remain active supplying water to the shower and change room trailers. Both lines will remain active throughout the project. There is no physical interconnection between the domestic potable water and the former process water lines.

12. West Bay Building Services **(Activity Completed)**

The roof security fence, the corrugated sheeting on the south wall, and the nonsupport structural members will be removed for disposal. The roof fence was part of the security system limiting access from the neighboring industrial facility roof to the roof of the west bay. Corrugated sheeting is installed on approximately 70 percent of the south wall. The nonsupport structural steel consists of the cooling tower support steel, elevated platforms, and miscellaneous steel members.

B. Removal of Interior Walls and Floors **(Activity Completed)**

The interior walls of the Apollo Facility consist of concrete blocks. The floors are poured concrete, approximately six inches thick. The thickness of the ground floor varies, but is no greater than six inches thick. The floors contain various types and sizes of reinforcement. The elevated concrete floor was constructed over corrugated steel decking supported by structural members. The structural members are supported by the interior and exterior walls.

The principal construction equipment that will be utilized for deconstruction of the interior of the Main Building will consist of excavators, backhoes, skidsteer or bobcat loaders and/or tool carriers.

Deconstruction of the internal walls and elevated floors will be performed in zones referred to as remediation areas. These areas are dictated by current plant layout, by ventilation requirements, and by the ability to move construction equipment within the areas.

The elevated floors and block walls will be removed and transported to a storage area for further processing and disposition. Mock-up tests will be performed to determine the proper methods for removing the elevated floors and block walls, while keeping the amount of dust to a minimum. These tests will also determine if dust suppression measures must be used, in addition to enclosures.

All structural members and corrugated sheeting will be stacked in a given area while awaiting NDA and shipment to a licensed LLRW disposal site. Any remaining building services will be removed with standard construction equipment and segregated for disposal.

The following sequence has been tentatively established for elevated floor and block wall removal (Figure 2-14):

- area 9,
- area 8,
- a portion of area 3 to access area 7
- area 7,
- area 6,
- area 5,
- area 4,
- remainder of area 3, and
- area 10.

At the completion of deconstruction in a remediation area, all loose dust and rubble will be removed and transported to the staging areas to feed the Processing Plant. All construction equipment used in this activity will be destaged and repositioned for the next remediation area. Decontamination may be performed on the equipment prior to relocation. The portable HEPA-filtered ventilation equipment will then be moved to the next remediation area. Removal of the concrete ground floor is further discussed below in Section 2.7.2.

2.6.2 West Bay (Activity Completed)

The West Bay is constructed of concrete block walls. The east wall and the north wall were in common with the neighboring industrial facility buildings thus complicating the deconstruction of the West Bay. However, the decision by the owner of this complex to terminate operations and raze these facilities greatly simplified the deconstruction of the West Bay.

The roof of the West Bay consisted of a corrugated roofing material fastened to the roof trusses. Deconstruction of the West Bay was accomplished in the following sequence:

A. The concrete floor was broken up using jackhammers. This deconstruction operation was completed inside of tents which were exhausted by portable nuclear air cleaning units. HEPA-filtered exhaust air from these units was discharged into the West Bay and subsequently to the Main Building.

B. The West Bay was prepared for deconstruction of the north, west and south walls of the West Bay (the east wall of the West Bay is in common with the Main Building). Because the north and west walls are in common with the neighboring industrial facility buildings, the roof sections of these neighboring buildings were opened up. Through these roof slots, Herculite curtains were placed on the outside of the West Bay north and west walls. A Herculite curtain was also hung on the outside of the south wall of the West Bay. These curtains thus created a complete tent around the outside walls of the West Bay. Portable air cleaning units were then placed in the West Bay and the exhaust discharged to the Main Building creating a negative pressure within the West Bay with respect to the outside. Except for the air cleaning unit and small access doors, other penetrations between the Main Building and West Bay were sealed.

C. The north, west, and south exterior block walls were removed. This was accomplished by manual means and with the use of a backhoe bucket pulling the walls down into the West Bay. Upon completion of wall deconstruction, block rubble was moved to the Main Building.

D. The West Bay structural steel, trusses, and Main Building wall (facing the West Bay) were surveyed. Identified hot spots were decontaminated or painted to fix contamination. Upon completion of the radiological survey and health and safety release of the area, the Herculite curtain walls were removed, exposing the building structural steel skeleton and the roof.

E. The roof panels, roof trusses, and structural steel members were removed using a crane.

West Bay structural steel and other material components were cut to size for shipment and disposal at a licensed LLRW facility. Block walls and concrete have been moved to a storage pile for processing in the crushing plant.

2.6.3 Utility Relocation or Removal

The Apollo site is serviced by several utility companies and the Borough of Apollo (Figures 2-29, 30 and 31). During the remediation efforts, all essential services will be maintained, but may require relocation to provide access to contaminated areas. Services will be phased out when they are no longer required.

Some of the essential services at the Apollo site are electrical power, water, sewer, and telephone. Electrical power is provided by West Penn Power, water by the Municipal Authority of Westmoreland County, sewer by the Borough of Apollo, and telephone by Alltel Telephone.

Following is a discussion of the key tasks associated with relocation of utilities:

A. Relocate West Penn Power Company Lines **(Activity Completed)**

Power lines and distribution poles will interfere with the remediation efforts in several locations. For this reason, West Penn Power Company will relocate the lines and poles away from the affected remediation areas. The known interferences are the 25 KV and 4 KV lines feeding the Borough of Apollo, which cross over the Main Building roof to power poles along Warren Avenue.

B. Provide Temporary Power for the Remediation Activities Along the Riverbank

A temporary power source will be installed along the riverbank to supply temporary power and lighting for planned remediation activities.

C. Reroute the Main Power Feed to the Main Building and Maintain Emergency Temporary Power. **(Activity Completed)**

During deconstruction, power to the Main Building must be maintained along with the emergency power system. This will be accomplished through temporary facilities that can be easily moved as deconstruction progresses. The 480 volt main feed for the Main Building is in the deconstruction area, which will necessitate its relocation.

D. Remove and Reroute Municipal Authority Water Lines

Several water lines cross the site. As remediation activities progress, these lines will be eliminated or rerouted as necessary. Fire protection water to the Main Building is maintained until the Main Building is removed.

E. Reroute the Borough of Apollo North Sewer

This 24 inch vitreous clay tile sewer is a combined sanitary and stormwater sewer that serves the Apollo residents, B&W, and the previous neighboring industrial facility. The sewer line discharges into the Kiski Valley Water Pollution Control Authority line except during periods of heavy rain at which time it is partially diverted to the Kiskiminetas River. The north sewer will be rerouted offsite. Following activation of the new north sewer line, the original north sewer will be removed as part of the soil remediation effort (Section 2.7.2).

F. Relocate the Callipare Natural Gas Line

The Callipare natural gas well is located on the southwest corner of the previous neighboring industrial facility's property. The well discharge, which operates at 28 psi pressure, is through a 2 inch line that traverses B&W property from north to south. This line crosses an area that requires remediation. Prior to soil remediation, the gas well will be capped. During soil remediation, sections of the gas line that cross through contaminated soil will be removed. Following remediation, a new line may be installed.

G. Removal of Railroad Tracks

Five sets of railroad tracks cross the neighboring industrial facility's former south bay area, and hence cross the south sewer. The decision of the owner of this complex to terminate operations and raze these facilities eliminates the need to maintain these railroad tracks during the remediation of the south sewer (See Figure 1-1). The appropriate sections of these railroad tracks will be removed during remediation of the south sewer and may not be replaced.

2.6.4 Site Restoration

At the completion of the Main Building deconstruction, soil remediation and the final radiation survey (Section 2.7), the site will be graded to allow a positive flow of surface water to the Kiskiminetas River. Based on current plans, the Apollo Facility area will be graded at approximately one percent slope and the parking lot graded at approximately one-half percent slope. The riverbank area will be lined with Fabriform or equivalent for slope protection and proper drainage. The exterior remediation areas will be seeded to reduce soil erosion. The interior and offsite remediation areas will be restored to their pre-remediation condition, or better.

2.7 Completion of Decommissioning Activities

The following activities are planned to be performed after the NRC has approved the Apollo Decommissioning Plan. The scope of these activities include:

- the external deconstuction of the Main Building,
- the remediation of soils beneath the Main Building, beneath the neighboring industrial facility's south bay, in the parking lot and the riverbank,
- operation of the crushing plant as described in Section 2.4.4,
- completion of the final site radiation survey.

These activities will complete the decommissioning program and allow the site to be released for unrestricted use.

2.7.1 External Deconstruction of the Main Building

The Main Building consists of four exterior walls and a roof. The exterior walls are constructed of three course, 12 inch thick brick. A series of structural steel columns support a gable that consists of corrugated sheeting supported by the roof purlins and trusses. The remediation of the exterior walls and roof will be performed in sections. The building will be deconstructed starting at the south end of the building and working to the north in approximately 70 foot sections. The actual size of these sections is dictated by ventilation requirements and the ability to move the construction equipment within the area.

The Main Building sections will be deconstructed inside of a mobile temporary enclosure for the Main Building (Figures 2-32 and 33). The mobile temporary enclosure is a structure approximately 100 feet wide, 75 feet long, and 50 feet tall. This structure is mounted on railcar trucks, enabling the progressive deconstruction of the Apollo facility while maintaining adequate containment of potentially contaminated airborne particulates. The HEPA-filtered ventilation equipment described in Section 2.4.3 of the Decommissioning Plan will provide the airborne contamination control for the enclosure. The enclosure, in conjunction with the HEPA-filtered ventilation equipment, will enable adequate containment of potentially contaminated airborne particles to be maintained throughout deconstruction.

The mobile temporary enclosure will be constructed in place over the south end of the Main Building. This structure will consist of a steel frame designed to AISC specifications, a corrugated steel sheeting exterior, and an interior polymer membrane contamination barrier. The polymer membrane will be weighted at the bottom and extend to the ground. A similar membrane will also be attached to the perimeter of the open end of the mobile enclosure and the exterior roof and walls of the Main Building. A final membrane will be attached to the exterior base of the enclosure and sealed to the ground with sand or equivalent, thus providing containment.

After the enclosed section of the building is deconstructed, operations will be suspended and the mobile enclosure will be advanced to the next building section, by means of a twin drum line pull hoist, and the process is repeated.

The exterior wall and roof rubble will be removed using standard construction equipment and transported to a storage area for further processing and disposition. Material from the Main Building deconstruction will be handled as described in Section 2.4.5. All construction equipment will be destaged and repositioned to the next remediation section. Decontamination may be performed on the equipment prior to relocation. Mock-up tests will be performed to determine the proper methods for removing the walls and roof while keeping the amount of dust to an acceptable level. These tests will also determine the dust suppression equipment required, including enclosures and supplemental ventilation.

Upon completing the progressive deconstruction of the Main Building, the polymer membrane will be lowered, decontaminated if necessary, and packaged. Then the mobile temporary enclosure will be disassembled using conventional methods.

2.7.2 Soil Remediation

Soil includes surface and subsurface soil materials, concrete floor slabs, subsurface concrete structures, and buried utilities. Remediated soil will be processed, sampled, and loaded into railcars as described in Section 2.4.4. Disposal of soil materials will be in accordance with acceptable guidelines, which include licenses of LLRW disposal sites. Volumes of soil to be excavated are found in Table 2-10.

Soil remediation will be performed so as to avoid creating airborne contamination above NRC specified limits. Wetting agents and covers will be used, as necessary, to remove and transport materials to the proposed onsite processing facility.

Standard construction equipment and tools will be used for soil and foundation removal work. The equipment typically consists of excavators, bulldozers, front end loaders, dump trucks, compactors, water trucks for wetting haul roads, skid loaders, and miscellaneous small tools. The equipment described in Section 2.6.1 may be used for the removal of the ground floor and soil under the Main Building.

Based on the inhomogeneity of the uranium contamination and the nature of excavation operations, some incidental intermixing of contaminated and non-contaminated soils is unavoidable. Such intermixing is inherent to the excavation process.

As the soil remediation tasks are completed, a final radiation survey will be performed (Section 4.0). Following the successful completion of the final radiation survey, and NRC concurrence, soil replacement and grading will be performed.

A. Remediation of Soils Beneath the Apollo Facility

Uranium contamination in soil beneath the Apollo Facility has been characterized (Figures 2-4 and 5). The soil > 2000 pCiU/g beneath the Apollo Facility has been removed. The remainder of the ground floor and soil will be removed prior to and during completion of the Main Building decommissioning activities described in Section 2.7.1.

Included in the remediation of the soils beneath the Main Building will be the remediation of the north sewer. As shown in Figure 2-5, the north sewer runs through one of the areas of higher uranium contamination on the Apollo site. Additionally, samples extracted from deposits on the inside of the north sewer have indicated the presence of uranium contamination in excess of the 30 pCi/gm concentration. Based on these facts, the north sewer will be rerouted as described in Section 2.6.3 E. The starting location for the reroute will be a point between the east side of Babcock and Wilcox's fence and Route 66. The reroute has been designed to circumvent all areas which are radiologically contaminated. Upon completion of the reroute of the north sewer and its connection to the KVWPCA, the original north sewer will be excavated. The soil surrounding the north sewer that is contaminated above 30 pCi/gm also will be removed. Approximately 85,000 cubic feet of soil and sewer line will be removed from the area traversed by the north sewer.

Prior to, during and after the Main Building deconstruction (as described in Section 2.7.1), the remainder of these soils will be remediated. Planned remediation activities for the Main Building soil include:

- removal of the remaining Main Building concrete floor slabs;
- removal of Main Building column and wall foundations;
- removal of remaining soil to an average contamination level less than 30 pCiU/g;
- removal of the north sewer;
- maintenance of the soil's angle of repose and slope stabilization for safe and effective slope management;
- final radiation survey (see Section 4) and NRC concurrence;
- soil replacement of the remediated area;

B. Remediation of Soils Beneath the Neighboring Industrial Facility's Former South Bay

As shown in Figure 2-4, some soil below the neighboring industrial facility's former south bay is contaminated above release limits. This contamination originates from and lies along the south sewer. The south sewer serves only B&W's Main Building and the previous neighboring industrial facility. B&W maintains an NPDES permit for discharge through this sewer.

This concrete sewer is 18 inches in diameter by 427 feet in length. As shown in Figure 2-31, the sewer starts on the south end of B&W's Main Building, under the site of the former box shop, proceeds west under the previous neighboring industrial facility, former south bay, and out to the Kiskiminetas River. The sewer has been used by B&W for the discharge of treated process effluents that met regulatory discharge limits. Portions of the sewer have, over time, deteriorated, permitting treated effluent to seep into the surrounding soil resulting in soil contamination near the sewer.

Some contaminated soil that is to be remediated lies beneath the former building support columns for the neighboring industrial facility's previous south bay. The neighboring industrial facility's south bay complex was deconstructed and removed in early 1992. The removal provides B&W with unrestricted access to the south sewer and the contaminated soils surrounding the sewer.

Removal of the soil containing uranium contamination above 30 pCi/g, along with the south sewer line, will be performed. Planned remediation activities include:

- removal of railroad tracks in the remediation area,
- removal of contaminated soil,
- removal of the south sewer,
- maintenance of the soil's angle of repose and slope stabilization for safe and effective slope management,
- final radiation survey (see Section 4.0) and NRC concurrence,
- backfilling remediated areas,

Since the previous neighboring industrial facility no longer exists, there is no need to replace the south sewer.

C. Remediation of Soils in the Parking Lot

There is parking lot contamination apparently associated with Apollo Facility operations. Additional operations of the laundry facility resulted in contamination of the soil beneath the structure. The estimated volume of in-place contaminated material in this area greater than 30 pCi/g is shown in table 2-10. This material, in general, does not pervade as deeply into the ground as some areas under the Apollo Facility, and along the south sewer and the riverbank. Affected utilities in this area include buried water lines, buried natural gas lines, overhead power lines, and overhead telephone lines. They will be removed or relocated as discussed in Section 2.6.3.

Planned remediation activities for this area include:

- removal or relocation of affected utilities,
- removal of concrete slabs,
- removal of existing or abandoned structure foundations,

- removal of contaminated soil containing uranium contamination above 30 pCi/g,
- maintenance of the soil's angle of repose and slope stabilization for safe and effective slope management,
- soil processing,
- final radiation survey (See Section 4.0) and NRC concurrence,
- backfilling of remediated areas,

D. Remediation of the Riverbank Area

Radiological contamination exists in the parking lot riverbank area and the offsite riverbank areas. Characterization data indicate the existence of radiologically contaminated soil with average activity concentration levels greater than 30 pCi/g. Volumes are included in Table 2-10. The remediation effort will be affected by the KVWPCA main trunkline, which runs south to north along the riverbank, and by the water table, which is directly related to the river elevation.

Riverbank remediation will consist of:

- maintaining the soil's angle of repose and stabilization for effective slope management;
- shoring and protecting the KVWPCA main trunkline;
- removal of material down to an average contamination level less than 30 pCiU/g;
- performing final radiation surveys (Section 4.0) and NRC concurrence;
- protecting the riverbank with Fabriform, Riprap, gabions, or equivalent, grading, and vegetation.

Because characterization of portions of the near riverbank indicates contamination greater than 30 pCiU/g, these areas will be remediated. This remediation will be performed so as to prevent the potential contamination of the Kiskiminetas River above acceptable limits. Flow deflectors and silt curtains will be used as required in order to prevent unacceptable siltation of the Kiskiminetas River. Further details of water control are found in Section 2.4.3 (Figure 2-19).

