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Title

ENVIRONMENTAL ASSESSMENT OF THE F AREA DECOMMISSIONING PROGRAM

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Subject Index

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3. JF Bagley	Fed	23. AE Engler	1100N	44. Extra	
4. " "	Fed	24. ML Faught	1101N	45. Extra	
5. " "	Fed	25. JL Goodenow	1720K	46. Extra	
6. " "	Fed	26. DL Hovorka	1100N	47. Extra	
7. " "	Fed	27. JW Jones	313		
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		38. RK Wahlen	1720K		
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18. LV Barker	1104N	40. UNI File	Fed		
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ENVIRONMENTAL ASSESSMENT

OF THE

F AREA DECOMMISSIONING PROGRAM

HANFORD PLANT

RICHLAND, WASHINGTON

May 12, 1978

Submitted to

U. S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
NUCLEAR FUEL CYCLE AND PRODUCTION DIVISION

Prepared by

UNITED NUCLEAR INDUSTRIES, INC.
Contract No. EY-76-C-06-1857

ENVIRONMENTAL ASSESSMENT

OF THE

F AREA DECOMMISSIONING PROGRAM

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ENVIRONMENTAL ASSESSMENT OF THE F AREA DECOMMISSIONING PROGRAM

1. PROPOSED ACTION

The U. S. Department of Energy (DOE) plans to decommission the 100-F Reactor Area at the Hanford Reservation. The 100-F decommissioning program will be a full scale decontamination and decommissioning (D&D) demonstration project directed towards the removal or stabilization of all radioactive materials in the 100-F Area.

Operational planning and detailed work procedures are planned to be completed and documented during FY-1979. Actual decommissioning work would start in FY-1980 with completion occurring in FY-1981. The total estimated cost for the decommissioning of 100-F Area is approximately 24 million dollars.

1.1 Purpose

The program objective is to effect decommissioning of the 100-F Area facilities and site consistent with a recommended disposition strategy. Although a specific reuse of the site has not been identified, the end product of the decommissioning program will permit near term controlled use with eventual release of the site for unrestricted use.

As a D&D demonstration project, the program will provide detailed cost and engineering information which can be used to determine the final disposition of the remaining retired production reactors at Hanford and other DOE-owned facilities. The experience and knowledge gained will be extremely valuable for future decommissioning activities on the Hanford Plant, and possibly nationwide, at both federal and private nuclear facilities.

1.2 Facility Description

F Reactor was retired in June, 1965, after 20 years of service. The facility currently requires significant maintenance/surveillance and it is expected that the cost of maintenance/surveillance will increase due to building deterioration. The proposed D&D project at 100-F Area includes the removal, stabilization, or control of potential radioactive and industrial hazards. The disposition of the reactor building will be the most costly, single task. Other contaminated ancillary buildings and liquid and solid waste disposal sites are also included in the scope of the project.

F Reactor is a graphite-moderated, water-cooled reactor used to produce weapons grade plutonium. The reactor building, designated building 105, contains a reactor block; a reactor control room; a spent fuel discharge pool, fuel storage basin and associated fuel handling equipment; fans and ducts for the ventilation and recirculating gas systems; and supporting offices, shops and laboratories. Figure 1, is a simplified drawing of the reactor building.

The lower portions of the reactor building are constructed of massive reinforced concrete walls (3-5 feet thick) while the upper portions are concrete block topped with a pre-cast concrete tile and reinforced concrete roof.

The reactor block is composed of graphite blocks which have been cored to provide channels for process tubes, safety and control rods, and other equipment. The graphite stack measures 28' x 36' x 36'. The reactor block contains 2004 aluminum process tubes which supported the fuel and provided cooling water channels. A cast iron thermal shield (8 - 10" thick) surrounds the graphite block. The thermal shield is constructed of overlapping blocks. Surrounding the thermal shield on all sides except the bottom is a 52" thick biological shield composed of alternate layers of masonite and steel.

Cooling water discharged from the reactor returned back to the Columbia River via the 107-F retention basin. The retention basin system consists of a rectangular concrete reservoir 230 x 467 x 20 feet deep, and associated effluent lines which ran from the reactor to the basin, and thence to the middle of the river. During reactor operation, the intense neutron flux in the core of the reactor, caused a number of the macro and trace constituents of the cooling water to become radioactive. The 107-F retention basin held the cooling water up long enough to allow decay of many of the short-lived activation products before the water was released to the river. Some of the activity was deposited with sludge which settled in the basin and effluent lines. In addition, some contamination was deposited in the soil around leaks in the retention basin and effluent lines. Effluents containing debris from fuel cladding failures were diverted to the 107-F liquid waste trench (116-F-2) located a couple hundred feet southeast of the basin.

