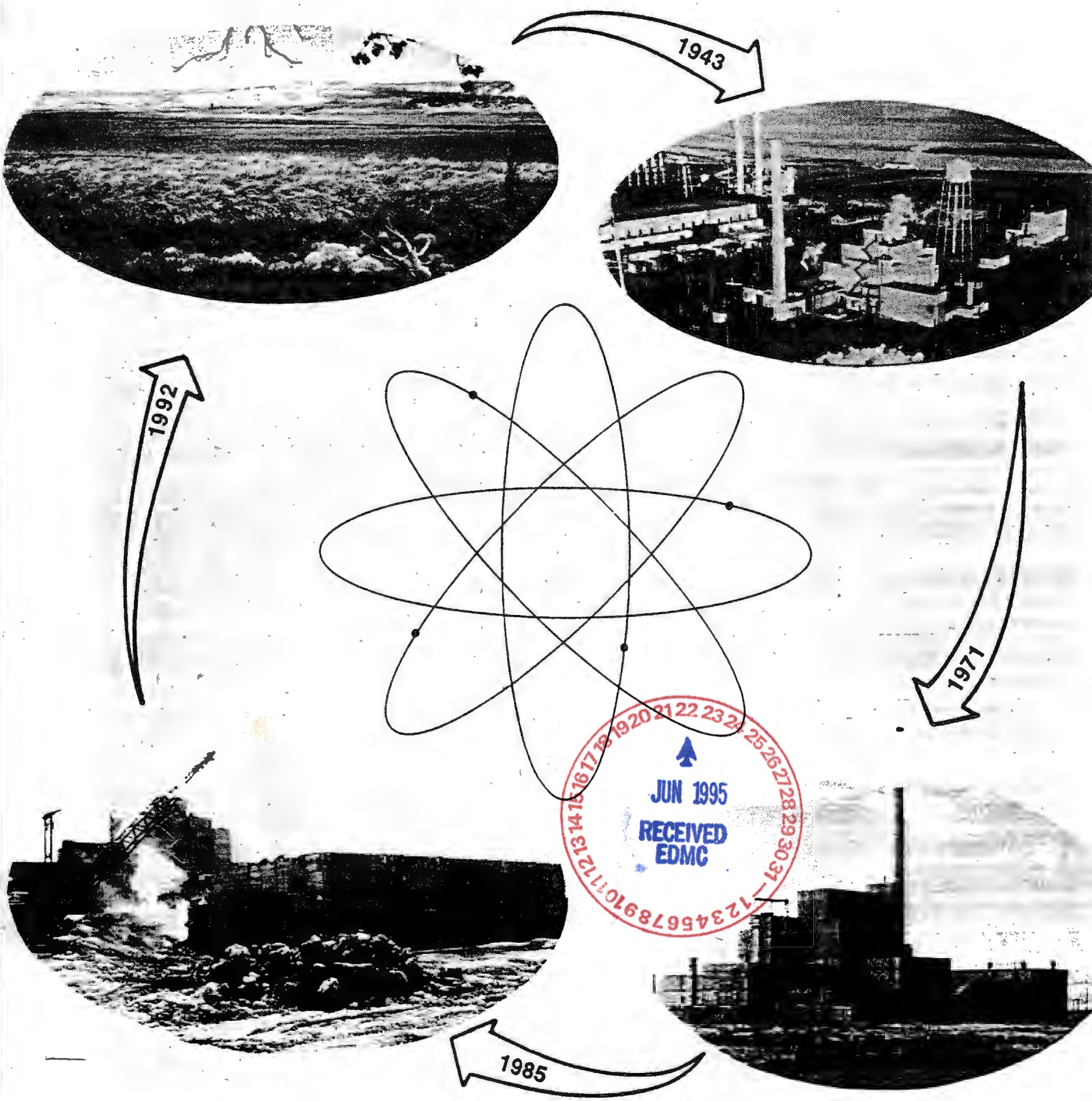
UNI-2533

Hanford 100 Area Long-Range Decommissioning Plan



Prepared for U.S. Department of Energy by UNC

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TABLE OF CONTENTS - contd.

TABLE OF CONTENTS - contd.

TABLE OF CONTENTS - contd.

PART 2 - FACILITY DESCRIPTIONS AND EVALUATIONS

LIST OF FIGURES

PART 1

LIST OF FIGURES - contd.

PART 2

LIST OF FIGURES - contd.

PART 2

LIST OF TABLES

PART 1

LIST OF TABLES - contd.

LIST OF TABLES - contd.

SUMMARY

Technical strategies, schedules, and cost estimates have been established for the safe and cost-effective decommissioning of the shut-down Hanford 100 Area facilities. Four categories of facilities are to be decommissioned:

- Reactor buildings
- Effluent water systems
- Ground disposal facilities
- Ancillary facilities

The facilities are located in five separate reactor areas: 100-B/C, 100-D/DR, 100-F, 100-H, and 100-KE/KW. Each reactor area contains structures from all four of the facility categories identified above. There are more than 40 separate structures, including eight reactors and various ancillary facilities, approximately 14 miles of effluent piping, and 61 ground disposal sites. (A ninth reactor, N Reactor, was started in 1963 and is still in operation. The decommissioning of N Reactor is not within the scope of this Plan.) Because of the large number and variety of structures and geographical separation, cost considerations dictate that the decommissioning work will generally proceed on an area-by-area basis.

Engineering evaluations, radiological studies, and comparative cost estimates were performed to identify several candidate decommissioning alternatives for the shut-down Hanford 100 Area facilities. Of these alternatives, the Department of Energy, Richland Operations Office (DOE-RL), has generally identified the in-situ method as the recommended preferred decommissioning alternative. In the in-situ alternative, structures containing residual radioactive material (except the reactor blocks), are demolished then covered with a barrier sufficient to

prevent migration of radionuclides from the site and protect against human intrusion into the site. UNC has previously used the in-situ alternative to decommission several 100 Area ancillary facilities.

All work will conform to DOE and National Environmental Policy Act (NEPA) reporting requirements. The appropriate level of NEPA documentation, as determined by DOE, will be completed before work begins on any decommissioning project. The final selection of the decommissioning alternative for a particular project will not be made by DOE until the applicable NEPA reporting process is complete.

Decommissioning of five 100 Areas will require approximately 8 years to complete at a total estimated cost of $80 million.

UNI-2533

HANFORD 100 AREA LONG-RANGE DECOMMISSIONING PLAN

PART 1

BACKGROUND INFORMATION, COSTS AND SCHEDULES

1.0 INTRODUCTION

1.1 PURPOSE OF THIS PLAN

The purpose of this Long-Range Plan is to describe the basic strategies and provide baseline cost estimates and schedules for decommissioning the Hanford 100 Area shut-down facilities. The project groupings and priorities ensure the cost-effective use of decommissioning resources, although they differ somewhat from the priorities presented in The Surplus Facilities Program Management Plan (Reference 1).* The strategies and priorities presented in this Plan are based on engineering studies and experience gained from previous 100 Area decommissioning work. Specifically, this plan:

- Describes the facilities' physical and radiological conditions;
- Provides conceptual cost estimates and schedules;
- Describes the decommissioning management plan;
- Describes the recommended preferred decommissioning alternative;
- Groups the facilities into manageable projects and prioritizes those projects; and
- Identifies special problems, R&D requirements, required equipment, and potentially reusable facilities and equipment.

1.2 PLAN REVISIONS

The information in this plan is based on current regulatory requirements, current technical knowledge, available radiological characterization data and assumptions about resources. The decommis-

*References are listed in Section 8, Part 1 of this Plan.

sioning activities described in this plan will require approximately 8 years to complete. Accordingly, the plan will be updated as necessary to reflect revised regulations, technology advances, and budget and scheduling changes.

1.3 BACKGROUND INFORMATION

The Hanford Site (Figure 1-1) was commissioned in 1942 for the production of plutonium by the Manhattan Engineering District of the U.S. Army Corps of Engineers. Eight graphite-moderated reactors and associated support facilities were constructed in the Hanford 100 Area between 1942 and 1954 to support the plutonium production effort. They are the 100-B, -C, -D, -DR, -F, -H, -KE, and -KW reactors. These facilities are now shut-down and require decommissioning. A ninth production reactor, N Reactor, was started up in 1963 and is still in operation. The decommissioning of N Reactor and its support facilities is not within the scope of this Plan.

The original eight production reactors, most of their support structures, and their associated ground disposal facilities were shut down between 1964 and 1971, and have since been kept in a safe storage condition. Safe storage activities for these reactors and support facilities consist of short-term "fixes" adequate to protect the workers and the environment for the present, and are not adequate to assure stabilized, long-term disposal.

1.4 SCOPE OF WORK

This Plan covers more than 100 separate facilities, including more than 40 buildings, 130 acres of ground disposal facilities, as well as approximately fourteen miles of mostly underground, effluent water piping. Figures 1-2 through 1-6 show the five Hanford 100 Areas.

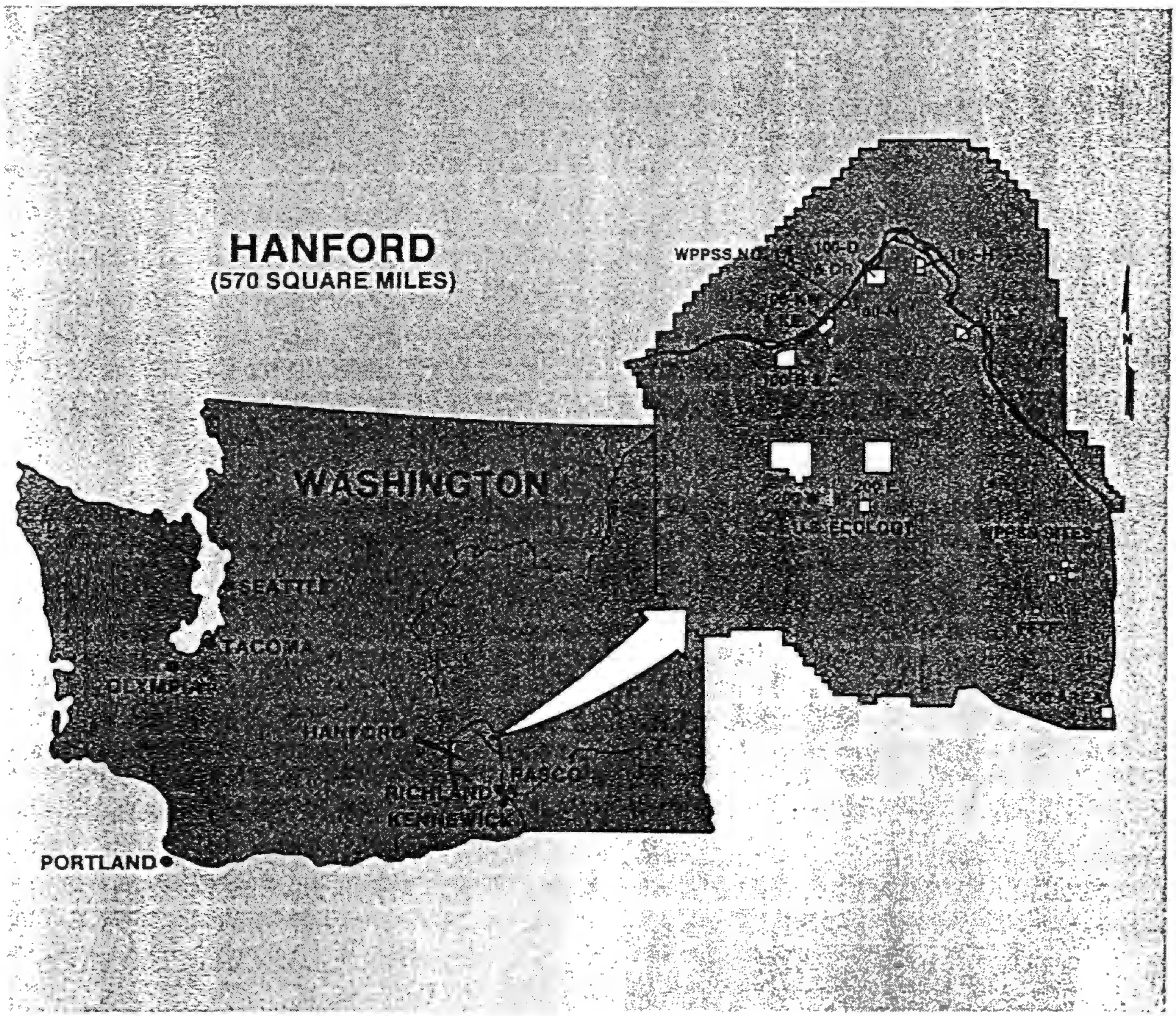

Figure 1-1. Location of Hanford Site.

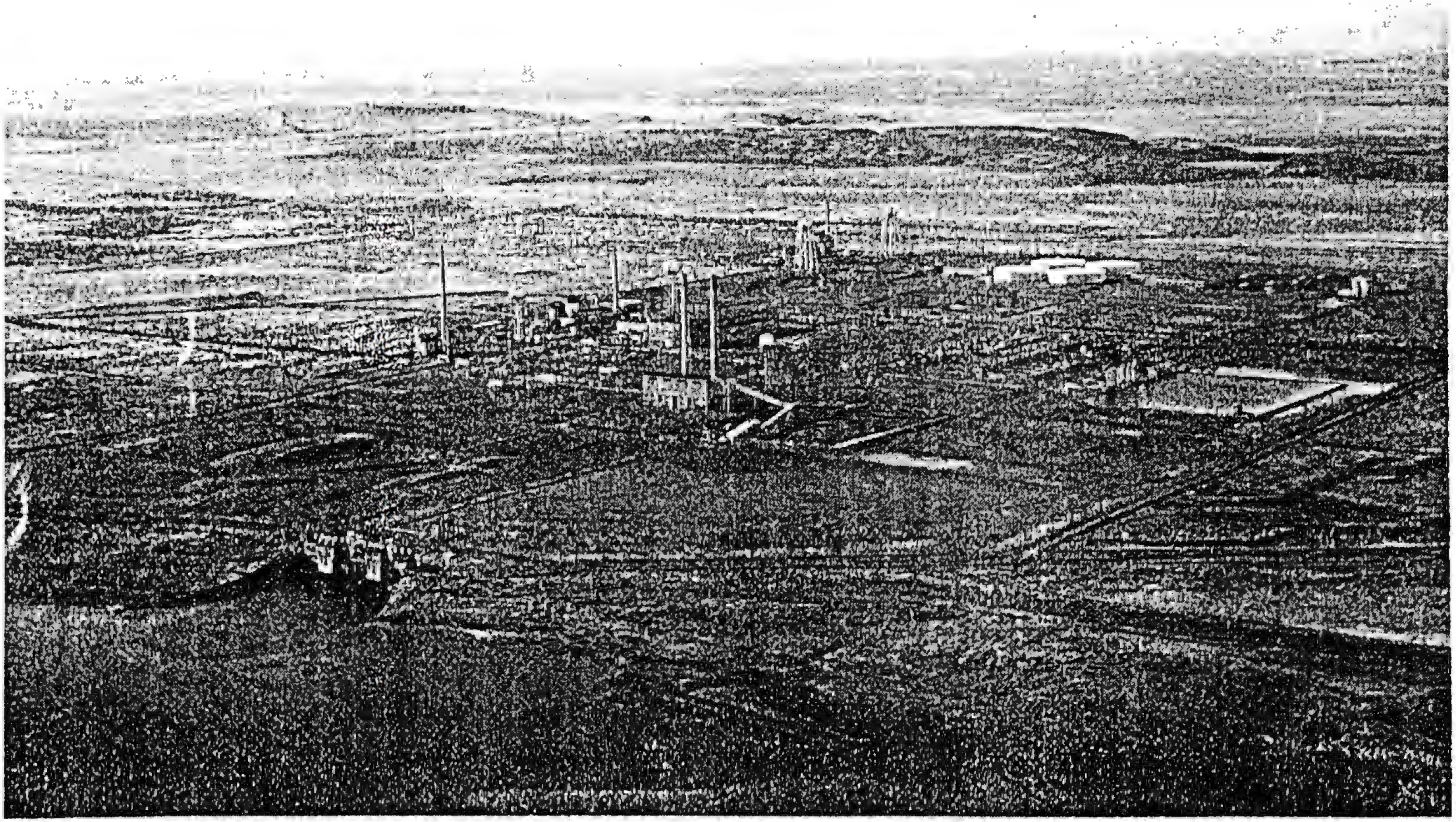

Figure 1-2. 100-B Area (1979).

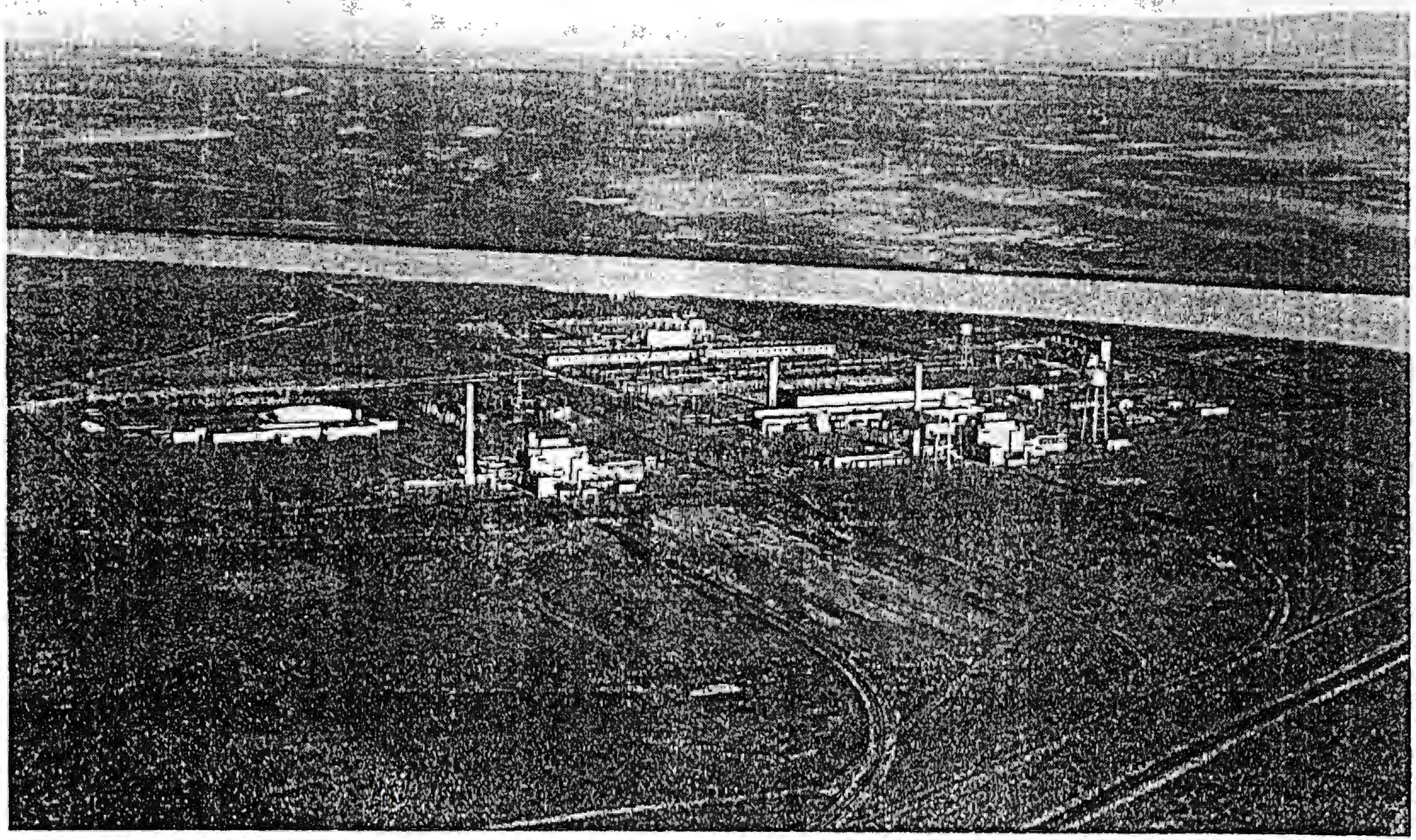

Figure 1-3. 100-D Area (1979).

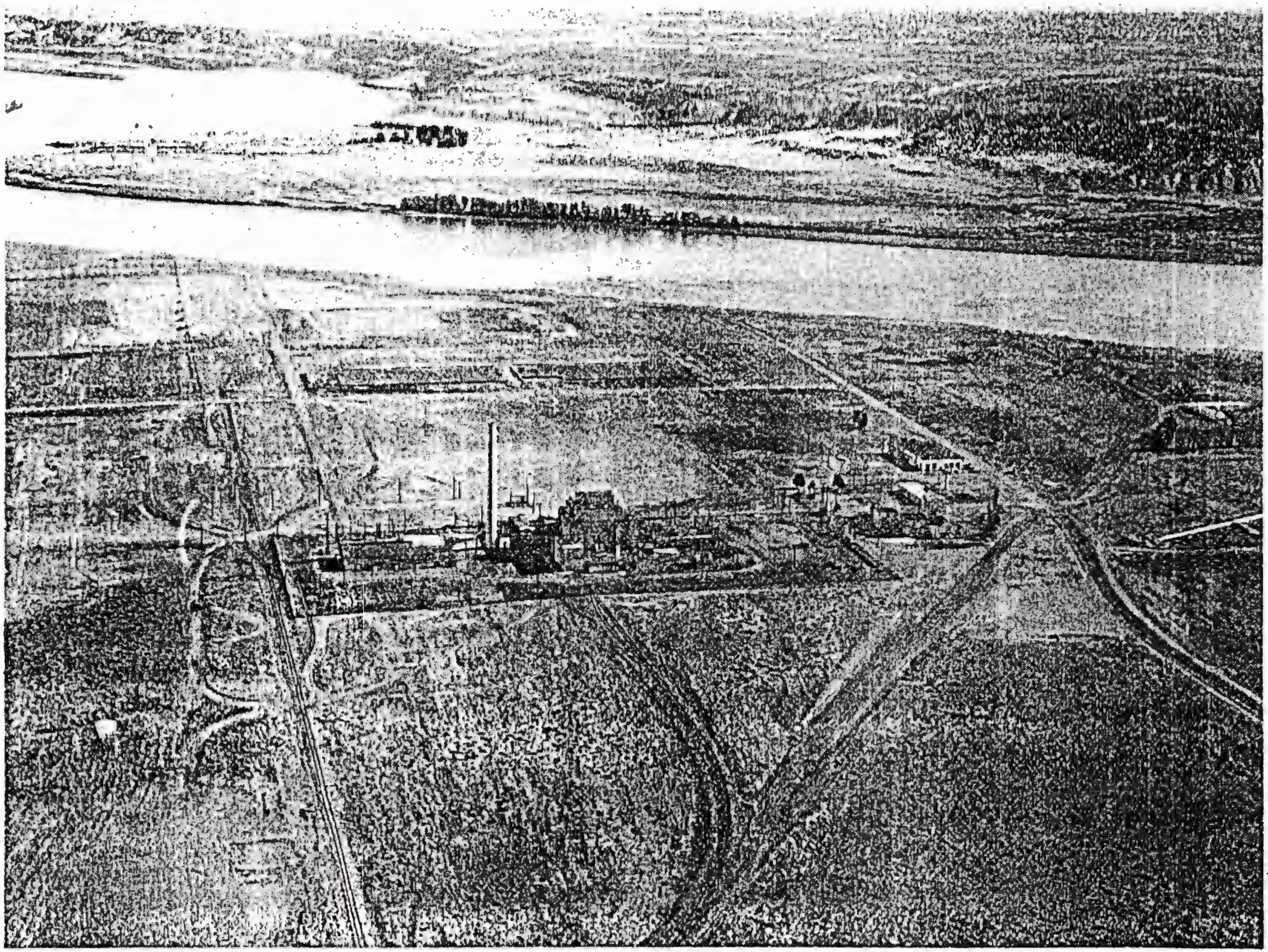

Figure 1-4. 100-F Area (1979).

