DECONTAMINATION AND DECOMMISSIONING AT THE WEST VALLEY SITE PROGRESS AND PLANS

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ABSTRACT

Decontamination and Decommissioning (D/D) at the West Valley Site includes all of the radioactive cleanup and dismantling operations associated with a nuclear fuel reprocessing plant that has been in operation for several years. The existing building and plant facilities at West Valley will be used to the greatest extent possible to accommodate the high-level radioactive waste (HLW) processing and vitrification systems and equipment, which are described in other reports. Therefore, the objective of the initial or previtrification D/D Operations is to make the various shielded cells and other plant facilities suitable for installation and operation of the HLW processing and vitrification systems. This will also include establishing facilities for supporting the D/D Operations and the other required services. After all of the HLW processing and vitrification operations are completed, there will be a final D/D to be jointly defined by DOE, NRC, EPA, and NYSERDA.

PLANT DESCRIPTION

The process plant, which is the largest building on the 3,300-acre West Valley Site, has over a 2.83E4 m^3 (1,000,000 cubic feet) of volume on six elevations, five above grade and one below grade. There are 235 area divisions in this building, including a fuel storage pool, 24 shielded cells of various sizes, several laboratories, and several other auxiliary areas. Figures 1 through 4 show where the more important areas are located in the plant.

About 35 percent of the plant areas will continue to be used for the present "shutdown" condition operations and maintenance. The remaining 65 percent will be used for the HLW processing and vitrification systems and transuranic (TRU) waste and high-level waste (HLW) storage.

DECONTAMINATION AND DECOMMISSIONING METHODOLOGY

Since contamination levels of up to 10^6 dpm/100 cm^2 alpha plus beta and radiation fields are present in some of the cells, West Valley Nuclear Services Co., Inc. (WVNS) has embarked on a program to characterize the radiation and contamination levels on a cell-by-cell basis. This program is used to determine the general area dose rates, identification of "hot" spots, cell contamination levels, and isotopic content of contaminants.

Entry into the cells for this characterization is by remote and manned entry where dose rates permit. Remote entries are first performed to determine radiation and contamination levels in the cell. Those cells not equipped with master slave manipulators are entered by boring a 2.032 E-1 m (8-inch) hole through the ceiling of the cell and inserting closed circuit video cameras to determine the condition of the equipment in the cell and to identify potential problems, such as leakage and accumulation of materials.

Airborne samples are taken, Thermal Luminescent Dosimeters (TLDs) are lowered into the cells to determine the radiation field, temperature measurements are made and grab samples of loose contamination are taken from accessible surfaces. These preliminary inspections provide the means to plan manned entries. Safety conditions are assessed, safety analyses are prepared, reviewed, and approved before entry. During manned entries, samples are taken from the floors for isotopic analysis, concrete samples are taken from the walls to determine the depth of contaminant penetration, various decontamination solutions are tried to determine their effectiveness, and photographs are taken for use in planning equipment removal and final decontamination methods.

Protection of the workers and prevention of the spread of contamination outside the cell during manned entries are achieved by detailed planning and work techniques. Based on data from the remote entry, worker maximum stay time is established and a detailed work plan is written. This plan locates the necessary work in the areas of lowest radiation level to minimize exposure and it details specific operations to be accomplished in the most efficient manner to reduce stay time. Detailed procedures with sign-off tasks are prepared, reviewed, and approved for each step of the D/D work. These procedures are tried and practiced by the radiation worker teams assigned to the D/D work before entering the contaminated areas. Each worker carries a self-reading dosimeter on the outside of his anticontamination clothing. At the midpoint of maximum stay time, these dosimeters are pulled and read. By comparing received dose with expected dose, a decision can be made to cut short the entry if the dose is running too high. Each worker who enters the cell wears four layers of anticontamination clothing, a forced-air respirator and a forced-air bubble hood. A radio headset with a voice-actuated microphone puts each worker in contact with the entry director. The director is also in visual contact with the workers through a closed circuit video system. The camera for this system is operated by the first backup man who is fully dressed and equipped for cell entry, but remains just outside the cell entryway. A doublechambered contamination control tent is erected and sealed around the entryway to the cell. This tent, along with techniques used by workers, provides the major barrier to the spread of contamination. The tent is built of Herculite and features zippered doors from the clean areas into the first chamber and from the first chamber into the second chamber. Above each door is a filter which permits air to flow through the tent chambers into the cell when the entryway to the cell is opened. The airflow is driven by the reduced pressure maintained in the cell.