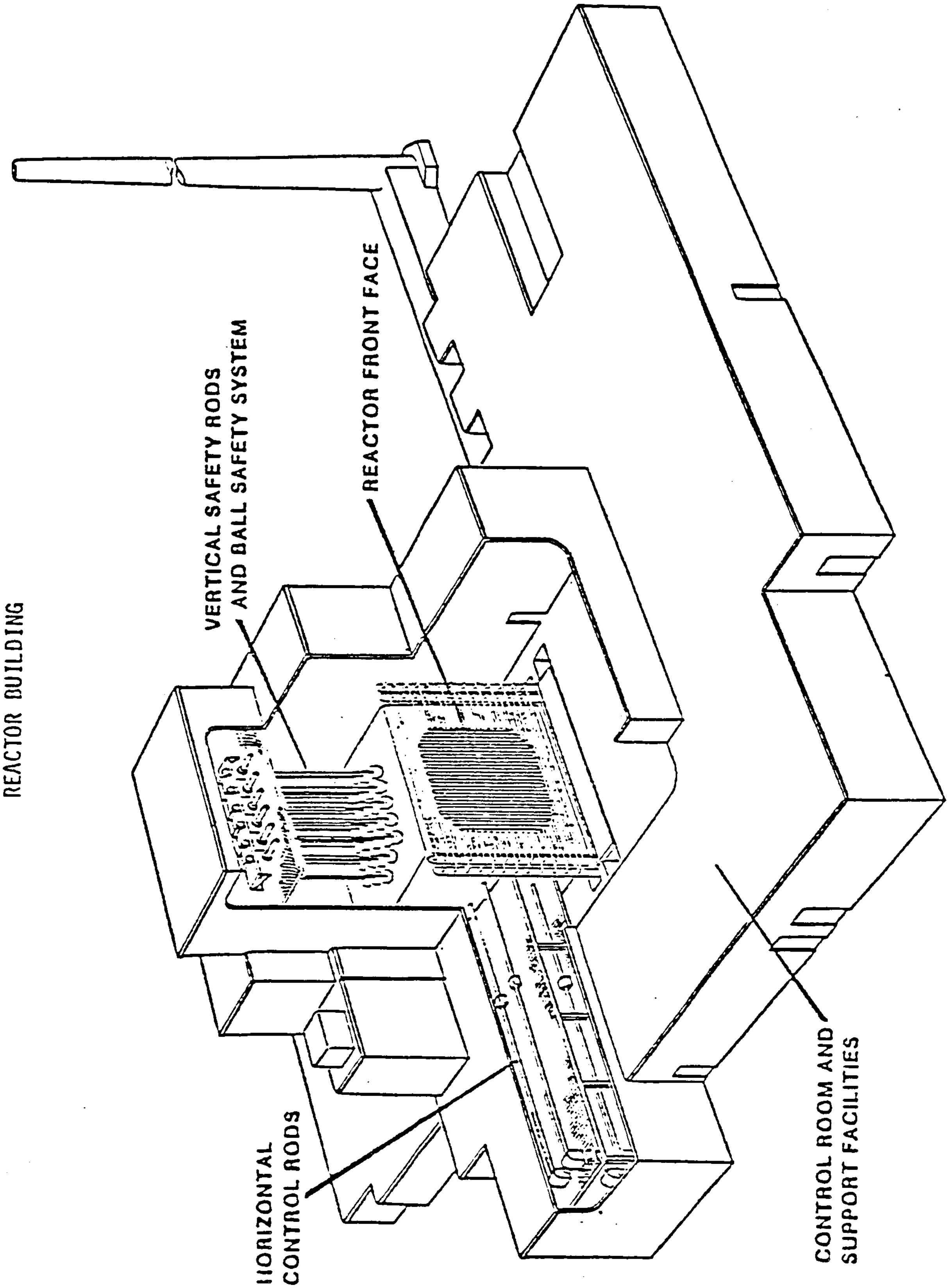
Two other major reactor ancillary structures are the 115 and 117 building. The reactor moderator (graphite) had a helium and carbon dioxide cover gas. The gas was recirculated at low pressures to minimize gas losses. Driers, injection and circulating equipment are located in the 115-F building. The reactor building exhaust gases (primarily ventilation) were filtered and, subsequently, exhausted through a 200-foot stack. This equipment is located in the 117 building. Sections of both the 115 and 117 buildings and connecting tunnels to the 105 building are contaminated.

Two contaminated Battelle Northwest biology buildings (108-F and 141-C) are also included within the scope of the 100-F decommissioning program. Here studies were conducted on animals of the effects of inhaled and injected radionuclides. The 108-F building was the main biology laboratory in 100-F Area, 141-C was a barn for large animals.

In addition to the facilities described above, there are six radioactive solid waste burial grounds, and seven contaminated liquid

FIGURE 1

REACTOR BUILDING



waste disposal facilities (cribs and trenches) which were established during the course of production and research work in 100-F Area. These ground disposal facilities have been retired and stabilized to establish short-term radiological control. The relative location of the facilities to be included in the F Area decommissioning program are shown in Figure 2.

1.3 Radionuclide Inventories

The highest concentration and inventory of radioactivity remaining in the 100-F Area is in the reactor block. The thermal shield has the highest concentrations of gamma activity in the reactor and is primarily from Co-60 with a half-life of 5.26 years. Based on detailed core sampling of a similar plutonium production reactor at Hanford (105-DR), approximately 22,000 Ci is estimated to be contained in the thermal shield. Approximately 88 percent of the inventory is from Co-60, and the remaining activity is from Ni-63. Ni-63 is a low energy beta emitter with a 92 year half-life. Direct insite dose rates of the thermal shields are 30 to 150 R/hr.

Again, based on sampling performed at the 105-DR Reactor an estimated 45,000 curies of radioactivity are contained in the 105-F Reactor graphite. Approximately 60 percent of the inventory is from Ni-63, 27 percent from H-3, and 11 percent from C-14. Other mixed fission and activation products are also present and account for the remaining 2 percent of the inventory. Pu-238, and Pu-239/240 are present with inventories of 7 and 4 curies and average concentrations of 4.1 x 10^3 and 2.6 x 10^3 pCi/g, respectively.

Background radiation levels in the 115 and 117-F buildings are generally less than 1 mR/hr with readings through piping and other equipment up to 25,000 c/m with a GM probe.

Compared to the reactor, four solid waste burial grounds containing reactor generated wastes have the second highest inventory of radioactivity in 100-F Area. The total estimated radionuclide inventory in these solid waste burial sites through 1972 was 1900 curies, primarily Co-60. These burial grounds do not contain transuranic materials. The two other burial sites in the area received wastes from the biological research facilities, and contain an estimated 15 curies of Sr-90, and 0.3 curies of Pu-239.