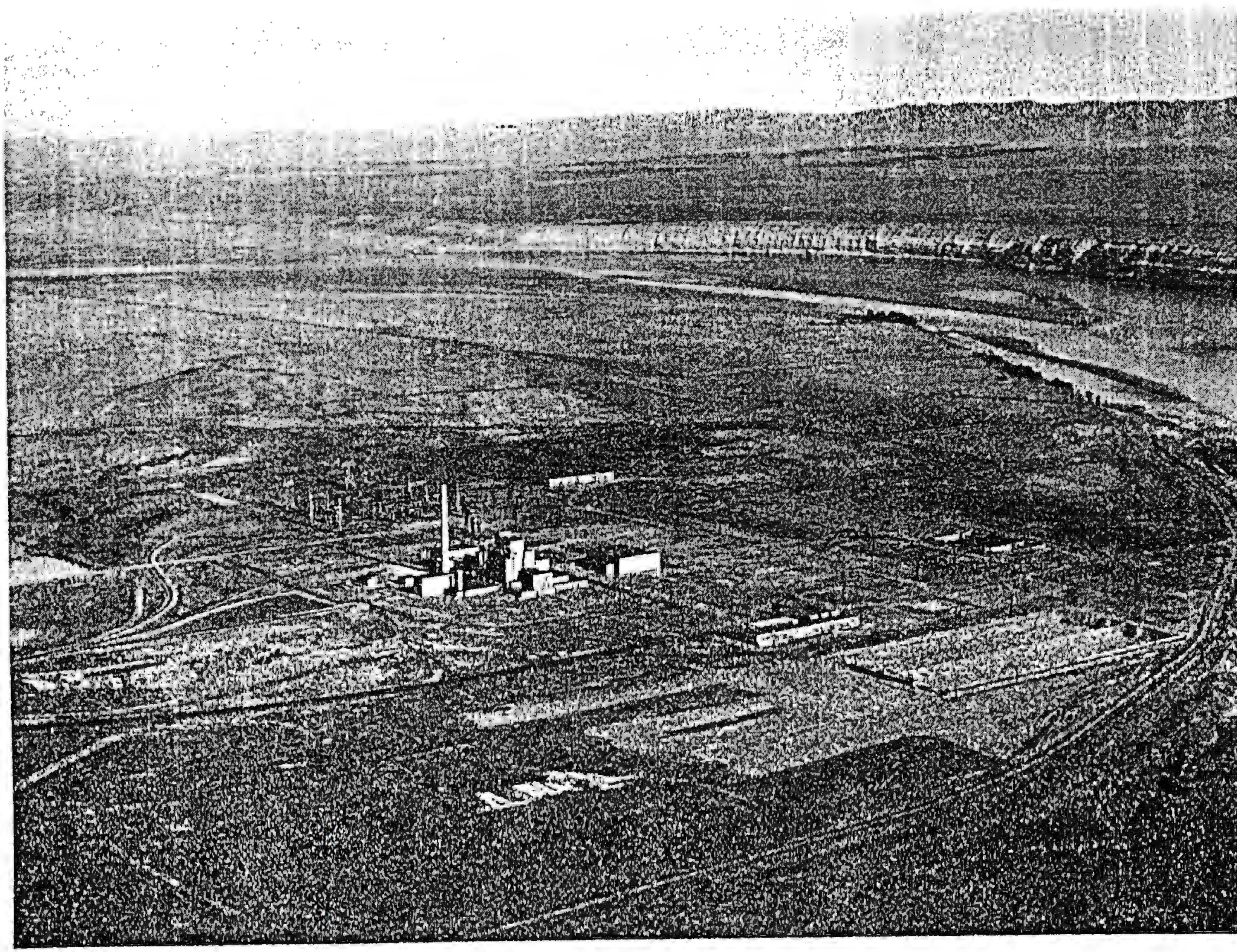

Figure 1-5. 100-H Area (1979).

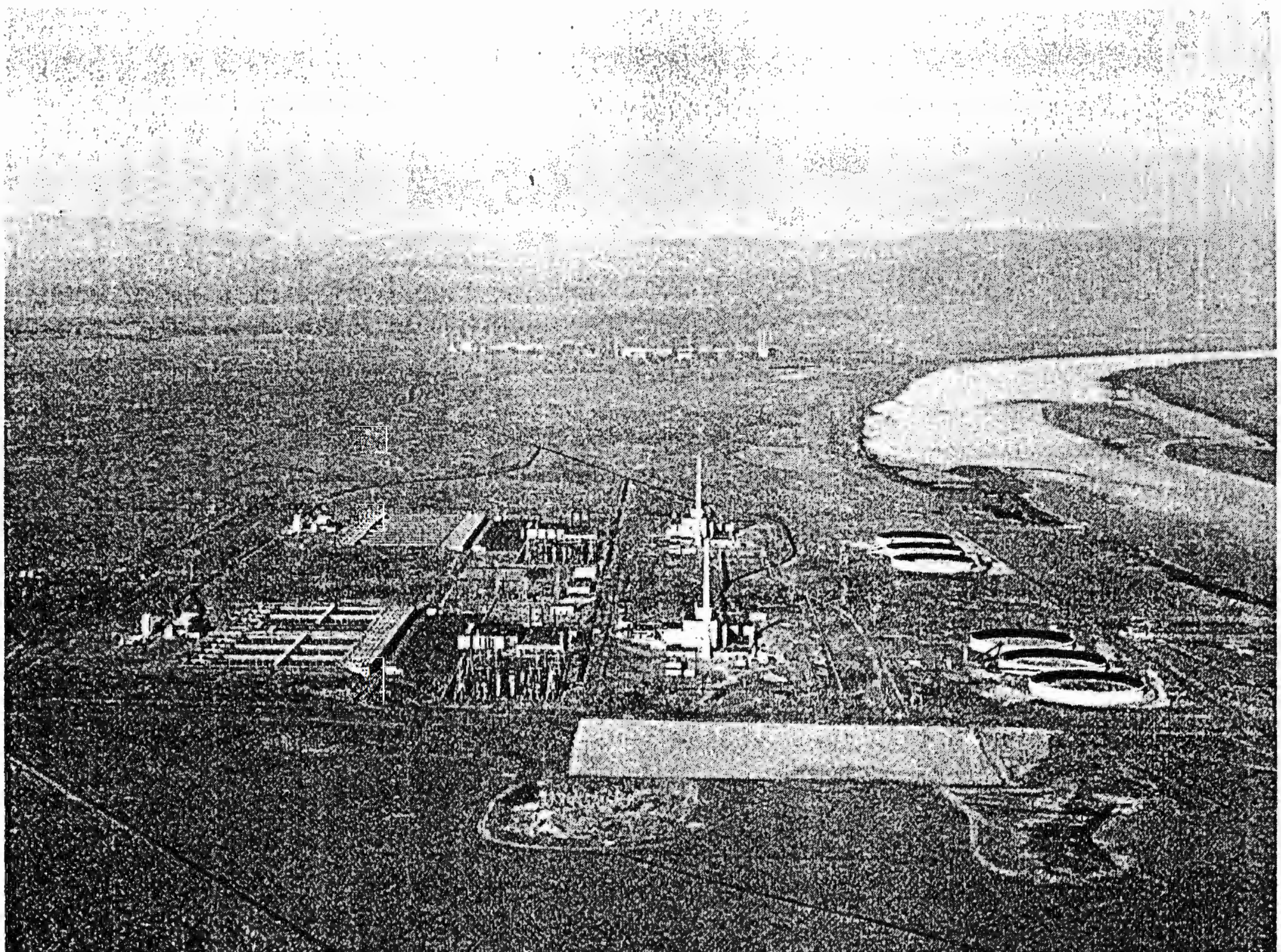

Figure 1-6. 100-K Area (1979).

Many nonradioactive support facilities in the 100 Areas have been demolished since their deactiviation, but to date, only a few contaminated facilities have been decommissioned. Figures 1-7 and 1-8 show the 100-F Area, before and after demolition of many facilities, nearly all of which had no residual radionuclides.

1.5 CONTENTS AND ARRANGEMENT OF THIS PLAN

This Long-Range Plan is presented in two parts. Part 1 provides comprehensive technical, cost and schedule, and management information. Part 2 provides specific physical, radiological, technical, and cost data on the facilities to be decommissioned.

PART 1 - BACKGROUND INFORMATION, COSTS, AND SCHEDULES

Section 1 - Introduction. Describes the Long-Range Plan document.

Section 2 - Decommissioning Management Plan. Describes the UNC and DOE responsibilities, organizations, and management relationships.

Section 3 - Hanford 100 Area Description. Generally describes the Hanford 100 Area ecology, demography, geology, climatology, site security, and categories of facilities to be decommissioned.

Section 4 - Decommissioning Assumptions, Criteria, and Priorities. Describes the assumptions and criteria upon which the technical approaches and scheduling are based, and provides a prioritized list of decommissioning activities.

Section 5 - Waste Management. Describes the radioactive and nonradioactive wastes to be dispositioned, the disposition method, the radiological criteria for release of decommissioned facilities and sites, and the Allowable Residual Contamination Levels method for determining site radiological release limits.

Section 6 - Decommissioning Alternatives. Describes the alternatives assessed, and how the in-situ alternative (the recommended preferred decommissioning alternative) would be used for each category of facility.

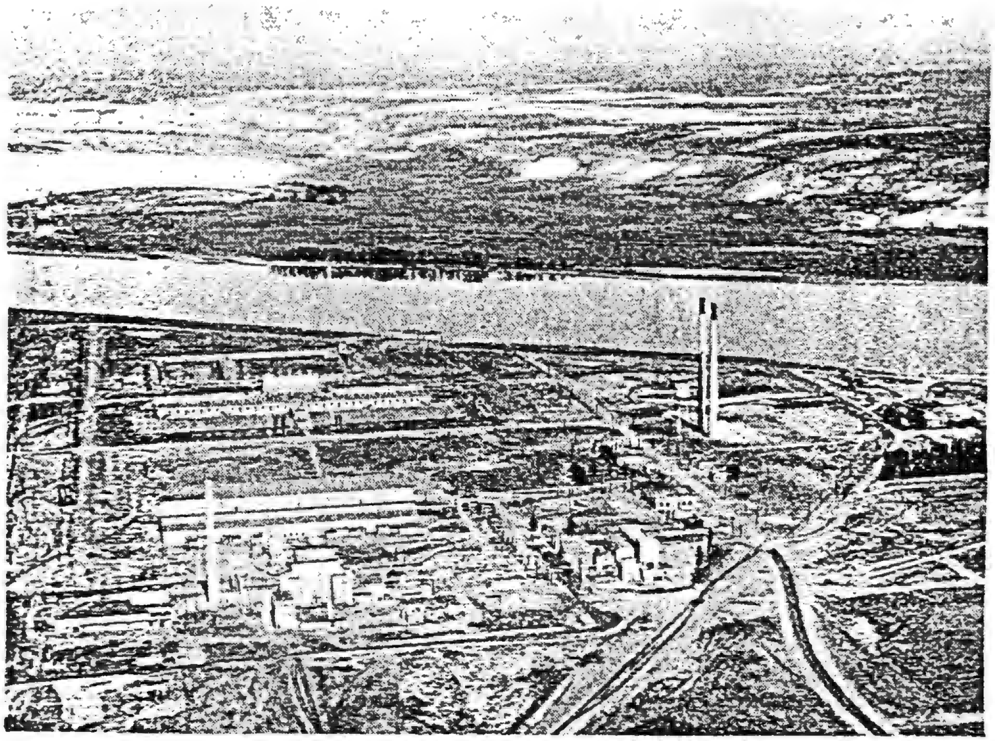

Figure 1-7. 100-F Area Before Decommissioning of Many Support Facilities (1974).

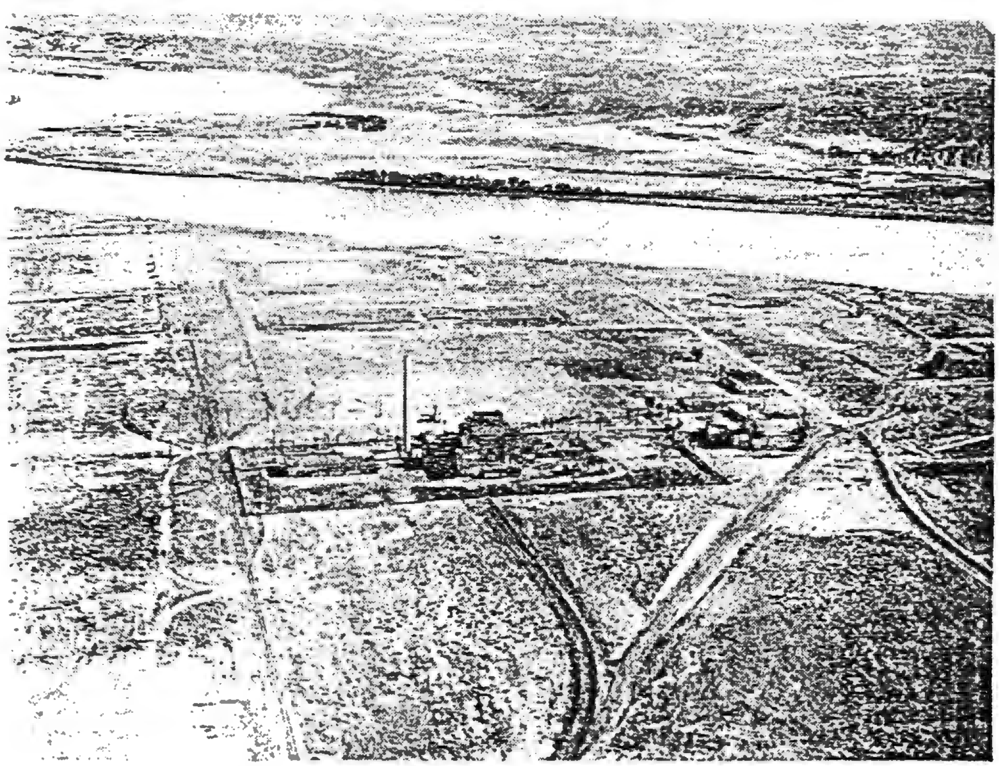

Figure 1-8. 100-F Area After Decommissioning of Many Support Facilities (1984).

Section 7 - Costs and Schedules. Provides conceptual cost estimates and completion schedules.

Section 8 - References. Lists the reference documents cited in this Plan.

PART 2 - FACILITY DESCRIPTIONS AND EVALUATIONS

Part 2 of this Long-Range Plan provides descriptive and explanatory data specific to each type of facility to be decommissioned:

- Reactor buildings
- Effluent water systems
- Ground disposal facilities
- Ancillary facilities

Information presented for each type of facility includes:

A. Operating History. Provides startup and shutdown dates, and other relevant historical data.

B. Physical Description. Provides physical description information, including dimensions, construction materials, facility layout and equipment, and other information relevant to the planned decommissioning work.

C. Current Physical and Radiological Condition. Describes facilities' structural status and projected maintenance costs prior to decommissioning, and describes the radiological conditions of the facilities.

D. Capital Equipment. Lists the anticipated capital equipment expenditures anticipated for in-situ decommissioning of each type of facility. (In general, in-situ decommissioning can be accomplished with a minimum of capital equipment expenditure and with standard tools and equipment already available on the Hanford Site.) Special tools, whether capital equipment items or not, are also identified.

E. Research and Development (R&D). Describes R&D requirements for the in-situ decommissioning of each type of facility.

F. Waste Volume Projection. Describes the type, volume, and disposal method for projected wastes that require disposal elsewhere.

G. Facility and Equipment Reuse. Identifies any cost-effective reuse that is planned for any part of a facility or equipment within a facility. Stainless steel inventories are specifically identified.

H. Project Work Elements and Costs. Identifies the major work elements and their associated costs for the decommissioning of each type of facility.

2.0 DECOMMISSIONING MANAGEMENT PLAN

2.1 DEPARTMENT OF ENERGY

The decommissioning activities described in this Plan are developed and implemented by the UNC Decommissioning Programs Department, under the overall management of the United States Department of Energy, Richland Office (DOE-RL). The DOE-RL Surplus Facilities Management Project Office (SFMPO) oversees the Hanford 100 Area decommissioning work as part of DOE's national decommissioning program. The major SFMPO responsibilities for the national program, including the Hanford 100 Area decommissioning activities are:

- Development of decommissioning objectives, schedules, criteria, and budgets;
- Coordination of administrative and programmatic matters with the DOE national headquarters; and
- Approval and funding of decommissioning activities prior to implementation.

The Surplus Facilities Management Program Plan (Reference 1) provides details of SFMPO's organizational structure, operations, responsibilities, and working relationships with government contractors. Figure 2-1 is a simplified depiction of the overall 100 Area decommissioning management structure.

2.2 UNC DECOMMISSIONING PROGRAMS DEPARTMENT

The SFMPO administers the Hanford 100 Area decommissioning activities through the UNC Nuclear Industries (UNC) Decommissioning Programs Department (DPD). The DPD develops written management plans (including this Long-Range Plan), engineering studies, work procedures, environmental studies, and other documents directly related to the Hanford 100 Area decommissioning work.

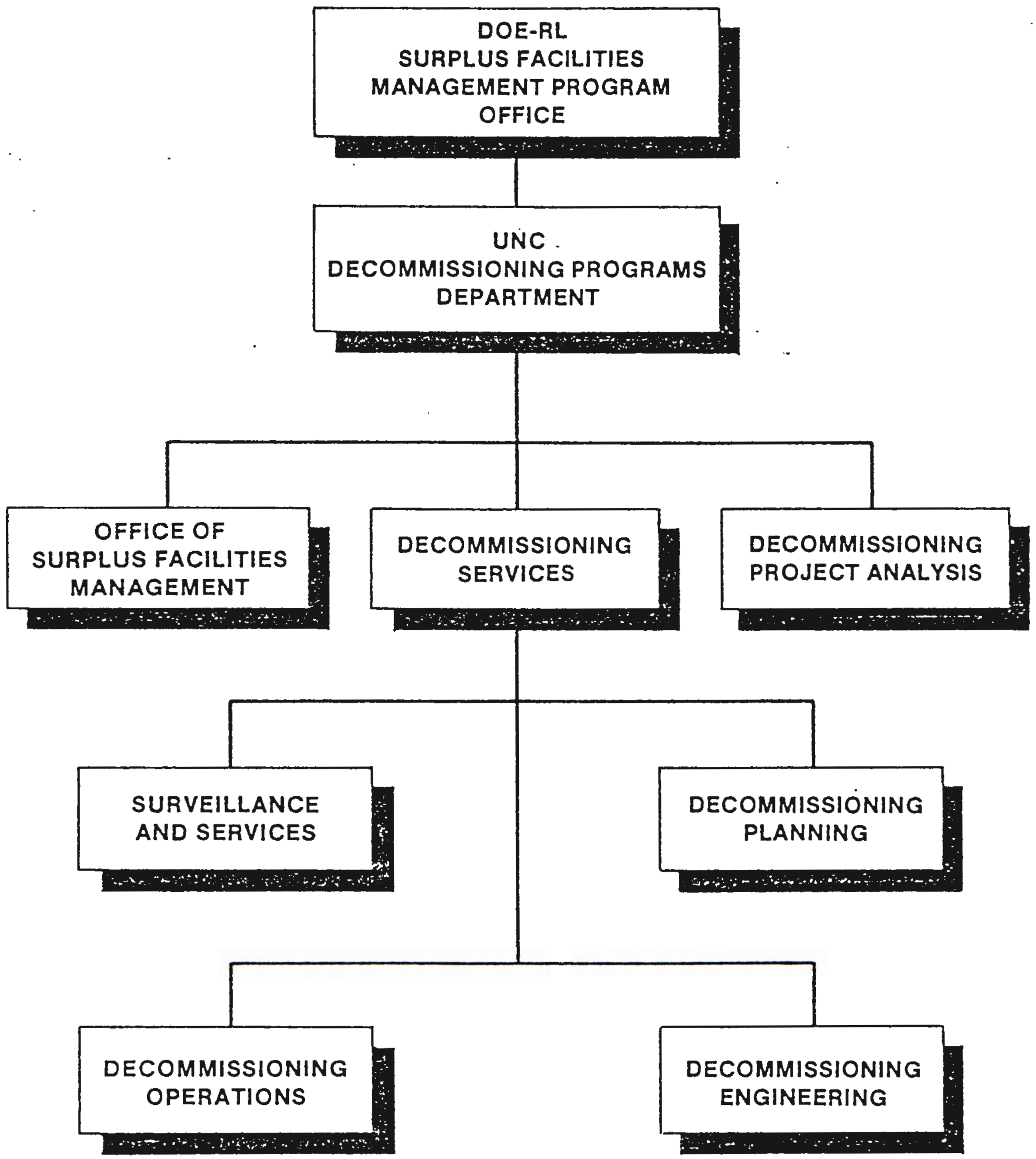

Figure 2-1. DOE/UNC Management Organization.

The DPD consists of three sections: the Office of Surplus Facilities Management (OSFM), which provides information gathering and dissemination, management, and technical support to DOE-RL for its national decommissioning activities; the Decommissioning Project Analysis Section, which provides technical support to the Nuclear Regulatory Commission for development of decommissioning standards and practices; and the Decommissioning Services Section (DSS).