These activities will be authorized by the Joint Permit approved by PADER and the U. S. Corps of Engineers. PADER Bureau of Dams and Waterways approved the Joint Permit on September 30, 1991, and the U. S. Corps of Engineers approved the Joint Permit on October 4, 1991. The Joint Permit has been modified to reflect improvements in the remediation design. The revised Joint Permit was submitted to PADER on April 2, 1992 and approval is expected by May 29, 1992.

2.7.3 Final Radiation Survey

The final radiation survey will be carried out as described in Section 4. Following completion of the survey in areas where excavation has been done and verified by the NRC that the release criteria specified in Section 4 have been met, the excavation will be backfilled with soil. Soil removed during remediation, which does not require disposal at a licensed LLRW facility will be replaced in excavations.

2.8 Schedules

An approximate schedule has been developed for the completion of all remaining decommissioning activities. This schedule is presented in Figure A-1, Appendix 2.

Three criteria were used in developing this schedule:

- Removal, to the extent possible, of contaminated materials containing greater than 2000 pCiU/g and disposal of that material in a LLRW disposal site prior to January 1992. All accessible material identified in the radiological characterization program as having uranium contamination greater than 2000 pCiU/g was removed and shipped to an LLRW disposal facility by the end of 1991 as planned. Characterization data has identified two isolated areas of soil contamination adjacent to the south sewer which are contaminated to levels greater than 2000 pCiU/g. These areas were not accessible during 1991 because of the neighboring industrial facility building foundations which were adjacent to this contamination. With the deconstruction of these facilities, this soil will be removed during remediation of the south sewer and shipped to a LLRW disposal site. It is not anticipated that additional areas containing greater than 2000 pCiU/g contamination will be discovered.

- Expeditious removal (prior to January 1993) of contaminated building materials and soil containing uranium concentrations greater than 30 pCi/g from the site, consistent with disposal site availability.

- NRC approval of the Apollo Decommissioning Plan in May 1992 and the soil processing plant being operational in May 1992.

B&W estimates that external deconstruction of the Main Building, excavation of the sewers and riverbank and processing of the soil, described in Section 2.7, will last approximately 6 months. Remediation of the soil under the Main Building will occur as the Main Building is removed. B&W estimates that the completion of the final radiation survey and NRC verification that the residual contamination limits have been met will be approximately two months after completion of external deconstruction. Site restoration will be completed approximately nine months later.

The schedule for the Completed Decommissioning Activities (Section 2.5) is shown in Appendix 2, Figure A-2, and for Ongoing Decommissioning Activities (Section 2.6) is shown in Appendix 2, Figure A-3.

2.9 Decommissioning Organization and Responsibilities

2.9.1 Overall Organizational Structure

Pennsylvania Nuclear Service Operations (PANSO), of B&W's Nuclear Environmental Systems Division (Figure 2-34), is organized by major functional activities with a Technical Control organization (Figure 2-35) designated to manage health and safety and regulatory requirements. Technical Control includes a compliance function for matters related to regulatory compliance requirements.

The basic structure of PANSO is in place and has been effective in managing the previous nuclear fuel manufacturing operations as well as the safe completion of the decommissioning activities at the Apollo site.

For the Apollo Decommissioning Project, a matrix organization (Figure 2-36) was established in August 1990 to manage the large, but temporary scope of work. This organizational structure results in the use of safety and administrative systems, procedures and experienced personnel that have been developed at PANSO over the past 30 years to effectively manage operations involving radioactive materials in a manner that protects the health and safety of the workers and general public. This organizational structure also ensures the independence of the safety related functions for the Project.

The Apollo Decommissioning Project organization includes a Project coordinator to ensure that there is effective interface between the Project and Technical Control Organizations. The Apollo Decommissioning Project organization also includes dedicated engineering and operations functions.

2.9.2 Key Positions and Responsibilities

Key positions are those that are responsible for assuring the safe decommissioning of the Apollo site. The key position responsibilities are described below:

A. Program Manager, Apollo Decommissioning Project

The Program Manager has the overall responsibility for the planning and management of the decommissioning activities of the Apollo site. It is his responsibility to meet safety requirements, technical performance, and budgeting criteria. He has the full authority to exercise the management controls necessary to assure the safe conduct of this decommissioning project. Some of the key positions of his organization are supplemented and complemented by PANSO personnel who represent functional disciplines - health and safety, licensing, quality assurance, nuclear safety and regulatory compliance, financial, and administration.

B. Manager, PANSO

The Manager of PANSO has full authority to exercise management controls necessary to assure safe operation of the site, including matters related to health and safety, licensing, quality assurance, and regulatory compliance. For safety related matters, he has the authority to overrule the Program Manager, Apollo Decommissioning Project.

C. Manager, Technical Control

The Manager of Technical Control is the senior licensing and safety individual, reporting to the Manager, PANSO. The Manager of Technical Control administers and is responsible for control programs to assure protection of the health and safety of the workers, general public, and the environment. He is responsible for maintaining sufficient technical expertise in control disciplines to assure an effective health and safety program, to maintain regulatory compliance, and to provide technical and regulatory advice and consultation in support of facility operation.

The Manager of Technical Control is independent of the Apollo Decommissioning Project functions and has the authority to terminate any operation that in his opinion could either directly or indirectly have a negative impact on the health and safety of employees and general public or compliance with regulatory requirements.

D. Manager, Engineering

The Manager of Engineering reports to the Program Manager and is responsible for managing a project engineering group that provides engineering support. He is responsible for the development of work plans, necessary detailed procedures, and engineering releases for decommissioning activities, design of temporary facilities, and analyses of permanent plant items and structures for developing deconstruction methods and techniques. He is also responsible for developing engineering documents for procurement of materials and equipment.

E. Manager, Operations

The Manager of Operations reports to the Administrative Project Manager and is responsible for implementing work procedures in a manner consistent with the work rules and guidelines of the Quality Assurance and Health and Safety programs. He is also responsible for ensuring the timely management of decommissioning activities and for implementing productivity improvement plans for achieving overall cost effectiveness of the project.

F. Supervisor, Health and Safety Operations

The Supervisor of Health and Safety Operations is responsible for the radiological, industrial, and environmental safety functions and reports to the Manager of Technical Control. He is responsible for implementing measures that provide safe and healthful working conditions, for maintaining radiation exposures as low as reasonably achievable, and for minimizing releases of radioactivity to the environment. This is accomplished through review of instructions and procedures, monitoring and surveillance, training, and investigation and evaluation of routine data and unusual events.

G. Manager, Environmental and Regulatory Affairs

The Manager, Environmental and Regulatory Affairs, reports to the Manager of Technical Control, and is responsible for the regulatory compliance program, document control, and employee training. He coordinates activities and provides technical advice to assure that compliance is maintained in the decision making process, that timely action is taken by the Apollo Decommissioning Project organization to correct any identified noncompliances, and that measures are taken to avoid re-occurrence of any noncompliance.

The Manager, Environmental and Regulatory Affairs, serves as the administrator for licenses and permits required by regulatory agencies and is responsible for auditing performance against regulatory requirements.

H. Supervisor, Quality Assurance and Services

The Supervisor of Quality Assurance and Services reports to the Manager of Technical Control. He is responsible for administering quality assurance programs that monitor quality related operations and for providing documented evidence that the required quality levels have been maintained in all work activities. He is responsible for quality assurance audits and inspections and for prompt correction of conditions which could adversely affect quality.

I. Supervisor, Health Physics Engineering

The Supervisor of Health Physics Engineering reports to the Manager of Technical Control and is responsible for developing the site health physics plan; preparing radiation work permits for decommissioning activities; performing site and area surveys; providing health physics services for decommissioning operations; and performing site characterization of the in-process work, including the final site characterization to verify release for unrestricted use.

J. Supervisor, Document Control

The Supervisor of Document Control, reporting to the Environmental and Regulatory Affairs Manager, is responsible for maintaining the document control tracking and management system, which encompasses issuance, maintenance, and upgrading of documents as delineated in the project Quality Control Manual.

K. Training Coordinator

The Training Coordinator reports to the Manager of Environmental and Regulatory Affairs and is responsible for implementing the ongoing PANSO training program to ensure that workers receive specific job-related training appropriate to the worker's level of involvement in the Apollo Decommissioning Project.

Job specific training may include:

- Job-specific work procedures,
- General procedures,
- Safety practices,
- Radiation safety training, and
- Hazardous material training.

2.9.3 Minimum Qualification for Key Positions

A. Program Manager, Apollo Decommissioning Project

The Apollo Decommissioning Program Manager must hold a B.S. degree in engineering or science and have a minimum of 10 years nuclear operation or construction experience. Five years of this experience should involve management of nuclear projects.

B. Manager, PANSO

The PANSO Manager must hold a B.S. degree in engineering or science and have a minimum of 10 years of nuclear experience, including five years of broad management experience; or must hold a Baccalaureate degree from an accredited college or university and have a minimum of 15 years experience associated with the nuclear industry and a minimum of five years broad management experience.

C. Manager, Technical Control

The Manager of the Technical Control function must hold a B.S. degree in science or engineering and have a minimum of 10 years of nuclear experience including a minimum of five years of technical management experience.

D. Manager, Engineering

The Engineering Manager must hold a B.S. degree in engineering or science and have a minimum of 10 years of experience in the design, operation and decontamination of NRC licensed nuclear facilities. A minimum of two years of this experience should involve managing the engineering and technical support of NRC facilities and activities.

E. Manager, Operations

The Operations Manager must hold a B.S. degree in engineering or science and a minimum of two years nuclear experience, or a high school diploma with 10 years of construction experience.

F. Supervisor, Health and Safety Operations

The Health and Safety Operations Supervisor must hold a B.S. degree in science or engineering and have a minimum of two years experience in radiological safety and health, or a high school diploma with at least 10 years of experience in radiological safety and health.

G. Manager, Environmental and Regulatory Affairs

The Environmental and Regulatory Affairs Manager must hold a B.S. degree in science or engineering and have a minimum of two years experience in nuclear operations, or a high school diploma with at least 10 years experience in nuclear operations.

H. Supervisor, Quality Assurance and Services

The Quality Assurance and Services Supervisor must hold a B.S. degree in science or engineering and have a minimum of two years of experience in nuclear operations, or a high school diploma with at least 10 years experience in nuclear operations.

I. Supervisor, Health Physics Engineering

The Health Physics Engineering Supervisor must hold a B.S. degree in health physics or equivalent and be certified by the American Board of Health Physics (ABHP) or be eligible for ABHP certification. Alternatively, this person shall have at least 10 years of experience in nuclear operations with at least five years of assignments in health physics.

2.9.4 Safety Advisory Board (SAB)

The Apollo Decommissioning Project is under the cognizance of a Safety Advisory Board (SAB). The SAB serves as the PANSO safety committee and is a vehicle for management review of all health and safety related matters.

The SAB consists of at least four senior members of PANSO's management and technical staff appointed by the Manager, PANSO. The SAB may form ad hoc committees to conduct some of its activities. The SAB remains responsible for the actions of the ad hoc committees. The Board Chairman, selected by the Board from among its members, is responsible for determining whether the appropriate disciplines are represented on ad hoc committees and at Board meetings to evaluate the items under consideration.

A. The responsibilities of the SAB include:

1. Acting as the ALARA committee, reviewing the annual ALARA Report and assessing progress in attaining ALARA goals considering:

   - programs and projects undertaken by the radiological safety function;
   - trends in airborne concentrations of radioactivity, personnel exposures, and environmental monitoring results; and
   - programs for improving the effectiveness of equipment used for effluent and exposure control.

2. Reviewing ongoing work activities including proposed major changes to operations and facilities, ad hoc committee activities, the health and safety program, and inspections and audits to assure that the health and safety program is being effectively implemented.

3. Providing professional advice and counsel on health and safety issues.

The SAB is responsible to the Manager, PANSO. Records of SAB proceedings and reviews, findings, and recommendations shall be reported in writing to the Manager, PANSO, and to the managers responsible for operations that have been reviewed by the Board.

2.10 Training

The PANSO organization includes a full time Training Coordinator to implement training programs which are applicable to each employee's work assignment. Training provided in connection with decommissioning activities is based upon existing PANSO internal procedures and manuals and includes the following features:

- Regulatory Guide 8.13 - Provision is made to give this information to female radiation workers and coworkers.

- Regulatory Guide 8.15 - The PANSO Respiratory Protection Manual has been issued and training is ongoing.

- Regulatory Guide 8.29 - This is incorporated into routine shoptalks.

- Safety rules and procedures are addressed by Health and Safety Instructions, Industrial Safety Instructions, job procedures, and equipment operating procedures.

- Work permit procedures are covered in "General Employee Training - Radiation Protection" and routine shoptalks with Health and Safety technicians.

- Dosimetry, bioassay, and air sampling requirements are addressed by License No. SNM-145 and the PANSO evaluations manual. Specific air sampling requirements are addressed in RWPs.

- Emergency plans and procedures are continuously reviewed for consistency with deconstruction. Training is accomplished through formal training sessions and shoptalks.

- The administrative system to report conditions potentially adverse to safety or quality is defined in the Quality Assurance Manual.

- All radiation workers are trained in the operation and proper use of personnel monitoring instruments. In addition, personnel are trained in the use of specific instruments and equipment which they are required to use in performing their work.

- ALARA considerations are covered through the existing site ALARA plan. Training is accomplished through shoptalks.

- Radiation workers are provided with documented training by the Training Department. There are also weekly shoptalks given by the foreman. Instruction is also given on specific procedures. These shoptalks and instructions are documented.

2.10.1 Radiation Safety

The PANSO radiation safety training program is used for the training and retraining of all unescorted individuals involved in decommissioning activities at the Apollo site. The purposes of the program are to promote an awareness of the potential risks involved and to provide a level of proficiency in personal radiation protective measures consistent with assigned tasks so that personnel involved in decommissioning the Apollo site can carry out their assigned responsibilities safely. On-the-job training is provided as part of the training program, as deemed necessary by Health and Safety personnel, to assure that all personnel are familiar with all aspects of their work. The existing PANSO training program is being used for Apollo decommissioning work.

Visitors are required to have fully trained escorts at all times. The escorts are responsible for ensuring that proper safety precautions are observed.

A. Training takes place before an individual enters a controlled area. Each individual is audited annually, and requalified every two years. Credit may be given for applicable training received off site, but plant-specific training is provided for all personnel. Training and examination results are formally documented.

B. The primary objectives of the radiation protection training program are:

- To provide information on the biological effects of stochastic and nonstochastic radiation, the potential risks associated with radiation exposure, and the basis for biological risk estimates.

- To enable each person to comply with plant rules and respond properly to warnings and alarms under normal and accidental conditions.

- To enable individuals to keep their own radiation exposures ALARA and to effectively apply ALARA considerations in making decisions that affect the radiation exposure of others.

C. The radiation safety training has been designed to ensure that the program can be reviewed and revised as needed to meet changing conditions, and that the instruction is sufficiently well understood to permit its practical application. In addition, the program has been designed to minimize redundant training. The status and extent of the training for each individual are documented to verify that workers are adequately trained for each assigned job.

D. The radiation safety training program includes the following topics:

- Radiation fundamentals - basic characteristics of radiation and contamination.

- Radiation exposure limits and controls - external radiation exposure control methods, procedures, and equipment.

- Radiation contamination limits and controls - contamination and internal radiation exposure control methods, procedures, and equipment.

- Contaminated materials associated with decommissioning work - potential radiological problems.

- Emergency procedures and systems - work related information and actions.

- Biological effects of radiation - basic understanding of biological dose and methods of assessment.

- Radiation Protection Program.

2.10.2 Industrial Safety

The PANSO industrial safety program is used for training and retraining all unescorted individuals involved in decommissioning activities at Apollo. The purpose of the program is to promote an awareness of the potential risks involved and to provide knowledge and proficiency in industrial Safety consistent with the assigned tasks. Personnel involved in the Apollo Decommissioning Project are trained to be able to carry out their assigned responsibilities safely. On-the-job training and equipment specific training are provided as part of the training program.

A. Training takes place on a continuing basis. Training in the proper use of specialized equipment is given before the individual uses that equipment. Credit may be given for applicable training received offsite.

B. The primary objectives of the industrial safety training program are:

- To provide information on the safety and potential industrial hygiene hazards associated with working at the Apollo site and the steps taken to provide a safe work environment.

- To enable each person to comply with plant rules and respond properly to warnings and alarms under normal and accidental conditions.

- To enable individuals to recognize potential hazards and to take appropriate measures to prevent personal injury and/or damage to facilities and equipment.

C. The industrial safety program has been designed to ensure that the program can be reviewed and revised as needed to meet changing conditions and that the instruction is sufficiently well understood to permit its practical application. The program minimizes redundant training. The status and extent of the training of each individual are documented to verify that workers are adequately trained for each assigned job.

D. The industrial safety training program includes the following topics:

- Weekly shoptalks - pertinent industrial safety information, injury statistics, specific safety topics.

- Specific training on specialized equipment - cranes, forklift trucks, front end loaders, scissor lifts.

- General industrial safety topics - proper lifting, hearing conservation, eye protection, slips and falls, hazardous material handling, use of power tools.

- Specialized training - first aid, CPR, fire fighting, use of respirators, HAZWOPER.

2.11 Contractor Assistance

It is B&W's intention to decommission the Apollo site primarily by using B&W employees under B&W supervision and management. Existing B&W procedures delineating the policies and administrative guidelines are applicable to the Apollo Decommissioning Project, and work is performed according to PANSO documents (Quality Assurance Program, Health and Safety Instructions and Procedures, Industrial Safety Procedures, Engineering Releases, and Work Requests).