The liquid waste disposal facilities (i.e., retention basin system, cribs and trenches, etc.) contain an estimated 120 curies, consisting primarily of Co-60, Eu-152, Eu-154, Eu-155, Cs-137, and Sr-90. The 107-F retention basin accounts for 78 percent of the above inventory. The bottom of the 107-F retention basin contains sludge having plutonium concentrations up to a maximum 45 pCi/g and averaging 11 pCi/g. This sludge has been covered with about 5 feet of soil fill. All reactor related cribs and trenches except the 105-F pluto crib (116-F-4) have plutonium concentrations of less than 1 pCi/g. The 105-F pluto crib is small (10' x 10' x 10' deep) and contains plutonium concentrations up to 110 pCi/g. The radioactivity in an animal waste leaking trench used by the biological laboratories formerly in 100-F Area has not been characterized.

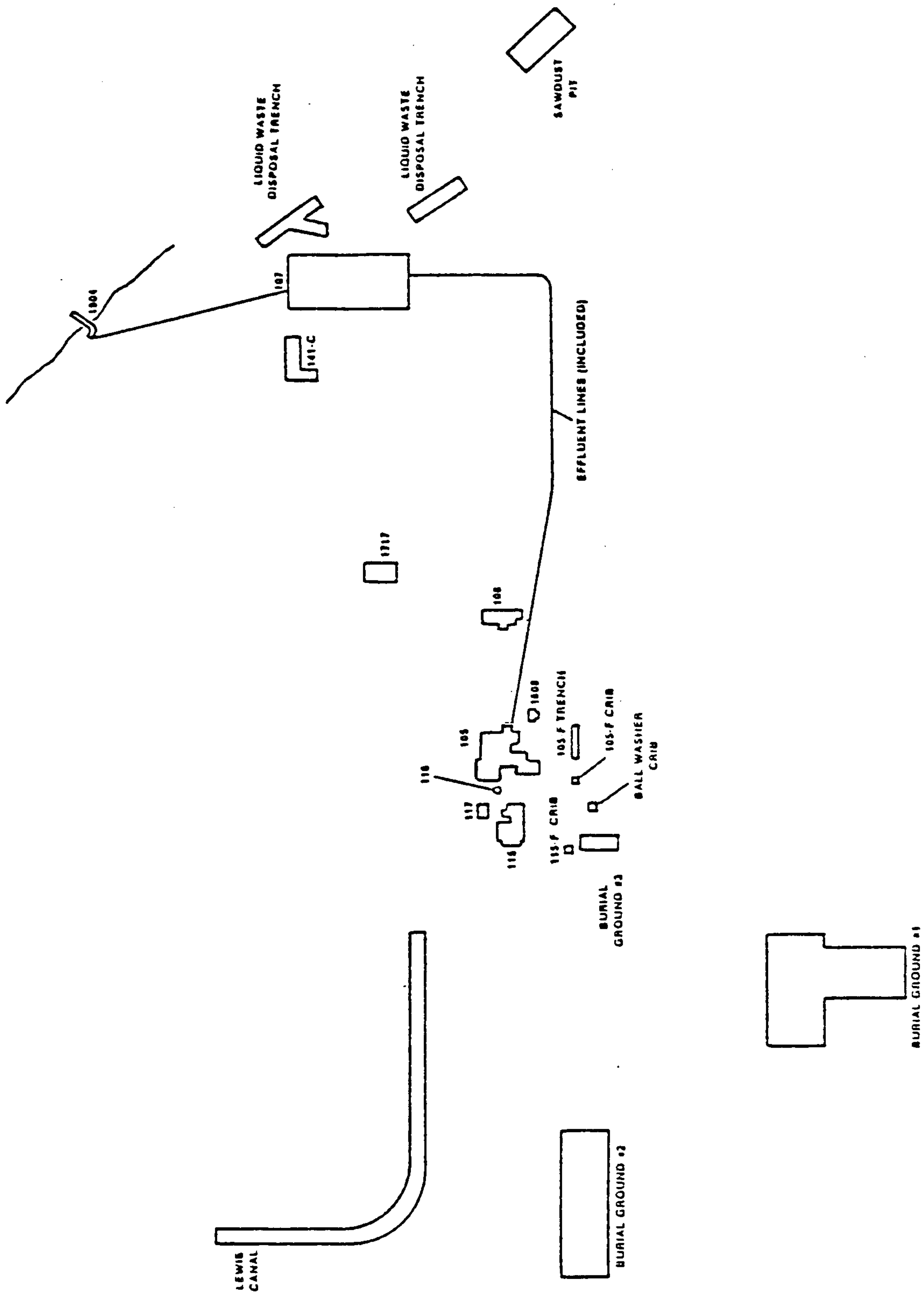


FIGURE 2
100-F AREA FACILITIES

The 105-F metal storage basin contains a few inch thick layer of sediment having plutonium concentration of 2 nCi/g and an estimated plutonium inventory of 0.1 curies. Approximately 100 curies of mixed fission and activation products are also contained in the sediment. This sediment has been covered with about 20 feet of soil.

The 108-F building contains 16 contaminated hoods, 11 uncontaminated hoods, 40 contaminated sinks and miscellaneous contaminated pipe and duct work. An estimated 0.012 curies of plutonium are contained within this facility. Animal stalls and the general interior of the 141-C building are contaminated. Contamination levels range up to a maximum of 90,000 counts per minute with a GM probe.

1.4 Scope of Decommissioning Activities

A DOE sponsored program, "Disposition of Retired Contaminated Facilities at Hanford" is studying the final disposition alternatives and strategies of all the retired Hanford facilities. The disposition strategy outlined herein is consistent with the preliminary results of this study.[1] The 100-F decommissioning program is based on the following disposition scenario.