The DSS is responsible for developing and implementing all aspects of the Hanford 100 Area decommissioning work. As shown in Figures 2-1 and 2-2, the DSS consists of four subsections: Surveillance and Services, Decommissioning Planning, Decommissioning Operations, and Decommissioning Engineering.

Some of the manpower for the decommissioning work in the Hanford 100 Area is provided by the Rockwell Hanford Operations Decommissioning Manpower Pool. UNC's DSS supervises all the Rockwell-supplied personnel and off-site subcontractors, as well as its own crafts personnel such as electricians, heavy equipment operators, carpenters, etc.

2.3 DECOMMISSIONING FUNDING

Because of DOE internal budget management requirements, two different funding sources are drawn upon for the Hanford 100 Area work. These sources are designated AR and GE. Decommissioning of the Hanford 100-D/DR, -F, and -H Areas is funded from the DOE AR budget. Decommissioning of the 100-B/C and 100-K Areas is funded from the DOE GE budget. The AR budget is for facilities covered by the Defense Waste and Byproduct Management Program; the GE budget for the Materials Production Program.

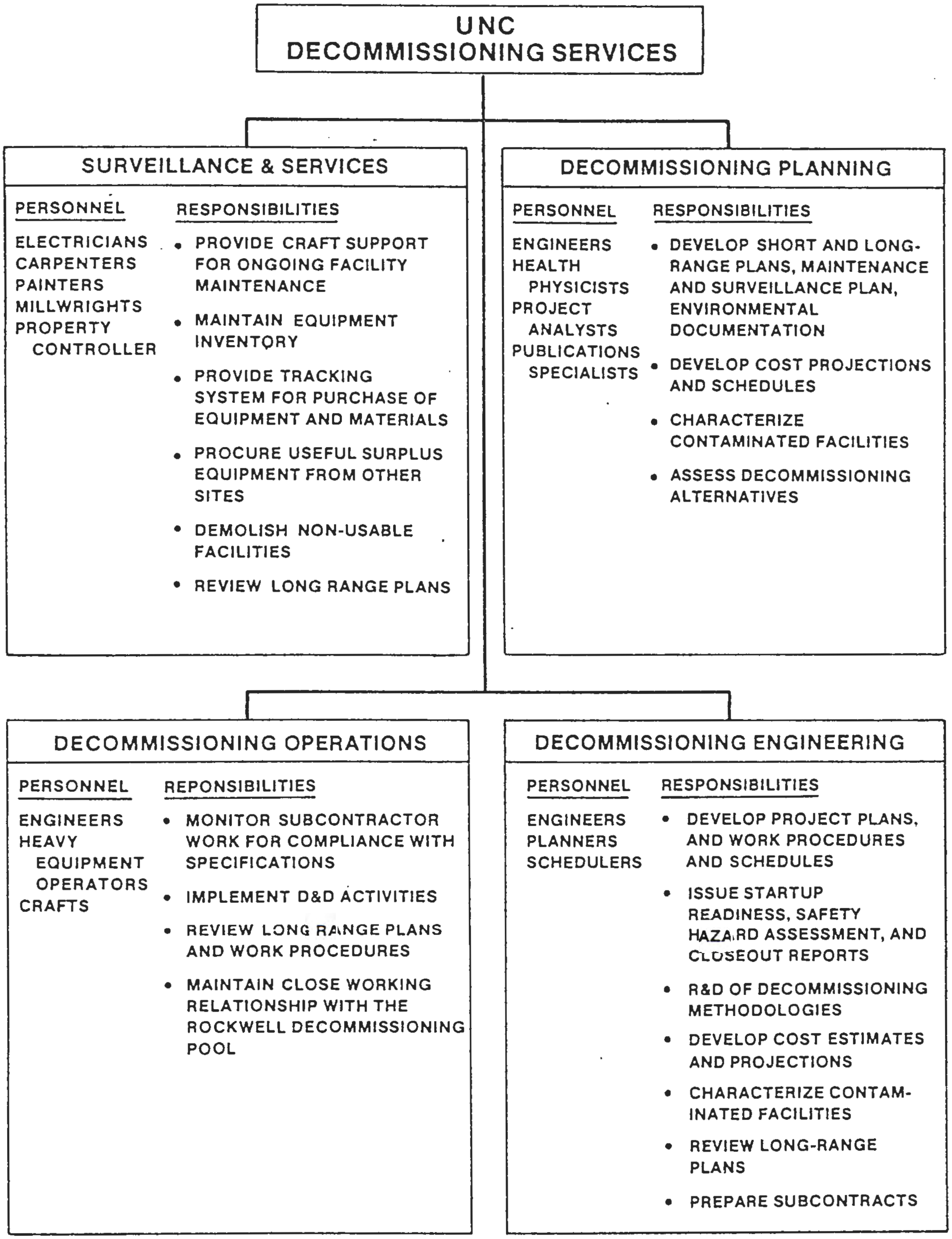

Figure 2-2. UNC Decommissioning Services Section Organization and Responsibilities.

2.4 DOCUMENT REVIEW AND APPROVAL AUTHORITY

The purpose of the documents identified in Table 2-1 is to ensure the health and environmental safety and cost-effectiveness of the decommissioning work. Environmental Impact Statements, Environmental Evaluations, and Environmental Assessments are generated by DOE, UNC or a subcontractor of UNC, and are approved by DOE-RL. Project Plans delineate schedules, budgets and technical approaches for discrete work projects. Decommissioning Work Procedures describe the step-by-step procedures and the Safety Hazards Assessment examines the safety considerations for specific decommissioning projects.

TABLE 2-1

MAJOR DECOMMISSIONING DOCUMENT REVIEW AND APPROVAL AUTHORITIES

DECOMMISSIONING DOCUMENT	UNC DECOMMISSIONING PROGRAMS DEPARTMENT (DPD)						UNC E&OS*	DOE-RL
	Surveillance & Services	Planning	Operations	Engineering	OSFM	DPD Director		
Long-Range Plan	R	D	R	R	R	R	R	A
Project Plan	R	R	R	D	R	R	A	A
Decommissioning Work Procedures			A	D			A	
Environmental Impact Statement							R	D,A
Environmental Evaluation		D					D,R	D,A
Environmental Assessment		D					D,R	D,A
Safety Hazards Assessment			A	D			A	

D - Develop
R - Review
A - Approve

* Environmental & Occupational Safety

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3.0 GENERAL DESCRIPTION OF THE HANFORD AREA AND SHUT-DOWN FACILITIES

Detailed descriptions of the ecology, demography, geology, climatology, and other physical characteristics of the Hanford Site are in ERDA 1538 (Reference 2). Figure 3-1 shows the five 100 Areas covered by this Plan. General site characteristics are summarized below.

3.1 ECOLOGY

The Hanford Site, which occupies approximately 570 square miles, lies in a semiarid region in southeastern Washington State, in the rain shadow of the Cascade Mountains. The area is mostly undeveloped terrain with no commercial or residential use. The Hanford 100 Areas have the region's natural sparse covering of sagebrush and shallow-rooted grass species. Animal species on the site are those common to the region, and include abundant game fowl and aquatic life.

3.2 DEMOGRAPHY

Human population within 50 miles of the Hanford Site totals about 250,000. The closest large population center is the Tri-Cities (Richland, Kennewick, and Pasco), with about 88,000 people. The Tri-Cities is located about 30 miles to the south of the Hanford 100 Reactor Areas, downstream on the Columbia River. The metropolitan Yakima area is about 45 miles to the east and has a population of about 53,000. Other population near the Hanford Site is spread out in small communities and agricultural land. Reference 3 provides detailed information on the demography of the areas surrounding the Hanford Site.

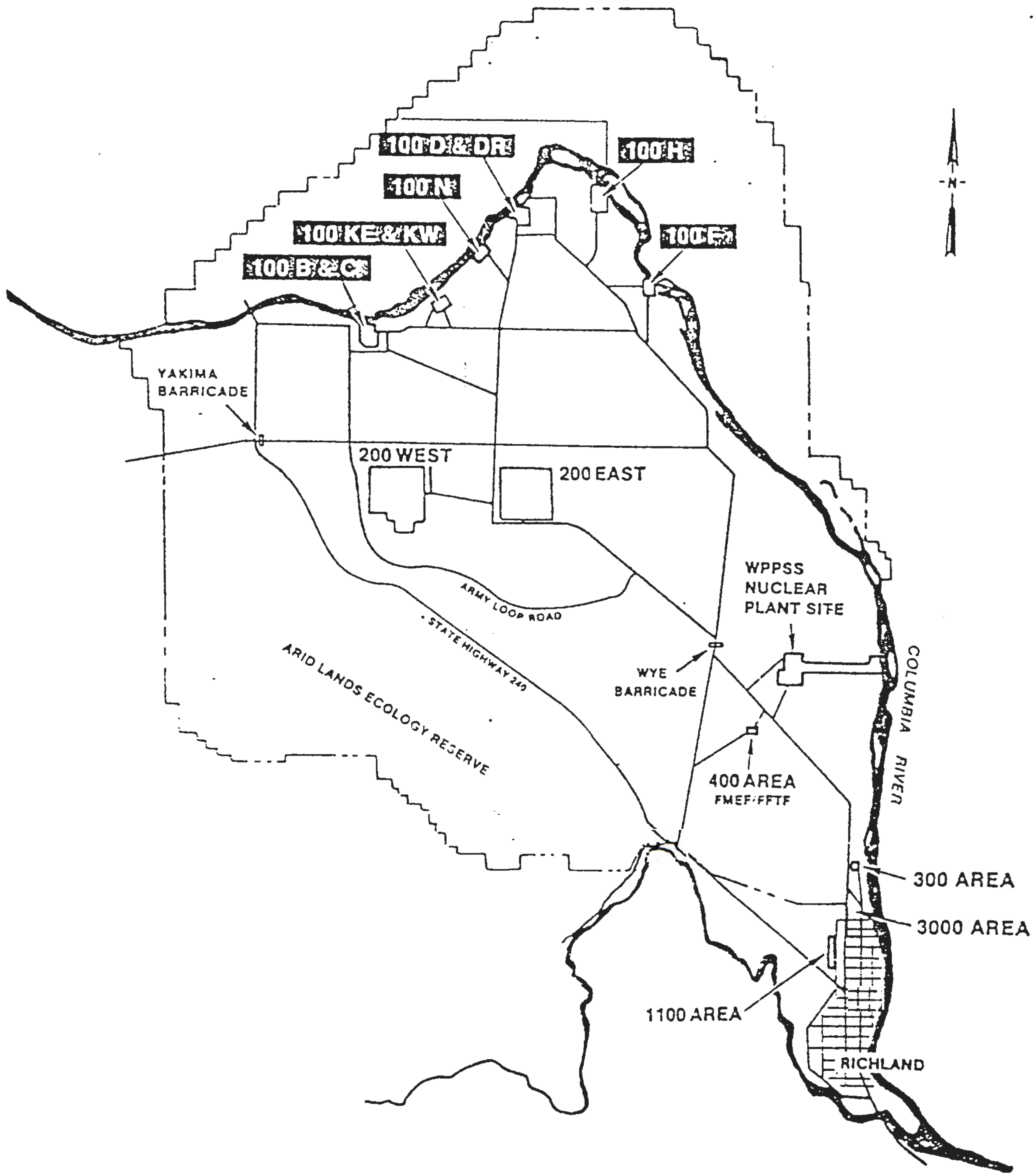

Figure 3-1. Hanford 100 Area Site Map.

3.3 GEOLOGY

The Hanford Site, situated in the Pasco Basin, is underlain by thousands of feet of geologically stable basalt, which in turn is overburdened by sand and gravel deposits. Studies show there is little chance of a significant earthquake in this area that would detrimentally affect the shut-down facilities. The area is included in Zone 2 in the Uniform Building Code seismic probability map. The maximum recorded earthquake in the Pasco Basin was 5.5 on the Richter scale. The maximum credible earthquake, as postulated by seismic experts, is 6.8 on the Richter, with an epicenter located several miles to the north of the 100 Area. All of the reactors in the 100 Area would survive such an earthquake with only insignificant or no damage. See Volume 2 of Reference 2 for more details.

3.4 CLIMATOLOGY

Rainfall in the area is very light. less than 7 in. per year, most of which falls during the winter months. Strong, steady winds blow frequently in the area, particularly in the spring. The maximum recorded gust was 80 mph. Tornadoes are rare in the region; no tornado damage has ever been recorded on the Hanford Site. Temperatures are mild in the winter, only occasionally falling below 0°F. Summers are hot and dry, with daily highs during July and August frequently in the 90°F to 100°F range. Reference 4 provides detailed climatological information.

3.5 SITE SECURITY

The Hanford Site is a federal reservation operated by the Department of Energy. Access to the Hanford Site is restricted to authorized personnel, and the Site is patrolled by the Hanford Security Patrol. As shown in Figure 3-1, only two access roads lead into the Hanford 100 Areas. Both roads have security checkpoints (Yakima and Wye barricades), each of which is approximately 15 miles from the 100 Area, and manned around the clock by a security guard. Each reactor building is surrounded by an 8-ft high chain link fence with a locked access gate. Unoccupied buildings are kept locked with access controlled by the on-site personnel.

The Columbia River flows within a mile of the 100 Area reactors and is freely accessible to the public. The shoreline on the plant side of the river is posted as restricted, but is not barricaded. The shoreline is patrolled by the Hanford Security Patrol.

3.6 SHUT-DOWN FACILITY CATEGORIES

For convenience in describing them in this Plan, the shut-down facilities to be decommissioned are grouped in four major categories, summarized in Table 3-1. The facilities identified in Table 3-1 are described in detail in Part 2 of this Plan.

TABLE 3-1

SHUT-DOWN FACILITY CATEGORIES

Category	Facility Designation	No.	Function
Reactor Buildings	105	8	Housed reactor and fuel storage basin (irradiated)
Ground Disposal Facilities	116* (Liquid) 118 (Solid)	36 25	In-ground disposal of liquid and solid wastes
Effluent Systems	107	8	Retention Basin
	1904/1908	8	Outfall Structures
	Effluent Pipe	8 systems (14 miles)	Transfer of reactor effluent cooling water
	1608	4	Pumping Station
Ancillary Facilities	103	2	Fuel element storage building (unirradiated)
	108	2**	Laboratory
	115	3**	Gas recirculation building
	116	5	Reactor stacks
	117	5	Exhaust filter buildings
	119	3	Exhaust sample building
	1706	1	Reactor loop testing facility

*116 designation, when used for liquid ground disposal facilities, is followed by a letter (representing the 100 Area) and an Arabic numeral. The 116 designation, followed only by a letter representing the 100 Area, is used for reactor stacks.

**Decommissioning work on 108-B and 115-F is currently in progress.

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4.0 DECOMMISSIONING ASSUMPTIONS, CRITERIA, AND PRIORITIES

4.1 ASSUMPTIONS

The decommissioning costs and management and technical strategies presented in this Plan are based on the assumptions listed below. These assumptions are based on experience gained in previous 100 Area decommissioning work, engineering studies, and radiological characterization data.

The following assumptions are consistent with the guidance provided in the SFMP Program Plan (Reference 1). A change in any of the assumptions would result in the need to re-evaluate this plan. The decommissioning assumptions are:

- Radiological dose rates to personnel and to members of the public will be controlled in accordance with DOE standards for radiation protection, and will be reduced to As Low As Reasonably Achievable (ALARA) levels.
- Radioactive materials in the shut-down facilities classify as low-level waste.
- Allowable Residual Contamination Limits (ARCL) for in-situ decommissioning will be calculated by using the pathway analysis methodology (Reference 5).
- Future radiological characterizations will not affect the overall decommissioning strategy. Estimated radionuclide inventories are based on the best data available when this Plan was prepared (Reference 6).
- Radioactive wastes not decommissioned in-situ will be disposed of at the Hanford 200 Area. Such disposals will comply with applicable DOE Orders and with Rockwell Hanford Operations requirements.
- Material or equipment removed from the site and released for uncontrolled use will meet all radiological DOE requirements invoked at the time of removal.
- Radioactive facilities decommissioned in-situ will be isolated in a manner that provides a degree of protection to the public and environment as afforded by 10 CFR 61 (Reference 7).

- Intrusion barriers can, if necessary, be designed to last at least 500 years. Such barriers may be either engineered (concrete, riprap, etc.) or a stable earth cover up to 5 meters thick. Intrusion barrier requirements are dependent on ARCL calculations.
- The reactor facilities and land they occupy can, if necessary, be institutionally controlled for a period of up to 100 years. Institutional control means the controlled use of a decommissioned site or area through regulation by local, county, state, or federal agencies. Because of radiological conditions, institutional control may include access control, minor maintenance and surveillance, and site use restrictions. Institutional control starts when a facility is considered to be decommissioned, and ends at 100 years, or any time within the 100-year period when radiological conditions warrant no further control.
- The site terrain will be restored to as near natural condition as practicable.
- An Environmental Impact Statement (EIS) will be required for decommissioning the reactors.
- Asbestos may be disposed of in place if it is isolated in a manner that provides protection equal to relocating the asbestos to a hazardous waste disposal site.

4.2 CRITERIA

4.2.1 Criteria Used in Assessing Decommissioning Alternatives

The following factors were used to assess the relative merits of several candidate decommissioning methods in order to objectively determine the recommended preferred alternative (in-situ decommissioning) for the shut-down Hanford 100 Areas:

- Dollar expenditure
- Public and occupational radiation exposure
- Manpower requirements
- Project duration
- Radioactive waste disposal volume

- Potential for reuse of equipment, material, and facility
- Time until site can be restored to a nearly natural condition

Criteria used to evaluate each factor are based on the guidelines presented in Reference 1 and are consistent with UNC's commitment to decommission the shut-down Hanford 100 Area facilities in the safest and most cost-effective way achievable.

4.2.2 Environmental Protection Criteria (NEPA)

Prior to implementing any decommissioning project in the Hanford 100 Areas, UNC, as a Department of Energy, Richland Office (DOE-RL) contractor, is required to comply with local, state and federal environmental protection criteria. The NEPA criteria are of particular concern because of the range of environmental issues addressed and the impacts on decommissioning budgets and schedules. DOE-RL Order RL 5440.1 (Reference 8) defines two major responsibilities for RL contractors in the implementation of the NEPA process:

- Develop and implement programs which provide timely awareness and review of all proposed contractor activities with the potential for impacting the environment.
- Provide for timely completion and submittal of appropriate NEPA documentation to the RL Safety and Quality Assurance Division (SQA) and appropriate RL program/project offices in accordance with the procedures contained in RL Order 5440.1.

The NEPA process will be implemented early in the planning stages in order to allow UNC and DOE-RL sufficient time to obtain public comments and to complete the necessary NEPA documentation. UNC recommends to the DOE-RL program office a level of environmental documentation for each decommissioning project. The DOE-RL program office considers the recommendation, then advises UNC of the required level of NEPA documentation. Depending on the proposed project, DOE may specify one of three levels of NEPA documentation. These include an

Environmental Evaluation (EE), Environmental Assessment (EA), and an Environmental Impact Statement (EIS). DOE may advise that an Action Description Memorandum (ADM) be prepared. The ADM serves as a basis for determining the required level of NEPA documentation.

Table 4-1 summarizes the NEPA documents that have been completed and the NEPA documents proposed for future 100 Area decommissioning work.

The level of NEPA documentation required can significantly impact project startup schedules. An EIS requires substantially more time to complete than the other levels of NEPA documentation. Figure 4-1 shows the major milestones in the EIS process. The estimated time to complete an EIS, from start to finish, is approximately two years.

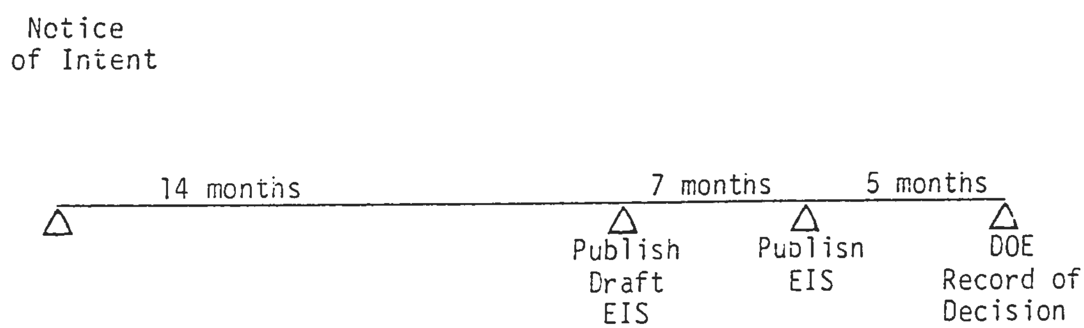

Figure 4-1. Major Milestones in the EIS Process.

The duration between the major milestones will vary, depending upon the scope of the EIS, public involvement, and the extent of comments received on the draft EIS. The draft will be reviewed by DOE and UNC. Public hearings will also be conducted prior to issuance of the final document. DOE has not decided on the required level of NEPA documentation for the various decommissioning projects. For planning purposes, it is assumed that only the reactor building projects will require an EIS.

TABLE 4-1

NEPA DOCUMENTS FOR CURRENT AND FUTURE 100 AREA DECOMMISSIONING PROJECTS

Facility	NEPA Document	Issue Date
All 100-F Area Non-Reactor Facilities	Environmental Assessment, issued by DOE	10/80
108-B	Environmental Evaluation, issued by UNC	8/83
105-B, -C, -D, -DR Fuel Storage Basin	Environmental Evaluation, issued by UNC	1/84
117-C, 117-H	Environmental Evaluation, issued by UNC	5/83
All Surplus 100 Area Facilities	Action Description Memorandum issued by UNC	1/84
Shut-Down Hanford 100 Area Reactors*	Action Description Memorandum issued by UNC	9/84
Ground disposal sites; reactor water effluent systems; and ancillary structures	Environmental Evaluation, or Environmental Assessment to be issued by UNC	Anticipated issue in FY 85

*DOE will review the ADM and make a decision on the level of NEPA documentation required for decommissioning the reactors. For planning purposes, UNC assumes that an EIS will be required.

4.2.3 Safety Criteria

Until decommissioning is complete, regular maintenance and surveillance will be conducted on the shut-down facilities to correct industrial and radiological hazards. The maintenance and surveillance program is described in References 9 and 10.

Completing the decommissioning work safely is of primary concern to UNC. Accordingly, the guidelines presented in DOE Order 5481.1A (Reference 11) will be followed for all decommissioning work. This Order establishes specific safety criteria for all DOE activities, including decommissioning work.