As work packages are developed, it may be determined that, from a cost or schedule standpoint, it is beneficial to use contractor personnel for certain specific activities. All contractor personnel working on the Apollo site are under the direct supervision of B&W personnel. Furthermore, all contractor personnel are trained in health and safety matters in a manner and to the extent determined by Health and Safety personnel.

Table 2-1
RADIOLOGICAL CHARACTERIZATION SUMMARY APOLLO SITE
[Sample values are in pCiU/g for soil, wall, floor, and roof samples and in pCiU/l for water samples.]

LOCATION	SAMPLE MATRIX	NO. OF SAMPLES	MIN. VALUE	MAX. VALUE	MEAN VALUE	MEDIAN VALUE
APOLLO FACILITY	SOIL	1,416	1.15	34,078	501	18.49
	WALL	684	3.62	104,510	900	46.6
	FLOOR	307	2.9	43,381	1,457	60.5
	ROOF	119	7.8	5,610	380	216.8
PARKING LOT	SOIL	1,617	2.4	1,169.6	36.4	16.4
INTERIOR OFFSITE [1] AREA	SOIL	1,167	2.63	4,158	61	13.6
	FLOOR	7	6.9	135.2	29.3	8.57
EXTERIOR OFFSITE [2] AREA	SOIL	2,408	1.2	1,764	34	14.25
	WATER [3]	32	63	5,594	1,414	1005.2
LAUNDRY	SOIL	251	3.1	487	24	11.7
	WALL	66	30	70	9	28.4
	FLOOR	9	35	118	58	46.3
GROUND-WATER ASSESS-MENT	WATER [4] (gross alpha)	46	<1	182	13.2	1.72

NOTES:

1. The interior offsite area is defined as the area inside of the neighboring industrial facility.

2. The exterior offsite area is defined as the area outside of the neighboring industrial facility extending to the river bank.

3. These sample values represent lower limits of detection using gamma spectroscopy analysis. The analysis was used for screening purposes. None of the water sample results exceed the limit for unrestricted release of water to the environment of 30,000 pCiU/l given in 10 CFR 20, Appendix B, Table II, Column 1.

4. These samples were taken in October 1991 and were analyzed for gross alpha/gross beta using EPA method 900.0. This is a more sensitive analysis than the gamma spectroscopy referenced in footnote 3, thus the lower values.

Table 2-10

SOIL VOLUMES [1]			
Main Remediation Areas	>30 pCiU/gram Volume [2] (Cu. Ft.)	Overburden Volume (Estimated Cu. Ft.)	Total Excavated Volume (Cu. Ft.)
South Parking Lot & Riverbank	241,429	200,000	441,429
North Sewer & Riverbank	52,883	498,069	550,952
South Sewer & Riverbank	433,774 [3]	193,184	626,958
Middle Sewer & Riverbank	37,712	406,683	444,395
Main Building & North Parking Lot	373,491	50,000	423,491
Soil Pile from South Bays & Alcove	48,000	0	48,000
Total	1,187,289	1,347,936	2,535,225

Note:

1. All soil volumes represent estimates of the bank run or in-place soil volume. The volumes shown were developed using an engineering solids modeling program for computer aided design.

2. The >30 pCiU/g values represent an estimate of the contaminated soil in place as of April 1992 and the remediated soil from the South Bays and the Alcove. These values do not include soil volumes for the >2000 PCiU/g soils that were previously remediated and shipped offsite for disposal.

3. The south sewer and riverbank volume include an estimated 250 ft^3 of >2000 pCiU/g contaminated soil.

3.0 DESCRIPTION OF METHODS USED FOR PROTECTION OF OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

3.0 DESCRIPTION OF METHODS USED FOR PROTECTION OF OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

3.1 Radiological History of the Apollo Site

3.1.1 Apollo Facility

The Apollo site was first licensed to work with source material (thorium, depleted uranium, and natural uranium) in July 1957. In December 1957, Atomic Energy Commission (now NRC) License No. SNM-145 was issued for processing ^{235}U as enriched uranium. During the period from 1957 through 1962, various small scale operations (ceramic fabrication, metals fabrication, and small machine shop operations) as well as high enriched uranium, low enriched uranium, and thorium operations were performed in the Apollo facility. By 1963, a continuous low enriched uranium production line had been installed in the northern third of the Apollo facility.

During the period from 1964 through 1977, the primary function of the Apollo facility was converting low enriched (less than 5% by weight ^{235}U) uranium hexafluoride (UF_6) to uranium dioxide (UO_2) and converting high enriched (greater than 93% by weight ^{235}U) UF_6 to UO_2. These operations included fuel manufacturing, scrap recovery, and materials evaluation, as well as research and development.

The high enriched operations were terminated in 1978 and the low enriched operations were terminated in 1983. By October 1984, all of the conversion process equipment was removed. From 1984 to the present, the scope of activities conducted at the Apollo facility focused on characterization and decontamination of the remaining building structural materials and the surrounding area while conducting limited laboratory and storage activities.

3.1.2 Laundry

The laundry building was first licensed to operate with radioactive material in December 1960. Licensed activities included the decontamination of protective apparel for customers who handle radioactive materials as well as the protective clothing from the Apollo and Parks Township facilities. Customers included U.S. government facilities, reactor operators, and nuclear fuel processors.

In March 1965, an amendment to the license was issued by the Atomic Energy Commission (now NRC) to allow decontamination of U.S. Navy control rod drive mechanisms at the laundry building. Laundry operations were terminated in about February 1984.

3.1.3 Description of Site Activities

Although many diverse operations took place at the Apollo site, the principal activity was the conversion of both low enriched uranium and high enriched uranium from UF_6 to UO_2. Other operations included scrap recovery, production of sintered UO_2 fuel pellets, and the operation of a decontamination laundry for onsite operations and for commercial and government customers.

Operations which involved work with radioactive materials have been grouped into three categories: Low Enriched Uranium (LEU); High Enriched Uranium (HEU); and Miscellaneous Operations such as waste treatment and shipping and receiving which operated in support of the LEU and HEU operations.

Throughout these plant operations, there were no known burials from past operations on the Apollo site. Further, there has been no evidence of waste burial found during drilling for site characterization or during site soil remediation activities completed to date.

A. Description of Operations - Apollo Facility

1. LEU Operations

Principal LEU operations included a production line for the conversion of UF_6 to UO_2, a scrap recovery line to process uranium scrap to uranyl nitrate, a trial area for fuel pellet fabrication, a uranium fuel pelletizing operation, and specially designated areas for safe storage of all forms of uranium.

- LEU Conversion

  Uranium hexafluoride having a ^{235}U enrichment of less than 5% was received in 30 inch diameter cylinders weighing 2 1/2 tons and was vaporized in electric and, later, steam heated autoclaves. The resultant vapor was hydrolyzed with deionized water to form a uranyl fluoride solution. The uranyl fluoride was then reacted with ammonium hydroxide to form a precipitate of ammonium diuranate

(ADU). The resultant slurry was filtered on a continuous vacuum filter belt and was dried and calcined in air to triurano-octo oxide (U_3O_8). This oxide was then reduced in a hydrogen atmosphere to UO_2. The UO_2 was blended in two- or three-metric ton batches for shipment.

- LEU Scrap Recovery

Wet recovery and purification of scrap uranium compounds were performed using procedures which included dissolution (using nitric acid) and extraction and purification (using tributyl phosphate in a high purity kerosene vehicle). An oxidation step was usually performed prior to dissolution of the scrap to remove fluoride and water.

- LEU Pellet Trial Fabrication

Each blended batch of final product UO_2 was tested by preparing approximately one kilogram of sintered fuel. A line for producing sintered UO_2 fuel pellets having an enrichment of less than 5% ^{235}U was in operation for this purpose. This line included a slug press, a granulator, a pellet press, and a sintering furnace.

- LEU Fuel Pelletizing Operation

This process consisted of the manufacture of UO_2 pellets by utilizing blenders, feeders, presses, sintering furnaces, and a centerless grinder.

- LEU Storage

Containers of LEU scrap, usually five gallons in size, were stored in specially designated storage areas. These areas consisted of a series of shelves in an array such that nuclear criticality safety was assured. In addition, a set of horizontal racks was used for storing final product UO_2.

- LEU Uranyl Nitrate Storage

LEU uranyl nitrate solutions were stored in a nitrate storage tank farm which was located in the West Bay. The tank farm consisted of 20 stainless steel tanks, 10 each on the first and second floor. The tanks and their interconnecting manifold piping and valves, had stainless steel drip pans underneath them. All tanks contained boron silicate raschig rings for neutron poisons and criticality control. The tanks also had a 13.5g $^{235}U/l$ limit and a 5% ^{235}U enrichment limit. These tanks have been removed and shipped to a licensed LLRW facility for disposal.

2. HEU Operations

Principal HEU operations included a conversion line, two scrap recovery lines, a fuel fabrication room, and storage areas. The HEU UO_2 conversion process and the wet scrap recovery process were analogous to those for LEU.

- HEU Conversion

  The HEU conversion process handled all enrichments greater than 5% by weight ^{235}U and essentially duplicated the LEU conversion process.

- HEU Scrap Recovery - Dry Process

  Scrap uranium compounds having a ^{235}U enrichment greater than 5% were recovered by direct fluorination. The UF_6 formed by this treatment was purified by passing it through various chemical traps and then condensing it by use of a cold trap. Some scrap forms required pretreatment prior to fluorination. A system was used to react such scrap with air, oxygen, steam, hydrofluoric acid, hydrochloric acid, or chlorine gas. Following pretreatment, the scrap underwent either direct fluorination or wet recovery.

- HEU Storage

  Containers (usually two-quart bottles) of HEU scrap and product were stored in specially designated storage areas until the material was needed. These storage areas were usually a series of shelves or cubicles which held the stored material in an array such that nuclear criticality safety was assured. Other areas were used to store uranium solutions in safe geometry, ten-liter bottles.

3. Miscellaneous Support Operations

Satellite operations took place in the Apollo facility in support of both the LEU and HEU operations.

- Incineration

  Low level uranium wastes such as cardboard boxes and paper towels were burned in an incinerator. Some contaminated oils were incinerated in small campaigns. Ashes from the incineration process were processed through either of the HEU or LEU scrap recovery processes, as appropriate, or were sent to a licensed LLRW disposal facility.

- Waste Treatment

  Most of the uranium-bearing liquid waste streams from the LEU and HEU operations were collected in tanks and were sampled to assure that approved limits were met prior to discharging to the environment. Other liquid wastes were continuously monitored as they were discharged.

- Laboratories

  Gram quantities of uranium-bearing materials were analyzed in the laboratories for impurities, uranium content, enrichment, physical properties, and various other characteristics. Included were two quality control laboratories, a corrosion testing area, a mass spectrography room, an R&D laboratory, a health physics laboratory, three analytical laboratories, and a metallurgical laboratory.

- Shipping and Receiving

  A single room and loading dock were used for the loading and unloading of radioactive materials.

4. Laundry Operations

Laundry operations washed protective clothing from uranium and thorium fuel manufacturing plants, mixed oxide fuel manufacturing plants, and nuclear power reactors. Standard commercial equipment and commercial laundry processes were used including a wash cycle, a pre-rinse cycle, an extraction (spin) cycle, and a drying cycle. All liquids from these operations were retained in hold-up tanks, sampled and analyzed before discharging. Initially discharges went to a river outfall but later (1976) went to the Kiski Valley sewer line. (Refer to Figure 2-31) In addition to the processing of clothing, a small portion of the laundry building was used for the decontamination of submarine control rod drive mechanisms.

As a result of these operations, the following types of radionuclide isotopes were handled at the laundry.

- Uranium isotopes typical of those encountered in low and high enriched uranium fuel manufacturing.
- Thorium isotopes typical of those encountered in thorium fuel manufacturing.
- Transuranium isotopes (TRU) typical of those encountered in mixed oxide fuel manufacturing (i.e. plutonium isotopes and americium isotopes) and in plutonium source fabrication.
- Activation product isotopes typical of those found in nuclear reactor operation.
- Fission product isotopes typical of those found in nuclear reactor operation and in gamma isotopic source fabrication.

Sampling of soils in the vicinity of the laundry was completed in 1986. Gamma isotopic analyses of these soil samples indicated the presence of by-product material (primarily Co-60) and TRU (Am-241) in addition to uranium contamination. This soil was remediated in 1986 and shipped to a licensed LLRW disposal site. Additional laundry area characterization efforts in 1989 have indicated detectable Am-241 contamination in 13 of 330 samples ranging from 1 to 3.4 pCi Am/g. Low-levels of thorium contamination (<10 pCi Th/g) have also been detected in soil samples in the vicinity of the laundry building. Remediation will be performed in those areas in which radioactive contamination exceeds NRC free release criteria.

3.1.4 Operational Occurrences

During plant operation, there were no known leaks or spills which caused extensive contamination of the Apollo buildings and the site. However, from time to time during normal operations, small process leaks and spills occurred which caused minor contamination of building interior walls, floors and the underlying soil. This contaminated material has been or will be removed during site decontamination and decommissioning operations. The history of minor leaks or spills will not adversely affect the health and safety of workers and the public during decontamination and decommissioning operations. There was one leak across a uranyl fluoride hydrolysis unit heat exchanger some 20 years ago that permitted uranyl fluoride solution to get into the north sewer with the cooling water. This spill resulted in the low level contamination of the north sewer. The north sewer will be remediated, but the contamination levels will have no impact on health and safety during decommissioning.

No known exterior leaks or spills occurred. Soil contamination in the south parking lot area is presumed to have resulted from the storage of contaminated uranium processing equipment in that area during the early years of operation, with the contamination being washed off by natural elements. contamination near the facility is presumed to have resulted from rainfall washing off the roofs, since at some point in the history of the processing facility there were in excess of 120 vent stacks through the roof.

Due to the completeness of the site characterization, all possible areas of operational occurrences that could affect the decommissioning activities have been characterized and are understood. (Refer to Section 2.3.)

A. Apollo Facility

During the life of the Apollo facility, there were operational occurrences, such as spills and releases, involving radioactive materials which have contributed to the residual radioactive contamination levels in the facility.

The operational occurrences involved small UF_6 releases from primary contamination in LEU and HEU conversion processes, as well as the HEU dry scrap recovery process; small fires in the HEU and LEU scrap recovery systems which resulted in temporary loss of primary containment; liquid spills from the various LEU and HEU scrap recovery process containment vessels (columns, tanks, etc.); and leakage of ADU, UO_2, and U_3O_8 from various production equipment. Appropriate actions were taken to recover from these occurrences and to make required reports to the NRC.

B. Laundry

There was one operational occurrence at the laundry. This involved a spill of steam and liquid containing ^{60}Co during the decontamination of submarine control rod mechanisms. This spill resulted in contamination of soil along the south side of the laundry building. However, this spill was effectively cleaned up such that the most recent samples, collected as part of the site characterization, have confirmed the absence of ^{60}Co contamination.

3.1.5 Systems and Equipment

With the exception of the Apollo Main Building nuclear air cleaning system (reference Section 2.4.3.A and Figure 2-16) and the Main Building air sampling system (reference Section 2.6.1.5) all process equipment used to perform the operations described above have been removed and disposed of at licensed LLRW disposal sites. Numerous drawings which depict the various equipment and design layouts have been retained and are currently stored at B&W's Parks Township, Pennsylvania, site.

3.2 ALARA Program

The existing formal PANSO ALARA Plan is designed to ensure that radiation exposures to workers and the public are maintained at levels as low as reasonably achievable (ALARA). The plan reflects a strong management commitment to monitoring and controlling occupational exposure and environmental releases.

Operations are monitored by management to identify needed upgrades in engineering controls (including equipment, containment, remote handling systems, and operating systems) or administrative controls (procedures, etc.) which, when implemented, result in reduced potential for radiation exposures to workers or the public. The management positions responsible for radiation protection and maintaining occupational exposure ALARA are described in the ALARA Plan.

An extensive Radiation Protection Program is utilized by PANSO. The major components of this program include:

- Source and contamination control,
- Radiation contamination and exposure surveillance,
- Respiratory protection,
- Radiological work control,
- Radioactive materials handling and storage.

Health physics radiation assessment systems provide the capability to organize and report exposure and effluent data for measuring and assessing trends. These systems provide a vehicle for identifying potential problem areas so that investigations can be initiated in a timely manner.

The Apollo Decommissioning Project utilizes the existing PANSO ALARA Plan and radiation protection program to maintain the Apollo Decommissioning Project individual and collective occupational exposure ALARA.

The Apollo Decommissioning Project's management commitment to the ALARA concept is emphasized in departmental level policies as evidenced by radiation management control programs, such as using the Radiation Work Permit (RWP) program with its interrelationship with the ALARA Plan, which are responsive to early indications of potential problems. In addition, implementing instructions to workers stress the importance of continuous effective exposure control.

Management attention also focuses upon operating conditions which require modification for reduced exposure. Major facility changes and equipment and process development programs during the Apollo Decommissioning Project are subject to safety reviews to assure that ALARA has been addressed in proposed project designs.