- All structures will be removed and the associated radioactive waste relocated at approved burial grounds in the 200 Areas of the Hanford Reservation.
- All long-lived radioactive material and transuranics in excess of unrestricted release limits will be relocated to approved burial grounds in the 200 Areas.
- Onsite ground disposal facilities containing material with half-lives less than approximately 30 years will be left. A suitable protective cover will be installed to prevent people, burrowing animals, and plants from penetrating the contaminated zone.

Guidance on acceptable levels of surface contamination is provided in AEC Regulatory Guide 1.86 "Termination of Operating Licenses for Nuclear Reactors." Materials having surface contamination below these levels may be granted unrestricted release from radiological controls. No definite guidelines or regulations currently exist on acceptable levels of radiological contamination for various classifications of nuclear facilities or for potential uses after decontamination. Only limited guidance has been provided on acceptable activity levels when radionuclides are uniformly distributed in some matrix. Battelle Northwest is establishing radiological release criteria for future decommissioning activities at Hanford as part of the "Disposition of Retired Contaminated Facilities at Hanford" study. Based on dose calculations, radiological release criteria are being derived that will provide long term public protection from any residual contamination remaining in decontaminated facilities.

The specific contaminated ground disposal facilities that will be left in 100-F Area will be determined on the basis of a detailed soil sampling program that has recently been completed for all retired 100 Area facilities. The measured contamination levels and radionuclide inventories will be carefully reviewed to assure that only those contaminated locations that do not contain significant quantities or concentrations of radionuclides with half-lives of greater than approximately 30 years are left in place for radioactive decay.

The exact design of the protective cover to be installed over contaminated soil columns is being established by Battelle Northwest. The protective cover will prevent migration of radioactive material to the ground surface. The preferred protective cover at this time appears to be a cover of rock, sand, top soil, and shallow rooted grass such as cheatgrass.

The F-Area Decommissioning Program will be conducted in two phases. First, engineering programs will be conducted which will concentrate on the development and testing of techniques to remotely remove highly radioactive or contaminated components, improvements in existing tooling to increase productivity, exposure reduction methods and volume reduction techniques. The end-product of the engineering program will be a detailed operational plan which will be used to direct and control the decommissioning program and assure that all decommissioning activities are executed safely, efficiently, and in compliance with all applicable regulations.

The second phase of the decommissioning program includes all activities directed towards the removal or stabilization of all radioactive materials. Phase two can be divided into six major tasks as follows:

- Facility and site preparation.
- 105-F reactor block dismantlement.
- 105-F building decontamination and demolition.
- Decontamination and demolition of reactor support and biological facilities.
- Disposition of burial grounds, cribs, and trenches.
- Site restoration and facility closeout.

Facility and site preparation includes temporary modifications to the facility and/or site to expedite decommissioning. To expedite the loading and unloading of railroad cars containing contaminated material, it will be necessary to construct a car loading facility at 100-F and an unloading facility in the 200 Area. Railroad beds into the area will be inspected and repaired as required. Electrical, water, and sewer services will be reactivated. A security check point, radiation monitoring office, and office space for project staff will be established utilizing the 1701-FA and 1717-F buildings.

Uncontaminated equipment, piping and structural components such as non-load bearing walls and partitions will be removed from the reactor building facility. Space gained as this effort progresses will provide an enlarged work area within the 105 building for demolition equipment, storage, and maintenance. A waste compaction and decontamination station will be established. Backfill material will be removed from the fuel storage basin. Transuranic contaminated sediments and materials along the basin floor will be removed for disposal in the 200 Areas.

The inlet and outlet piping, control rods, and other external hardware will be removed from the reactor block. The preferred method of reactor dismantlement is to seal all openings, ports, expansion joints, etc. in the reactor shell. The reactor would then be filled with water to provide shielding from the irradiated components and minimize the spread of loose contamination from the interior of the reactor block. Removal of the graphite, thermal shield, and inner sections of the biological shield will be performed from the top of the unit using remote equipment.

A system for draining and treating the water from the reactor will be installed. The contaminated sewer system from the 105-F building empties into the 1608-F waste water pumphouse, where a considerable quantity of liquid waste can be retained prior to treatment and/or shipment. No radioactive liquid wastes will be disposed of at 100-F Area or released to the Columbia River.

A penetration through the wall of the 105-F building will be made immediately adjacent to a rail spur which will have been extended to a point alongside the 105-F building. This "hole" will be large enough to permit direct loading of materials into cars from within the building. A chute or conveyor will be used to move materials from the top of the reactor into rail cars. This concept is indicated in Figure 3. A containment envelope will be erected, extending from the wall of the 105-F building out and over the rail spur and wall penetration noted above. This enclosure will likely be a metal frame structure with corrugated sheet metal siding. It will be equipped with an exhaust system to filter air before it is released to the atmosphere.

Disposition of reactor support and biological research facilities (115-F, 117-F, 107-F, etc.) will involve the use of standard dismantling techniques, modified where necessary to accommodate specific conditions of contamination and/or presence of radioactive material. After removal of equipment and decontamination of the facilities, the remaining shells will be demolished. Particular emphasis will be placed on the development and utilization of effective decontamination techniques to minimize the waste volumes generated as part of this phase of the program.