The use of this tent prevents contamination spread beyond the tent chamber at the entryway. This is accomplished by removing and bagging the first layer of anticontamination clothing in the cell, the second and third layers in the tent chambers, and the final layer is in a controlled step-off area immediately outside the tent. The use of strippable coating in the innermost chamber of the tent has proven very effective in decontaminating the tent. The walls are sprayed periodically and cleanup has become a simple and effective matter of peeling off the coating.

DECONTAMINATION AND DECOMMISSIONING ACTIVITIES SINCE TAKEOVER

The following is a brief summary of some of the D/D activities at the West Valley Demonstration Project since it was taken over by WVNS in early 1982. The office areas, Utility Room, access aisles, and some other plant standby operating spaces were not contaminated, and hence, were accessible for starting and staging D/D Operations.

Master Slave Manipulator Repair Shop

The Master Slave Manipulator Repair Shop (MSMRS), which is located on ground elevation (100'-0") and has access from the outside, is needed for D/D activities associated with the refurbishment of plant manipulators and other equipment. It is shown shaded in Fig. 1 as maintenance shops. The MSMRS has been decontaminated from loose surface contamination as high as 10^5 dpm/100 cm^2 and radiation fields up to 5.56E-8 Sv/sec (20 mR/hr) to an "uncontrolled" area. To accomplish this, all of the tools, equipment, and furnishings were removed, walls were stripped, and repainted, and the contaminated concrete floor was removed and disposed of as low-level waste (LLW). A new concrete floor was poured with embedded stainless steel anchor strips. Stainless steel sheets were then welded to these anchor strips. The stainless steel extends 18 inches up the walls from the floor. This provides the Project with an easily decontaminated D/D Facility, which is now in service. Figure 5 shows some of the floor removal operations.

Plutonium Product Storage Area

The Plutonium Product Storage (PPS) Area is located as shown in Fig. 2. This area was used for storage; it has been cleaned out and decontaminated. It was then refurbished and converted for radioactive waste handling, packaging, and compaction. A 4.45E5 N (50-ton) radioactive waste compactor was procured, installed, and is now operational in this area, which has been designated the Waste Reduction and Packaging Area (WRPA). A segmented gamma scanner for surveying waste drums has also been installed in this area. This equipment is now providing the Project with volume reduction of low-level compactible wastes which results in improved burial ground utilization.

Laboratory Areas

There has been considerable D/D work on the third floor elevation where the laboratories are located as shown in Fig. 1. The Standards and Quality Control Laboratory (SQCL) and the Hot Laboratory (HL) have been decontaminated, dismantled and refurbished as an Analytical Chemistry Laboratory and a Radiochemistry Laboratory. The old Mass Spectroscopy Laboratory (MSL) has been decontaminated, dismantled, and refurbished as a Quality Assurance Instrumentation Calibration Laboratory. The old Counting Room 2 (CR 2) on the northeast corner has been decontaminated, dismantled, and refurbished as an Instrumentation Laboratory. The old Emission Spectroscopy Laboratory and its associated Darkroom are being decontaminated and dismantled for future D/D activities. The Sample Storage Cell (SSC) has been equipped with a new entry port and associated equipment. The Master Slave Manipulators for the SSC were replaced to improve cell usage. This cell has been used, along with some of the Analytical Cells for observing and testing specimens of the HLW obtained from the underground storage tanks on the West Valley Site.

Chemical Crane Room

The Chemical Crane Room (CCR) is the service area for the cranes, which operate in the large Chemical Process Cell (CPC), as shown in Fig. 3. The CCR, which previously had radiation fields as high as 1.39E-7 Sv/sec (50 mR/hr) and "hot" spots as high as 2.78E-5 Sv/sec (10 R/hr), has been decontaminated by stripping the paint off the concrete floor, grinding the floor surface, repainting the floor, applying strippable coating to the floor, and covering the floor with Herculite sheeting. This has reduced the general fields to 1.39E-8 Sv/sec (5 mR/hr). The CCR crane, with the power manipulator, was equipped with an instrument cage containing a video camera, a smear-taking device, and other radiation detectors as shown in Fig. 6. This cage on the crane was used to make radiological surveys inside the CPC. Video information was also taken and recorded. The crane, manipulator, and instrument cage were operated in the usual manner from the control stations in the Chemical Viewing Aisle (CVA) on the second story elevation. Direct video screen images were also used to perform the remote in-cell operations.