3.3 Health physics Program

The Apollo Decommissioning Project Health Physics Program utilizes the existing PANSO Health Physics Program. Elements of this program include:

- Health and safety protection measures and policies as expressed in the appropriate PANSO manuals and procedures
- ALARA Plan
- Quality assurance provisions
- Equipment and instrumentation
- Monitoring policy methods, frequency and procedures
- Radiological Contamination Control Program
- Airborne Radioactivity Monitoring Program
- Respiratory Protection Program
- Radiation Work Permit (RWP)
- General Emergency Plan
- Posting and labeling
- Records and reports
- Potential sources of contamination exposure.

3.3.1 Quality Assurance Provisions

The Apollo Decommissioning Project Health Physics Program is subject to the provisions of the Decommissioning Project Quality Assurance Outline (QAO). In addition inspections, audits and management reviews are required as part of the normal ongoing PANSO Health Physics Program.

Inspections of decommissioning activities are conducted according to the requirements of the QAO. Radiological surveys, including sampling and analysis, are performed in order to evaluate the success of decontamination efforts in maintaining adequate radiological controls and to evaluate materials for removal and disposal. Hold points are incorporated in the appropriate work plans to insure the completion of these radiological surveys.

Health Physics equipment is inspected prior to use. Equipment failing the inspection, or found to be inappropriate due to use restrictions, is not used.

Respiratory protection equipment is inspected according to the requirements and schedules specified in the existing PANSO Manual of Respiratory Protection.

Periodic formal and informal audits of the Health Physics Program are conducted. The audits are performed by Quality Assurance according to the requirements of the QAO.

Annual management reviews are conducted of all health physics related procedures and plans, including the Respiratory Protection Program. Management reviews are also triggered by the ALARA Plan. Unusual events are investigated as they occur.

3.3.2 Equipment and Instrumentation

Health and Safety personnel determine the quantity, performance, necessary capabilities, and proper use of radiation detection equipment and instrumentation. Apollo Decommissioning Project management ensures an adequate supply of the needed instrumentation, as defined by Health and Safety.

A. Selection Criteria

Selection criteria for portable and laboratory counting equipment are based upon the types of radiation to be detected, maintenance and calibration requirements, ruggedness, interchangeability, and upper and lower limits of detection capabilities.

B. Instrument Type, Purpose, and Range

Table 3-1 lists the typical types of radiation detection instruments expected to be used. The data include manufacturer, model, probe, radiation type, and range.

C. Storage, Maintenance, Calibration, and Testing

Radiation detection equipment is stored and made available for routine use at various plant and plant service locations, such as the radiation protection office, controlled contamination change areas, and other locations designated by Health and Safety. Environmental counting laboratory equipment and *in vivo* bioassay equipment are primarily located at Babcock and Wilcox's Parks Township Site.

If necessary, portable instrumentation can be made available from the inventory stored at the Parks Township, Pennsylvania, site. Emergency equipment is stored and made available in designated emergency lockers at the site emergency control center. Maintenance is provided by assigned B&W maintenance functions, manufacturer's representatives, or contracted service vendors.

Monitoring and laboratory counting instruments utilized for radiation safety purposes are calibrated before initial use, after major maintenance, and on a routine basis. Such calibration, at a minimum, consists of performance checks on each scale range of the instrument with a radioactive source of known activity traceable to the National Institute of Standards and Technology (NIST).

Calibration procedures and methodology are contained in existing PANSO procedures. Prior to each use, operability checks are performed by Health and Safety personnel on monitoring and laboratory counting instruments utilized for radiation safety purposes.

3.3.3 Monitoring Policy Methods, Frequency and Procedure

A. Surveys

Routine radiation and contamination surveys are performed and the results evaluated by Health and Safety personnel to determine the effectiveness of the overall radiation safety program. The information is used to evaluate equipment designs and modifications, operational procedures, and other measures to further reduce personnel exposures.

Surveys are conducted using instrumentation and methods appropriate to the radiation type, contamination type (fixed or loose), survey type (general area, equipment, bulk, effluent, material, airflow, personnel), and purpose.

A system of structured survey procedures has been developed and implemented through the existing radiation safety program. Examples of these procedures include:

- Control of radionuclide concentration in liquid effluent,
- Radiation protection instrumentation,
- Surface contamination and control,
- Effluent monitoring and control,
- Containment air flow inspections,
- Shipment and receipt of radioactive materials,
- Environmental monitoring.

1. Personnel Contamination Surveys

Personnel contamination surveys are performed to detect and quantify the possible presence of radioactive material on the body. They are an important part of the Apollo Decommissioning Project contamination control program. Radiation workers normally perform self monitoring.

Self monitoring is required upon exit from all controlled areas as well as at other areas which may be designated by Health and Safety. If contamination is found in excess of the levels specified in PANSO procedures, the individual is required to notify Health and Safety personnel.

Health and Safety personnel supervise any necessary personnel decontamination activities and evaluate the need for bioassay analysis. Bioassay is initiated unless proper respiratory protection was used and nasal smears are negative.

Personnel surveys are normally conducted prior to whole body counts. Contamination levels in excess of PANSO limits require decontamination. When decontamination efforts cannot reduce the contamination to below PANSO limits, whole body counts may be performed at the discretion of Health and Safety. Health and Safety ensures that personnel performing the count are aware of this circumstance, proper evaluation of the data is performed, and another count is performed after successful decontamination.

2. Area Contamination Surveys

Routine surveys for surface contamination are conducted in all controlled and uncontrolled areas. The surveys include fixed and removable radiation measurements based on the potential for contamination in the area and operational experience. Minimum survey frequencies are daily for controlled areas and weekly for uncontrolled areas. Corrective actions are taken if levels of contamination are discovered which exceed the PANSO uranium based action levels shown in Table 3-2.

Area surveys are performed as required by Health and Safety to provide data for determining RWP conditions, to monitor ongoing radiological work, to close out an RWP, and to provide the data necessary to direct materials sampling plans for walls and surfaces. Survey results are compared to the PANSO limits.

During decommissioning, building interior surfaces are surveyed with one or more measurements per one-meter square grid, as defined in a sampling plan. These measurements are used as a guide to material sampling locations.

3. Materials Sampling and Analysis

Surface contamination surveys and radiation surveys are used as a guide to determine the proper location for materials sampling. If surface and radiation surveys indicate that unrestricted release is probable, a statistical sampling program is developed for material sampling. If unrestricted release is not probable, the location for materials sampling is normally the surface or area showing the highest reading.

Samples are also taken from locations considered probable sites of contamination, such as the soil beneath processing area floors. These samples are taken in a random fashion; however, at least one sample per 25 foot grid location is taken.

Additional samples may be taken at locations that walkover radiation surveys or knowledge of historic operations indicate as potentially contaminated. Additional samples may be taken to define the boundaries of a body of contaminated soil. Material samples are gathered in accordance with PANSO procedures.

4. Equipment Surveys

Equipment being removed from a controlled area is surveyed for fixed and removable contamination. Surfaces which may be contaminated are surveyed. Equipment disassembly may also be a required action. Surveys are conducted to evaluate radiological conditions, to obtain data necessary to open or close an RWP, and to establish compliance with the appropriate limits. Survey results are evaluated in comparison with the PANSO action limits.

5. Shipping and Receiving Surveys

Surveys for shipping and receiving are conducted in accordance with the requirements of 49 CFR and PANSO procedures.

6. Unrestricted Area Waste Surveys

Waste from uncontaminated areas is monitored prior to disposal to ensure that proper waste segregation has been accomplished.

7. Waste Soil and Material Analysis Surveys

The analysis of samples taken from waste soil and bulk materials is in accordance with the appropriate PANSO procedures.

B. Effluent and Environmental Monitoring

For many years, PANSO has had a program to routinely sample the airborne and liquid effluents discharged from the Apollo site. In addition, samples are routinely collected or measurements are routinely made at onsite and offsite locations to determine the environmental affects of these discharges. Table 3-3 shows the sample points, frequency and action levels associated with this program. Figure 3-1 shows the location of the environmental monitoring stations.

1. Effluent Air Sampling

Each operating exhaust stack from the facility work areas is representatively sampled on a continuous basis at a point prior to discharge. The measurement from each stack sample is utilized to determine activity concentration in the discharge and total activity discharged from the stack. Radioactive releases in the airborne effluents are summarized monthly, including pertinent information for each stack and for the total site. Any monthly average of effluent samples exceeding 10% of 10 CFR 20, Appendix B, Table II levels, is evaluated by Health and Safety for necessary supplemental action to assure that releases of radioactive materials are ALARA.

Standard laboratory counting equipment is used to determine the activity on the stack sample filters. The counting system is calibrated using standards traceable to NIST. This system provides a lower limit of detection below 10% of the 10 CFR 20, Appendix B, Table II limit. The activity release data is reported to the NRC on a semi-annual basis.

2. Environmental Air Sampling

Each environmental sampling station is equipped with a fallout collector, air sampler, and a thermoluminescent dosimeter (TLD). The fallout collector collects airborne materials, such as precipitation, dusts, and insects indigenous to the sampling area. The air sampler draws air through a filter via an opening in the sampler holder. The dosimeter consists of several thermoluminescent chips which are capable of measuring the gamma radiation dose.

Collection and analysis of the continuous air samples are performed at a minimum frequency of weekly. Analysis is for gross alpha and gross beta activity, with U 235 and Co 60 or other isotopes as determined by Health and Safety personnel used as limiting isotopes. Calibrations of the analytical instrumentation are performed using standards traceable to NIST.

3. Effluent Liquid

Liquid waste streams that are not contaminated, and are not likely to become contaminated (e.g., cooling water, etc.) may be discharged to the storm sewer without sampling.

Sanitary sewage from the main building is no longer discharged to the Kiski Valley Water Pollution Control Authority's waste treatment facility. Certain sanitary wastes (sink and shower water) are collected in a final holding tank system to await confirmation that the radioactive content is acceptable for subsequent release to the main intercept line for the Kiski Valley Water Pollution Control Authority's (KVWPCA) waste treatment facility, or to a commercial sanitary waste contractor. A record of radioactive content and water volume data is generated for each release. These data are summarized on a monthly basis and reviewed against the internal action guides. The activity release data are reported on a semi-annual basis to the Nuclear Regulatory Commission.

4. Surface Water Sampling - Kiskiminetas River

No process liquid wastes are released to the Kiskiminetas River. However, the river is sampled for comparisons of radioactive concentrations upstream and downstream from the site.

Twice each calendar quarter, samples are collected for nonradiological analysis of the parameters listed in the NPDES Permit. One liter grab samples are collected upstream at the Apollo Bridge and downstream at the mixing zone and Vandergrift Bridge. Sample analyses for the nonradiological parameters are performed on a contract basis by a vendor laboratory. Results of all analyses are retained on file by Technical Control and reported to state and federal regulatory agencies required by the permit.

Once each quarter, one liter or larger liquid samples are collected upstream at the Apollo Bridge, and downstream at the Vandergrift Bridge and at the Leechburg Foot Bridge. Each sample is analyzed for pH and for gross alpha and beta activity. Lower limits of detection are 10% or less of the appropriate 10 CFR 20 value determined by Health and Safety. Monthly river sampling may be employed during time periods in which operations are being conducted which Health and Safety personnel feel could affect the Kiskiminetas River activity levels.

5. Ground Water Sampling

Several ground water wells sample the Apollo site ground water. Samples are analyzed on a quarterly basis for radiological and nonradiological contaminants. Nonradiological contaminant analysis is performed by a vendor laboratory. Groundwater samples are analyzed for gross alpha and beta activity. The lower limits of detection are 1 pCi/liter for gross alpha and 5 pCi/liter for gross beta. These limits are less than 10% of the appropriate 10

CFR 20 values based on U 235 and Co 60 as the limiting isotopes. Calibrations are traceable to NIST.

6. Fallout

Liquid fallout is collected continuously at locations shown in Figure 3-1. Once each week this liquid is removed and measured for volume. At a minimum, the liquid composite is analyzed for gross alpha and beta activity on a monthly basis. Analysis results are kept on file by Technical Control. The lower limit of detection is less than 10% of the 10 CFR 20 Appendix B, Table II, Column 2 limits. Instrument calibrations are performed using NIST traceable standards.

7. Soil Sampling

The primary objective of performing periodic offsite soil sampling as part of the environmental monitoring program is to determine if there is measurable ground disposition from airborne releases. Soil samples are collected semiannually from each of the permanent environmental monitoring stations. The samples are analyzed by gamma spectroscopy using an intrinsic germanium or HPGe system. The lower limit of detection is less than 0.1 pCi/g for ^{235}U. Analysis results are kept on file by Technical Control.

8. Direct Radiation

The radiological safety program is designed to assure that direct radiation in unrestricted areas does not exceed limits in 10 CFR § 20.105. The objective of the direct radiation monitoring component of the program is to check the effectiveness of the control program.

Penetrating radiation monitoring is performed using standard environmental thermoluminescent dosimeters which are placed at various locations around the perimeter of the restricted area. These dosimeters are collected by Health and Safety personnel and analyzed quarterly by a contracted vendor to measure the integrated gamma dose for each location. The minimum reporting level for environmental themoluminescent dosimeters is 0.10 mRem. The data are retained by Technical Control.

9. Action Levels

Table 3-3 presents the effluent and environmental action levels. If an action level is exceeded, the Technical Control Manager is notified and corrective action is implemented as appropriate.

10. Environmental Analysis Equipment

Radiation measuring instruments are used to analyze environmental samples for alpha, beta, gamma, and neutron activities. Alpha and beta contamination is measured using GM or gas proportional instruments, gamma contamination is measured using scintillation or ionization instruments and neutron radiation is measured using boron-lined proportional counters.

Environmental instruments are calibrated in accordance with established PANSO procedures. Technicians perform operational tests on environmental bench counting instrumentation each day that the instruments are used. These tests are performed using a standard calibration source traceable to NIST. Test results are plotted on a quality control graph and retained by Technical Control.

Typical lower limits of detection of analytical equipment are 10% or less of the applicable Maximum Permissible Levels (MPL).

C. Personnel External Exposure Monitoring

All personnel who routinely work in radiologically controlled areas are provided with whole body thermoluminescent dosimeters (TLD). Whole body TLDs may also be assigned to any other person who enters radiologically controlled areas, at the determination of Health and Safety. Personnel dosimeters are processed at least quarterly or more frequently, as determined by Health and Safety.

All personnel who are likely to receive exposure in any calendar quarter in excess of 25% of the applicable value specified in 10 CFR § 20.101 (a) are provided with dosimetry.

Up-to-date external exposure records are maintained and reviewed by Health and Safety in accordance with 10 CFR § 20.101 and 10 CFR § 20.102. Exposure results are monitored and evaluated by Health and Safety. Appropriate investigative action would be taken in the unlikely event that an individual's exposure exceeds the administrative action levels shown in Table

3-4. The individual would be restricted from further radiation work until the evaluation is complete.

D. Personnel Internal Exposure Monitoring

Internal exposure monitoring is composed of two primary components: airborne exposure monitoring by air sampling and time of exposure (including the assignment of airborne exposure) and an internal monitoring program using bioassay and *in vivo* counting.

1. Airborne Assignment and Control

Internal exposure for individuals working in areas with potential airborne radioactivity is administratively controlled on the basis of assigned exposure. Individual airborne exposure assignments are made based on airborne concentrations in the area in which the individual worked, the time the individual spent there, and respiratory protection factors, if applicable. Exposure to airborne radioactivity is assessed daily and assigned on a seven day basis. If an individual's assigned exposure exceeds the administrative weekly control levels, the individual is restricted from further work in radiologically controlled areas until an evaluation is completed by Health and Safety personnel. The assigned exposure is evaluated along with all other exposures for the period (week, quarter, year) to determine if further action is required. Bioassay or *in vivo* counting are required as a response to certain levels of assigned airborne exposure as shown in Table 3-5.

2. Internal Monitoring

The bioassay program is necessary and desirable to aid in determining the extent of an individual's internal exposure to concentrations of radioactive materials. Excreta analysis and *in vivo* measurements are utilized to estimate the quantity of radioactive material deposited in the critical organ, the rate of elimination and the airborne radioactivity levels to which an individual may have been exposed. The bioassay sampling program is conducted to reflect the guidelines in Regulatory Guides 8.9, 8.11, and 8.26.

The urinalysis program (excreta analysis) is designed to permit the determination of transportable radionuclide intake and to verify the validity of the air sampling program and radiation control program. This is accomplished by establishing routine urine sampling for radiation workers and by special and supplemental sampling for unusual occurrences. Sampling frequencies and conditions under which routine, special, and supplemental sampling are performed are provided in Tables 3-6 and 3-7.

The *in vivo* analysis program is designed to permit the determination of both transportable and nontransportable radionuclide intake. This is accomplished by a routine *in vivo* counting program for individuals who normally work in areas where there is significant potential for intake of radioactive materials. Individuals are scheduled based upon their airborne exposure assignments. In addition, special and supplemental *in vivo* counting is performed as necessary. Counting frequencies and conditions under which routine, special and supplemental sampling are performed are provided in Table 3-8 and 3-9.

Nasal smears of potentially exposed persons are taken and analyzed prior to and following the use of respiratory protection, or following an uncontrolled or suspected occurrence of airborne radioactive material.

Investigation of any elevated bioassay results includes calculating the maximum potential uptake based on the elapsed time from the previous sample. If the individual may have received a significant uptake as determined by Health and Safety personnel (based on air samples or nasal smears, for example), the individual is immediately restricted from work that could result in additional exposure. Re-entry is only authorized when bioassay results return to acceptable levels. Administrative control levels are summarized in Table 3-10.

For nonroutine operations, perturbations, or an incident where internal exposure is suspected, and at the discretion of Health and Safety personnel, additional bioassay sampling may be required.