It is currently believed that the disposition of the burial grounds, cribs, and trenches will consist primarily of providing protective covers over these facilities. Though a few of these facilities could

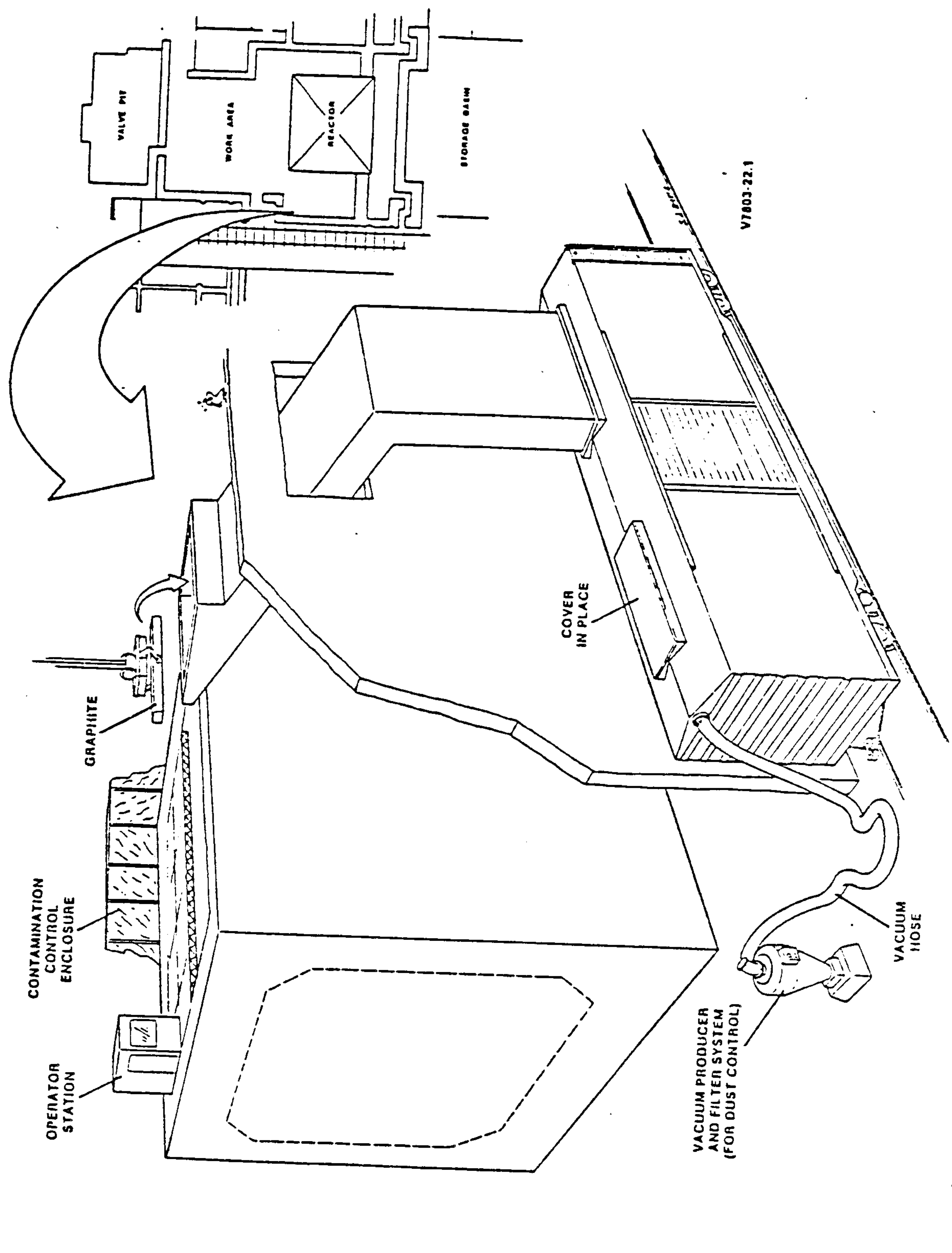


FIGURE 3

105-F REACTOR BLOCK DISMANTLEMENT

be exhumed, removal will only be considered if long-lived radionuclides (primarily plutonium) are present at levels above unrestricted release limits which will be established based on safety and dose analyses.

Site restoration and facility closeout will include the removal of the 1717-F and 1701-FA which will have been used for project offices. Utilities, railroad tracks, and roads will be removed and final site grading performed. Disturbed ground areas will be planted with cheatgrass. Comprehensive radiation surveys will be performed. A closeout document will be prepared, providing a summary of the disposition activities and the final status of the site.

During decontamination operations, precautions will be taken to eliminate or minimize any discharge of radioactive materials. Temporary contamination control barriers with exhaust filtration will be used as required for contamination control during dismantling operations. Procedures will be prepared to assure that all activities are carried out in accordance with accepted radiation work practices. A health physics technician will be at the job site at all times to provide dose rate evaluations, and in general assist in maintaining good contamination and radiological control. Constant air monitoring will be provided during all operations where measurable airborne contamination could potentially occur. The air monitoring equipment will be capable of providing an alarm should air contamination become a problem. Air samples will be taken as deemed necessary by health physics personnel.

Considerable quantities of low-level radioactive solid waste will be generated as a result of this project. The majority of radioactivity contained in wastes generated from decommissioning 100-F Area will result from dismantling the reactor block and the 105 building. Some of the wastes (e.g., the thermal shield) will require packaging in shielded containers. Estimated contaminated waste volumes for dismantling the reactor are as follows:

graphite	1500 yd^3 (4,800 Ci of C-14, 12,000 Ci of H-3, 27,000 Ci of Ni-63)
noncombustible solids (shielded containers)	1500-2000 yd^3 (17,000 Ci of Co-60, 4,900 Ci of Ni-63)
other noncombustible solids	500-1000 yd^3
combustible solids	200 yd^3

Contaminated wastes generated from other portions of the F-Area decommissioning will contain the order of a few hundred curies of radioactivity, but will result in a larger waste volume of the order of 10,000 yd^3.

2.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

The project will be carried out within the 100-F Area on the Hanford Reservation. The semiarid Hanford site occupies about 570 square miles of the southeastern part of the state of Washington. Current activities on the Hanford Project and associated environmental releases are described in detail in the Hanford Environmental Impact Statement, HEIS.[2]

As indicated in Figure 4, the 100-F Area is located on the south bank of the Columbia River in the northern portion of the Hanford Reservation. 100-F Area is approximately 20 miles from the city of Richland, Washington. The reactor and surrounding buildings and land which comprise the 100-F Area occupy slightly less than 1 square mile.