Equipment Decontamination Room

The Equipment Decontamination Room (EDR) is on the ground floor and located as shown in Fig. 3. Initial entries were made into this contaminated area through the outside shield door via a contamination tent. Radiological information was obtained, including samples from the large Soaking Pit, which was previously used to decontaminate the process equipment. Some of the large contaminated equipment was transferred into the CPC using the existing service cart for that purpose. Other tools, smaller equipment, and furnishings were removed to prepare the EDR for decontamination.

Liquid Waste Cell

The Liquid Waste Cell (LWC) is located near the center of the plant on ground elevation, as shown in Fig. 2, and extends to the below grade elevation. Since there is no floor entrance, remote entry was made by coring out a 2.032E-1 m (8-inch) diameter hole in the top of the cell, which is also the floor of the Chemical Operating Aisle (COA) on the floor above. In addition to the observations, radiological data and debris samples were obtained for decontamination planning.

Extraction Cells - Bottom Entries

Two manned entries into the bottom of the contaminated Extraction Cell 2 (XC-2) and two entries to the bottom of Extraction Cell 3 (XC-3) were completed. These cells are 18.3 m (60 feet) high from the ground elevation and there are no shielded windows or means for observing the inside of these cells, which are located in the plant as shown in Fig. 2. Radiological data, pipe and debris specimens, observations, and video recordings were obtained in order to plan for the decontamination and dismantlement of these cells.

Extraction Chemical Room

The decontamination and dismantling of the Extraction Chemical Room (XCR) located on the fifth floor of the plant, shown in Fig. 2, has been completed. All piping, tanks, supports, and equipment have been cleared out to provide a work area of about 279 m^2 (3,000 square feet) and 5.2 m (17 feet) high.

This area has been equipped for staging, decontamination, size reduction, and packaging operations in connection with the decontamination and dismantlement of the Extraction Cells located below the XCR. The main entry to the Extraction Cells is via shield plug hatches in the XCR floor over each Extraction Cell. The four Extraction Cells, which extend 18.3 m (60 feet) below the XCR floor, contain the partition, extraction, and purification equipment of the nuclear fuel reprocessing system.

All chemcials used in the reprocessing of the nuclear fuels when the plant was in operation were prepared in the XCR. This chemical preparation involved 27 tanks ranging in size from 38 to 3,800 L, 35 pumps, eight small pots, 11 chemical pulsers, a large glove box, heaters, motor controllers, instrumentation, supports, structures, and hundreds of feet of piping and tubing. When the XCR was dismantled, it had not been in operation for about ten years. Radiation fields were 2.78E-9 Sv/sec (1 mRem/hr) and contamination was low.

Part of the adjacent Pulser Equipment Aisle (PEA) was included in the XCR dismantlement. Figure 7 is a photograph of the XCR scale model looking into the east wall illustrating the amount of equipment and piping that were involved in the dismantlement.

The piping in the XCR was removed first. Each pipe run was identified and a determination was made with regard to its content and contamination level. Detailed procedures were prepared, reviewed, approved, and issued to the D/D Supervisor before removal began. Each pipe was "telltaled" under controlled conditions and a radiological survey was made of its contents. Contaminated pipe was filled with a plastic expanding foam to fix the contamination before the pipe was cut out of the system. All piping and fittings were cut to fit into 208 L (55-gallon) drums. The cut ends or openings were plugged, sealed, bagged, and taped for disposal as LLW. Instrumentation, electrical components, supports, etc., were given similar disposition. Removal was through the west doorway in the XCR by means of the existing 907 kg (1-ton) monorail hoist and a roof-mounted jib crane. The XCR tanks were permanently plugged, covered, welded, and sealed then removed through hatches in the XCR roof by means of a ground level mobile crane to temporary storage on the plant site.