3.3.4 Radiological Contamination Control Program

Radiological contamination control during the Apollo Decommissioning Project is primarily based on the basic principles expressed in the existing PANSO Operational Health Physics Manual and the existing PANSO Health and Safety Instruction Manual. The principal elements of the contamination control program are:

- Access Control
- Protective Clothing
- Airborne Contamination Control
- Containment and Storage
- Contamination Limits

- Use of RWPs
- Surveys

A. Access Control

Access to controlled contamination areas is through designated areas which include a controlled side and an uncontrolled side, with a clearly defined step-off area provided between the two. Clean protective clothing is available on the uncontrolled side to personnel entering a controlled area. Used protective clothing will be stored on the controlled side and collected there.

Entry points to controlled contamination areas are posted in accordance with 10 CFR § 20.203. Instructions describing proper techniques for entry and exit are posted at the entry points. Special instructions regarding personnel dosimetry, protective clothing, personnel surveys and emergency evacuation, etc., are also posted as necessary.

Personnel survey meters are provided in the step-off area for use by personnel leaving the controlled areas. Notification instructions regarding contamination detected during the exit survey are also provided. Personnel are required to notify Health and Safety personnel before performing decontamination activities if they detect any contamination on their skin, hair, or personal clothing above the action levels specified in existing PANSO procedures.

B. Protective Clothing

Protective clothing is provided to all persons who are required to enter controlled contamination areas. The amount and type of protective clothing required for a specific area or operation is determined by operational experience and the contamination potential. Available clothing includes caps, hoods, laboratory coats, coveralls, safety glasses, boots, shoe covers, gloves, safety shoes, and respiratory protection equipment.

Protective clothing requirements are outlined in existing PANSO procedures. Protective clothing requirements made by Health and Safety personnel or stated in an RWP supersede the requirements of PANSO procedures.

C. Airborne Contamination Control

The principal control mechanism that maintains radiological protection for workers and the general public during the decommissioning is the HEPA-filtered ventilation equipment. This section describes the airborne contamination control equipment that supports decommissioning operations.

As described in Section 3.1, the principal materials processed in the Apollo Facility were low and high enriched uranium. The only radionuclides that have been found in characterization studies within the Apollo Facility are uranium and its decay daughter products. The uranium compounds processed in the Apollo Facility included UF_6, ADU, uranium oxides (UO_2, U_3O_8, UO_3), and uranyl nitrate. Uranium hexafluoride is a volatile gas which hydrolizes, upon contact with air, to form nonvolatile uranyl fluoride. Thus, uranium contamination at the Apollo site consists of dry, nonvolatile compounds. This contamination exists on plant masonry block walls, concrete floors, structural steel, and contaminated dirt. Decommissioning activities described in Sections 2.5, 2.6, and 2.7, may generate airborne dust. Removal of the uranium-contaminated dusts in the Apollo Facility and other associated enclosures is accomplished by a ventilation system which contains High Efficiency Particulate Air (HEPA) filters. These dust filters have a rated efficiency of 99.97% for a 0.3 micron filter at rated air flow.

HEPA-filtered ventilation equipment is used in the Apollo Facility to control radioactive material contamination and ensure the protection of workers, the general public, and the environment. The Apollo Facility is partitioned into zones and ventilation equipment is used to ensure that air always flows from a zone of lower contamination to a zone of higher contamination prior to exhaust. Access to higher contamination potential zones is through air locks or through doorways which maintain appropriate air inleakage. These operational zones are established by exhausting the zone of contamination using a separate ventilation exhaust system. (HEPA-filtered ventilation equipment is also to be used in the temporary enclosure associated with soil processing. See Section 2.4.4.)

Within a HEPA-filtered building, air is maintained at negative pressure with respect to the outside air. The pressure differential between the inside of the building and the outside was established initially by the architectural design of the building (i.e., by the air tightness of the building siding). This is accomplished by exhausting the building air through HEPA-filters and exhaust fans which maintain pressure differentials of a fraction of an inch of water gauge or greater, thereby ensuring the leakage of outside air into the building.

HEPA-filtered ventilation equipment consists of serial arrangements of roughing filters, prefilters, and HEPA-filters. The equipment ensures proper air exchange within a control zone and the filtration of exchange air through

HEPA-filters. Duplicate fan and filter systems for the Apollo Facility exhaust systems are used to ensure the overall reliability of the equipment. The Apollo Facility air ducts minimize dust accumulation in the ductwork through the use of prefilters as close to the dust generation operation as possible and by maintaining high air velocities in ductwork. Instruments are used in HEPA-filter banks to measure filter pressure drop, which serves as an indication of both filter and ventilation system performance. High pressure drop indicates a plugged filter and as a result reduced system air flow, while a low pressure drop indicates a failed filter fan.

In summary, all deconstruction activities which have the potential to generate airborne contamination of radioactive material which could approach 25 percent of the 10 CFR 20, Appendix B, Table I limits are performed in enclosures or other devices to protect and minimize the radiological exposure of workers and the public. The enclosures have separate ventilation systems which exhaust the enclosure. The exhaust is discharged through HEPA-filters.

Reliability of the HEPA-filtered ventilation equipment during operations is ensured as follows:

- Dioctyl Pthalate (DOP) testing of all HEPA-filters as they are received.

  Filters must be at least 99.97% effective for removal of 0.3 micron particles. This testing ensures that filters do not have leaks or other manufacturing defects. In addition, DOP testing is conducted on HEPA-filter systems to ensure that bypass leakage around HEPA-filters has not occurred.

- Daily monitoring of HEPA-filter and prefilter pressure drops.

  Whenever the differential pressure reaches four inches of water, the effectiveness of the filter is evaluated to ensure minimum air flow requirements are still maintained. Filters are changed when pressure drop exceeds manufacturer's recommendation for maintaining pressure differential specifications, or when minimum air flow requirements cannot be met.

- Direction of air flow within the main building, the planned soil processing enclosure, and the remediation zones is checked by Health and Safety personnel whenever a new remediation zone is established.

This evaluation ensures that a ventilation zone has been properly established and that air flows from an area of lower contamination into a zone of higher potential. This air balance evaluation is also made routinely by Health and Safety personnel to ensure maintenance of proper balance of building and remediation air.

- Measurement of air flow through access openings to the Apollo Facility, remediation zones and other temporary enclosures is checked by Health and Safety personnel routinely to ensure protection of personnel and the general public.

D. Containment and Storage

All work involving smearable radioactive material above existing PANSO limits for unrestricted areas and equipment is performed in containments approved by Health and Safety or in designated areas equipped with exhaust ventilation and absolute HEPA-filtration. Local containments are used when there is a potential for airborne contamination to approach 10 CFR 20 Appendix B, Table I, Column 1 limits. Containments are negative to the surrounding area and are designed to prevent release of contamination to general work areas during normal operations and release of contamination during foreseeable abnormal conditions.

Contaminated metallic materials and equipment may be stored inside the facility. If radiation and contamination levels are below the unrestricted area limits of existing PANSO procedures, the materials and equipment may also be stored unpackaged outside the facility. Metallic materials and equipment contaminated above the PANSO unrestricted limits may be stored in a fenced area outside the facility in packages meeting all regulatory requirements for transportation.

Contaminated soils and other nonmetallic building rubble associated with remediation which exceed regulatory limits for unrestricted use, may be stored inside the facility or outside within fenced areas. Such materials stored outside are covered in order to control the dispersion of radioactive materials.

E. Contamination Limits

The Apollo Decommissioning Project surface, equipment, liquid, and airborne contamination action limits are set forth in existing PANSO procedures and are shown in Tables 3-2 and 3-3. Radiation limits for shipping and receiving are those set forth in existing procedures. Additionally, all radioactive contamination and radiation are kept to ALARA levels.

F. Use of RWPs

A major goal of the PANSO radiological safety program is the control of contamination determined to be generated, or potentially generated, by job evaluation or found by the surveys. To this end, the radiation work permit (RWP) and its issuance process ensure a thorough evaluation of radiological safety conditions (including work processes and planning). The issuance process includes appropriate surveys, review of potential and estimated exposures (including ALARA reviews if indicated), job planning, determination of radiological safety measures (anti-contamination clothing, ventilation, respiratory protection, enclosure, degree of on-the-job coverage) by Health and Safety personnel, in-process job review and post job closeout and evaluation. A more detailed discussion of the RWP process is contained in Section 2.4.1.

G. Surveys

Radiation, contamination, and airborne surveys, described in other parts of this section, are used to determine radiological conditions, monitor ongoing work, and determine the success of control measures.

3.3.5 Airborne Radioactivity Monitoring Program

The criteria for sampling, analyzing and assessing radioactivity on the Apollo site is described in the existing PANSO Health Physics procedures.

The air sampling program conducted by Health and Safety personnel provides the data on airborne contamination necessary to allow actions to be taken to prevent the regulatory limits from being exceeded.

Any monthly average of an air sample from a single sampling location, which exceeds 0.5 times 10 CFR 20 Appendix B levels, is evaluated by Health and Safety personnel for necessary action.

The routine radiation air sampling program is supplemented with backup portable air sample surveys as required to evaluate operational trends or to evaluate breaches in containment. Portable air samplers also serve as backup when continuous air samplers are not operational. Personal or lapel air samplers are also used to augment the routine air sampling program. These samplers are used to obtain correlations between the continuous air samplers and concentrations of airborne radioactivity in the immediate vicinity of a worker's breathing zone. Certain workers, as specified by Health and Safety, are required to wear lapel air samplers during routine and nonroutine operations to aid in the determination of these correlation factors.

Special surveys of airborne concentrations may be conducted by Health and Safety for nonroutine activities and, based on these special surveys, additional airborne protection measures for the particular operation may be required. Typical of these special operations are burning, welding, and cutting operations which have the potential to result in increased airborne concentrations.

Portable air samples are taken during excavation, removal and transfer of contaminated soil and similar bulk material. Personal air samplers may be issued to one or more members of the work crew at the discretion of Health and Safety personnel.

The routine air sampling data and assigned individual personnel exposures are monitored by Health and Safety to evaluate the effectiveness of the internal exposure control measures. Individual airborne exposure assignments are made based on airborne concentrations in the area in which the individual worked and the time the individual spent there. Administrative controls are provided to prevent an individual from receiving additional exposure if the weekly control level is exceeded. Control actions include restricting the individual from working in an area containing airborne radioactivity for the remainder of that work week, and corrective actions to prevent recurrence.

3.3.6 Respiratory Protection Program

Normally, the inhalation of airborne radioactive material is controlled by the application of engineering controls, including process containment, and ventilation equipment. When such controls are not feasible or cannot be applied, respiratory protection is used, with the concurrence of Health and Safety. When it becomes necessary for individuals to work in areas where the airborne radioactive contamination could potentially exceed the levels given in 10 CFR 20, Appendix B, Table I, Column 1, or for emergency situations, respiratory protection equipment is used pursuant to 10 CFR § 20.103 (c).

Only respiratory protection equipment specifically approved by NIOSH or by the NRC is used. The use of respiratory equipment on the Apollo Decommissioning Project is in accordance with the existing PANSO Manual of Respiratory Protection and its implementing procedures.

3.3.7 Radiation Work Permit (RWP)

The RWP is an important element of the PANSO radiological safety program and is described in detail in Section 2.4.1.

3.3.8 General Emergency Plan

The radioactive material inventory at the Apollo site does not exceed the NUREG-0767 threshold for which a radiological contingency plan is required.

Babcock & Wilcox does however, maintain an Emergency Procedures Manual to guide responses to emergencies. These procedures address such subjects as evacuation, personnel accountability, emergency rescue, determination of offsite radiological and nonradiological concerns, offsite evacuation, agency notification, etc. These procedures are reviewed annually and updated as necessary by Technical Control and are approved by the manager of Technical Control. In addition, PANSO maintains an active emergency response team comprised of employees who are trained in first aid and CPR, general emergencies, contamination incidents, fire fighting and emergency rescue.

Because of the small quantity and immobile form of fissile uranium remaining from previous operations, the emergency procedures need not address accidental nuclear criticality.

3.3.9 Posting and Labeling

All areas where radioactive materials are utilized are posted in accordance with the requirements of 10 CFR § 20.203. Containers of radioactive materials and licensed sealed source materials are marked with the standard radiation symbol and the words "Caution Radioactive Material." Areas are classified and posted as radiation areas, high radiation areas, or radioactive material areas, per 10 CFR § 20.203. In addition, areas where radioactive material is handled in dispersible forms, so that an inhalation potential may exist, are designated as controlled contamination areas and are posted as contamination areas or airborne radioactivity areas.

Emergency routes and exits are posted according to the existing Emergency Procedures Manual.

Determination of the area postings is made by Health and Safety personnel. Health and Safety routinely inspects for proper postings and evaluates the need for additional postings.

3.3.10 Records and Reports

Records of individual exposures to radiation, radiation surveys and monitoring results and the disposal of licensed material are maintained in accordance with 10 CFR § 20.401. Table 3-11 summarizes the types of records and the minimum retention periods.

Records which are generated by PANSO personnel, but are related to the decommissioning effort, are retained by both the Apollo Decommissioning Project and PANSO as required by the Project's Quality Assurance Outline.

Records related to the radiation safety program are either microfilmed, stored in archive files, or stored on computer software files. Records which are maintained in this fashion include personnel exposure, respiratory protection, radiation surveys and monitoring results, accident investigations, bioassay, stack releases, liquid releases, TLD badge reports, and waste disposal.

Reports of radiation surveys and individual exposure status are provided to management as necessary to keep them fully informed of radiation exposure status of individuals. Annual ALARA reports are provided to project management and to the Safety Advisory Board.

Formal reports are submitted to federal, state, and local authorities as required by applicable regulations, licenses, and permits.

3.3.11 Potential Sources of Contamination Exposure

Since low enriched uranium is the primary contaminant, external radiation exposure is an insignificant source of exposure to occupational workers or the public relative to the Apollo Decommissioning Project. Internal exposure, on the other hand, could be a source of exposure. The principal operations that have the highest potential of generating airborne contamination and their primary control measures are discussed below.

A. Scabbling

Local ventilation is employed where large scale scabbling is performed. Scabbling generated dust is removed as generated to control the spread of airborne contamination. Dust control methods such as mist, foam and enclosure (whole or partial) are used where practicable.

B. Removal of Overhead Items

Smearable contamination is controlled by being removed or fixed in place prior to removal of overhead items. The potential for airborne contamination is considered in evaluating removal methods. Local ventilation is supplied for operations considered likely to generate a significant amount of airborne contamination. Unnecessary dropping, shocks, banging, etc. are avoided as far as possible to reduce possible generation of loose contamination material (such as paint chips).

C. Processing Plant Operations

The Processing Plant operations will be fully enclosed and ventilated. The enclosure will be at negative pressure to the surrounding area. Exhaust from the enclosure will be prefiltered and HEPA-filtered prior to release. Mists and foams will be employed where appropriate to control dust generation.

D. Soil Removal

If the level of soil contamination is such that handling is likely to cause airborne contamination levels in excess of 10% of applicable limits, excavation of such soil takes place within an enclosure and the soil is covered when not enclosed. Mist, foam, and other stabilizing agents are used as needed to control the generation of airborne material during such soil removal. The Surge Piles resulting from such excavations are covered when access to these Surge Piles is not required or at the close of the day's operation.

E. Loading and Transport

During rubble and soil loading operations, Health and Safety personnel determine the type and level of dust suppression required. Ventilated enclosures, partial or complete, may be used to control the spread of airborne contamination. Mist, foam and other wetting agents may be used to control the generation of airborne contamination during loading, unloading and transport of soil, rubble and crushed rubble. Vessels of soil or rubble are covered when not in the process of being filled or emptied. Unprocessed soil or rubble handling may be performed using dust suppression devices.

F. Interior Wall Removal

Local ventilation is used to control the airborne contamination which could be caused by wall removal and the loading of rubble for transport. The use of enclosures is evaluated on a case-by-case basis as a control measure. Mists and foams are employed where practical to prevent and control airborne contamination. Prior to wall removal, smearable contamination is removed or fixed.

G. Roof Removal

The potential for airborne contamination generation is considered as a factor in evaluating methods of roof disassembly. Smearable materials are removed from the roof upper surface. Smearable radioactive contamination above approved limits are removed from or fixed to the roof, including the underside. Local ventilation control, enclosures, and other methods are evaluated on a case-by-case basis for the purpose of containing any radioactive material generated by the disassembly process.

H. Exterior Wall Removal

Smearable radioactive contamination is fixed or removed prior to wall removal unless the wall removal is performed in a suitable enclosure. Enclosures and ventilation are used to control the airborne contamination which could be caused by wall removal and the loading of rubble for transport. Mist and foams may be used prior to, during and after removal to prevent and control airborne dust generation.

I. Floor Removal

Floor removal operations are performed in ventilated enclosures and the exhaust air is HEPA-filtered. The design and use of these enclosures are evaluated on a case-by-case basis to control the airborne contamination. Mist and foams may be used to prevent and control airborne contamination.

J. Housekeeping Operations

The principal methods and considerations of housekeeping operations are
- The use of HEPA-filtered wet vacuums as the primary dust collection device,
- Damp mopping and scraping,
- Wipedowns using absorbent or dampened cloths,
- Minimization of liquid waste, and
- Evaluation of additional cleanup methods.

3.4 Contractor Personnel

3.4.1 Procedure

PANSO's existing radiation protection policies and procedures are followed to ensure that contractor occupational exposure is controlled in accordance with the PANSO ALARA Plan. Contractors performing work at the Apollo site complete all the required training before starting a job. Health and Safety specifies these requirements for all contractors and the Apollo Decommissioning Project management prior to the job and assures training is completed in a timely manner.