Of the six plutonium production reactor sites included within the Hanford Reservation, the 100-F Area is the furthest downstream. The 100-F complex was built during World War II as a weapons grade plutonium production facility. The 105-F reactor operated from 1945 to 1965 when it was permanently retired from service. In the intervening years, many of the uncontaminated buildings have been removed as part of a site cleanup program. The site cleanup program is aimed at the correction of potential radiological and industrial hazards in the retired and standby 100-Area facilities, and the removal of non-required uncontaminated equipment and structures in the retired 100-Area facilities. A separate environmental assessment has been prepared for the site cleanup program.

Today, only the 105-F building (which contains the reactor), several reactor related buildings and facilities, and two biology laboratory facilities formerly used by Battelle Northwest, remain at 100-F Area.

The closest residence (ranch) to the 100-F Area is located approximately 7 miles (11,000 m) northeast of the area. The nearest point of unrestricted access by the general population is the Columbia River. The Columbia River is located approximately 700 meters northeast of the 105-F reactor building. Until recently, access of the general population was restricted from the Hanford Reach of the Columbia River. Boating is now allowed, but no trespassing along the shorelines is permitted.

Contaminated solid wastes will be buried in existing burial facilities in the 200 Areas. These solid waste burial trenches are described in HEIS.

As part of the Hanford Environmental Surveillance Program managed by Battelle-Northwest, measurement is made of the radionuclide concentrations in local air, water, and food stuffs, along with direct radiation measurements. Extensive onsite and offsite air and water monitoring stations provide estimates of the Hanford operations radiological impacts on the biosphere, in addition to providing indication of unusual results or trends which might indicate loss of control of radioactive waste disposal operations. Groundwater is monitored by a network of test wells. The routine Hanford Environmental Surveillance Program is described in the Master Schedule - Hanford Environmental Surveillance Routine Program.[3]

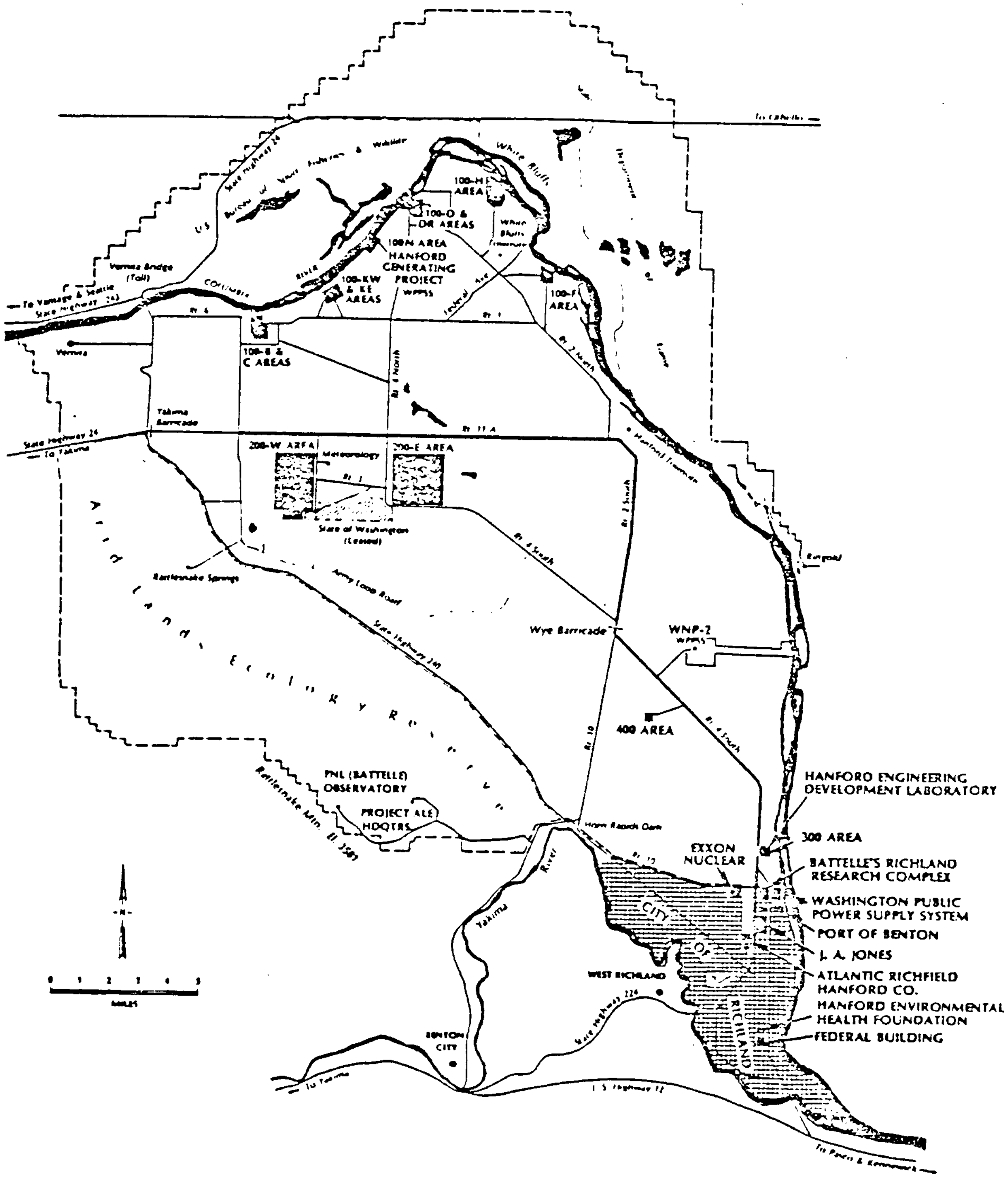


FIGURE 4

MAP OF HANFORD RESERVATION

In addition to the Hanford Environmental Surveillance Monitoring stations, constant air monitoring will be provided at the job site during all operations where measurable airborne contamination could potentially occur.