Essentially, everything was removed from the XCR to bare walls. Refurbishing and equipping the XCR for the decontamination and dismantlement of the Extraction Cells overlapped the dismantlement of the XCR itself. The floor on the north half of the XCR was originally enclosed with a 2.032E-1 m (8-inch) high curb to contain spills from the mixing tanks and equipment. Contamination had been fixed to this floor area, which was rough and worn by acid spills and decontaminating over the years of operation. This floor area has been refurbished by pouring concrete in this curbed area to fill it flush with the top of the curb. The surface of the floor was then finished, sealed, and painted. Figure 8 shows the new floor and the dismantled XCR.

A 4,536 kg (5-ton) monorail crane was installed for moving items out of the XCR to ground level and vice versa. A large doorway was made in the west wall of the XCR and a steel structure was erected from this doorway extending out of the west side of the building to clear roofing at lower elevations and to obtain a straight drop to ground level. Figure 9 shows the monorail structure and hoist outside the building and the steel structure. A 9,072 kg (10-ton) gantry crane was installed in the XCR to service the D/D Operations in the Extaction Cells through the shield plugs in the XCR floor. Figure 8 shows this gantry in the right background. Figure 10 shows a 4,536 kg (5-ton) jib crane also installed in the XCR for handling operations. The jib and gantry cranes perform their handling operations inside a large plastic containment tent inside the XCR. Parts of this containment are shown in Fig. 10. The piping, vessels, and equipment to be decontaminated and removed from the Extraction Cells are illustrated by Fig. 11, which is a photograph of the scale model of an Extraction Cell.

A Temporary Ventilation System (TVS) has been installed in the XCR to provide airflow into the top of the Extraction Cells through the floor shield plug openings to prevent the airborne contamination from the Extraction Cells entering the containment tent. This TVS is located outside the containment in the southeast area of the XCR. It provides a flow of 8.49 m^3/s (18,000 SCFM) from the Extraction Cells and discharges it through a bank of HEPA filters to the plant exhaust system. The blower and its electric motor and other ventilation components were obtained from the plant's new off-gas system, which was installed 10 years ago, but had not been in "hot" operation when the plant was placed on "standby" condition.

D/D Operations in XC-3 and the Product Purification Cell (PPC) will begin when all the containment, cranes, utilities, and other equipment are checked out, and when the safety analyses, D/D work plans and procedures are completed and issued. The surfaces inside these contaminated cells will be cleaned by vacuum cleaners, high-pressure water lances, and mechanical techniques. Entry will be via the top shield plug hatches, which will be covered by the containment tent. D/D Technicians in four layers of antidecontamination clothing and air masks will be lowered on mechanical platforms into these Extraction Cells for semi-remote and manual D/D Operations.

Piping will be first removed using the telltaling, foaming, and cutting techniques used in dismantling the XCR. The top pipe runs will be removed first so as to provide access from the top to the lower piping runs. The vessels and other equipment will then be removed and lifted through the top shield plug hatches using the gantry crane. Decontamination, size reduction, and packaging operations will be performed, as required, on the vessels and equipment taken out of the Extraction Cells. The XCR containment tent has compartments equipped for these operations. After packaging the materials from the Extraction Cells as LLW, they will be transferred out of the XCR containment tent by means of the new XCR monorail crane (see Fig. 9) and lowered to ground level for disposition and eventual burial. After decontamination and dismantlement, these Extraction Cells will be equipped with part of the radioactive waste treatment system associated with high-level waste vitrification operations at West Valley.

Fuel Receiving and Storage

The Fuel Receiving and Storage (FRS) Area is a large fuel storage pool with shielded shipping cask handling facilities. It is located at the back (east side) of the plant with the service facilities on ground elevation, as shown in Fig. 4. Shipments to return the 750 spent core fuel assemblies stored in the FRS to their utility owners have started. Figure 12 shows one of the loaded shield cask trucks outside of the FRS. Before these shipments began, the FRS cask handling area was used for temporary storage of LLW drums filled as a result of plant D/D activities. These drums were moved to burial and the cask handling area was decontaminated and made ready for fuel subassembly handling and cask loading operations. The large FRS crane was refurbished and load tested for cask operations. It will require two years of fuel shipment operations to vacate the FRS. After shipment operations, the FRS will be equipped for size reduction operations associated with plant D/D.