A Safety Hazards Assessment will be completed before work begins on any decommissioning project. The Safety Hazards Assessment is a systematic investigation of three categories of hazards associated with a particular project: industrial, radiological, and environmental.

The key to the Safety Hazards Assessment is use of a matrix, based on hazard severity and hazard probability, to determine if a particular piece of work has an acceptable risk. Hazard severity and probability designations are described below.

Hazard Severity Categories

Category I	- May cause death or system loss.
Category II	- May cause severe injury, severe occupational illness, or major system damage.
Category III	- May cause minor injury, minor occupational illness, or minor system damage.
Category IV	- Will not result in injury, occupational illness, or system damage.

Hazard Probability Categories

Category	Single Project or Procedure	Multiple Projects or Procedures
A - Frequent	Likely to occur frequently	Continuously experienced
B - Reasonably Probably	Will occur several times in life of an item	Will occur frequently
C - Occasional	Likely to occur sometime life of an item	Will occur several times
D - Remote	So unlikely, it can be assumed that this hazard will not be experienced	Unlikely to occur, but possible
E - Extremely Improbable	Probability of occurrence cannot be distinguished from zero	So unlikely, it can be assumed that this hazard will not be experienced
F - Impossible	Physically impossible to occur	Will not occur

The following matrix is used to determine the Hazard Class Designation.

Hazard Class Matrix

Hazard Severity Categories	A	B	C	D	E	F
I	H	H	H	M	L	L
II	H	H	H	M	L	L
III	M	M	M	L	L	L
IV	L	L	L	L	L	L

Hazard Probability Categories

Hazard Class Designation

L = Low

M = Moderate

H = High

Low and Moderate designations are acceptable risks. A high designation means the work is unacceptably hazardous, and the procedures must be revised before they are put into use. UNI-M-89 (Reference 12) provides details on the hazard evaluation process.

In addition, a Start-Up Readiness Review is conducted prior to implementation of each project. Based on this review, a Project Readiness Report is completed. This report is a compilation of all the NEPA documents, work procedures, safety documents, and other applicable documentation for a particular project. Comprehensive safety check sheets are included, and must be signed as appropriate, by the responsible UNC Decommissioning Services personnel.

4.3 PROJECT PRIORITIES

4.3.1 Prioritization Criteria

Due to the large number of surplus facilities in the Hanford 100 Areas awaiting final disposition and the funds available to perform this work, decommissioning priorities must be set. Once priorities are established, detailed costs and schedules that reflect these priorities can be developed with more accuracy.

DOE-SFMP has established criteria to guide participating decommissioning contractors in determining project priorities and ranking (Reference 13). The six factors are listed below in order of priority assigned by SFMPO.

1. Legal and Safety Standards

   The evaluation factor of generally greatest concern to SFMPO is legal or contractual obligations. Legal requirements generally pertain to the safety of the public, workers, and the environment. SFMPO assigns highest priority to assuring that the facilities in the program pose no unacceptable safety risk. Surveillance and maintenance of surplus facilities in a safe condition (until a decommissioning project can be initiated) is considered to be the highest overall program priority.

2. Economic Impact of Delayed Versus Immediate Decommissioning

   Consideration must be given to the tradeoff between the cost of continued maintenance and surveillance, and the cost of final facility disposition. SFMPO has developed an economic analysis model that utilizes a monetary discounting technique to calculate the "present value" cost for surveillance and maintenance as well as for decommissioning.

3. Health Risks of Delayed Decommissioning

The health risk to on-site personnel and the general public as a result of postponing decommissioning must be considered. SFMPO has developed a health risk model that ranks each project relative to all other SFMP projects based on the condition of the facility, the amount and types of radioactive material present in the facility, and the population and meteorological conditions of the area surrounding the facility.

4. Future Site Plans

The compatibility of the existing facility with future plans for the site is a factor used to identify facilities which are incompatible with either existing or projected future uses of the site on adjoining sites.

5. Cost-Effectiveness Program Management

Cost-effective program management is another evaluation factor that could result in early initiation of a decommissioning project or delay it until a later date. This factor concerns the availability of a developed, efficient organization for the facility project. Where organized programs are already in place at a site, D&D work for facilities on the site will proceed more efficiently and safely than for projects where staff development and training ramp-up are still required. Cost-efficient program management may have important influence on the total cost of this project. SFMPO assigns high weight to cost, thus this factor may have significant bearing on project prioritization.

6. Other Special Factors

In some instances special factors may be unique to a few projects and might contribute to the overall priority ranking of these projects. Special factors such as local government concerns and public opposition or acceptance of proposed D&D work may influence a project priority.

4.3.2 Prioritization of Projects

For criteria 1 through 4, no clear priority could be assigned to one facility over another. Each reactor has approximately the same radionuclide inventory; each facility is in approximately the same state of repair; each presents the same relative postponement risks, and each area, except for parts of B, D, KE and KW, are totally shut down with only decommissioning personnel on site.

For these reasons, criteria numbers 5, Cost Effective Program Management and number 6, Other Special Factors, were used to establish the priority ranking.

Past and present decommissioning work efforts in the 100 Areas have demonstrated that concentrating a trained work crew in one area is more cost-effective than trying to work in several areas at one time. Concentrating work in one area allows for better utilization of equipment, D&D workers, and supervisors. Instead of hiring and training additional crews to work many smaller projects, the same trained crew can be kept intact when working projects area by area. This tends to levelize work efforts, which in turn strengthens job safety and prevents costly lay-offs, rehiring, and retraining.

The present strategy for decommissioning the 100 Area surplus facilities calls for working the majority of the ancillary and above-grade effluent facilities in a particular 100-Area prior to completing final disposition on the reactor and ground disposal facilities. This will allow time for the NEPA documentation to be completed on the reactor facilities. (For long-range planning purposes, it has been anticipated that an EIS will be required in order to decommission the reactors.)

Because of the ongoing utilization of the irradiated fuel storage basins at both the 105-KW and 105-KE reactors, these facilities have been chosen to be among the last 100 Area decommissioning projects. Finally, because the 105-B reactor may be preserved as a national historical museum, decommissioning of that facility will probably be performed last, in order to allow time for the decision to be made.

Based on the above, the recommended priority rankings are shown in Tables 4-2 and 4-3. The priorities are also reflected in the cost and schedule tables in Section 7. These project groupings differ somewhat from those in the SFMP Program Plan (Reference 1). This is due to the new project groupings by like facilities instead of project groupings by a particular 100 Area.

TABLE 4-2

DECOMMISSIONING PROJECT GROUPINGS AND PRIORITIES

AR FACILITIES

Priority Ranking	Project Group	Facilities
1.	Ancillaries	115-D/DR, 117-D, 117-DR, 119-DR 108-F, 116-D, 116-DR and 103-D
2.	Effluent	107-D, 107-DR, 107-F, 107-H, 1608-F, 1608-H, 1608-D, 1608-DR, 1904-F*, 1904-H*, 1904-D and DR*, 100-F Effluent Line*, 100-H Effluent Line*, 100-D/DR Effluent Line*
3.	Reactor	105-F and Fuel Storage Basin 105-H and Fuel Storage Basin 105-D and Fuel Storage Basin 105-DR and Fuel Storage Basin 105-D/DR Process Water Tunnel 105-H Process Water Tunnel 105-F Process Water Tunnel
4.	Ground Disposal	116-F Liquid Waste 118-F Solid Waste 116-H Liquid Waste 118-H Solid Waste 116-D/DR Liquid Waste 118-D/DR Solid Waste

*Below-grade facilities.

TABLE 4-3

DECOMMISSIONING PROJECT GROUPINGS AND PRIORITIES

GE FACILITIES

Priority Ranking	Project Group	Facilities
1.	Ancillaries	115-B/C, 108-B, 104-B.1, 104-B.2, 117-C, 117-B, 115-Ke, 115-KW, 117-KE, 117-KW, 119-KE/KW, 116-KE/KW, 1706-KE/KEL/KER, 103-B, 116-B
2.	Effluent	107-B, 107-C, 107-KE, 107-KW, 1904-B.1, 1904-B.2*, 1904-C*, 1908-K, 100-B/C Effluent Line*, 100-KE/KW Effluent Line*
3.	Reactors	105-C and Fuel Storage Basin 105-KE and Fuel Storage Basin 105-KW and Fuel Storage Basin 105-B and Fuel Storage Basin 105-B/C Process Water Tunnel, 105-KE/KW Process Water Tunnel
4.	Ground Disposal	116-B/C Liquid Waste 118-B/C Solid Waste 116-KE/KW Liquid Waste 118-KE/KW Solid Waste

*Below-grade facilities.

5.0 WASTE MANAGEMENT

5.1 INTRODUCTION

This Section describes the waste disposal and the radiological release policies for facilities to be decommissioned in the Hanford 100 Areas. This Section addresses:

- Radioactive waste to be removed from the site and buried elsewhere;
- Radioactive waste to be left at the site;
- Allowable Residual Contamination Levels (ARCL);
- Release of material for unrestricted offsite use, and
- Disposition of nonradioactive hazardous materials.

As described in Section 6, in-situ disposal of the radioactive material has been identified as the most cost-effective method of decommissioning the 100 Areas. The available radiological data (Reference 6) indicate that 100 Area wastes meet the requirements for low-level waste as defined by DOE Order 5480.1 (Reference 14) and by 10 CFR 61 (Reference 7). Any waste not appropriate for in-situ disposal, will be removed for disposal at the Hanford 200 Area. The Allowable Residual Contamination Level (ARCL) methodology developed by Pacific Northwest Laboratory (PNL) will be used to define the amount of radioactive material that may safely remain after decommissioning a facility.

5.2 RADIOACTIVE WASTE

5.2.1 Waste Removed from Site

Waste that is not appropriate for in-situ disposal will be removed, packaged, and transported to the Hanford 200 Area for disposal. Such disposal will comply with the applicable DOE Orders and with the burial site operator regulations. Packaging and transport of the waste will be accomplished in accordance with UNI-M-29, Shipment of Radioactive and Other Hazardous Materials (Reference 15). UNI-M-29 provides for a degree of safety equal to that required by the Department of Transportation for offsite shipments.

Projected waste volumes to be removed from the 100 Areas are low (1% of all radioactive material) because the preferred in-situ decommissioning alternative will leave the facilities in place rather than removing them for disposal elsewhere.

5.2.2 Waste Left at the Site (Decommissioned In-Situ)

The majority of radioactive wastes will be left in place as the facilities are decommissioned. The amount (curies) that can safely remain in a decommissioned facility are dictated by the ARCL methodology. This methodology is explained in the following Section. Using the in-situ alternative, an estimated 99% of the radioactive material will be left in place in the 100 Areas.

5.3 ALLOWABLE RESIDUAL CONTAMINATION LEVELS (ARCL)

It has been the historic practice at Hanford to release equipment and materials for unrestricted use when they were found to be "free of contamination." The definition of free of contamination has generally been less than detectable with portable radiation detection instrumentation such as a Geiger Muller or portable alpha monitor. This same approach has been used for decontamination and decommissioning of surplus facilities; i.e., cleanup to less than detectable levels prior to release and demolition.

DOE recently adopted the release limits defined in Regulatory Guide 1.86 (Reference 17). These limits, in some cases, are less restrictive than the less than detectable criterion. In the spirit of the ALARA philosophy, the less than detectable criterion will be used whenever practicable. However, in all cases, material released for offsite use will, as a minimum, meet the limits defined in Regulatory Guide 1.86. Use of Regulatory Guide 1.86 release limits requires the prior approval of UNC Environmental and Occupational Safety (See Section 5.4).

This conservative approach is considered a good practice when releasing equipment and materials for offsite use; however, when the less-than-detectable criterion is applied to cleanup of surplus facilities, it can result in unreasonably high funding. Therefore, DOE-RL has directed the Hanford Contractors to use the ARCL methodology to establish radiological release criteria for decommissioning surplus contaminated facilities on the Hanford Site (Reference 16).

The ARCL method, developed by Pacific Northwest Laboratories defines the amount of radioactive material that may safely remain after a facility has been decommissioned. The ARCL method defines realistic exposure scenarios, based on an analysis of potential radiation exposure pathways. The scenarios consider the numerous ways in which persons could be exposed to the remaining radioactive materials during or after institutional control of the site.

The predicted radiation doses are then calculated and compared to an established dose limit to define the ARCL for the specific mixture of radionuclides present at a specific facility or location. If the predicted potential dose to an individual determined by this method is less than a selected dose limit, then no further actions would be required for that site. If the predicted potential dose exceeds the limit, then additional remedial action must be taken. Reference 5 is the PNL document that explains how the ARCL method is used to determine release values for the Hanford 100 Areas.

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A Hanford Production Reactor Decommissioning Plan

September 1, 1984

HANFORD 100 AREA LONG-RANGE DECOMMISSIONING PLAN

Prepared by
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UNC Nuclear Industries, Inc.
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UNC Nuclear Industries, Inc.
RICHLAND, WASHINGTON

TABLE OF CONTENTS

PART 1 - BACKGROUND INFORMATION, COSTS, AND SCHEDULES

5.3.1 Application of the ARCL Method

Current DOE guidance requires that the dose to a maximally exposed person, following the release of a decommissioned facility or land area for unrestricted use, be less than 25 mrem/year to the whole body or any organ. (A maximally exposed site resident is assumed to receive the maximum possible radiation dose from all of the exposure pathways on a particular site.)

If the ARCL analysis indicates that the 25 mrem/year criterion cannot be achieved cost-effectively for a particular site, then DOE-RL must approve the specific dose levels for that sight, calculated by use of the ARCL method, prior to initiation of the decommissioning work. The As Low As Reasonably Achievable (ALARA) philosophy is applicable whenever it is cost-effective to reduce doses below the 25 mrem/year level.

Table 5-1 lists dose levels to a maximally exposed person, and how they relate to site status after decommissioning. The ALARA philosophy and cost effectiveness are of primary importance in determining which release level will be achieved for a particular site.

TABLE 5-1

RELEASE LEVELS AND PRIORITIES FOR DECOMMISSIONED FACILITIES AND LAND AREAS

Priority	Release Level	Site Status
1	Decontaminate to less than detectable.	Site can be released immediately for unrestricted use.
2	ARCL of 25 mrem/year or less immediately following decommissioning.	Site can be released immediately for unrestricted use.
3	ARCL of 25 mrem/year or less within 100 yr institutional control period.	Site can be released in the year that the radio-nuclides have decayed to ARCL value of less than 25 mrem/year.
4	ARCL of up to 500 mrem/year at end of 100 yr institutional control period.	DOE-RL approval is needed to exceed 25 mrem/year.

5.4 RELEASE OF MATERIALS FOR UNRESTRICTED OFFSITE USE

DOE recently adopted the release limits defined in Regulatory Guide 1.86 (Reference 17). These limits, in some cases, are less restrictive than the less than detectable criterion. In the spirit of the ALARA philosophy, the less than detectable criterion will be used whenever practicable. However, in all cases, material released for offsite use will, as a minimum, meet the limits defined in Regulatory Guide 1.86. Use of Regulatory Guide 1.86 release limits requires the prior approval of UNC Environmental and Occupational Safety. Table 5-2 lists these criteria.

TABLE 5-2

ACCEPTABLE SURFACE CONTAMINATION LEVELS
FOR MATERIALS REMOVED FROM THE SITE

Nuclide[a]	Average[b,c]	Maximum[b,d]	Removable[b,e]
U-nat. U-235, U-238, associated decay products	5,000 dpm a/100cm^2	15,000 dpm a/100cm^2	1,000 dpm a/100cm^2
Transuranics. Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100cm^2	300 dpm/100cm^2	20 dpm/100cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm/100cm^2	3000 dpm/100cm^2	200 dpm/100cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5000 dpm/β-γ/ 100cm^2	15,000 dpm β-γ/ 100cm^2	1,000 dpm β-γ/ 100cm^2

[a]Where surface contamination by both alpha- and beta-gamma emitting nuclides exists the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.
[b]As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive materials as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.
[c]Measurements of average contaminant should not be averaged over more than 1 square meter. For objects for less surface area, the average should be derived for each such object.
[d]The maximum contamination level applies to an area of not more than 100cm^2.
[e]The amount of removable radioactive material per 100cm^2 surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

5.5 DISPOSITION OF CONTAMINATED EQUIPMENT

Equipment contaminated with radioactive materials should be dispositioned using the priorities listed below. The intent of these priorities is to practice the ALARA philosophy by minimizing the movement and handling of radioactive materials.

1. Reuse Equipment. Equipment should be removed for reuse if it is cost-effective to do so and if a new user for the equipment has been identified. The new user will provide the funds for removal and transport to the new location.

2. Leave Equipment in Place. If a cost effective reuse is not identified, equipment should be left in place. This priority should be used only if the radioactive material on the equipment can be contained during the demolition phase of decommissioning.

3. Relocate Equipment in Same Facility. If there is a potential for release of radioactive material to the enviroment during demolition of the facility containing the equipment, before demolition the equipment should be relocated to an area in the same facility where it is protected (e.g., tunnel, basement, etc.).

4. Relocate Equipment to Another Contaminated Facility. If equipment cannot be left in place or relocated in its own facility, the equipment should be relocated to a below-grade void in another contaminated facility where it can be covered with a minimum of 1 meter of clean fill.

5. Relocate Equipment to a Noncontaminated Facility. If the equipment can not be relocated to a void in another contaminated facility, it should be relocated to a void in a noncontaminated facility that is scheduled to be decommissioned. Special authorization from UNC Environmental and Occupational Safety is required for this option.

6. Remove Equipment for Burial. As a last resort, the equipment should be removed and packaged for disposal at the Hanford 200 Area low level waste disposal site.

5.6 DISPOSITION OF NONRADIOACTIVE HAZARDOUS MATERIALS

The disposition of nonradioactive, hazardous wastes and/or materials, including asbestos, mercury, PCB oil, and possibly other materials, will be addressed in the Safety Hazards Assessment issued by UNC, in accordance with DOE directives, before any actual decommissioning work begins on a facility. The applicable Decommissioning Work Procedures will provide explicit instructions to control the release of any hazardous material during decommissioning work. Table 5-3 lists the significant, nonradioactive hazardous materials present in the Hanford 100 Area facilities.

TABLE 5-3

NONRADIOACTIVE HAZARDOUS MATERIALS PRESENT IN THE 100 AREA SHUT-DOWN FACILITIES

Material	Quantity	Location	Preferred Disposition
Asbestos	2,700 yd^3	Pipe insulation in 105's and many ancillary facilities; siding material on 105's and other facilities.	For facilities that are demolished and placed below-grade, below-grade asbestos is left in place, and above-grade asbestos is placed below-grade.
Mercury	1,025 lb	Panel gages for control equipment in all 100 Areas.	All mercury will be removed prior to decommissioning.
PCB oil	Unknown	In transformers.	All PCB remaining in 100 Area shut-down facilities will be removed prior to decommissioning. A sampling program is currently being conducted to determine PCB inventories.

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6.0 DECOMMISSIONING ALTERNATIVES

As a result of conceptual engineering and cost evaluations of many decommissioning alternatives for the reactors and ground disposal facilities, in-situ was selected by DOE-RL as the recommended preferred alternative. And because the advantages of the in-situ alternative are also applicable to the ancillary facilities and effluent systems, DOE-RL has selected the in-situ alternative for all Hanford 100 Area facilities.

In essence, in-situ decommissioning means disposing of the facility in its present location (as opposed to hauling it away for disposal elsewhere), then installing a protective barrier designed to isolate the radioactive residues from pathways to man and the environment. Although in-situ is the preferred alternative, no alternative will be implemented for any project until the NEPA process is completed (see Section 4.2.2).

The following paragraphs describe the alternatives considered for the reactor and ground disposal facilities, and how the in-situ alternative will be used for all of the Hanford 100 Area facilities.

6.1 REACTOR FACILITIES

6.1.1 Alternatives Assessed for the Reactors

Conceptual engineering and cost evaluations were made of three candidate decommissioning alternatives for the eight reactors: safe storage/deferred dismantlement; immediate dismantlement; and in-situ. Detailed descriptions and assessments of these decommissioning alternatives are in UNI-2619 (Reference 18).

Safe storage/deferred dismantlement means temporarily storing the reactor in a safe, secure status to allow a predetermined amount of radionuclide decay, and then dismantling the reactor and transporting the radioactive material to an approved disposal site. The advantage of deferring the dismantlement work, say for several decades, is that much of the high energy, gamma-emitting radiation will have decayed, allowing the dismantling work to be done more safely and cost-effectively, without need of special remote handling equipment, shielding, etc. However, deferring the dismantlement work would impose the high cost of maintaining the facility in a safe condition for decades, and would impose a long delay in beginning the 100 year institutional control period. For the shut-down Hanford 100 Area facilities, the safe storage period would be 75 years.

In the immediate dismantlement mode, the entire reactor facility is immediately removed from the site and the site is restored to unrestricted use status. Two alternative methods for accomplishing this decommissioning mode have been identified as practicable from an engineering and construction standpoint. They are:

IMMEDIATE DISMANTLEMENT DECOMMISSIONING MODES

Alternative	General Description
No. 1, Piece-by-Piece Removal	Remove structures surrounding reactor block. Flood reactor block with water to provide shielding. Cut and dismantle reactor from top down. Transport reactor block pieces to 200 West Area low-level waste disposal site.
No. 2, One-Piece Removal	Remove structures surrounding reactor block and excavate under reactor. Lift reactor and transport on crawler to 200 West Area low-level waste disposal site.

The building demolition, reactor removal, and site restoration procedures for these alternatives would be very similar to those for deferred dismantlement of the reactor following safe storage. However, given the current inventory of radionuclides in the reactor block (see Table 1-3 in "Reactor Buildings" in Part 2), the immediate piece-by-piece dismantlement of the reactor block would involve very high occupational exposure (about 2,000 man-rem) and would require the design, fabrication, and use of special containment, shielding, remote work, and water cleanup equipment. These requirements would result in a very high total decommissioning cost (estimated at $200 million) and produce over 4 million ft^3 of solid radioactive waste volume. Removal of the reactors in one piece will require an evaluation of the reactor base support and foundation, engineering of an excavation procedure for positioning the crawler, and development of crawler transport technique.

For the eight reactor facilities, the in-situ alternative is dramatically superior to the other alternatives in five assessment factors of cost, occupational exposure, manpower, completion time, and waste volume, and thus has been determined by DOE-RL to be the recommended preferred decommissioning alternative. Figure 6-1 summarizes the advantages of the in-situ alternative over the safe storage/deferred dismantlement, and immediate dismantlement alternatives for decommissioning the reactors.