3.0 POTENTIAL ENVIRONMENTAL IMPACT

The environmental impact of the proposed decommissioning of the 100-F Area is primarily beneficial resulting in the removal and/or stabilization of potentially hazardous and radioactively contaminated structures. The demonstration and evaluation of D&D techniques in this program will minimize the environmental impacts associated with the eventual decommissioning of all retired contaminated facilities on the Hanford Project. The decommissioning of 100-F Area will represent the first time at Hanford that such a large area will be placed in a stable condition so that the possible effects of radiation on the environment are minimized. Eventually the project would allow removing 100-F Area from radiological controls. The area would become aesthetically much more pleasing in that unsightly concrete buildings would be removed from the desert landscape.

All building and equipment rubble will be buried. No soil erosion is anticipated, and no objectionable odors or noise to the public will result. No environmental releases of radioactive or nonradioactive air or water pollutants are anticipated. After decontamination of the facilities, there will be some onsite noise and dust associated with the dismantling and site restoration operations. Water sprays will be used to minimize the generation of dust. All activities will be carried out in a remote location about 20 miles from the nearest town. No offsite impact from the dismantling activities is anticipated. No adverse impact has been identified for ecological, aesthetic, historic, archaeological, recreational, or wild life preservation sites.

Contaminated solid wastes generated as the result of the F-Area decommissioning will be buried in existing burial facilities in the 200 Areas. The 200 Areas are in the middle of the Hanford site, on a plateau about 7 miles from the Columbia River. The fuel and waste processing and waste storage activities are located in the 200 Areas. The location of the 200 Areas provides the most isolation from the Hanford site boundaries and is the most removed from both surface and subsurface water. Under this area, the groundwater table is some 150 to 300 feet below the surface. Approximately seven million ft^3 of contaminated solids have been buried on the 200 Area plateau since the start of chemical processing operations. The contaminated solid waste is buried in 19 sites on the 200 Area plateau using 178 acres. The approximate radionuclide inventory of solid waste disposal in the 200 Areas through 1977 includes 1,000 kCi of beta-gamma activity and 425 Kg of plutonium. Approximately 189,000 ft^3 (7,000 yd^3) of contaminated solid wastes are buried annually in the 200 Areas as the result of current Hanford operations. The annual contaminated solid waste burial volumes would be approximately doubled during the 2 years which the 100-F decommissioning work would be performed.

Contaminated solid wastes generated as the result of the 100-F Area decommissioning will contain approximately 6 percent of the existing radionuclide inventory in the 200 Area solid waste burial facilities. (This does not include the radionuclide inventory contained in contaminated buildings, liquid waste trenches, and high level liquid waste storage tanks in the 200 Areas.) The resulting volume will represent approximately 6 percent of the seven million ft^3 of solid wastes which have been buried on the 200 Area plateau. Though large volumes of low-level contaminated solid wastes will be generated, these wastes will result from existing contaminated facilities for which the ultimate disposition must be established. As a D&D demonstration project, considerable emphasis will be placed upon dismantling and decontamination techniques which minimize the volume of contaminated wastes to be disposed of in the 200 Areas.

The 200 Area plateau is considered to be a more suitable location for the storage of the remaining long-lived radionuclides above unrestricted release limits currently in 100-F Area. The water table is generally about 33 feet below the ground surface at F Area. F Area is also close to the Columbia River, and would be easily accessible to trespassers. The 200 Area provides the most isolation from the Hanford site boundaries, and is the most removed from both surface and groundwater.

The HEIS concluded that impacts of the normal solid radioactive releases to ground in the 200 Areas is a total of 4 acres of land use per year and essentially zero population dose. During the 2 years of the 100-F decommissioning work, this impact would be increased by approximately 4 acres per year, i.e., 8 acres of land use could be associated with the 100-F decommissioning program. The potential impacts, including an evaluation of credible accidents from the 200 Area burial grounds and onsite radioactive shipments, are described in detail in HEIS.

Radioactive solid wastes generated as the result of the F Area decommissioning program will be transported by truck or rail to approved burial facilities in the 200 Areas. Shipments will be made over approximately 15 miles of roadway or rail within the controlled area of the Hanford Reservation. At no point will the shipment route intersect any highway with unrestricted public access.

Approximately 200,000 ft^3/year of contaminated solid waste will be transported to the 200 Areas as the result of this 2-year project. The bulk of the wastes (70%) will contain only a few hundred curies of mixed fission and activation products. The remaining waste volume will contain the several thousand curies of radioactivity contained within the reactor block. All of the radioactive solid wastes, however, will be low specific activity (LSA) wastes. As LSA materials, the wastes will be packaged in strong, tight, sealed containers which would withstand the conditions of transport under which they will be used. The exact packing procedures have not been established. Utilization of modified retired rail freight cars is being considered as a possible economical method of packaging, shipping, and burial of the contaminated waste from 100-F Area.

A rail car carrying reactor thermal shield waste to the 200 Areas could contain up to 1200 curies of Co-60, and 350 curies of Ni-63. Radioactivity within the reactor thermal shield wastes is induced activity within cast iron blocks, therefore, there would be little potential for dispersal of radioactivity to the offsite environment from any shipping accident pertaining to these wastes.

Transportation accidents involving the wastes discussed in the above paragraphs would be less severe than the credible accidents described in HEIS.

The reactor graphite wastes represent the greatest potential for dispersal of radioactivity resulting from a shipping accident. A shipping accident during which the entire contents of a railroad freight car filled with contaminated graphite were spilled out onto the surrounding ground area has been evaluated. The resuspension of radionuclides by wind currents would not be a likely occurrence, since the graphite will be wet or damp as the result of flooding the reactor core during dismantling operations. For purposes of dose assessment, however, 0.05% of the total radionuclide inventory was conservatively assumed to be suspended over an 8-hour period as the result of 22 mph (10 m/sec) winds. Source terms for this accident are given in Table 1.