Miscellaneous D/D Operations

Other D/D Operations in less important areas inside the plant Process Building and in some of the other auxiliary buildings have been completed. Also, considerable amounts of contaminated ground soil around the plant site were excavated and transferred to burial. D/D activities associated with sampling the HLW in the underground tanks at West Valley and in characterizing studies of this HLW were also performed.

D/D characterization by remote entry has been completed on the following shielded cells: PPC, XC-2, XC-3, Uranium Product Cell (UPC), LWC, and CPC. Further D/D characterization by manned entry have been completed for cells: XC-2, XC-3, EDR, and CCR. D/D and refurbishment for Project activities of the following plant areas have been completed or are in progress: MSMRS, PPC, Chemical Crane Room (CCR), XCR, PEA, Laboratory Areas, Analytical Cells, and EDR.

D/D Developments

Developing optimum D/D techniques for each particular application is a continuing activity at West Valley. It involves searching and keeping up with D/D developments throughout the world, studying new commercial materials and equipment for D/D application, and in conceiving and trying-out innovative techniques to accomplish specific tasks and to conform with ALARA goals.

Some of these developments have become part of the D/D methodology at West Valley. "Telltaling" and foaming the inside of pipes have become routine procedures. Fixing contamination by plastic foaming techniques has also been used to decontaminate small concrete excavations and niches inside the plant. It is planned to use these foaming techniques to fix contamination inside extraction columns and other internally structured or Raschig Ring-filled vessels for D/D Operations. Video techniques have been developed to provide remote observations inside contaminated cells and to perform remote radiological surveys.

Adaptations of standard tooling have been made by WVNS to automate decontamination operations, thereby saving time and reducing personnel exposure. A standard concrete scarifier, designed for manual operation on floor surfaces only, was adapted by WVNS to remove concrete from walls and vertical surfaces while being remotely operated from outside the cell. Visual monitoring of the operation is by closed circuit video or through existing cell shielded windows. The machine has also been fitted with a vacuum system which permits rapid concrete removal with virtually no dust or debris being deposited in the cell. This wall scarifier was used to decontaminate the Chemical Crane Room, and will be used for other concrete decontamination.

Commercially available glass bead and frit shot blasting equipment has been combined with an air eductor and HEPA filter vacuum collection components to form an effective surface cleaning and decontamination machine for remote operation.

A freon spray cleaning rig was adapted for remote operation and tested for decontaminating crane components. Electrocleaning was also studied for decontaminating crane rails and other components. High pressure water lance tests have also been conducted for D/D applications.

D/D Statistics

The D/D activities at West Valley has generated approximately 1.42E 3 m^3 (50,000 cubic feet) of LLW containing 3.33E13 Bq (900 curies). No significant amounts of liquid LLW waste were generated. Approximately 8,000 man hours have been expended with less than 3.7E-1 Man Sv (37 man rem) total site exposure, and less than 1.25E-2 Sv (1.25 rem) per year for the maximum exposed radiation worker.

DECONTAMINATION AND DECOMMISSIONING PLANS

D/D activities will continue in accordance with overall plans and schedules. Figure 1 illustrates the plant locations of the initial D/D work for refurbishing laboratories and shops for plant operation and D/D activities. The schedule for these operations is included at the bottom of Fig. 1. Some of these activities have been completed as reported in other sections of this report. Figure 2 shows the plant locations and schedule for D/D Operations to provide space for the radioactive waste treatment system associated with the HLW vitrification process. The plant locations and schedule for the D/D Operations to provide plant space for the HLW vitrification system and the HLW interim storage are shown in Fig. 3. These plant areas include the CPC which is the largest shielded cell at West Valley, its CCR and the EDR. The Component Test Stand (CTS), shown at the right of the plant illustration is a new facility being built for demonstrating the glass melter used in the HLW vitrification system. The location and schedule for D/D Operations to provide space in the plant for the TRU Waste Interim Storage and the Size Reduction Facility in the FRS are illustrated in Fig. 4.