3.4.2 Health and Safety Operations Responsibilities

In order to provide effective radiological safety support to contractors during decommissioning activities, Health and Safety has the responsibility to:

- Perform radiation and contamination surveys prior to performing work in both the restricted and unrestricted areas of the site;
- Review and approve work authorizations and the issuing of RWPs;
- Support contractors in job planning to implement ALARA;
- Monitor contractor personnel for external exposure and contamination in both the restricted and unrestricted areas of the site;
- Post and remove radiation and contamination area boundaries;
- Survey and approve all materials and equipment before leaving the site; and
- Ensure that all contractor support functions, (surveys, reports, reviews, etc.) are properly documented, maintained and available for reference.

3.5 Radioactively Contaminated Material

The radioactive contaminated material management program for the Apollo Decommissioning Project is based upon the existing PANSO waste management program. The program, described below, ensures that contaminated materials associated with decommissioning the Apollo site are handled, stored and disposed of in accordance with applicable regulatory requirements and the limits adopted for release of the site for unrestricted use, discussed in Section 4.0.

3.5.1 Management of Contaminated Material

The kinds and quantities of contaminated material and their associated management are described in Section 2.4.5, and as well as in Section 2.7.2. Further details are provided below.

A. Soil

Soil will be dewatered, excavated, and transferred in covered transport vehicles to temporary storage, Surge Piles, pending processing and sampling. The soils will be processed through the Processing Plant (Figure 2-38). Based on site characterization data, some soil may be loaded directly into shipping containers, if the soil is adequately dry. The processed material will also be sampled, in accordance with a statistically sound sampling plan based upon applicable standards, to ensure that the samples are adequately representative of the actual level of the soil. The material will remain segregated as the batch activity levels are verified. Soil with a concentration greater than 30 pCi/g will be prepared for shipment to Envirocare or to another licensed LLRW disposal site. Soil with an average activity less than 30 pCi/g will be replaced in site excavations following NRC verification of the activity level as discussed in Section 4.0.

B. Crushed Concrete, Block, and Brick

Crushed concrete, block, and brick will be treated as soil, with the exception that dewatering will not be required. The material will be staged in an area near the Processing Plant.

C. Roofing Material

The roofing material, tar, tar paper, and insulation, is being removed from the roof in sections using simple hand tools. The majority of the roofing material will be loaded directly into shipping containers, as previous sampling has adequately characterized the roofing activity levels. The remaining material will undergo 100 percent analysis by the PANSO Nuclear Materials Control (NMC) group, in accordance with established procedures or sampled in accordance with a sampling plan based on applicable standards, prior to being loaded into shipping containers. All roofing material will be shipped to a licensed LLRW disposal site.

D. Structural Steel

To facilitate handling and staging, structural steel will be cleaned of smearable contamination, in excess of levels provided in Annex C, prior to removal. The steel will be staged either inside the Apollo Facility or outside near the railcar loading station. The steel will be analyzed by the PANSO NMC group. The steel will then be loaded into shipping containers and transferred to a licensed metals contractor for processing and disposal or transported directly to a licensed LLRW disposal site.

E. Miscellaneous Metallics

In order to facilitate handling and staging, miscellaneous metallics (building safety, monitoring, ventilation and utility systems, platform steel, cooling tower, and minor sources of metal) are routinely cleaned of smearable contamination above applicable limits prior to removal. The metallics will be staged inside the Apollo Facility for volume reduction (as feasible) or outside near the railcar loading station. The material will be analyzed by the PANSO NMC group. This material will be shipped to a licensed metals contractor for processing and disposal or to a licensed LLRW disposal site. Onsite volume reduction will be performed using simple hand tools, such as bolt cutters, saws, metal shears, torches, wire snips, wrenches, and screwdrivers to dismantle or cut up metallics.

F. Contaminated Aqueous Liquids

It is the policy of the Apollo Decommissioning Project to minimize the production of contaminated aqueous liquids. Aqueous liquids are collected and sampled for analysis to determine their suitability for release. Suitable liquids will be released to the south sewer system in accordance with the site NPDES permit conditions. Liquids unsuitable for release will be solidified or evaporated, reduced to a residue, and disposed of as a solid radioactive waste. Contaminated aqueous liquids are not expected in Apollo decommissioning activities.

G. Dry Active Waste

Dry active waste (DAW) will be produced as a result of the remediation process and will consist primarily of plastics and paper. The material will be collected, volume reduced, analyzed for activity and shipped to a licensed LLRW disposal site. Volume reduction, if preferred, will be by compaction.

H. Groundwater

Groundwater is not expected to be contaminated above acceptable levels based upon site characterization data obtained to date.

I. Surface and Roof Runoff and Sediment

Water flow on the Apollo site will be closely controlled by a site surface water drainage system which terminates into a lined sediment basin capable of holding 5,500 cubic feet per acre of runoff. The sediment will periodically be removed and processed as a soil. The water will be released after sampling in accordance with the site PADER/Corps of Engineers permit.

J. Water from the Soil Dewatering Process

Based upon previous analyses, water from the soil dewatering process is expected to be acceptable for discharge. Following treatment for suspended solids, water will be continuously discharged to the Kiskimentas River through a PADER approved outfall.

3.5.2 Regulatory Requirements and Decommissioning Limits

Management of contaminated materials is being carried out in accordance with the relevant requirements of 49 CFR, 10 CFR 61, 10 CFR 71, 10 CFR 20, and applicable disposal site license conditions for the processing and disposal of radioactive waste, as well as the unrestricted release limits for the site, as contained in Annex C of License No. SNM-145, Option 1 of the 1981 Branch Technical Position paper and Section 4.0 of this Plan. Compliance with the requirements, conditions, and limits ensures that material contaminated greater than 30 pCi/g will be removed from the Apollo site and that the site, following completion of site restoration, will be suitable for unrestricted use. The waste classification, shipping, surveillance, and packaging requirements of these regulations are met through the use of the existing PANSO shipping and waste handling procedures. These procedures will be amended and extended as required in order to address project and disposal site needs and changing regulatory requirements.

It is recognized that the waste packaging and transportation requirements of the Apollo Decommissioning Project may be affected by the revised 49 CFR and 10 CFR 71 IAEA compatibility regulations published in the Federal Register on December 21, 1990. B&W personnel responsible for packaging, labeling, and shipping contaminated materials are cognizant of these revisions and will assure compliance with the new regulations when they become effective.

Analysis requirements of 10 CFR § 61.55 and 10 CFR 71 are met by use of the PANSO Analytical Services Laboratory and equipment used specifically for the analysis of special nuclear material. Knowledge of site activities is extensive and the radionuclides that are or may be present are known. Contaminated material will be analyzed either by means of sampling plans or a survey prior to disposition.

PANSO Analytical Services Laboratory uses gamma spectroscopy equipment as its primary analysis tool. All analytical equipment calibrations are NIST traceable. Laboratory analyses are in accordance with applicable PANSO analytical procedures.

In cases where the nuclides are not amenable to gamma spectroscopic analysis or additional capacity is desired, outside laboratories skilled in 10 CFR § 61.55 analysis will be employed. Routine quantification of such isotopes (if necessary) is accomplished by means of scaling factors developed from their analysis.

The quality assurance provisions of 10 CFR 71 subpart H and 10 CFR § 20.311 are met by the Apollo Decommissioning Project Quality Assurance Outline, which is based upon the PANSO Quality Assurance Program. The program meets the requirements of 10 CFR 71 and 10 CFR § 20.311 and is approved by the NRC.

The waste characteristic requirements of 10 CFR § 61.56 are satisfied in the course of processing the waste for shipment. *In situ* sampling has shown that the waste does not contain hazardous materials and is not capable of generating toxic gases, vapors, or fumes. Dewatering and sampling assures compliance with water content requirements. Volume reduction, block crushing, and loading techniques are used to reduce void space to a minimum. Disposal site acceptance criteria are satisfied in part by *in situ* sampling to determine the chemical content of the waste.

Positive control of the contaminated material is maintained in accordance with applicable PANSO procedures. Contaminated material that is temporarily stored outside will be within a fenced area, with security personnel monitoring the site on a 24 hour a day, seven days a week schedule.

3.5.3 Projected Quantities of Contaminated Material to be Shipped from the Apollo Site

As previously discussed, a significant amount of decommissioning work has been and continues to be performed under existing NRC License No. SNM-145. Essentially all of the contaminated material associated with this work meets LSA criteria and has been shipped for disposal. The remainder of the contaminated material is also expected to meet LSA criteria.

The contaminated material falls into four main categories; soil, roofing material, metallics, and dry active waste. Soil consists of all soils, crushed brick, block, and concrete, and all residues from contaminated liquid treatment. No significant quantities of special wastes such as chelates, chemicals, or mixed waste are expected to be generated. These types and quantities of contaminated material are summarized in Tables 2-5,6,7,8,9,10.

3.5.4 Temporary Onsite Storage of Contaminated Materials Prior to Shipping

Temporary onsite storage will be a prominent feature of contaminated materials handling at the Apollo site. Temporary storage of material contaminated in excess of the unrestricted release limits discussed in Section 4.0 is needed to stage material for various phases of processing prior to shipping, to accumulate sufficient material for economical shipments, and to coordinate shipments with carrier and disposal site availability. Onsite temporary storage prior to shipping will be provided as necessary for roofing material, dry active waste, such contaminated liquids as may be generated, and soils, block, concrete, and brick contaminated in excess of 30 pCi/g.

Contaminated soils and other contaminated materials, which exceed regulatory limits for unrestricted use, may be stored inside the Main Building or outside within a fenced area. Materials stored outside are covered with tarpaulins or an equivalent heavy duty material during non-working hours. The storage piles are uncovered only enough to perform project tasks during working hours.

Equipment and materials stored or staged in a controlled contamination zone, which meet the contamination limits for a controlled contamination zone, may be stored unpackaged.

A. Soil, Block, Concrete, and Brick

The majority of these materials will be stored adjacent to the Processing Plant (Figure 2-24). These storage piles will be covered with tarpaulins or other heavy duty material during non-working hours and uncovered only enough to perform project tasks during working hours. In addition material will be stored in covered day bins after processing until sampling and analysis are complete (See Section 2.4.4), the proper disposition of the waste has been determined and the material can be shipped or stored for NRC free release survey prior to being used as backfill.

Soil (including crushed concrete, block, and brick) with an activity greater than 30 pCi/g will be shipped to Envirocare, Inc. in Utah or to another licensed LLRW facility. Soil with an average activity concentration less than 30 pCi/g will be stored prior to replacement in site excavations after NRC verification of the activity level as discussed in Section 4.0.

The exposure rates at the site access points due to storage of these materials, are maintained below the applicable 10 CFR § 20.105 limit.

B. Metallics

The principal reasons for onsite storage of metallics are the need to survey the material and to accumulate sufficient material for shipment. The structural steel inventory is expected to be no more than 1600 cubic feet. The miscellaneous metallics inventory is also expected to be 1600 cubic feet. The material will be stored onsite until a sufficient amount is accumulated for a cost effective shipment. This material will be either stored in sea van containers or stored outside and covered with tarpaulins or other heavy duty material.

C. Roofing Material

The roofing material was loaded directly into shipping containers and sent for disposal at a licensed LLRW disposal site. The site inventory consisted of roofing material from the Main Building and West Bay which totalled approximately 1000 cubic feet.

D. Dry Active Waste

Dry active waste will be continuously collected and surveyed. This material will be stored in sea vans until packaged for shipment to a licensed LLRW disposal site.

E. Contaminated Aqueous Liquids

All site liquids are expected to be suitable for disposal under the conditions of the various PADER discharge permits. The site inventory of potentially contaminated liquids, although varying due to weather conditions, will be minimal. A sediment basin large enough to handle 5500 ft^3 per acre runoff will be used to catch surface water runoff. This water will be tested and discharged per the PADER NPDES permit PA0002071. An 85,000 gallon Modutank will also be used for collecting groundwater during dewatering operations. This water will be continuously discharged per a PADER Permit granted in October 1991.

3.5.5 Mixed Waste

The Apollo Decommissioning Project does not anticipate generating any mixed waste. Site characterization to date has shown that the volume of mixed waste, if present at all, is expected to be small.

If mixed waste should be encountered, the impact on the decommissioning schedule is expected to be minimal. Since several activities will be operating concurrently, an alternate activity can probably be performed until preparations have been made to support the mixed waste situation. The schedule may have to be revised, but this revision is not expected to delay the final remediation.

Adequate resources are available to ensure that proper handling of any mixed waste will occur. These resources include hazardous waste operations and emergency response (HAZWOPER) trained laborers, supervisors, engineers, technicians, and management; the appropriate surveillance equipment for volatiles, flammables, and oxygen content are in routine use at the site; sufficient engineering staff to write and revise work procedures to reflect any hazardous materials considerations; and an adequate supply of personal protective equipment. A hazardous materials response plan will be in place as required by OSHA regulations.

4.0 PLANNED FINAL RADIATION SURVEY

4.0 PLANNED FINAL RADIATION SURVEY

Revision 2 to this section will be provided as a separate submittal during the week of May 18, 1992.

5.0 FUNDING

5.0 FUNDING

Due to the Proprietary nature of the information, the detailed cost estimate for decommissioning is provided under separate cover.

6.0 PHYSICAL SECURITY PLAN AND MATERIAL CONTROL AND ACCOUNTING PLAN PROVISIONS IN PLACE DURING DECOMMISSIONING

6.0 PHYSICAL SECURITY PLAN AND MATERIAL CONTROL AND ACCOUNTING PLAN PROVISIONS IN PLACE DURING DECOMMISSIONING

The Apollo Decommissioning Project does not propose changes to the present NRC-approved physical security plan and special nuclear material control and accounting plan, which are now in place at the Apollo site.

APPENDIX 1

APPENDIX 1
REVISION 2 (5/11/92)

10 CFR PART 51 CATEGORICAL EXCLUSION ANALYSIS

1.0 INTRODUCTION

This analysis is part of the Apollo Decommissioning Plan (the Plan) submitted by Babcock and Wilcox, the holder of NRC materials license SNM-145. The Plan describes decommissioning activities previously completed at the Apollo site (Section 2.5), ongoing decommissioning activities which are being and will be conducted under the authority of license SNM-145 (Section 2.6), and decommissioning activities which will be undertaken when Babcock and Wilcox notifies the NRC that it has determined to terminate all activities authorized under the license and the NRC approves the Plan (Section 2.7).

The NRC is considering approval of the Plan. Such approval would constitute a continuation of NRC approval of ongoing activities and approval of proposed activities not currently authorized under SNM-145. These new activities include operation of the Crushing Plant and deconstruction of the main building external shell at the Apollo site.

The purpose of this analysis is to show that approval of the Plan is eligible for a categorical exclusion from the environmental review requirements of 10 CFR Part 51. Paragraph 51.22 (c) (11) of Part 51 provides that:

> Issuance of amendments to licenses for fuel cycle plants. . . and amendments to materials licenses identified in § 51.60 (b) (1) which are administrative, organizational, or procedural in nature, or which result in a change in process operations or equipment, provided that (i) there is no significant change in the types or significant increase in the amount of any effluents that may be released offsite, (ii) there is no significant increase in individual or cumulative occupational radiation exposure, (iii) there is no significant construction impact, and (iv) there is no significant increase in the potential for or consequences from radiological accidents [is eligible for a categorical exclusion].

As discussed below, approval of the Plan meets these criteria.

The Apollo site was used for many years for the fabrication of uranium nuclear reactor fuels. Review of the operating history of the plant and site characterization studies conducted to date indicate that contaminants of concern in decommissioning are limited to uranium isotopes and their short-lived daughters, which are present in building materials and in soils.

The activities involved in the Plan are summarized in Section 2 below. The categorical exclusion criteria listed above are addressed in turn in Sections 3-6 below as they relate to these activities.

It must be noted that activities to be conducted in the Plan are similar to some activities previously conducted in operation of the plant and in the completed and ongoing decommissioning activities under license SNM-145. Information related to environmental impacts from these previous and ongoing activities is discussed below to help form a basis for estimating the significance of any changes to these impacts as a result of proposed new activities.

2.0 DESCRIPTION OF DECOMMISSIONING ACTIVITIES TO BE APPROVED BY APPROVAL OF THE APOLLO DECOMMISSIONING PLAN

The new activities to be undertaken upon NRC approval of the Apollo Decommissioning Plan, which are described in the Plan, include operation of the Processing Plant and deconstruction of the external portions of the main building at the Apollo site.

Processing Plant

The Processing Plant will be used to reduce building material and soils to provide a uniformly sized material suitable for sampling to determine uranium concentration and suitable for either transport offsite or replacement onsite, as determined by the measured uranium concentration.

The major components of the Processing Plant will be housed in a small temporary structure. The gondola rail cars will be located in an adjacent small temporary structure and will be loaded with material via an enclosed conveyor from the Processing Plant. The Processing Plant facility is equipped with a ventilation system designed to capture dust generated during soil processing. Air exhausted through the system will be filtered, first through a high-efficiency cartridge filter system and then through roughing filters and HEPA filters to remove dust prior to discharge to the atmosphere. The cartridge filter system can be backflushed with air to limit buildup of particulate material on the filters. Dusts removed during backflush are directed back to the Processing Plant conveyor which is attached to the ventilation system. The system is described in the Babcock and Wilcox application to the Pennsylvania Department of Environmental Resources (PADER) for an air quality permit to operate this equipment (submitted under cover letter dated 2/10/92 from B. Haertjens (B&W) to W. Charlton (PADER)).