The accident is assumed to occur near the 105-F reactor building, the point along the shipment route closest to unrestricted access by the general population. Moderately stable atmospheric conditions are assumed. Using the Hanford meteorological model and a ground level release, the 50-year dose commitment to the critical organ, bone, was calculated for a maximum individual located approximately 700 m northeast of the 105-F building. This maximum individual represents a fisherman (or equivalent) moored along the Columbia River at a point closest to the 105-F building during the duration of the release. The 50-year dose commitment to the bone of an individual in the closest residence to the 105-F building was also calculated. The maximum individual would incur a 50-year dose commitment to the bone of 1.0×10^{-1} rem, and the individual in the closest residence 3.0×10^{-3} rem. These dose estimates are lower than many of the dose commitments resulting from accidents described in HEIS. Furthermore, the resuspension of radionuclides could be essentially eliminated if the graphite and surrounding soil were maintained wet until any loose material could be immobilized. The individual along the river bank would also be evacuated under such conditions drastically reducing his resulting dose.

No atmospheric releases of radioactivity are anticipated as the result of the dismantling activities associated with the 100-F decommissioning program. Under the current preferred decommissioning technique for the reactor, the 105-F reactor block would be made watertight. The reactor core would then be filled with water during the removal of the graphite and thermal shield. No airborne contamination problems should be encountered. In addition, a vacuum producer and filter system will be tied into the rail car during loading operations for dust control. The rail car will also be enclosed in a contamination control enclosure with exhaust filtration. An accident as the result of dismantling activities would be less severe than the graphite shipping accident previously discussed.

TABLE 1

SOURCE TERMS OF REACTOR GRAPHITE SHIPPING ACCIDENT

Radionuclide	Atmospheric Release Over 8-hour Period (Ci)
Pu-238	2.9×10^{-4}
Pu-239/240	1.8×10^{-4}
Am-241	2.6×10^{-5}
Sr-90	4.1×10^{-2}
H-3	4.8×10^{-1}
Eu-152	3.9×10^{-3}
Co-60	6.0×10^{-3}
Eu-154	3.0×10^{-3}
Cs-134	1.8×10^{-4}
Cs-137	2.2×10^{-3}
Eu-155	5.5×10^{-4}
C-14	2.0×10^{-1}
Ba-133	2.6×10^{-5}
Ni-63	1.0×10^{0}

There could potentially be some unplanned leakage of the shielding water used to flood the reactor core. Any such leakage would drain into the concrete 115 tunnels underneath of the reactor block. Provision will be made beforehand to assure that no leakage of contaminated water to ground would result.

4.0 COORDINATION WITH FEDERAL, STATE, REGIONAL AND LOCAL PLANS

No known or potential conflicts with federal, state, regional, or local plans or programs have been identified for the proposed decommissioning of 100-F Area.

5.0 DESCRIPTION OF ALTERNATIVES

Present plans call for the complete decontamination and dismantling of the 105-F reactor building and ancillary buildings in order to demonstrate and test D&D techniques and associated costs. Long-lived radioactive materials and transuranics in excess of unrestricted release limits will be relocated to the 200 Area radioactive solid waste burial grounds.

The alternative of no action at all is not considered since the ultimate disposition of the retired reactor facilities has to be established and selected decommissioning techniques demonstrated. Other alternatives which have been considered are outlined below:

Layaway

Remove all exposed, loose contamination from the 105 building, and seal all building openings to prevent unauthorized entry.

Protective Storage

The reactor block is placed in protective storage until radiation levels decay to permit dismantling of the block using contact operations - nominally 50 to 100 years. The reactor block would be isolated by enclosing it in a semi-permanent protective shell. Unused portions of the 105 building would be demolished. Other segments of the reactor system would be treated in a manner compatible with the protective storage of the reactor block.

Entombment

Isolate the reactor block and entomb it in an impenetrable concrete shell. Unused portions of the 105 building would be removed. Other segments of the reactor system would be disposed of in a manner compatible with entombment of the reactor block.

Removal of transuranic materials above unrestricted use levels and installation of a suitable protective barrier over contaminated soil columns is essentially a protective storage disposition mode restricting the use of the sites (the order of approximately 100 years) until the remaining radioactivity decays to unrestricted use levels. Layaway of contaminated ground disposal sites would restrict access to the contaminated soil columns and control plant growth and soil erosion. Entombment techniques for contaminated soil columns have not been demonstrated, but would possibly utilize a hard cover and a chemical agent such as grout to stabilize the radionuclides in place in the soil column. Entombment could only be considered for contaminated soil columns only if acceptable entombment procedures could be developed. Dismantling of all the contaminated liquid and solid waste disposal sites would consist of removing all radioactivity in these facilities currently above unrestricted release limits for disposal at the 200 Area burial site.

With respect to the reactor, the layaway and protective storage modes would provide considerably less D&D information than the dismantling alternative. They would also be interim D&D solutions since the relatively large inventories of C-14, Ni-63 and plutonium in the graphite stack would eventually require a more permanent disposition than offered by these alternatives. Entombment may not be a viable decommissioning alternative for the Hanford production reactors because of the several thousand year half-lives of the C-14 and plutonium present in the reactor cores. Entombment would require the demonstration that these radionuclides in the graphite would pose little or no potential hazard to the environment over the next several thousands of years. If required, the removal of the entombed reactor block at a later date would be extremely difficult and costly. Economically, the entombment of the reactor block could be irreversible. The area in the immediate vicinity of the reactor would have use restrictions indefinitely into the future.