6.1.2 Preferred In-Situ Alternative for Reactors

e recommended preferred in-situ alternative consists of leaving the actors in place, under an earthen mound of clean gravel and concrete le. The earth for the mound will be taken from local gravel pits ne the reactor sites, and the clean concrete rubble will be provided by the demolished reactor building superstructures. The 9,000-ton reactor block, left intact, will serve as its own high-integrity, long-term radiological burial container. The mound will provide a degree of environmental isolation superior to that achievable by dismantling the reactor shields and block, and then burying the disturbed radioactive material in a conventional shallow land, low-level waste disposal site.

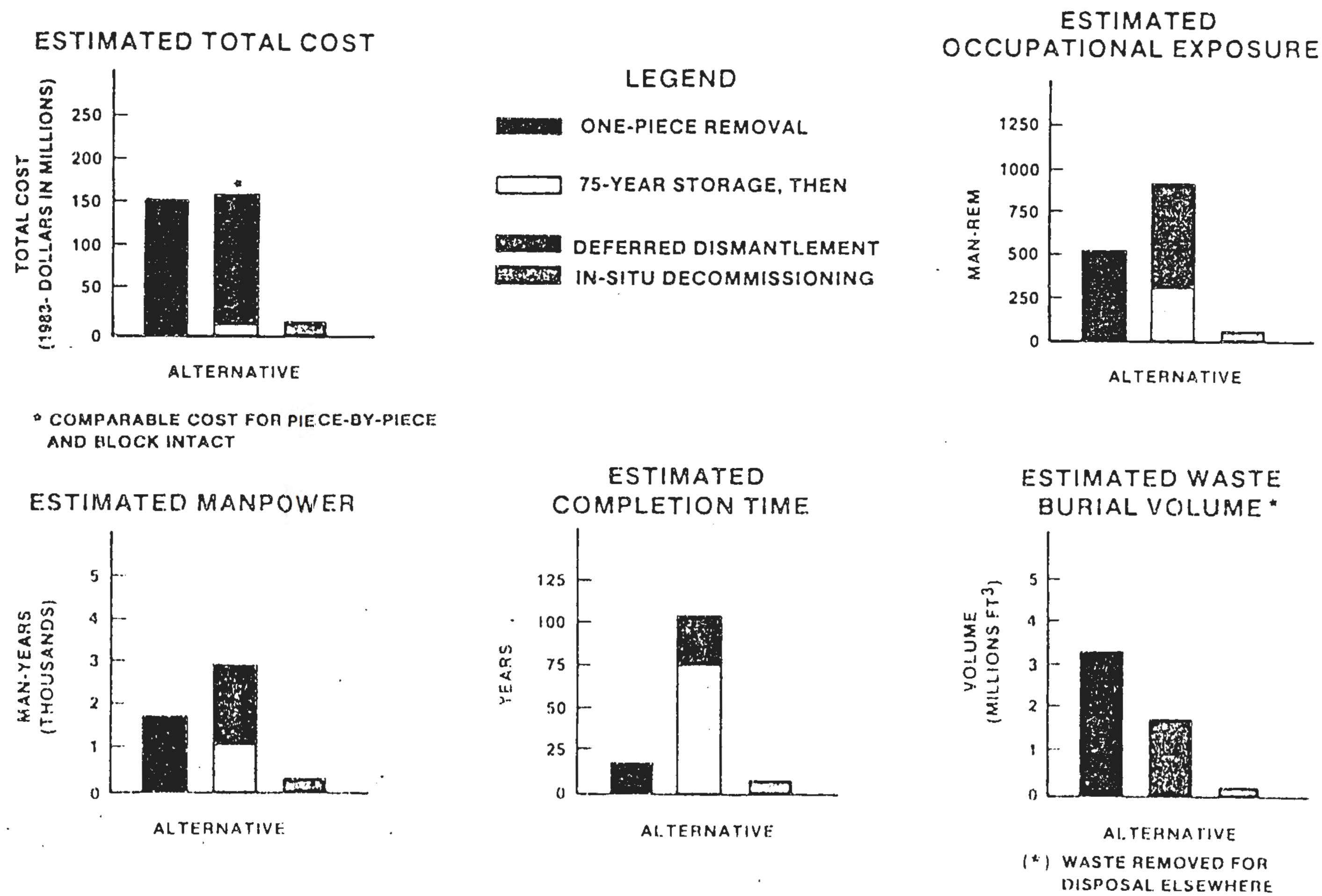


Figure 6-1. Comparative Summary Data for Decommissioning all Eight Reactor Facilities.

A typical reactor block consists of a 1/4-in. steel outer plate, a 40 to 80 in. thick biological shield comprised of alternating layers of steel and Masonite, and an 8 to 10 in. thick cast steel thermal shield, all encasing a solid stack of graphite blocks. (See "Reactor Buildings" in Part 2 of this Plan for detailed information.) This welded, vault-like structure is expected to provide long-term containment capability under environmental conditions far harsher than any that may be encountered in the dry Hanford soil. The majority of radionuclides remaining within the reactor block are chemically "locked up" in the physical matrix of cast steel and graphite and, if the reactor block were opened up, would not readily migrate to the environment or contaminate human food pathways.

The on-site architect engineering firm, Kaiser Engineering Hanford (KEH), has prepared a Conceptual Design Report (CDR) for in-situ decommissioning of the eight reactors (Reference 19). The CDR analyzes four alternative in-situ plans and cost estimates in order to arrive at a recommended feasible concept. Plans 1 and 2 would decommission each reactor separately. Plans 3 and 4 would decommission them concurrently, rotating crews from one area to another. The degree of demolition of the superstructure varies between Plans 1 and 2. Of the four plans, Plan 4 is the most cost-effective.

Plan 4 involves the major tasks of contamination fixing, demolition, and burial. The decommissioning work will be performed by UNC personnel, site D&D workers, an off-site specialty explosives consultant, and an off-site earth moving contractor. Initially, decommissioning workers will fix loose contaminants to the extent necessary to prevent radionuclide release during building demolition. Areas below grade will be filled with slurry, rubble, and/or soil, so decontamination or fixing in these areas will be minimal. Contamination on surfaces which could disperse to other areas when disturbed can be removed by dry vacuuming, or the contamination will be fixed using either a latex-based film or a sodium silicate solution. Three permanent survey marker control points will be established at each decommissioned reactor site.

The fuel storage basins require individual attention. The fuel storage basins at B, C, D and DR-105 facilities are currently being cleaned by removing the water and sludge and fixing the remaining contaminants. This work is scheduled to be completed in FY 1984 or early FY 1985. The fuel storage basins at 105-H and F have had the water removed and were backfilled with gravel and dirt in 1969. This backfill may have to be removed prior to decommissioning to assure that no fuel elements have been inadvertently left in the basin. The 105-KE and KW fuel storage basins are currently being used to store irradiated fuel from N Reactor, and will continue to be used until the stored fuel can be processed at PUREX. The estimated date for completion of removal and processing of this fuel is 1987.

The CDR identifies above- and below-ground voids for each reactor facility. These voids will be filled using either local earthen fill material or a cement slurry mix of 300 psi compressive strength. The use of slurry vs earthen backfill will be determined on a void by void basis, based on safety, accessibility, and cost-effectiveness. A batch plant will be brought onsite to mix and pump slurry as necessary. Depending on location and effect on the integrity of the mound, certain voids may be left unfilled. Openings such as pipes, ducts, and conduits that lead from outside the earthen mound to the reactor are defined as pathways for radionuclide migration and have been identified for each of the eight reactors. All such pathways that could be used by burrowing animals, or provide a means of unobstructed flow for water or air, would be removed, sealed off, or filled for a distance of at least 16 feet from the outer perimeter of the mound, inwards.

The reactor block will be left in place on its foundation, and the reactor equipment (gamma monitors, work elevators, safety ball hoppers, etc.) will be left in place on or around the reactor block. The vertical safety rods and the horizontal control rods will be left inserted in the reactor block. Water risers, cross headers, downcomers, capped process tubes, and nozzles will also be left in place as installed on the reactor block.

Once below-ground voids are filled and contaminants fixed, the perimeter of the 105 building, except for reinforced concrete walls, will be reduced to rubble. The lower reinforced shield walls will also remain in place around the reactor block. These 42 to 56 ft high, 3 to 5 ft thick reinforced concrete walls will provide a strong intrusion barrier around the reactor block and will assist in retaining the buried materials in place.

An 80-ton crane with a 5-ton wrecking ball and 100-ft boom is currently used for most of the demolition work in the 100 Areas, and will be the primary equipment used for the 105 decommissioning. An explosives expert will assist in razing portions of the structure. Both the wrecking ball and the explosives will break the concrete into rubble, which will be left as fill around the reactor.

The rubble, as it first falls, will be in large pieces which can bridge between each other creating large voids and pockets. To reduce or eliminate these voids and minimize future subsidence of the mound, the rubble on the ground may require additional breakage, cutting, and rearrangement. Ductwork, tanks, and large pipes will be flattened. Metal decking, grating, and structural steel will be arranged as necessary to eliminate voids. Care will be taken when demolishing and backfilling in and around the work area to prevent breaking nozzles on the front and rear faces of the reactor block and the ball hoppers on top of the reactor.

A layer of slurry or earthen fill will be placed over the rubble. Grading equipment or a vibrating compactor will be used on this initial layer so that the slurry or earth backfill will fill the majority of the voids.

After the demolition and backfilling within the reactor building are complete, the outside of the building will be backfilled. Selected backfill material from borrow pits located near the reactor will be self-loaded into scrapers or loaded into bottom dump trucks with front-end loaders. The load will be hauled to the reactor site and dumped in 12-18 in. lifts. Bulldozers will spread the material and assist in leveling the fill and shaping the mound as required. The heavy equipment working on the ground will also help to compact the material. The resulting earthen mound will be approximately 70 ft high, with a minimum depth of 16 ft (5 m) above the reactor block, with a slope of 3:1 (horizontal:vertical).

For stabilization of the mound surface, the ground will be covered with approximately 2 ft of topsoil and seeded with shallow-rooted indigenous plants. The topsoil and plant growth will absorb water, prevent runoff, reduce the need for a flatter slope and provide a natural-looking mound which blends into the surrounding terrain.

The overall settlement in the mound is estimated to be approximately 4 ft. Engineering estimates indicate that the majority of this settlement will occur within the first ten years. If, during the ten-year post construction maintenance period, differential settlement should create unsafe conditions, they can be corrected easily by hauling in and placing additional backfill.

Engineering estimates indicate that the earth mound will last a minimum of 500 years with little or no maintenance. Erosion rates for the mound are based on erosion data for natural soils in similar areas. Very little erosion of the mounds is anticipated during the 500-year period. Natural mounds of roughly the same size, shape, and composition have existed in the Hanford Site for over 13,000 years.

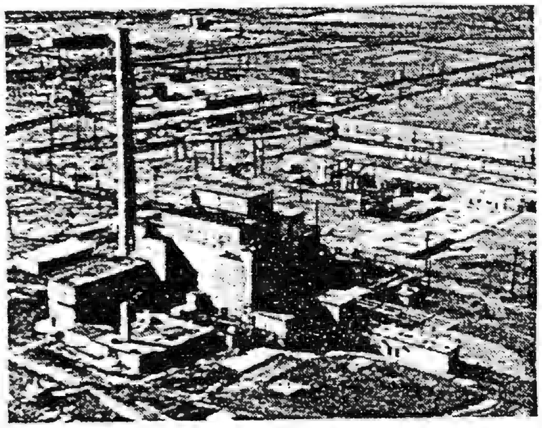
The 16-ft earth/gravel mound will protect inadvertent intruders and isolate the radioactive materials from significant pathways to man and the environment for a minimum of 500 years. The in-situ decommissioning of the shut-down Hanford production reactors is illustrated in Figure 6-2.

6.2 GROUND DISPOSAL FACILITIES

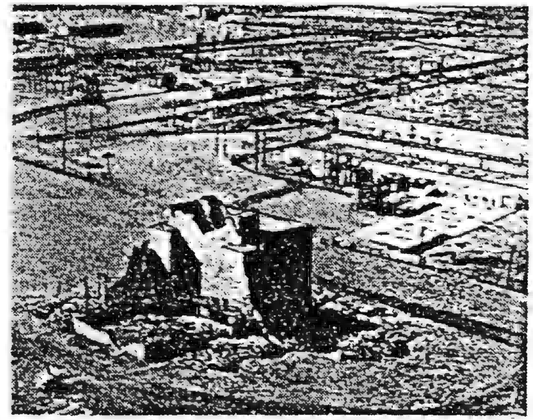
6.2.1 Alternatives Assessed for the Ground Disposal Facilities

Three basic decommissioning alternatives were considered for the ground disposal facilities: safe storage/deferred dismantlement; immediate dismantlement; and in-situ.

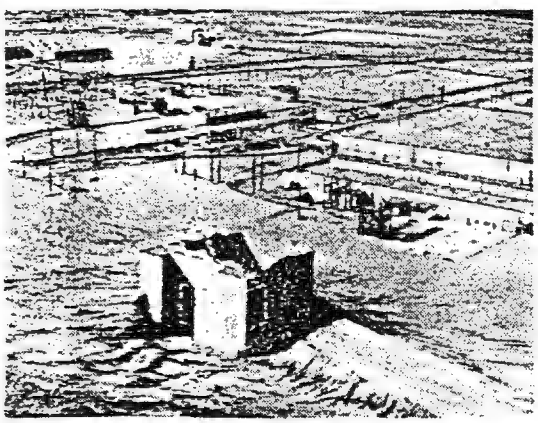
Safe storage/deferred dismantlement of a contaminated ground facility means temporarily storing the ground facility in a safe and secure status to allow a predetermined amount of radionuclide decay, and then disposing of the radioactive waste by excavation and removal to the 200 Area low-level waste disposal site. The advantage in deferring the dismantling work is that most of the higher energy, short half-life radionuclides will have decayed, enabling the disposal work to be accomplished more safely and cost-effectively, and with less total waste volume involved. Disadvantages are the cost of maintaining the facility for decades, and the long delay in releasing the site for other use. Based on the characteristics of the radioactive waste materials contained in the ground facilities, the optimum safe storage period for this decommissioning mode would be 75 years.



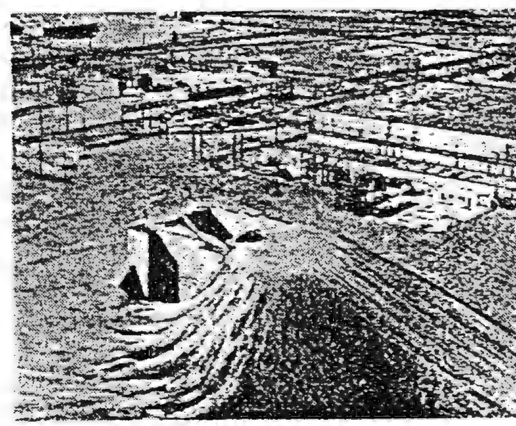
1. Reactor 105 building before decommissioning.



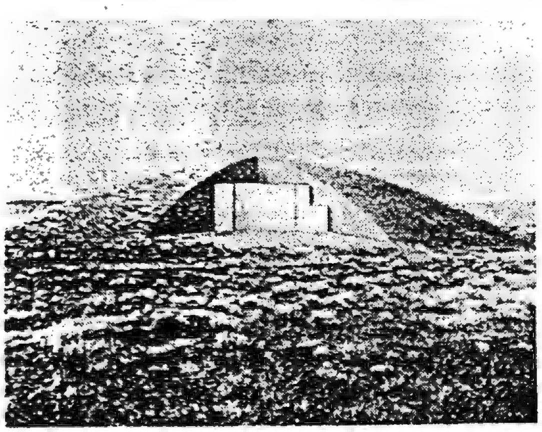
2. Reactor outer walls, stack and roof are razed, using standard equipment and techniques. Reactor block remains intact.



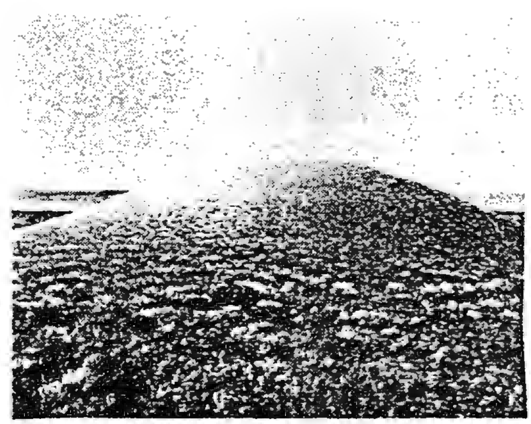
3. Reactor shielding walls remain standing. Rubble from razed portions is used as fill within shielding walls.



4. Clean earth/gravel taken from nearby gravel pits on the Hanford Site are mounded over the building using standard earth moving equiopment.



5. Cutaway showing reactor building buried under 5 meters of clean earth/gravel.



6. Mound, after seeding with indigineous vegetation, is extremely erosion-resistant and compatible with the surrounding environment.

Figure 6-2. In-Situ Decommissioning of Reactor (Artist's Conception).

Three alternatives for the safe storage phase have been identified as practical from an engineering and construction standpoint. Only one practical alternative for the dismantlement phase has been identified. The alternatives are:

SAFE STORAGE/DEFERRED DISMANTLEMENT DECOMMISSIONING MODE

Safe Storage Phase Alternative	General Description
No. 1, Roller Compacted Concrete Barrier	Fill voids and install a biological barrier using roller-compacted concrete. Maintain the barrier for 75 years.
No. 2, Single Dense Grass Barrier	Fill voids, seed topsoil, and maintain the barrier for 75 years, including necessary irrigation, fertilization, and selective weed control.
No. 3, Existing Weed Control	Fill voids, and lay down a covering of 1 ft to 4 ft of clean soil. Cover with clean gravel. Treat with herbicides to maintain weed free. Maintain barrier for 75 years.

Dismantlement Phase Alternative	General Description
Excavate all facilities	Excavate sites and transport radioactive material to low-level waste site in 200 Areas.

In the immediate dismantlement mode, all radioactive contamination above release levels is immediately removed from the ground facilities and shipped for disposal to the 200 West Area. The only approach within this alternative identified as practical from an engineering and construction standpoint is complete excavation of all contaminated sites (about 130 acres) and backfilling the sites with clean earth. This procedure would be technically feasible and would allow the sites involved to be immediately released for unrestricted use upon its accomplishment.

All radioactive materials would be excavated from the burial sites, including adjacent and underlying contaminated soil and material. The clean overburden soil would be removed first, and would be segregated from the contaminated soil and stockpiled for use later as backfill. After the contaminants were removed, the sites would be surveyed to ensure satisfactory decontamination, then backfilled with clean soil and rubble. Upon achieving successful final site radiation survey results, the sites would be compacted, graded to blend with the surrounding terrain, and seeded with native vegetation. Upon completion of the work they could be released immediately for unrestricted use.

Implementation of this mode would require the development of techniques for monitoring and segregating large volumes of clean fill and topsoil. An enormous amount of materials, about 270 million ft^3, would be excavated, sorted, and either disposed of as waste or returned to the sites as backfill. While this mode would allow immediate restoration of the site to unrestricted use, it would entail a very high dollar cost due to the large volume of waste material to be handled.

DOE-RL has determined that in-situ is the recommended preferred alternative for decommissioning the ground disposal facilities. Figure 6-3 summarizes the advantages of the in-situ alternative over the safe storage/deferred dismantlement and immediate dismantlement alternatives.

6.2.2 Preferred In-Situ Alternative for Ground Disposal Facilities

In-situ decommissioning of the ground disposal facilities means disposing of them in place as opposed to excavating and hauling the material containing radionuclides away for disposal elsewhere. In-situ decommissioning is accomplished by providing some form of long-term protective barrier of sufficient integrity to isolate the radioactive

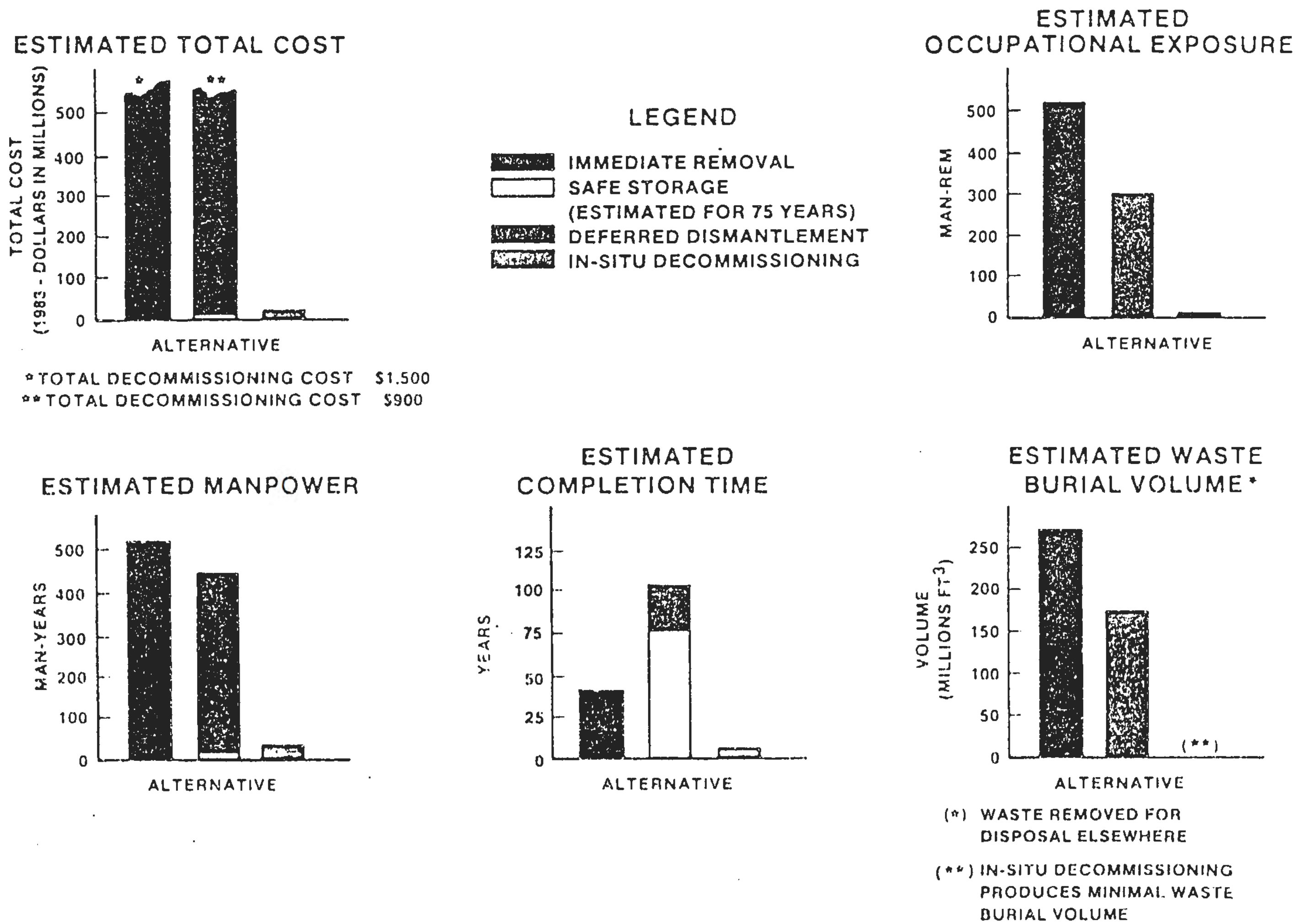


Figure 6-3. Comparative Summary Data for Decommissioning the Ground Disposal Facilities.

materials from significant pathways to man. For the Hanford 100 Area ground disposal facilities, an effective barrier could consist of clean dirt, gravel, riprap, concrete, or any combination of these materials layed down over the material already buried in the disposal site.