These D/D activities cover a span of seven years and extend to Fiscal Year 1988 when the solidification of the HLW begins. At that time, D/D work will continue on the rest of the plant and then begin on the plant cells and areas associated with the HLW vitrification processes.

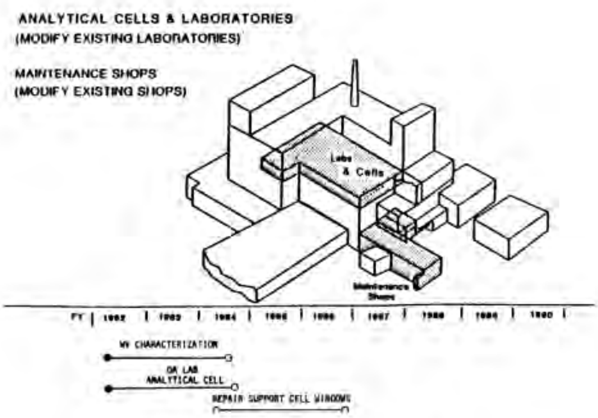

Fig. 1 Labs, Cells, Shops.

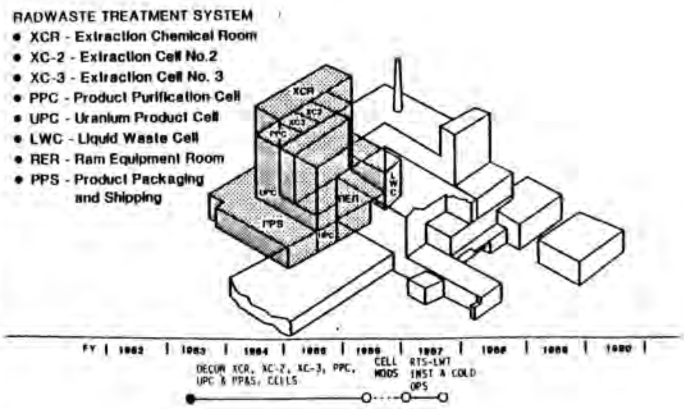

Fig. 2 XCs, LWC, etc.

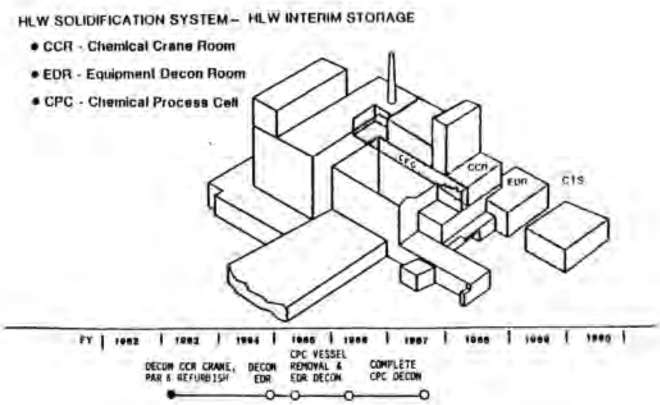

Fig. 3 CTS, EDR, CPC, etc.

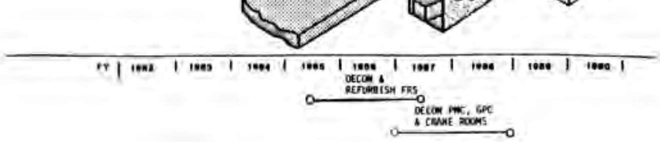

Fig. 4 PMC, GPC, FRS, etc.

Fig. 5 MSMRS floor removal.

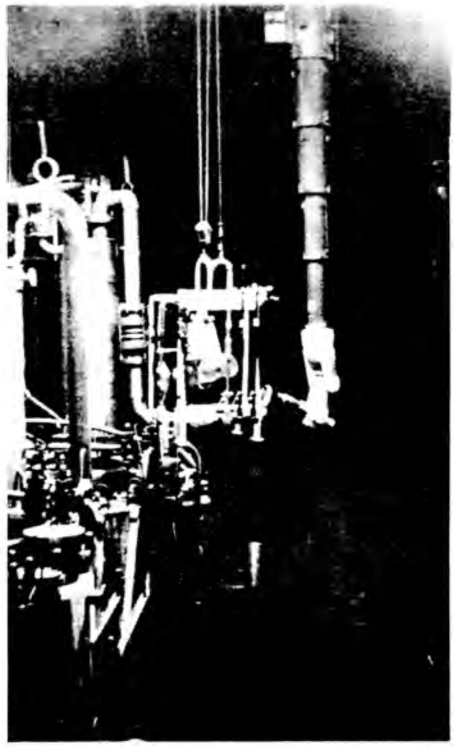

Fig. 6 Instrument cage in CPC.