Main Building Deconstruction

Main building deconstruction will consist of removing the external walls and roof of the main building. Specifically, the four exterior walls and the roof will be removed within a mobile temporary enclosure, which will enable progressive deconstruction to be carried out while maintaining adequate containment of potentially contaminated airborne particles. The deconstruction will use standard construction equipment. Mock-up tests will be performed to ensure that operations are conducted so as to minimize dust generation. As the exterior walls and roof are removed, the material will be transported to a staging area where it will be prepared for disposal in accordance with established PANSO procedures, as described in Section 2.4.5 of the Plan.

Potential Impacts

The potential environmental impacts of greatest concern would be releases of uranium-bearing materials in such a way that workers or the public could be exposed. The potential for releases of any significance is low because of the combined effects of a number of factors including the properties of the contaminant (quantities, concentrations, and radiological characteristics), the containment measures to be applied in handling the materials, and the protective measures to be applied in limiting exposure of workers. Decontamination activities conducted over the last several years have resulted in negligibly low exposures to workers and the public because of these factors.

The inventories and concentrations of radioactive materials handled in the external deconstruction of the main building will be small. See Tables 2-5 and 2-10 of the Plan. The total uranium inventory to be handled is well below 10 curies. The average concentration of uranium in materials to be handled is below 100 picocuries per gram. This concentration is many orders of magnitude lower than the concentrations of uranium in materials processed during fuel fabrication, which ranged from about 1 microcurie per gram to 50 microcuries per gram, and the potential hazard for airborne release of uranium in this dilute form is correspondingly lower.

To assure adequate control, deconstruction and soil processing will be carried out within ventilated temporary enclosures for control of contamination. Appropriate elements of the PANSO radiation protection program, including work area and effluent air and water sampling, will be applied as described in the Plan.

3.0 NO SIGNIFICANT CHANGES IN THE TYPES OR SIGNIFICANT INCREASE IN THE AMOUNTS OF ANY EFFLUENTS RELEASED OFFSITE

Analyses of the impacts of radiological effluents from routine operations have been described in earlier licensing submittals. The Babcock and Wilcox report, "Environmental Data for the Apollo Site Materials Plants of the Nuclear Materials Division of the Babcock & Wilcox Company," dated August 1, 1975, was submitted as part of an application to renew SNM-145 to permit continued fuel fabrication operations. The NRC described its analysis of impacts from routine operations in its report, "Environmental Impact Appraisal of the Babcock & Wilcox Nuclear Materials Division Commercial Nuclear Fuel Fabrication Plant, Borough of Apollo, Pennsylvania," dated October 1978. These reports formed the basis for an NRC conclusion that no environmental impact statement for the license renewal was necessary because there would be no significant environmental impact associated with the operations.

After fuel fabrication operations ended, Babcock and Wilcox updated its environmental analysis to reflect impacts from operations proposed at the time, including site decontamination and decommissioning activities, and submitted its analyses in the report "Environmental Analysis, Nuclear Service Operations, Apollo Pennsylvania" revised June 1988.

As will be shown below, the potential radionuclide concentration in effluents during soil processing and external deconstruction of the main building are well within the effluent concentrations resulting from previous plant operations and decommissioning activities, as authorized under license SNM-145. Thus, soil processing and external deconstruction of the main building will not result in significant changes to the types of or significant increases in the amounts of any radionuclide emissions that may be released offsite.

3.1 Liquid Effluents

Measured liquid effluent discharges for plant activities (shower water, etc.) have been very low and did not exceed 25 microcuries of alpha-emitting isotopes per year in 1989 and 1990. (Those discharges were made to the local waste water treatment facility, rather than the Kiskiminetas River.) Current and expected discharge rates to the Kiskiminetas River during the ongoing decommissioning activities are difficult to estimate accurately because they are dominated by surface runoff, which can not be measured easily. Patterns of contamination at the soil surface indicate that surface runoff is very low.

Surface runoff during decommissioning activities and after the completion of these activities should decrease from present levels because of measures to control erosion and sedimentation to be implemented as part of the Plan. These measures are described in the "Erosion and Sedimentation Control Plan--Babcock and Wilcox Facility," dated March 6, 1992, and prepared by ICF Kaiser Engineers. Erosion and sedimentation control measures to be taken during remediation work include:

- diversion of site runoff water to a sediment basin lined with 40 mil high density polyethylene (HDPE) and designed to contain 5,000 cubic feet of runoff water per acre,

- collection of pumped groundwater in an 85,000 gallon temporary holding tank equipped to filter water prior to discharge,

- the use of a silt fence in areas where accelerated erosion may occur, and

- the use of diversion barriers and silt curtains for excavation along the riverbank.

Measures designed to limit erosion and sedimentation after completion of remediation work include grading of the site and stabilization of all slopes and ditches with suitable vegetation.

Potential loss of some excavated uranium-bearing soil to the river during remediation of the riverbank could increase uranium release to the river. Agitation of water and soil in the excavation process will increase the concentration of suspended solids in water in the vicinity of the excavation. Without control measures, waters near the excavation areas would mix with other river water and would transport the suspended solids downstream. However, the planned use of diversion barriers and silt curtains to isolate the excavation area from the river should limit this potential source adequately. Even if as much as one percent of the 209,000 cubic feet material to be excavated from the riverbank is lost to the river, the total uranium release would be less than 0.006 curies, based on the conservatively high assumption that the average uranium concentration in this material is 100 picocuries per gram. This is a small fraction of the upper limit annual release rate from all runoff sources estimated below.

Discharge of uranium in groundwater pumped to dewater areas for excavation below the water table could also increase uranium discharge rates to the river. The expected uranium release rate can be estimated from the expected pumping rate and the expected concentration of uranium in groundwater. The planned pumping rates vary from 200 to 1,750 GPM (Plan, p. 2-18). The anticipated groundwater uranium concentrations can be estimated from gross alpha measurements of monitoring well water in Table A3-1 in Appendix 3 of the Plan. All but two of 21 results are less than 10 picocuries per liter. The two higher values, 36 picocuries per liter and 133 picocuries per liter are associated with samples drawn from adjacent wells and probably represent a highly localized situation. If 30 picocuries per liter is taken as a reasonable estimate for concentration of uranium in well water, and the average pumping rate is 1000 GPM, the released quantity over the estimated dewatering period of 10 months will be 0.05 curies.

An upper limit release rate from all runoff and erosion sources can be estimated based on analysis of radioactive material in river water conducted routinely as part of the Babcock and Wilcox environmental radiation monitoring program. Analysis of Kiskiminetas River water for the years 1988 through 1990 and for the first seven months of 1991 indicate that concentrations of alpha-emitting isotopes including naturally occurring isotopes, such as natural uranium and radium, did not exceed the lower limit of detection, 0.02 picocuries per liter. Given the average river flow rate of approximately 3,000 cubic feet per second, the lower limit of detection would be equivalent to a discharge rate of 0.05 curies per year, about a factor of ten below discharge rates estimated in the 1975 B&W report and in the 1978 NRC report, and about a factor of ten below discharge rates measured during that period, when fuel fabrication operations were being conducted.

Actual current discharge rates may well be orders of magnitude less than the upper limit based on the lower limit of detection for the analytical method. Even if they are not, however, resulting committed doses would be less than 6 millirem to any organ and less than 2 millirem effective dose equivalent, based on scaling of results of the analysis performed to evaluate accidental release to the river (discussed in Section 6 of this appendix). These doses are far below any applicable regulatory limit.

Soil processing and external deconstruction of the main building will not produce contaminated water waste streams. Therefore, these activities will not result in any significant change in the types or significant change in the amounts of any liquid effluents released offsite.

3.2 Airborne Effluents

Estimates of annual release rates for uranium in airborne effluents were determined to be 3.6×10^{-3} curies of uranium in the 1975 Babcock & Wilcox report and 7.0×10^{-4} curies of uranium in 1978 NRC report. In the 1988

Babcock & Wilcox report an effective release rate was calculated based on the measured net uranium concentration in air at environmental air sample stations near the boundaries of the site. (Measured release rates from the building ventilation system did not include any contribution from suspension of contaminated soils outside of the building.) Based on an average of measured air concentration of 5.6×10^{-4} picocuries of uranium per cubic meter of air during the period 1985-86, the release rate was estimated to be approximately 6.2×10^{-5} curies of uranium per year (1988 report, Table 3.1), at least a factor of ten below the estimates for periods during plant operations. Analysis of environmental air sample data for the period 1987-90 indicates that average concentrations at stations near the site boundary remain slightly below 5.6×10^{-4} picocuries of uranium per cubic meter of air, so that the effective release rate would be about the same.

Movement of substantial quantities of contaminated soil was conducted during this period, which indicates that such movements do not increase offsite air concentrations significantly. The maximum estimated organ dose committed from the release rate to the atmosphere calculated in the 1988 report was 5.8 millirem (1988 report, Table 7.4). The corresponding effective dose equivalent was not calculated, but would have been less than 2 millirem per year, far below any applicable regulatory limit.

Analysis of anticipated fugitive dust levels associated with outside movement of soil and building material also indicates that the uranium release rate to the atmosphere from this source should be low. This analysis is included in the Babcock and Wilcox application to the Pennsylvania Department of Environmental Resources for an air quality permit to allow remediation operations involving potential fugitive dust emissions (submitted under cover letter dated 8/7/91 from B. Haertjens (B&W) to W. Charlton (PADER). That analysis estimates an emission rate of 3.1 pounds of dust per hour from the outdoor area under remediation, assumed to be no greater than 0.5 acre in area at any one time. If the average concentration of uranium in soil is taken to be 100 picocuries per gram, the uranium emission rate would be 1.4×10^{-7} curies per hour, or 4.3×10^{-4} curies per year based on 12-hour per day, 5 day per week operation continuously throughout the year, which is compatible to or less than measured uranium release rates to the atmosphere during fuel fabrication operations.

Operation of the processing plant will result in essentially no change in the types or increase in the quantities of radioactive materials in airborne effluents. The previously cited air quality permit application includes estimates of dust load to the ventilation system, and expected discharge rates from the system. The quantity of dust expected to be introduced into the ventilation system (i.e., prior to filtration) is anticipated to be 8.7 pounds per hour, or based on an average uranium concentration of 100 picocuries per gram, slightly less than 0.001 curies of uranium based on the assumption that the equipment operates half the time for the expected six-month operating period. The quantity of uranium that would be expected to be discharged to the atmosphere after filtration would be at least six orders of magnitude lower, and negligible compared to calculated releases from other sources at the site, calculated above.

External deconstruction of the main building will not result in any significant change in the types or amounts of any airborne effluents released offsite. As described in Section 2.7 of the Plan, external deconstruction of the main building will take place within a temporary enclosure approximately 100 feet wide, 100 feet long, and 50 feet tall. The HEPA-filtered ventilation equipment described in Sections 2.6 and 3 of the Plan will provide the airborne contamination control for the enclosure. The enclosure, in conjunction with the HEPA-filtered ventilation equipment, will enable adequate containment of potentially contaminated airborne particles to be maintained throughout deconstruction. For purposes of comparison, the completed HEU floor removed operation resulted in a total release of 9.26 microcuries of uranium in the air discharged. Since contamination levels in the main building walls are significantly lower than that found in the HEU floor, release rates can be expected to be significantly lower.

4.0 NO SIGNIFICANT INCREASE IN INDIVIDUAL OR CUMULATIVE OCCUPATIONAL RADIATION EXPOSURE

The small inventory and low concentrations of radioactive material contamination, coupled with the protective measures provided for workers as described in the Plan, will assure that occupational radiation exposures will be negligible. Direct radiation levels at all locations on the site differ only negligibly from natural background levels. External doses to B&W workers have been negligibly low, and there is no reason that they should not remain so.

The potential for internal exposure is somewhat greater than the potential for external exposure, but remains small in the absolute sense. Except for localized elevated concentrations in the immediate vicinity of deconstruction operations that create substantial levels of dust, airborne uranium concentrations are typically far below 1.0×10^{-10} microcuries per cubic centimeter, the most restrictive maximum permissible concentration for uranium isotopes in 10 CFR Part 20, Table I, Column I. Special operations that pose the potential for raising substantial levels of dust are subject to special controls, such as water spray or confinement in temporary enclosures with filtered exhaust. Unless contaminant concentrations are low, workers within the enclosures wear respiratory protective equipment as a precaution. Experience shows that even in the dust-laden atmospheres within the enclosures, airborne concentrations do not exceed maximum permissible concentrations by large margins.

The recent removal of the HEU floor (see Section 2.5 of the Plan) probably serves as a conservative representative case for estimating the potential for exposure of workers to airborne uranium concentrations. In this case, the floor was broken up into small pieces by jackhammer within a temporary ventilated enclosure. Approximately 317,000 pounds of structural materials averaging approximately 2,100 picocuries of uranium per gram of material were removed. Workers within the enclosure wore lapel samplers to sample air in the worker's breathing zone. During the work within the enclosure (about 550 person-hours), the average airborne uranium concentration within the enclosure was approximately 2.4 times the most restrictive maximum permissible concentration noted above. (Concentrations immediately outside the tent averaged less than 0.6 times the maximum permissible concentration.) The maximum breathing zone concentration averaged over any single shift was approximately 12 times the most restrictive maximum permissible concentration. Respiratory protection equipment used in the operation provided a rated protection factor of 50. Therefore, the airborne concentrations actually breathed by workers were small fractions of the maximum permissible.

Measurement of work area air concentrations during movement of substantial quantities of contaminated soil confirm that airborne uranium concentrations in air near the potential source are low. These measurements are based on gross alpha measurement of general area air samples drawn using portable pumps positioned in the work areas at locations where elevated air concentrations might be expected. Typically sampling duration was a single shift. Concentrations of uranium in soil materials being moved were generally comparable to concentrations expected in the remainder of the remediation work yet to be performed. Therefore, these measured concentrations should be representative of concentrations that might be expected. The following is a summary of results for different tasks:

- Alcove remediation (3/11/88 - 4/11/88) - 42 samples, average concentration 2.9×10^{-13} microcuries per cubic centimeter, range from 4×10^{-14} to 5×10^{-13} microcuries per cubic centimeter.

- Box shop/Annex remediation (7/24/90 - 1/9/91) - 779 samples, average concentration 4.0 X 10^{-13} microcuries per cubic centimeter, range from 1.3 X 10^{-13} to 3.8 X 10^{-11} microcuries per cubic centimeter.

- South Bay (Bay 3 of adjoining facility) remediation (7/19/88 - 10/14/88) - 61 samples, average concentration 2.6 X 10^{-12} microcuries per cubic centimeter, range from 6.2 X 10^{-13} to 9.9 X 10^{-12} microcuries per cubic centimeter.

- Main building LEU concrete floor and soil removal (>2,000 pCi/g) (10/3/91 - 12/16/91) - 1146 samples, average concentration 6.7 X 10^{-12} microcuries per cubic centimeter, range from 2.0 X 10^{-14} to 4.0 X 10^{-11} microcuries per cubic centimeter.

- West Bay (main building addition) remediation (2/17/92 - 3/18/92) - 155 samples, average concentration 3.7 X 10^{-13} microcuries per cubic centimeter, range from 2 X 10^{-14} to 2.3 X 10^{-12} microcuries per cubic centimeter.

Characteristics of airborne soils have been analyzed *Atmospheric Science and Power Production* (DOE/TIC-27601, edited by D. Randerson, published by the US Department of Energy in 1984). Airborne soil concentrations are discussed in Section 12-2.2 in a chapter on deposition and resuspension. The author of that chapter cites a paper, "The Resuspension of Particulate Material from Surfaces," by K. Stewart (in *Surface Contamination*, edited by B. R. Fish and published by Pergamon Press in 1967) for the statement that a dust loading of 110 mg/m^3 is "barely tolerable for breathing". If one conservatively assumes that the average concentration of uranium in dust is 200 pCi/g, the uranium activity concentration in air corresponding to 110 mg/m^3 would be 2.2 X 10^{-11} uCi/cm^3. This concentration is substantially lower than the current 10 CFR 20 most restrictive maximum permissible concentration of uranium in air for occupational exposure, 1 X 10^{-10} uCi/cm^3, and is only slightly higher than the new 10 CFR Part 20 most restrictive derived air concentration limit, 2 X 10^{-11} uCi/ml. It would appear that workers would not be able to physically tolerate even short-duration exposure to airborne uranium in concentrations significantly greater than the concentration limits that are intended to be limits for long-duration average exposure. Therefore, measures implemented to maintain dust concentrations within permissible limits (i.e., OSHA, NIOSH, etc.) will assure that exposure of workers to airborne uranium will be maintained well below applicable limits.

Based on the foregoing, soil processing and external deconstruction of the main building will not result in a significant increase in individual or cumulative occupational radiation exposure.

5.0 NO SIGNIFICANT CONSTRUCTION IMPACT

External deconstruction of the main building and soil processing will result in some negative construction impacts of short duration; specifically, physical impacts (visual, audible, etc.) from building deconstruction or remediation, and physical impacts from train shipments of contaminated materials to licensed disposal facility (approximately 500 carloads over no more than 2 years).

These negative impacts are minor in nature and will be temporary in duration. Therefore, negative impacts from construction can be considered to be insignificant. They are also far out-weighed by the long-term positive impact of returning the decommissioned site to unrestricted use.