The radioactive materials contained in the waste sites are listed in Table 6-1. The March 1, 1985 to March 1, 2085 time period represents a 100 year institutional control period.

TABLE 6-1

TYPICAL INVENTORY* OF RADIOACTIVE MATERIAL IN THE 100 AREA LOW-LEVEL WASTE SITE

Radionuclide	Curies on March 1, 1985	Curies Remaining on March 1, 2085
H 3**	40	.2
C 14	.1	.1
Co 60	750	.002
Ni 63**	400	200
Sr 90	2.0	0.2
Cs 137	2.0	0.2
Eu 152	18	0.1
Eu 154	35	0.07
U	.5	.5
Pu	.5	.5
	~1240 curies	~200 curies

*Estimate based on available data.
**Calculated using ratios of material present in the fuel storage basins.

In the event a dense grass layer is applied, a 2-ft layer (minimum) of fertile soil will be applied to the ground disposal facilities prior to seeding with the dense grass. The grass cover should absorb much of the precipitation, help prevent surface water from acting as a driving force to carry radionuclides to the water table, and deter the growth of deep-rooted plants.

6.3 PREFERRED IN-SITU ALTERNATIVE FOR EFFLUENT SYSTEMS

The effluent systems consist of concrete and steel pipe (48 in. to 60 in. diameter), concrete and steel retention basins, pumping stations, and outfall structures. In-situ decommissioning of the effluent pipe involves filling the pipe at access points with earth or grout, reducing the junction boxes to below-grade and filling with earth or grout, and leaving the pipe in place in the ground. The earth or grout filling will retard pipe erosion, help prevent the migration of radionuclides to the environment, and reduce the possibility of cave-ins caused by eventual pipe deterioration. In general, the industrial hazard of cave-ins is equal to or greater than the radiological hazard to the environment, as the interior of the pipes contain only low levels of residual radioactive material.

Except for several hundred feet of above-ground pipe in the F Area, virtually all of the effluent pipe in the Hanford 100 Area remains in place as it was installed. The dismantled above-grade pipe in the F Area is currently in storage in the 107-F retention basin and may be sectioned for use as burial containers for other low-level waste.

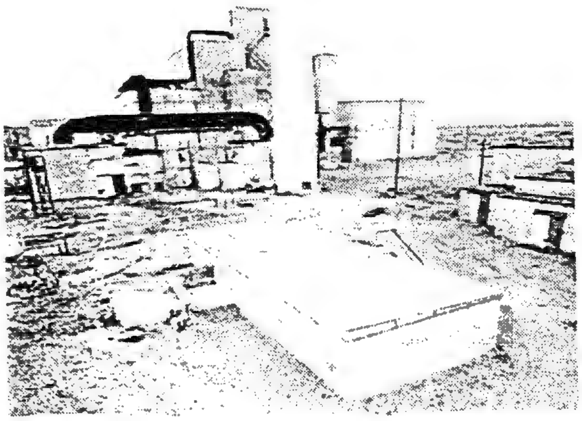
In-situ decommissioning of the 107 retention basins consists of dismantling the above-grade exterior basin walls, filling the structures with clean dirt or rubble, then covering the rubble with a minimum of 1 meter of clean earth/gravel.

The concrete retention basin walls will be demolished by blasting or wrecking ball. The steel retention basin walls will be sectioned, using standard steel cutting techniques such as cutting torches. All demolished basin walls will be used as fill within or adjacent to the basins, rather than transported for disposal elsewhere. The clean earth/gravel fill will come from natural gravel pits, nearby on the Hanford Site.

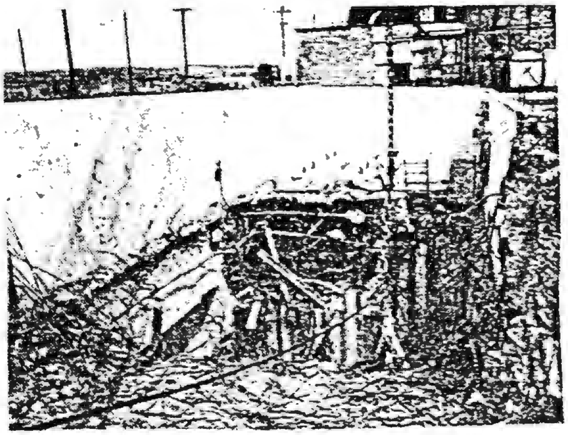
In-situ decommissioning of the outfall structures and pumping stations is very similar to the procedure used for decommissioning of the 117-F Building (Figure 6-4). The above-grade concrete walls will be demolished and used as fill for the below grade exterior walls left intact. Then the entire area will be filled to grade level, or higher, with clean earth/gravel.

6.4 PREFERRED IN-SITU ALTERNATIVE FOR ANCILLARY STRUCTURES

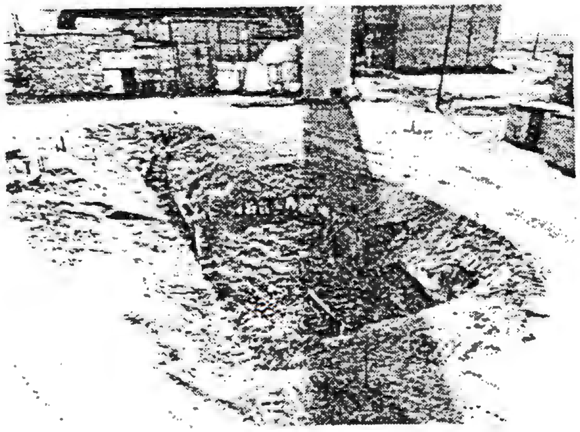
In-situ decommissioning of the ancillary structures is similar to that used for the reactor facilities. The buildings are razed using standard techniques, and then covered with a barrier (typically of clean earth and/or gravel) to minimize radionuclide migration and reduce the potential for human intrusion. Above-grade walls will be rubblized and used as fill in the building's below-grade area. Figure 6-4 shows how the in-situ method was applied to a typical ancillary structure, the 117-F filter building, which was decommissioned in 1983. Figure 6-5 shows how the in-situ method was used on a 116 reactor stack.



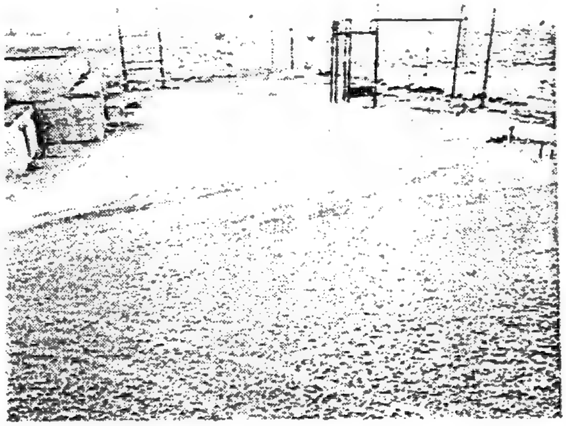
1. 117-F building before in-situ decommissioning.



2. Above-grade walls were razed using standard equipment and techniques. Interior walls and cells were demolished. Below-grade perimeter walls and floor were left intact, as containment for fill material.

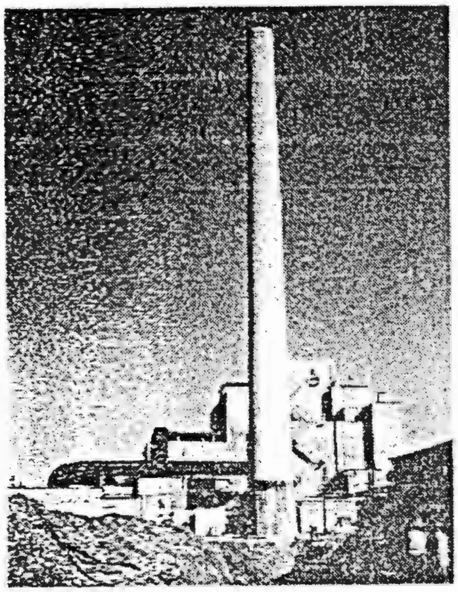


3. Rubble from razed portions was used as fill within below-grade, perimeter walls.

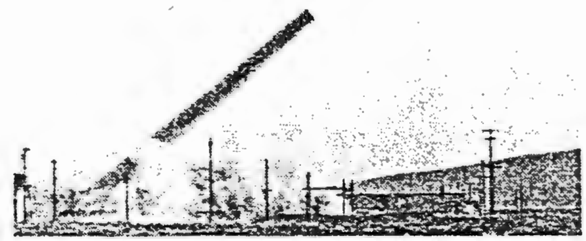


4. Entire area was filled with clean earth to grade level.

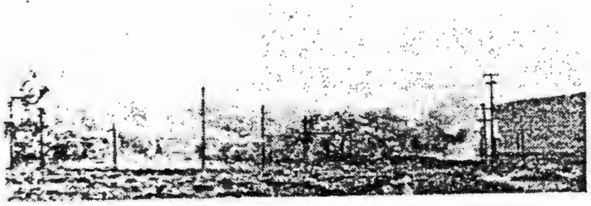
Figure 6-4. In-Situ Decommissioning of Typical Ancillary Facility.



1. 116 reactor stack and burial trench before in-situ decommissioning.



2. Explosive charges are set and detonated by expert subcontractor.



3. Stack falls into the burial trench. Except for base, the stack is pulverized by the impact.

4. All of the stack remnants are buried below grade and entire area is covered with clean earth.

Figure 6-5. In-Situ Decommissioning of Reactor Stack.

8.0 REFERENCES

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6. Dorian, J. J., Richards, U. R., Radiological Characterization of the Retired 100 Areas, UNI-946, UNC Nuclear Industries, Richland, WA, 1978.

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17. Regulatory Guide 1.86, "Termination of Nuclear Operating Licenses for Nuclear Reactors," U.S. Nuclear Regulatory Commission, Washington, DC., 1974.

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HANFORD 100 AREA LONG-RANGE DECOMMISSIONING PLAN

PART 2

FACILITY DESCRIPTIONS AND EVALUATIONS

REACTOR 105 BUILDINGS

This Long-Range Plan covers the reactor buildings listed below. Priorities listed are for 105 buildings only. Overall priorities and schedules are in Sections 4 and 7, Part 1.

DECOMMISSIONING PRIORITY		SFMP	($ in M) TEC	EST PROJECT DURATION[a]	DOE FUNDING DESIGNATION	DOE WBS NO.
1.	105-F	Yes	$5.4[b]	23 mos.	AR	4.7.2
2.	105-H	Yes	$5.3	23 mos.	AR	4.7.5
3.	105-D	Yes	$3.6	25 mos.	AR	4.7.10
4.	105-DR	Yes	$5.1	26 mos.	AR	4.7.10
5.	105-C	No	$4.9	26 mos.	GE	1.1.4.1.4
6.	105-KE	No	$6.3	28 mos.	GE	TBD
7.	105-KW	No	$6.3	32 mos.	GE	TBD
8.	105-B[c]	No	$4.4	33 mos.	GE	1.1.4.1.4

[a]Total duration for decommissioning all eight reactor buildings is 5 years.
[b]Includes procurement of slurry batch plant, pump, screens, etc., at a cost of $1 million.
[c]Preferred disposition of 105-B is historical museum, as the first production reactor built, rather than in-situ decommissioning. Cost shown is for in-situ decommissioning.

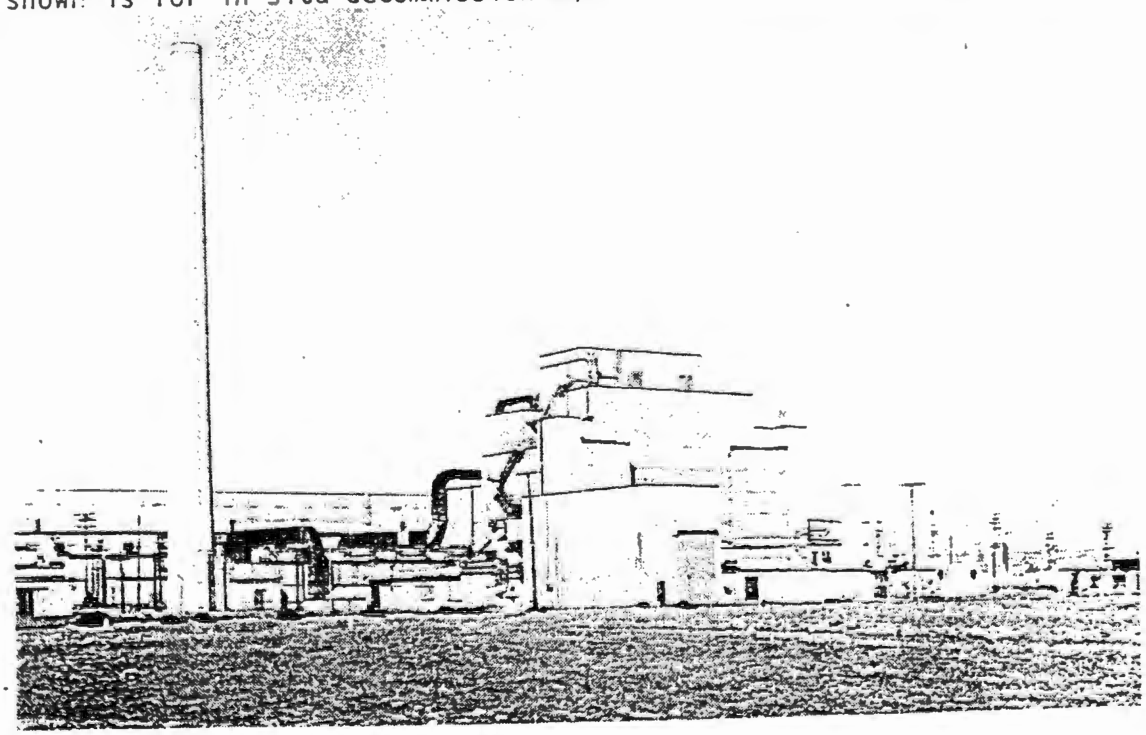

Figure 1-1. 105 D Reactor Facility (Typical).

CATEGORY: Reactor
FACILITY: 105

A. Operating History

All eight Hanford production reactors were shut down between 1965 and 1971. A significant amount of equipment and many support buildings have been transferred to government agencies or sold publicly to the highest bidder. All reactor sites are currently being maintained in a safe storage mode.

Table 1-1 summarizes the reactor 105 building operating histories.

TABLE 1-1
REACTOR OPERATING HISTORIES

Area	Reactor	Construction Start	Initial Startup	Shutdown
100-B	105-B*	8/1943	9/26/44	2/13/68
	105-C	6/1951	11/18/52	4/25/69
100-D	105-D	11/1943	12/17/44	6/26/67
	105-DR	12/1947	10/3/50	12/30/64
100-F	105-F	12/1943	2/25/45	6/25/65
100-H	105-H	3/1948	10/29/49	4/21/65
100-K	105-KW	11/1952	1/4/55	2/1/70
	105-KE	1/1953	4/17/55	1/28/71

*B Reactor was shut down and held in standby status from March 19, 1946 to June 2, 1948, then restarted and operated until February 1968.

B. Physical Description

Reactor Building

The reactor 105 buildings house the production reactors and related systems and equipment. Except for the reinforced concrete portions, these buildings can be classified as light, non-airtight, industrial structures. A typical reactor facility (Figure 1-2) is a reinforced concrete and concrete block structure some 250 ft long x 230 ft wide x 95 ft high. The building has massive (3 ft to 5 ft thick) reinforced concrete walls around the reactor block at the lower levels to provide additional radiation shielding, with lighter construction above -- either concrete block or corrugated asbestos cement. Roof construction is primarily precast concrete slab or poured insulating concrete.

As shown in Figure 1-2, the reactor block is located near the center of the building. Horizontal control rod penetrations are on the left side of the reactor block (when facing the reactor front face), and safety rod penetrations are on the top of the reactor. Fuel discharge and storage areas are located adjacent to the rear face of the reactor. Experimental test penetrations are on the right side of most of the reactors.

Reactor Block

A typical reactor block (Figure 1-3) consists of a graphite moderator stack encased in cast iron thermal shielding, and a biological shielding consisting of alternating layers of Masonite and steel or concrete. The entire block rests on a massive concrete foundation. A typical reactor block assembly weighs approximately 9,000 tons, and has overall dimensions of 46 ft high, by 46 ft wide, by 40 ft deep.

The principal components of a production reactor block are:

- The reactor moderator stack, which is an assembly of graphite blocks cored to provide channels for process tubes, control rods, and other equipment.
- The process tubes, which contained the uranium fuel elements and provided channels for cooling water flow.
- Horizontal control rods.
- Vertical safety rods.

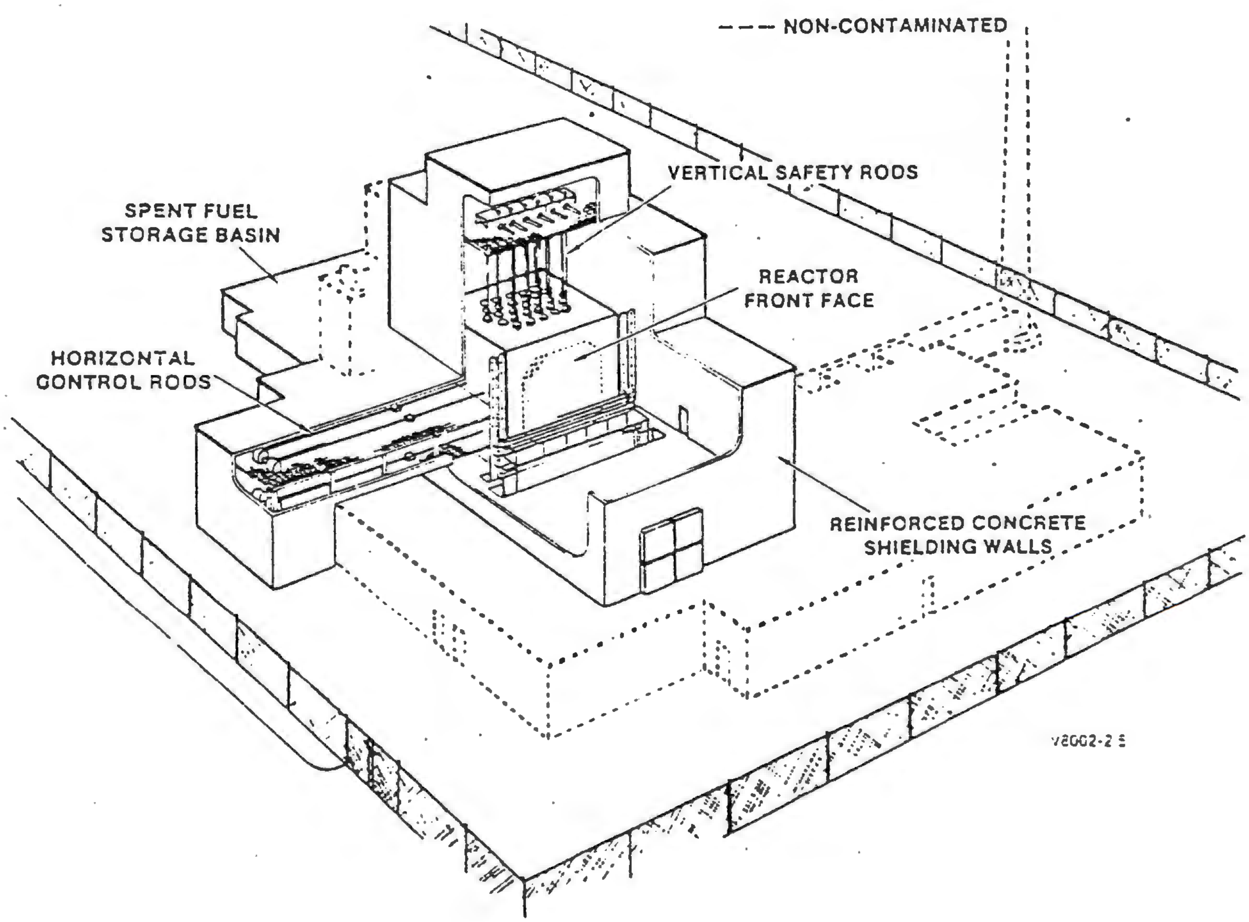

Figure 1-2. Typical Reactor 105 Building.