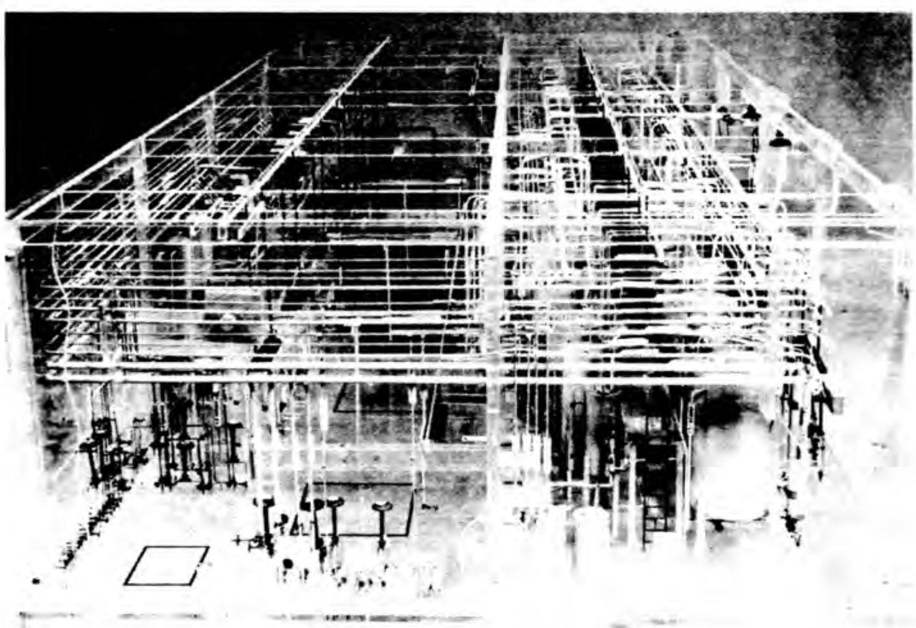

Fig. 7. Model of XCR.

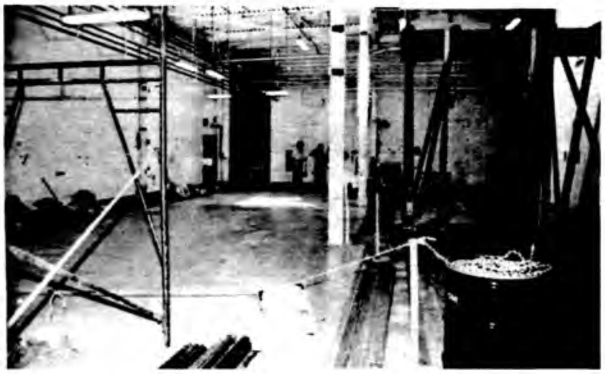

Fig. 8 XCR dismantled with gantry.

Fig. 9 XCR monorail hoist, outside.

Fig. 10 Jib crane in XCR.

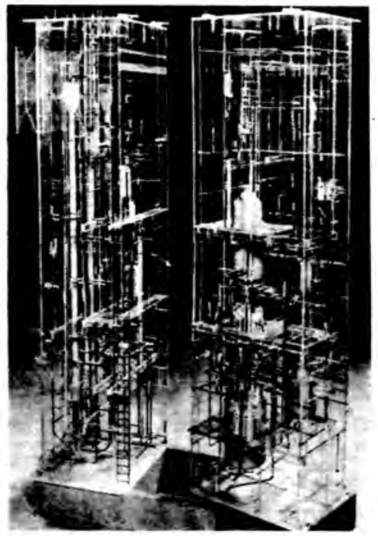

Fig. 11 Scale model of XC-3 (split).

Fig. 12 Shielded cask truck.