6.0 NO SIGNIFICANT INCREASE IN RADIOLOGICAL ACCIDENT POTENTIAL OR CONSEQUENCES

Analyses of the impacts of potential accidents were included in earlier licensing submittals listed in Section 3 above. The range of potential accidents evaluated in the 1988 report was significantly less severe in terms of consequences than the range evaluated in the earlier reports. Included in the 1988 report were assessments of some potential accidents involving residual uranium on the site. Table 8.1 of that document includes an analysis of the consequences of two accidents that would reasonably represent the upper bound to the range of accidents that might be associated with decommissioning activities. One of these accidents addressed potential release to the Kiskiminetas River, and the other addressed potential release to the atmosphere.

The small inventory of radioactive material, the low concentrations of radioactive material in substances handled, and the inert properties of the materials in process and in handling limit the potential for accidental release and the consequences of any accidental release during soil processing and external deconstruction of the main building to levels negligible in both the absolute sense and in the relative sense, when compared to other more severe potential accidents analyzed in the 1988 report and when compared to the more severe potential accidents analyzed in the earlier reports.

In the analysis of accidental release to the river in the 1988 report, one percent of the site inventory of uranium in soil, estimated to be about 3 curies at that time (Table 2.1), was assumed to be released to the river in a single year. Behavior of the uranium on the site indicates little migration, so the assumption of loss of one percent of the inventory in a single year is considered incredibly high. The maximum organ dose from all aquatic pathways from such a release was estimated to be 3 millirem per year. (The maximum effective dose equivalent was not evaluated, but would be substantially less, about 1 millirem per year.) This estimate was based on an assumption that drinking water and ingested fish were obtained from the river. Those pathways do not exist under current conditions, and are not likely to exist during decommissioning, so that the dose estimate is an artificially high estimate.

In the analysis of accidental release to the atmosphere in the 1988 report, several scenarios involved residual uranium. The most severe, a laboratory area fire releasing material in the high-enriched uranium processing floor above the laboratories, is no longer plausible because both the laboratories, which posed the fire hazard, and the floor, which provided the relatively concentrated source of potential airborne uranium, have been removed as part of facility decommissioning.

The potential accident scenario involving breach of an effluent air filter is the most plausible remaining scenario involving residual uranium. In this scenario, it was assumed that 2.6×10^{-5} curies of uranium contaminated dust in a form that would be readily dispersible in air would be released (Section 4.7 of the 1988 report). The assumptions leading to this release estimate would not be directly applicable to conditions expected during external deconstruction of the main building or during soil processing, but the quantity assumed to be released can be considered at the high end of the range of possibility. For example, at a concentration of 100 picocuries per gram, likely to be a high estimate of the average concentration in material to be handled, the activity released would be equivalent to a mass of approximately 600 pounds of material readily dispersible in air. Dust loading on the filters in the ventilation system serving deconstruction of the main building is likely to be very low because of the low dust concentrations expected. The input dust load to the soil processing ventilation system is expected to be high, 8.7 pounds per hour, virtually all of which would be removed in the cartridge filter system. However, the cartridge filter system is designed to be backflushed automatically to keep dust loading on the filters low enough to maintain design airflow rates. The release assumed in the accident analyzed would be equivalent to complete release of an inventory of 15 pounds of dust on each of the 40 filters in the cartridge filter system. Nonetheless, the maximum organ dose commitment estimate from such a release was calculated to be 39 millirem, well below any regulatory emergency response action level or limit.

The consequences of the accident scenarios described above are minor relative to other potential accident scenarios evaluated for operations underway or proposed at the time the environmental analyses were performed. Conduct of the previous decommissioning activities has further reduced the potential likelihood and severity of accidents relative to those that have formed the basis for an NRC finding of "no significant environmental impact" in the past. External deconstruction of the main building and soil processing would not result in any significant increases to either likelihood or severity.

7.0 CONCLUSION

The above evaluation establishes that exterior deconstruction of the main building and soil processing will not have a significant impact, either individually or cumulatively, on the human environment and that the criteria for a categorical exclusion, set forth in 10 CFR § 51.22 (c) (11), have been met.

APPENDIX 2

COMPLETION OF DECOMMISSIONING ACTIVITIES

SUPPORT MILESTONE ACTIVITIES

- PROCESSING PLANT READY FOR OPERATION
- NRC APOLLO DECOMMISSIONING PLAN APPROVAL
- REROUTE OF THE NORTH SEWER
- SHORE THE KISKI VALLEY (KVWPCA) SEWER LINE

EXTERNAL DECONSTRUCTION OF MAIN BUILDING [SECTION 2.7.1]

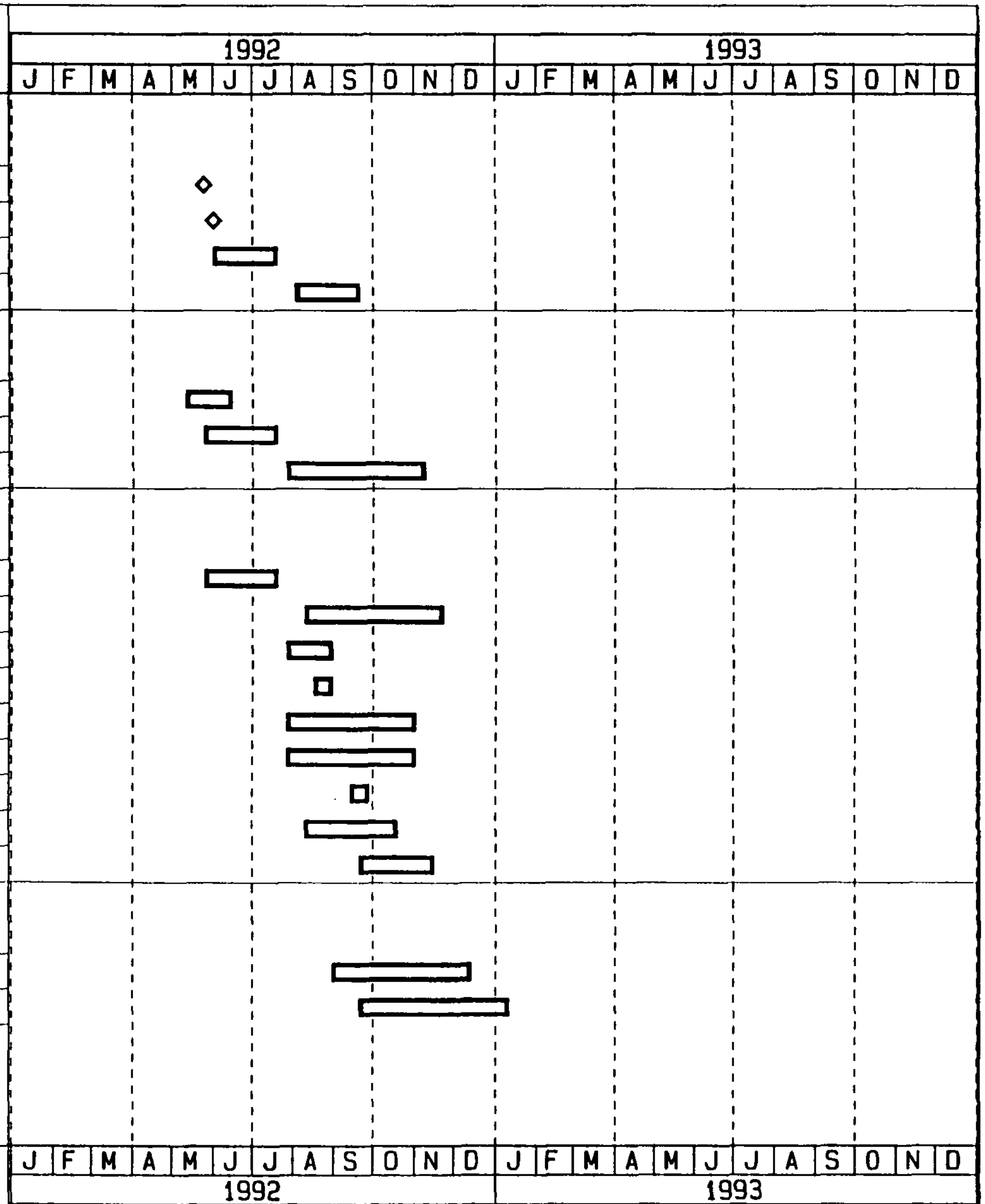
- ERECT EXTERNAL BUILDING ENCLOSURE
- PROCESS BUILDING RUBBLE FROM INTERIOR
- EXTERNAL BUILDING DECONSTRUCTION

SOIL REMEDIATION [SECTION 2.7.2]

- PROCESS EXISTING SOIL MOUND
- REMEDIATE WEST BAY & MAIN BUILDING SOILS
- REMEDIATE NORTH SEWER SOILS
- REMEDIATE MIDDLE SEWER SOILS
- REMEDIATE SOUTH SEWER SOILS
- REMEDIATE RIVERBANK SOILS
- REMEDIATE RIVER SEDIMENT
- REMEDIATE NORTH PARKING LOT SOILS
- REMEDIATE SOUTH PARKING LOT SOILS

FINAL RADIATION SURVEY [SECTION 2.7.3]

- RADIATION SURVEY BY BABCOCK & WILCOX
- RADIATION SURVEY BY THE NRC



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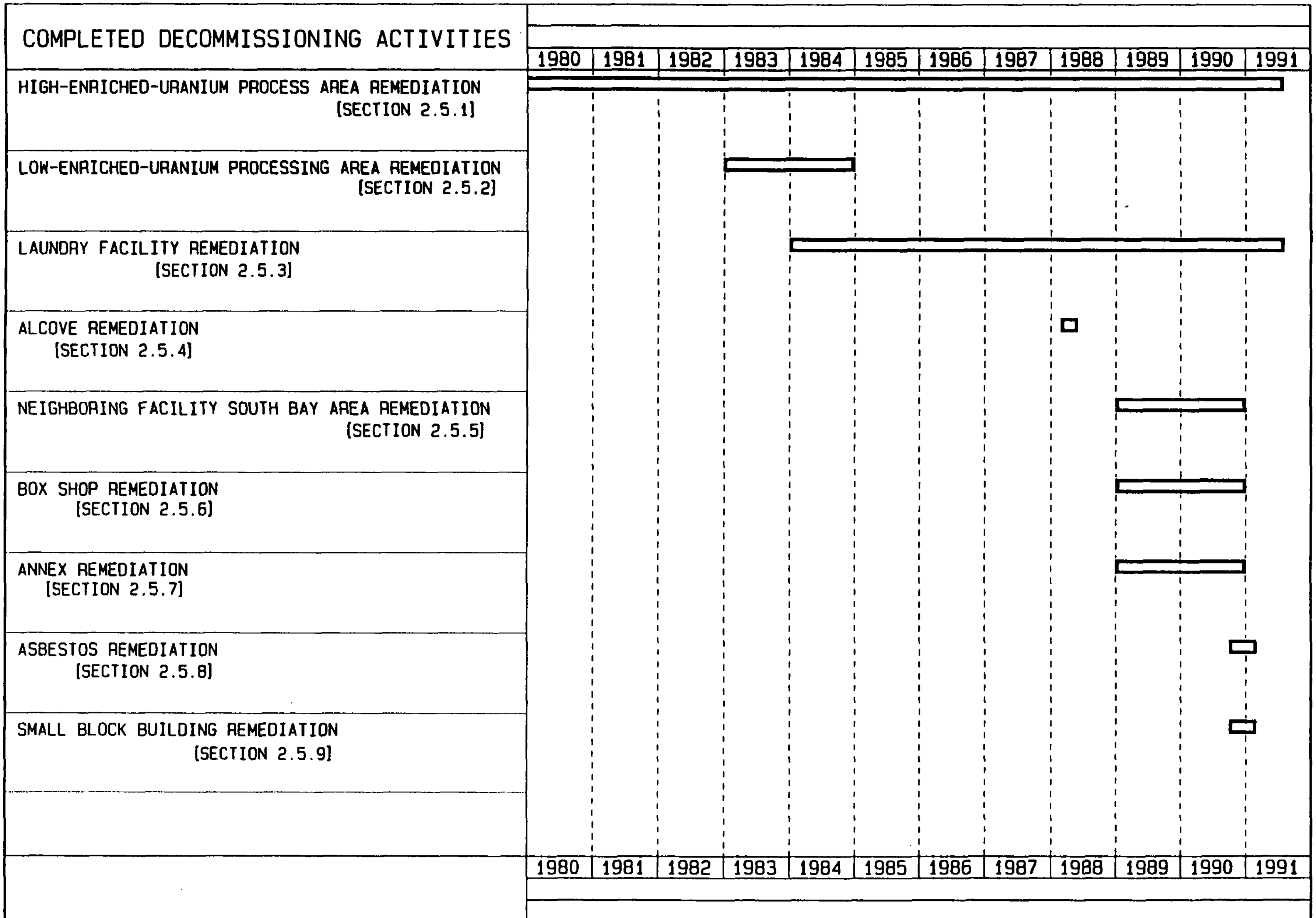
Project Start 31DEC90
Project Finish 10JAN93

Sheet 1 of 1

BABCOCK & WILCOX - APOLLO
COMPLETION OF DECOMMISSIONING ACTIVITIES
FIGURE A-1

REVISION 2



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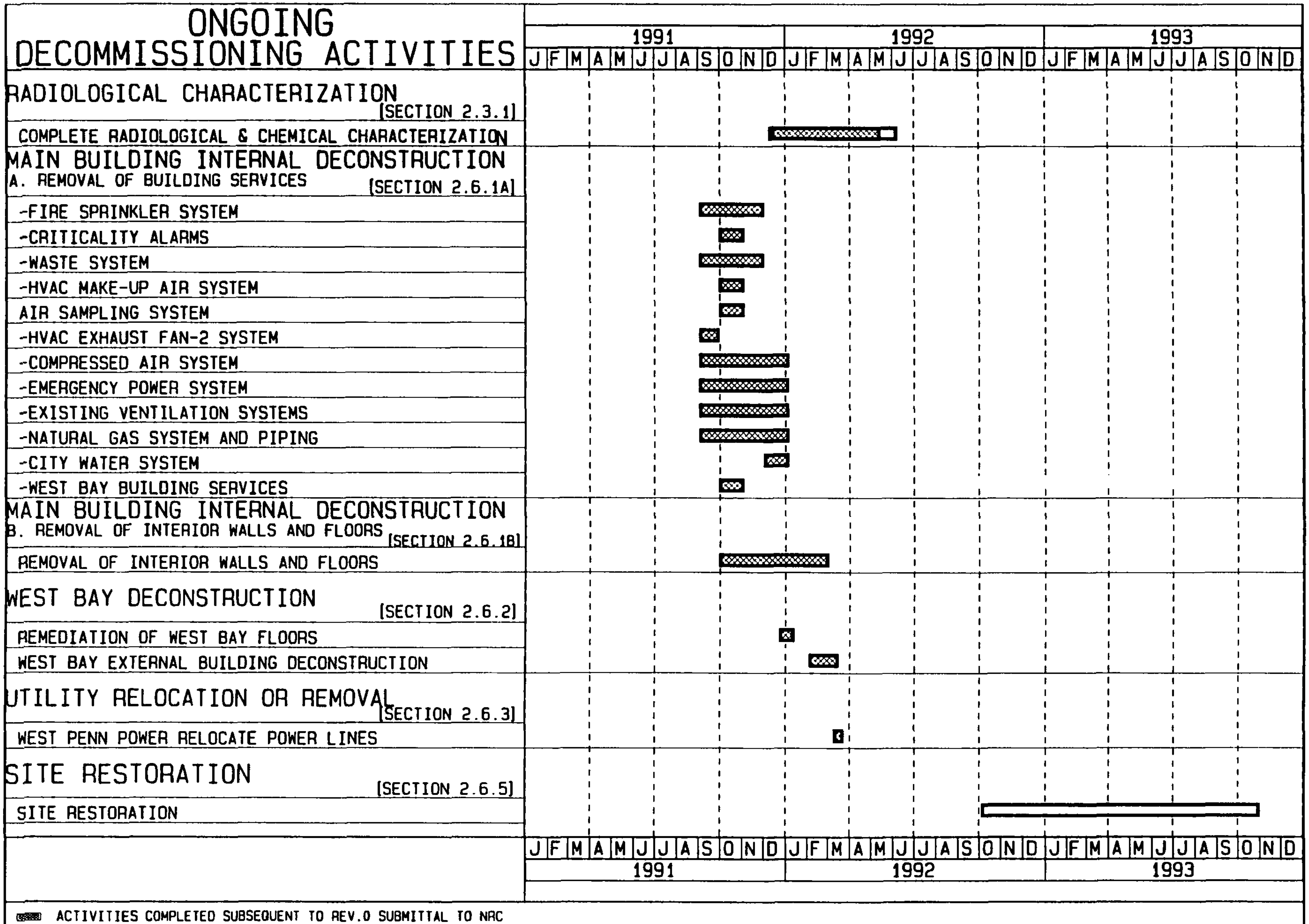
BABCOCK & WILCOX - APOLLO
COMPLETED DECOMMISSIONING ACTIVITIES
FIGURE A-2

REVISION 2



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Sheet 1 of 1

BABCOCK & WILCOX - APOLLO
ONGOING DECOMMISSIONING ACTIVITIES
FIGURE A-3

REVISION 2

APPENDIX 3

APPENDIX 3 **RADIOLOGICAL ASSESSMENT**

The revision to this Appendix will be provided as a separate submittal.

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