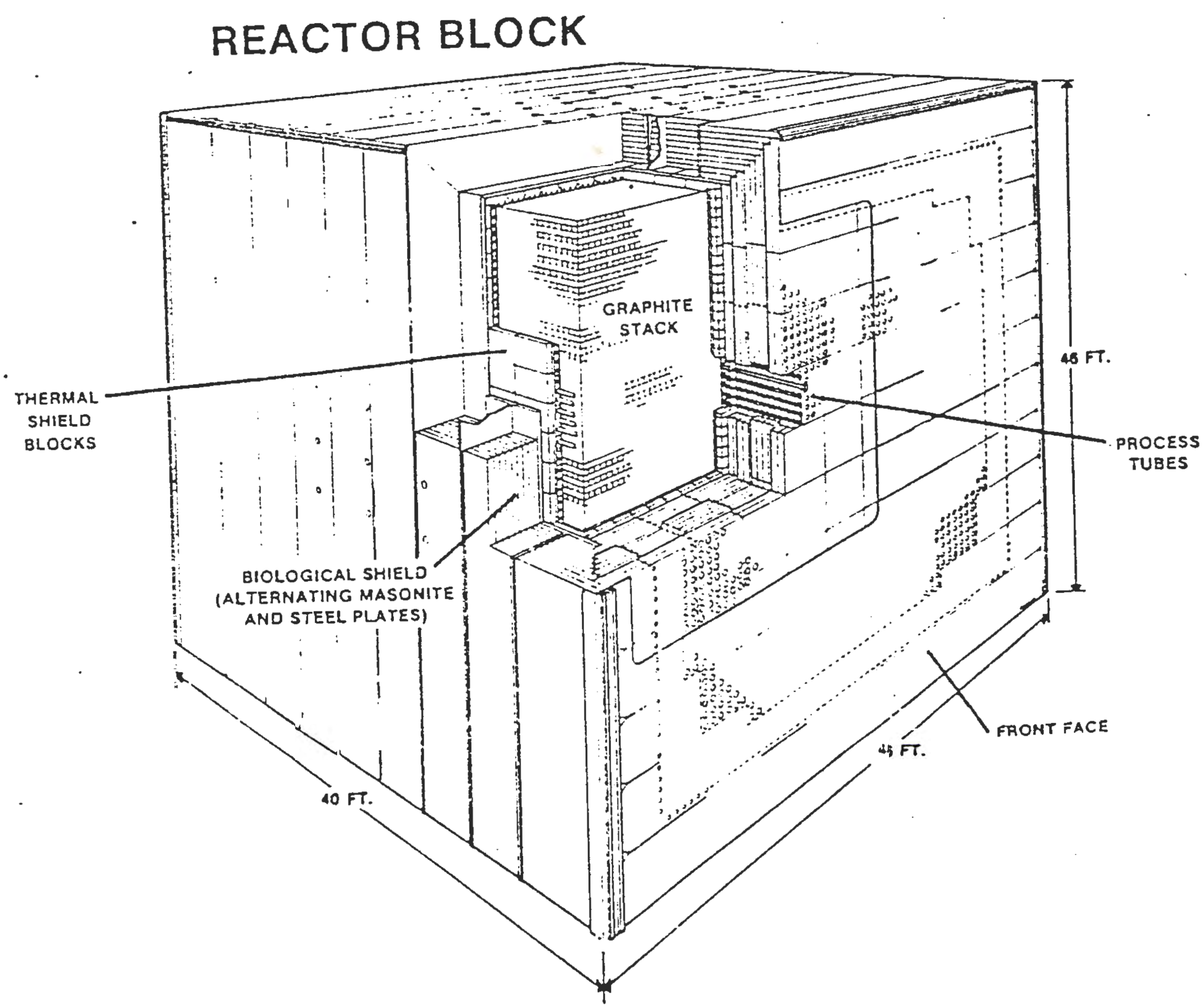

Figure 1-3. Reactor Block Construction.

- Ball 3X system, for dropping neutron absorbing steel balls (reactor poison) into vertical safety rod channels for emergency reactor shutdown.
- Monitoring and experimental test equipment.
- Thermal and biological shielding, surrounded by a heavy, vault-like steel outer shell equipped with gas-tight seals for the reactor block penetrations.

The shut-down production reactors are quite similar in design. The K Reactors differ from the older production reactors mainly in the number, size, and type of process tubes, the size of the moderator stack, and the type of shielding employed. Table 1-2 gives information on reactor block size and construction materials used for all eight shutdown reactors.

TABLE 1-2
HANFORD REACTOR DESIGN DATA

Reactors	Graphite Stack Dimensions (ft) Front to Rear	Top to Bottom	Side to Side	Process Tubes Number	Type	ID (in.)	Thermal Shield Type	Thickness (in.)	Biological Shield Type	Thickness (in.)
B, C,[a] D, DR, F, H	28	36	36	2004	Aluminum	1.75	Cast Iron	8-10	Steel and Masonite	52
KE, KW	33.5	41	41	3220	Zircaloy and Aluminum	1.8	Cast Iron	10	Heavy-Aggregate Concrete	45-83

(a)C Reactor has slightly larger diameter process tubes than the other reactors in this group. It contains about 60 Zircaloy process tubes, and has a heavy-aggregate concrete biological shield (7 ft thick) atop the reactor in place of steel and masonite.

Fuel Storage Basins

Each reactor 105 building contains a fuel storage basin (Figure 1-4). The basin served as a collection, storage, and transfer facility for the irradiated fuel elements discharged from the reactor. A typical reactor fuel storage basin consists of the fuel element pickup area, the storage area, and the transfer area. Irradiated fuel elements were sorted in the pickup area, transferred to buckets, transported by monorail to the storage area, and held to allow decay of short-lived radionuclides prior to reprocessing. Following the storage period, the buckets of fuel elements were moved to the transfer area, placed in lead-shielded casks, and loaded into a railroad well for transport to the chemical reprocessing facilities.

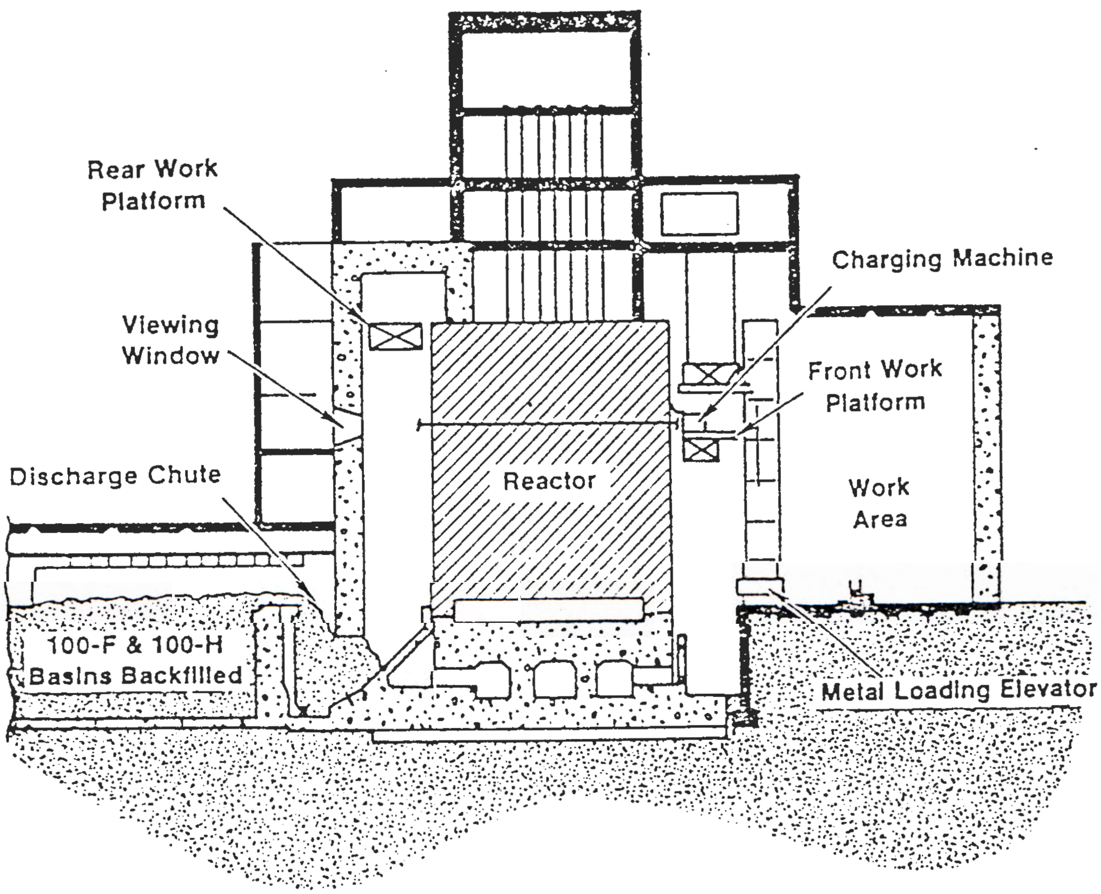

Figure 1-4. Side View of Fuel Element Storage Basin.

A wash pad, which was used for equipment decontamination, and an underwater inspection facility were included in every storage basin area.

The total area of each fuel storage basin, including the fuel element pickup and transfer areas, is 7,000 to 10,000 ft^2. The basins are about 22 ft. deep, have either wooden slotted or steel grating floors, and contained about 20 ft of water during operating periods.

The average thicknesses of the outside walls and bottoms of the basins are 20 in. and 6 in., respectively. The total volume of concrete in each basin is estimated to be about 750 yd^3.

C. Current Physical and Radiological Conditions

1. Physical Condition

The current surveillance and maintenance program for the shutdown reactors has been successful in controlling contamination inside established radiation zones and maintaining the reactor block and reactor building intact. Ongoing maintenance and surveillance of 105 buildings and their associated facilities include security, radiological and industrial safety inspections, and routine (weekly, monthly and annual) maintenance inspections (Reference 8). There has been a gradual degradation of the roof structure, and cracking of the brick walls. If decommissioning is not started soon, a significant expenditure (about $5,000,000) will be required over the next five years. This work will upgrade roofs, walls, foundations, doors, windows, and trim to a maintainable condition.

2. Radiological Condition

Contaminated surfaces in the 105 buildings that are readily accessible to surveillance personnel have been cleaned to a nonsmearable status and zones reading greater than 1 mrem/hr have been identified. The majority of the radioactivity is in or adjacent to the reactor block and is not easily dispersible.

The radioactive materials in the reactor block are contained in the graphite stack and in the thermal shield, process tubes, and control rods. Table 1-3 shows the estimated inventory, in curies, for a typical reactor block. Based on these data, the graphite stack, thermal shield and other reactor components classify as low-level waste.

TABLE 1-3
INVENTORY OF RADIONUCLIDES IN A 100 AREA
SHUT-DOWN REACTOR*

Note: Typical inventory for one of eight production reactors. Radiological data calculated for a March 1, 1985 inventory.

Radioactive Material	Half-Life (yr)	Total Inventory (Ci)
^{3}H	12.33	700
^{14}C	5,730	4,000
^{60}Co	5.27	3,000
^{63}Ni	100	700
^{90}Sr	29	0.002
^{93}Mo	3,500	2.
^{94}Nb	20,000	2.
^{137}Cs	30.17	0.002
^{152}Eu	13.4	8.
^{154}Eu	8.2	0.3
^{238}Pu	87.74	4.0
$^{239/240}Pu$	24,110	3.
Typical Reactor Total Ci present:		8,000

*Best estimate based on available data.

The major source of radioactivity outside the reactor block is the sludge on the floors of the fuel storage basins (Table 1-4). The sludge and other high dose rate materials are currently being removed from B, C, D, and DR fuel storage basins. This work is scheduled to be completed by the end of FY 1984. The 105-F and 105-H fuel storage basins were backfilled with clean earth in 1969. These basins were surveyed prior to backfilling, and the high dose rate materials were removed. Prior to decommissioning of the 105 building, the sludge and water will be removed from the basins, and the residual radioactivity will be fixed on the basin floor and wall surfaces. The backfill material may have to be removed from the 105-F and 105-H fuel storage basins to ensure that no fuel elements have been inadvertently left in the basins.

TABLE 1-4
ESTIMATED INVENTORY OF RADIONUCLIDES IN A TYPICAL IRRADIATED FUEL STORAGE BASIN

Note: Typical inventory for one of eight fuel storage basins. Radiological data calculated for a March 1, 1985 inventory.

Radioactive Material	Half-Life (yr)	Total Inventory (Ci)
^{3}H	12.33	0.01
^{60}Co	5.27	12.
^{63}Ni	100	25.
^{90}Sr	29	0.9
^{137}Cs	30.17	4.
^{152}Eu	13.4	2.
^{154}Eu	8.2	4.
^{155}Eu	4.76	0.3
$^{238}U+D$	1,500,000	0.001
^{238}Pu	87.74	0.004
^{239}Pu	24,110	0.08
Estimated Total Ci present:		50.0

D. Capital Equipment and Tools

The only anticipted capital equipment expenditure is for a portable slurry batch plant. The batch plant will mix and pump the grout that will be used to fill major voids (pipes, tunnels, etc.) prior to demolition of the 105 facility.

Besides the batch plant, required equipment and tools are those commonly used in construction and demolition and are available on the Hanford Site. A comprehensive list of required tools will be identified in the applicable Detailed Work Procedure.

E. Research and Development (R&D)

No R&D is anticipated for in-situ decommissioning of the reactor buildings.

F. Waste Volume Projections

In-situ decommissioning will require a minimum movement of contaminated waste. The major building surfaces to be demolished are essentially free of contamination. Where spot decontamination is required, the waste volume resulting from the decontamination will be less than 10,000 ft^3 per reactor. For the most part, this waste will be packaged and used to fill voids around the reactor block. Other contaminated equipment such as the vertical safety rod winches and motors, rupture monitor sample room equipment, etc. will be removed and used as fill adjacent to the reactor block. Any waste that is determined to be inappropriate for use as fill material will be removed, packaged, and transported for burial in the Hanford 200 Area low-level burial ground.

G. Facility and Equipment Reuse

1. Facility Reuse

No cost-effective reuse of the 105 facilities has been identified. All 105 facilities have been shut down for at least thirteen years and are completely inoperable. The buildings have been minimally maintained to prevent major deterioration to their structures, but they would require extensive and expensive renovation to be made useable for any purpose.

2. Equipment Reuse

Salvage of equipment or material remaining in the 105 buildings will be extremely costly. The remaining equipment is inoperable and has suffered corrosion and deterioration caused by prolonged disuse. Since salvage costs would be greater than replacement costs, cost estimates in this plan assume no salvage will be performed.

A significant amount of contaminated stainless steel (<10 mr/hr), remains in the reactor front and rear faces, inlet/outlet crossheaders, loop header piping, and downcomer sleeve/baffles. Although the estimated stainless steel inventories are large, as shown below, salvage is not anticipated because of the high cost, which, in any case, would be assumed by the user.

Facility	Stainless Steel (Tons)
105-B	70
105-C	151
105-D	70
105-DR	42
105-F	70
105-H	42
105-KE	508
105-KW	508
Total	1,461 Tons

H. Project Work Elements and Costs

Table 1-5 shows the escalation, contingency, and Washington state tax breakdowns for the decommissioning of each reactor building. Table 1-6 breaks down the estimated costs for the in-situ decommissioning of a typical reactor building. Decommissioning costs include labor, special and normal tooling and equipment, waste disposal and facility overheads required for the project work.

TABLE 1-5

REACTOR BUILDING COST BREAKDOWNS

Note: Escalation is 39.6%; contingency is 35%; state tax is 7.5%.
Reactor costs are midpoint of decommissioning work, September 1989.

Building	$ Amounts
105-F	$ 2,597,700
Escalation	1,031,300
Contingency	1,270,200
State Tax	213,500
TOTAL	5,112,700
105-H	$ 2,586,600
Escalation	1,024,300
Contingency	1,263,900
State Tax	148,200
TOTAL	5,023,000
105-DR	$ 2,519,200
Escalation	997,600
Contingency	1,230,900
State Tax	128,300
TOTAL	4,876,000
105-D	$ 1,702,300
Escalation	674,100
Contingency	831,600
State Tax	108,300
TOTAL	3,316,300
105-C	$ 2,411,600
Escalation	955,100
Contingency	1,178,500
State Tax	133,500
TOTAL	4,678,700
105-KE	$ 3,099,800
Escalation	1,227,500
Contingency	1,514,600
State Tax	198,200
TOTAL	6,040,100
105-KW	$ 3,099,800
Escalation	1,227,500
Contingency	1,514,600
State Tax	198,200
TOTAL	6,040,100
105-B	$ 2,157,900
Escalation	854,400
Contingency	1,054,200
State Tax	121,600
TOTAL	4,188,100
TOTAL	$39,275,000
ENGIN	$ 1,946,800
	$41,221,800
TEC (rounded down)	$41,200,000

CATEGORY: Reactor
FACILITY: 105

TABLE 1-6

COST SCHEDULE FOR IN-SITU DECOMMISSIONING OF A TYPICAL REACTOR BUILDING

(Costs in $000)[a]

PROJECT TASK	FY 1	FY 2	FY 3
Engineering/Planning/Supervision (include characterization and closeout)	90	80	80
Procurement[b]	130		
Contamination Fixing &/or Removal		20	
Demolition		1,130	
Void Reduction		770	
Mounding/Surface Stabilization/ Location Survey			2,700
Storage Basin Screening[c]		150	
FY Cost Total	$220	$2,150	$2,780

Total estimated cost $ 5,150[a,b]

Total estimated cost for all eight is $41,200

[a]Dollars are midpoint of decommissioning work, September 1989.

[b]Slurry batch plant, pump, screens, etc. will be procured before decommissioning the first reactor facility, at a cost of $1,000,000. The costs in this Table represent this cost averaged over all eight reactors.

[c]Only 105-F and 105-H fuel storage basins may require screening of fill material at a total cost of about $590,000 each. The $150,000 figure represents these costs (about $1,180,000) averaged over all eight reactors.

EFFLUENT SYSTEMS

A typical reactor effluent system consists of a retention basin, an outfall structure, piping, and a pumping station.

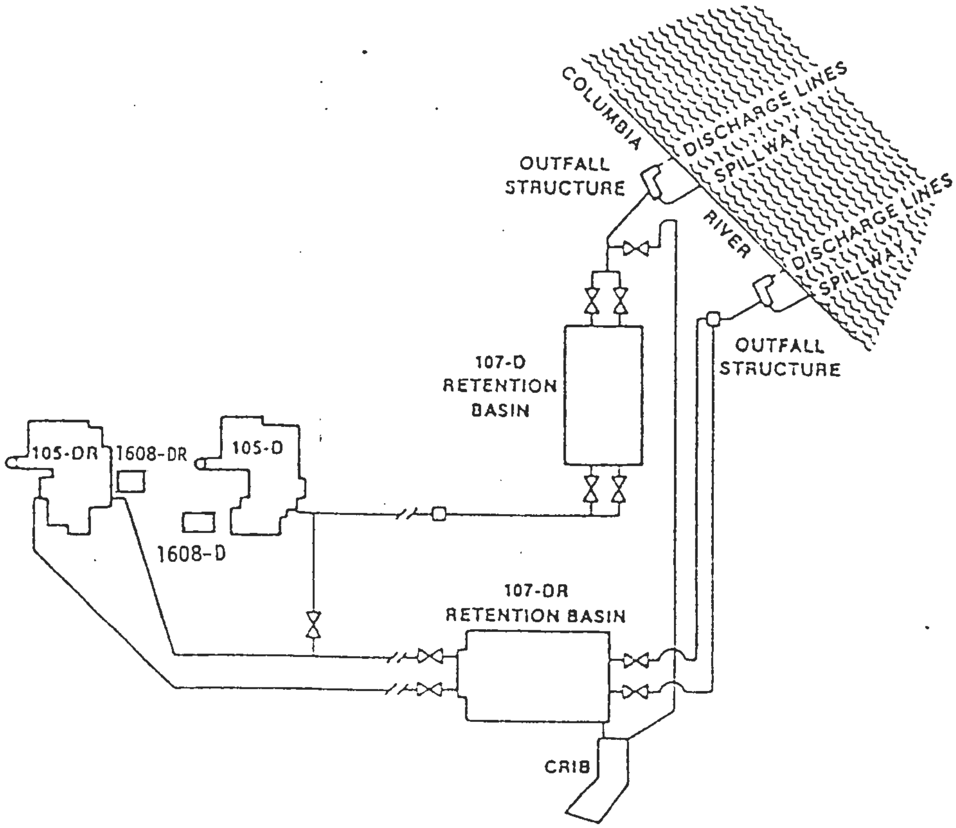

Figure 2-1. D/DR Effluent System (Typical).

The 107 retention basins, located between the reactors and the river, were used to hold up effluent reactor coolant water long enough to permit radioactive decay of short-lived activation products before returning the water to the Columbia River. Two types of retention basins were used. The B, D, DR, F, and H facilities used rectangular, concrete reservoirs; the C, KE, and KW facilities used cylindrical, carbon-steel tanks. All basins were open-toppped.

The 1904 outfall structures are open, reinforced-concrete boxes that were used to direct the discharge water from the retention basins through either the discharge lines or the spillways to the Columbia River. The outfall structures range in area from about 23 m^2 to 110 m^2 (250 ft^2 to 1,200 ft^2).

The effluent pipe (approximately 14 miles total) carried reactor coolant water to the Columbia River. Most of the pipe is steel, although a relatively small amount is concrete. Most pipe remains in place in the ground. Above-ground piping at 100-F has been removed and is being stored in the F Area retention basins for possible future use as shipping containers.

The 1608 effluent water pumping stations, located adjacent to their associated 105 buildings, housed pumps and related equipment that removed water from the fuel storage basins and other reactor building facilities, and returned it to the Columbia River via the effluent piping and 1904/1908 outfall structures.

107 RETENTION BASINS

This Long-Range Plan covers the 107 retention basins listed below. The priorities apply only to the basins. Overall priorities and schedules are in Sections 4 and 7, Part 1.

PRIORITY		SFMP	($ in K) TEC	EST PROJECT DURATION	DOE FUNDING DESIGNATION	DOE WBS NO.
1.	107-F	Yes	340	10 mos	AR	4.7.2
2.	107-H	Yes	306	10 mos	AR	4.7.5
3.	107-D	Yes	317	10 mos	AR	4.7.10
4.	107-DR	Yes	337	10 mos	AR	4.7.10
5.	107-C	No	511	8 mos	GE	1.1.4.1.4
6.	107-KE*	No	514	6 mos	GE	TBD
7.	107-KW*	No	514	5 mos	GE	TBD
8.	107-B	No	317	10 mos	GE	1.1.4.1.4

*Basin work includes D&D of 150-KE and 150-KW glycol heat exchange facilities.

Figure 2-2. 107-B (Rectangular) and 107-C (Circular) Retention Basins.

CATEGORY: Effluent System
FACILITY: 107 Retention Basin

TABLE 2-1

107 RETENTION BASIN CHARACTERISTICS

Area	Retention Basins	Dimensions	Total Volume yd^3	Depth of Current Backfill	Concrete Volume yd^3
B	107-B	230 x 467 x 20 ft deep	80,000	4	4,200
	107-C	2 tanks, 330 ft diam x 16 ft deep	101,000	4	(steel)
D	107-D	230 x 467 x 20 ft deep	80,000	2	4,200
	107-DR	273 x 600 x 20 ft deep	120,000	2	7,000
F	107-F	230 x 467 x 20 ft deep	80,000	5	4,200
H	107-H	273 x 600 x 20 ft deep	120,000	4	7,000
K	107-KE	3 tanks, 250 ft diam x 29 ft deep	158,000	4	(steel)
	107-KW	3 tanks, 250 ft diam x 29 ft deep	158,000	4	(steel)

TABLE 2-2

INVENTORY OF RADIONUCLIDES IN THE SLUDGE OF A TYPICAL 107 RETENTION BASIN[1,2]

Note: Typical inventory for one of eight retention basins.
Radiological data calculated for March 1, 1985.

Radionuclide	Half-Life (yr)	Inventory (Ci)
^{3}H	12.33	0.05
^{14}C	5,780	0.3
^{60}Co	5.27	6
^{63}Ni	100	36
^{90}Sr	29	0.5
^{137}Cs	30.17	0.4
^{152}Eu	13.4	15
^{154}Eu	8.2	6
^{155}Eu	4.76	0.34
^{238}U+D	1,500,000	0.003
^{238}Pu	87.74	0.003
$^{239/240}Pu$	24,110	0.09

Typical Retention Basin Total Ci Inventory: ~64

[1]Best estimate based on available data.
[2]Sludge has been removed from the 100-C and 100-K basins.

D. Capital Equipment and Tools

There is no anticipated capital expenditure for in-situ decommissioning of the 107 retention basins. Required equipment and tools are those commonly used in construction and demolition and are available on the Hanford Site. A comprehensive list of required tools will be in the applicable Decommissioning Work Procedure.

E. Research and Development (R&D)

No R&D is anticipated for in-situ decommissioning of the 107 retention basins.

F. Waste Volume Projections

In-situ decommissioning of the 107 retention basins will require a minimum movement of contaminated waste. The basin work will essentially produce no low-level radioactive waste requiring disposal elsewhere. However, any waste that is determined to be inappropriate for use as fill material will be removed, packaged, and transported for burial in the Hanford 200 Area low-level burial ground.

G. Facility and Equipment Reuse

1. Facility Reuse

No functional cost-effective reuse of the 107 retention basins has been identified.

2. Equipment Reuse

No significant cost recovery opportunities through salvage and reuse have been identified for any of the retention basins. No significant amount of stainless steel is salvageable in the retention basin facilities.

H. Project Work Elements and Costs

Table 2-3 breaks down the estimated costs for the in-situ decommissioning for a typical retention basin. Costs include labor, special and normal tooling and equipment, waste disposal and facility overheads required for the project work.

TABLE 2-3

COST SCHEDULE FOR IN-SITU DECOMMISSIONING
OF ONE TYPICAL RETENTION BASIN

(Costs in $000)[1]

PROJECT TASKS	PROJECT DURATION: 3 mo	6 mo	9 mo	12 mo
Engineering/Planning/Supervision (includes characterization and closeout)	59			
Site Preparation		43		
Demolish Auxillary Equipment		20		
Dismantle Basin			119	
Backfill and Restore Surface/ Monuments				154
FY COST TOTAL	$395			

TOTAL ESTIMATED COST: $ 395
TOTAL ESTIMATED COST FOR ALL EIGHT: $3160

[1] Dollars are FY85

CATEGORY: Effluent System
FACILITY: 107 Retention Basin

1608 EFFLUENT WATER PUMPING STATIONS

This Long-Range Plan covers the 1608 effluent water pumping stations listed below. The priorities listed are for 1608 stations only. Overall priorities and schedules are in Sections 4 and 7, Part 1.

PRIORITY		SFMP	($ in K) TEC	EST PROJECT DURATION	DOE FUNDING DESIGNATION	DOE WBS NO.
1.	1608-F	Yes	304	4 mos	AR	4.7.2
2.	1608-H	Yes	304	4 mos	AR	4.7.5
3.	1608-D	Yes	304	4 mos	AR	4.7.10
4.	1608-DR	Yes	304	4 mos	AR	4.7.10

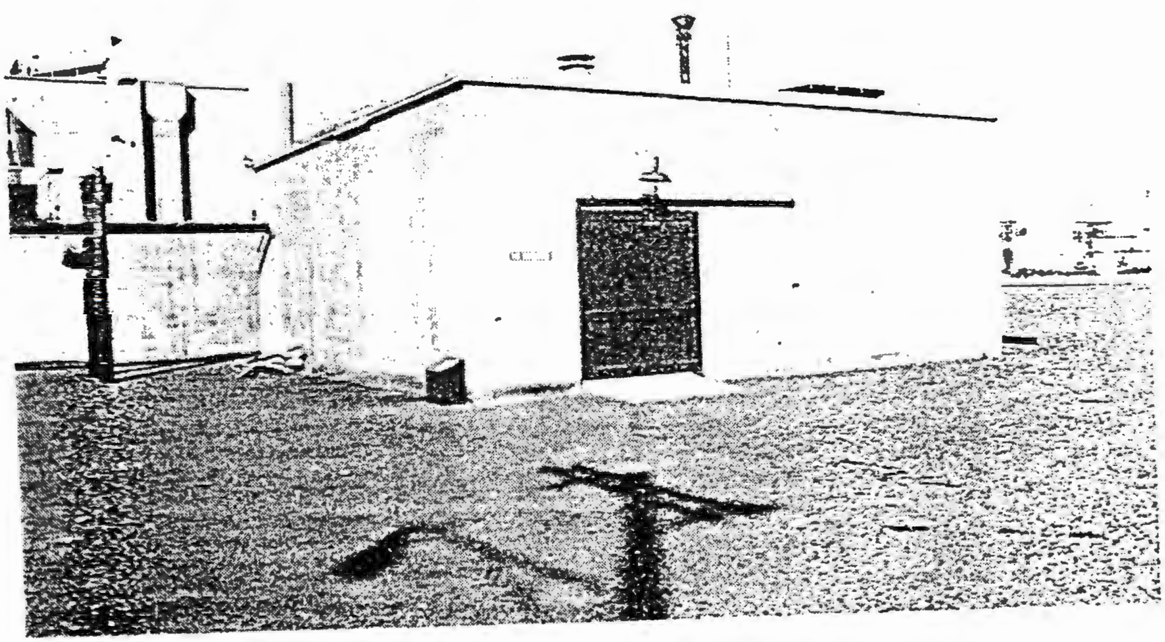

Figure 2-3. 1608-DR Effluent Water Pumping Station (Typical).

A. Operating History

The 1608 effluent water pumping stations were constructed and shut down with their associated reactors. (See "Operating History" in the "Reactor Buildings" Section.) No 1608 is currently in use for any purpose. There are no 1608 facilities for the 105-KE, -KW, -B and -C reactors.

B. Physical Description

The pumping stations are generally located within 100 feet of the reactor 105 fuel storage basins and adjacent to the effluent pipes. The majority of the structure is reinforced concrete. The top-floor operating level housed the pumping equipment. The pump sump inlet chamber is located beneath the basement. The maximum thickness of concrete in the structure is 2 feet, which occurs in three locations: the base of the sump walls, the floor over the sump inlet chamber, and the floor over the sump chamber.

The major equipment originally contained within the effluent water pumping stations are two 3,000 gpm vertical turbine type pumps, and their associated controls and electrical switchgear. One of these pumps was driven by a 75-hp electric motor and the other by a 75-hp steam turbine. The building also contained an 11,000 gpm pump powered by a 300-hp electric motor.

Table 2-4 summarizes the physical characteristics of the 1608 pump stations.

TABLE 2-4
1608 PUMPING STATION DATA

Facility	Above Grade, ft	Below Grade, ft	Length ft	Width ft	Construction walls, floor roof deck	Equipment Status
1608-F	12	32	36	34	Reinforced Concrete	Removed
1608-H	12*	32	36	34	Reinforced Concrete	In Place
1608-D	12**	32	34	36	Reinforced Concrete	In Place
1608-DR	12*	32	36	34	Reinforced Concrete	In Place

*The above grade walls are concrete block.
**This structure has two above-grade components: a small concrete stairwell structure set on a reinforced concrete roof deck at about four feet above grade.

C. Current Physical and Radiological Conditions

1. Physical Condition

The 1608-D, -DR, and -D facilities are in good structural condition; the 1608-F facility is in poor condition.

The current maintenance and surveillance program has been successful in controlling contamination in and around the effluent water pumping stations. There has been a gradual degradation of the roof structure, and cracking of the brick walls.

Ongoing maintenance and surveillance of 1608 pump stations includes security, radiological and industrial safety inspections, and routine (weekly, monthly and annual) maintenance inspections (References 9 and 10).

2. Radiological Condition

Residual radioactive material is located primarily in the sludge and residue in the basins and sumps. The inlet and outlet piping and pumps are contaminated. The radionuclides present are essentially the same as those listed for the fuel storage basins (see Table 1-4 in "Reactor 105" Section).

Radiation levels within the 1608 buildings are low, with general background levels ranging typically from less than 200 cpm up to 500 cpm. Radiation levels are highest in the 1608-H building, with direct GM readings of piping and pumps up to 4,000 cpm.

Low-level, smearable beta contamination along floors, walls and equipment ranges from less than 10 dpm/100 cm^2 up to a maximum of 3,000 dpm/100 cm^2.

D. Capital Equipment

There is no anticipated capital expenditure for in-situ decommissioning of the 1608 facilities. This assumes that the present on-site equipment will be operational and available and any schedule changes will not require obtaining additional equipment.

E. Research and Development (R&D)

No R&D is anticipated for the recommended preferred in-situ decommissioning alternative.

F. Waste Volume Projections

The recommended preferred in-situ mode of decommissioning will require a minimum movement of contaminated waste, producing essentially no low-level radioactive waste requiring disposal elsewhere. However, any waste that is determined to be inappropriate for use as fill material will be removed, packaged, and transported for burial in the Hanford 200 low-level burial ground.

G. Facility and Equipment Reuse

1. Facility Reuse

No cost-effective reuse of the 1608 facilities has been identified.

2. Equipment Reuse

No significant cost recovery opportunities through salvage and/or reuse have been specifically identified for any of the 1608 pumping stations.

No significant amount of stainless steel is available in the pumping station facilities.

H. Project Work Elements and Costs

Table 2-5 breaks down the estimated costs for the in-situ decommissioning of a typical pumping station. Costs include labor, special and normal tooling and equipment, waste disposal, and facility overheads required for project work.

TABLE 2-5

COST SCHEDULE FOR IN-SITU DECOMMISSIONING

A TYPICAL PUMPING STATION

(Costs in $000)[1]

PROJECT TASKS	PROJECT DURATION			
	2 mo	4 mo	6 mo	8 mo
Engineering/Planning/Supervision (includes characterization and closeout)	4			
Site Preparation	5			
Demolition		10		
Backfill and Restore Surface		12		
FY COST TOTAL	$31			

TOTAL ESTIMATED COST: $31

TOTAL ESTIMATED COST FOR ALL FOUR: $122

[1]Dollars are FY85

CATEGORY: Effluent System

FACILITY: 1608 Pumping Stations

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CATEGORY: Effluent System
FACILITY: 1608 Pumping Station

1904/1908 OUTFALL STRUCTURES

This Long-Range Plan covers the outfall structures listed below. The priorities listed apply only to the outfalls. Overall priorities and schedules are in Sections 4 and 7, Part 1.

DECOMMISSIONING PRIORITY*	SFMP	($ in K) TEC	EST PROJECT DURATION	DOE FUNDING DESIGNATION	DOE WBS NO.
1. 1904-F (116-F-8)	Yes	3.0	1 mo	AR	4.7.2
2. 1904-H (116-H-5)	Yes	3.0	1 mo	AR	4.7.5
3. 1904-D (116-D-5)	Yes	3.0	1 mo	AR	4.7.10
4. 1904-DR (116-DR-5)	Yes	23.2	2 mos	AR	4.7.10
5. 1904-C (116-B-8)	No	3.9	1 mo	GE	1.1.4.1.4
6. 1908-K (116-K-3)	No	24.5	2 mos	GE	N/A
7. 1904-B-2 (116-B-7)	No	3.9	1 mo	GE	1.1.4.1.4
8. 1904-B-1	No	23.2	2 mos	GE	1.1.4.1.4

*Designations in parentheses are sometimes used.

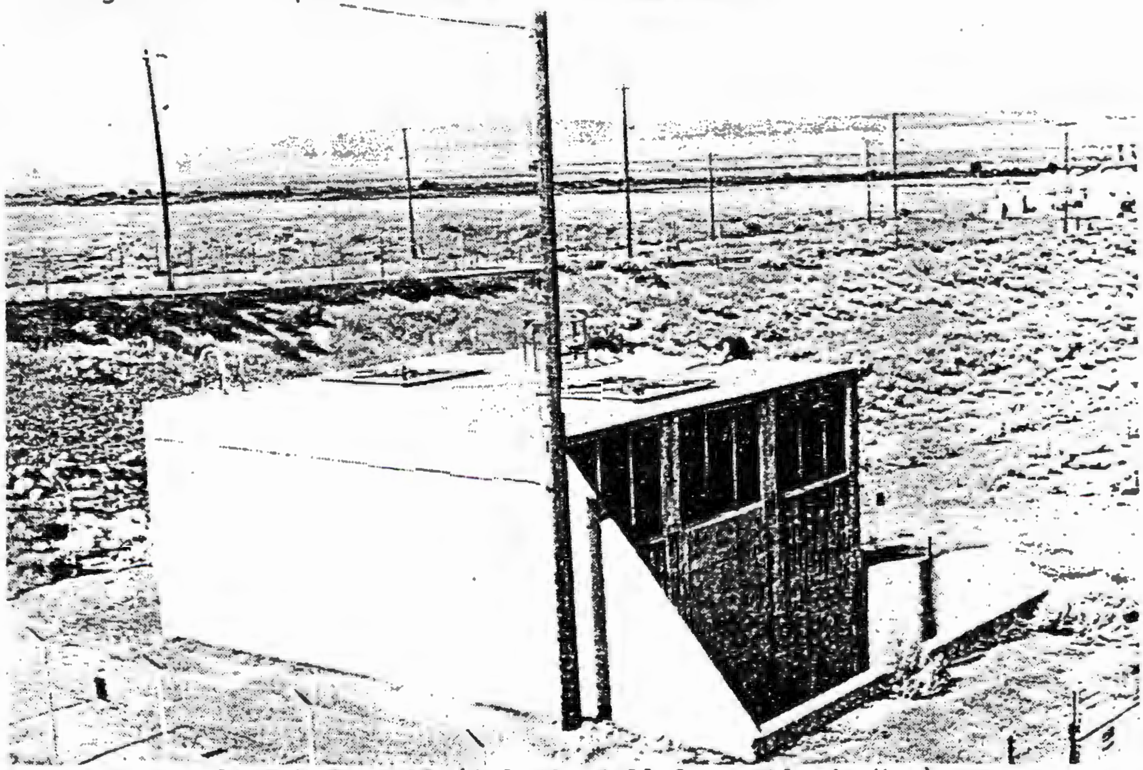

Figure 2-4. 1908-K Outfall (Only Outfall Currently in Use).

CATEGORY: Effluent System
FACILITY: 1904/1908 Outfall Structures

A. Operating History

The 1904 or 1908 outfall structures, located between the 107 retention basins and the Columbia River, directed the reactor discharge effluent water through either a discharge pipe to the middle of the river (primary line-up) or through a flume/spillway (secondary line-up). The 1904/1908 outfall structures were constructed and shut down with their associated reactors (see "Operating History" in the "Reactor Buildings" Section), except for 1908-K, which is being used because of use of the K-Area fuel storage basins for storage of N Reactor spent fuel.

B. Physical Description

The outfalls are reinforced, compartmentalized concrete water boxes. Spillways are constructed of reinforced concrete or a rip-rap filled flume.

The intact outfall structures are enclosed by chainlink security fencing with aviary exclusion mesh covers.

All outfalls, except 1908-K, are 27 ft long by 14 ft wide, with walls 1 ft above grade and 25 ft below grade. 1908-K is 30 ft long by 40 ft wide, with walls 20 ft above grade and 20 ft below grade.

C. Current Physical and Radiological Condition

1. Physical Condition

Outfalls B-1, -~~DR~~ D and -K are intact structurally. 1908-K is currently in use, because the 100-KW/KE fuel storage basins are being used for fuel storage. Outfalls 1904-B-2, -C, -D, F and H have been reduced to near-grade level and backfilled with clean earth to prevent the spread of residual radionuclides. These bermed outfalls (see Table below) can remain in place with minimal maintenance until their decommissioning. The three intact outfall structures require periodic maintenance to repair the surrounding fence, railings and aviary mesh cover. There has been a gradual degradation of above-grade, metal components and of the backfill covering below grade structures.

The current operational status of the 1904/1908 facilities is given below.

CATEGORY: Effluent System
FACILITY: 1904/1908 Outfall Structures

Facility	Operational Status
1904-B1	Operable, structure intact
1904-B2 (116-B-7)	Bermed Safe Storage
1904-C (116-B-8)	Bermed Safe Storage
1904-D (116-D-5)	Bermed Safe Storage
1904-DR (116-DR-5)	Structure Intact
1904-F (116-F-8)	Bermed Safe Storage
1904-H (116-H-5)	Bermed Safe Storage
1908-K (116-K-3)	In Operation

2. Radiological Condition

The current surveillance and maintenance program has been satisfactory in controlling contamination in and around the outfall structures. Radioactive material is primarily in the sludge and residue in the bed of the weir box and spillway channel. The radionuclides present are essentially the same as those listed for the 107 retention basins. (See Table C-1 in "107 Retention Basins" Section.)

The exposure rate from the sludge is generally less than 1 mR/hr and the contamination is less than 3,000 cpm.

D. Capital Equipment and Tools

There is no anticipated capital expenditure for in-situ decommissioning of the outfalls. This assumes that the present on-site equipment will be operational and available for this work and any schedule changes will not require obtaining additional equipment.

Required equipment and tools are those commonly used in construction and demolition and are available on the Hanford Site. The project plan and Detail Work Procedure (DWP) prepared for decommissioning the individual facilities will list the required major equipment and tools.

E. Research & Development (R&D)

No R&D is anticipated for in-situ decommissioning of the outfall structures.

F. Waste Volume Projections

In-situ decommissioning of the 1904 effluent outfall structures will require a minimum movement of contaminated waste, producing

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CATEGORY: Effluent System
FACILITY: 1904/1908 Outfall Structres

EFFLUENT PIPE SYSTEMS

The following effluent pipe systems are covered by this Plan. The priorities listed apply only to the effluent pipe systems. Overall priorities and schedules are in Section 4 and 7, Part 1.

DECOMMISSIONING PRIORITY		SFMP	($ in K) TEC	EST PROJECT DURATION	DOE FUNDING DESIGNATION	DOE WBS NO.
1.	100-F*	Yes	36.0	1 mo	AR	4.7.2
2.	100-H	Yes	73.1	2 mos	AR	4.7.5
3.	100-D/DR	Yes	143.8	3 mos	AR	4.7.10
4.	100-B/C	No	157.7	4 mos	GE	1.1.4.1.4
5.	105-KE/KW	No	258.8	4 mos	GE	TBD

*Above-ground pipe was removed in FY 1984.

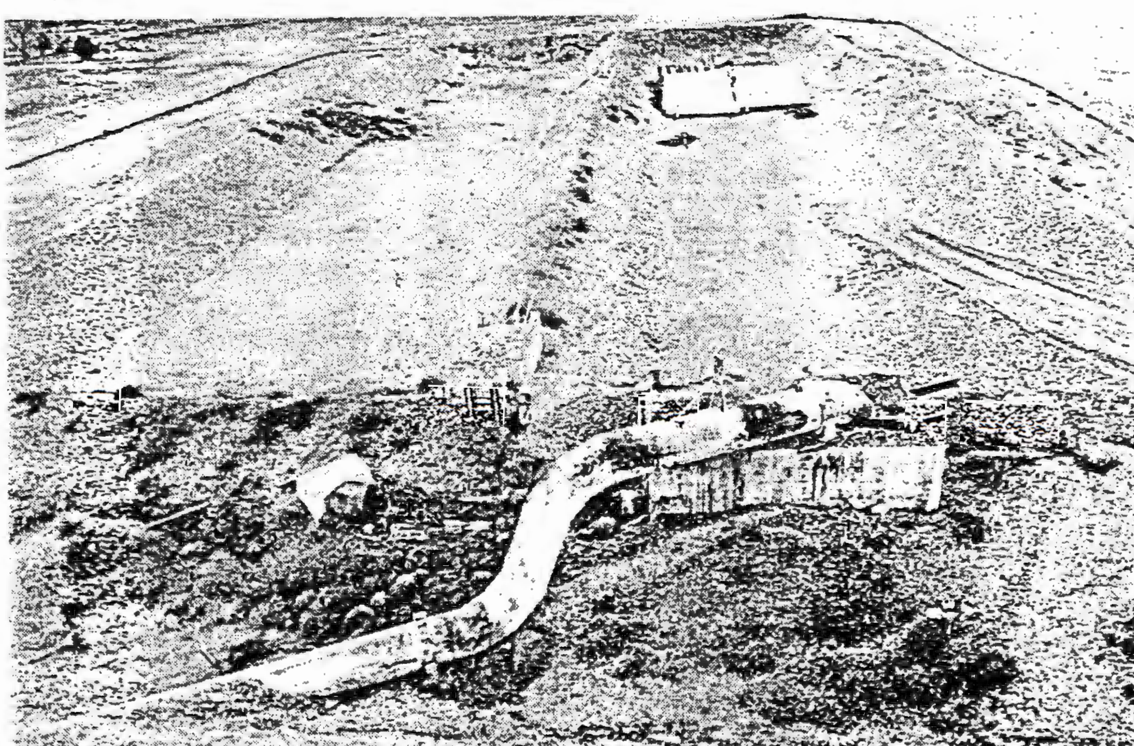

Figure 2-5. Effluent Water Pipe, 107-F Retention Basin.

A. Operating History

The five 100 Area effluent pipe systems were constructed and shut down with their associated reactors (see "Operating History" in the "Reactor Buildings" Section). Except for portions of the K Area effluent pipe system, which is in use to support fuel storage basin operations in that area, no effluent pipe system is currently in use. The entrances have been sealed to prevent the spread of residual radionuclides and personnel entry.

B. Physical Description

Each reactor coolant effluent line system runs from the reactor building to the retention basin, from the retention basin to the outfall structure, and from the outfall structure to the middle of the Columbia River. There are from 1.6 to 6.9 Km (1 to 4.3 miles) of spillways or subsurface effluent lines per reactor site. The lines, mostly underground, are of .3 to 2 m (1 to 7 feet) diameter and are constructed of carbon steel or reinforced concrete. The lines have inspection manholes, junction boxes, tie-lines between parallel legs, and valves for routing the effluent cooling water. Table 2-7 shows effluent pipe physical dimensions and volumes.

TABLE 2-7
EFFLUENT PIPE ESTIMATED DIMENSIONS AND WASTE VOLUMES

	Length, ft									
	Steel Pipe Diam, in.					Concrete Pipe Diam. in.			Total Volume	Total
Area	12-16	18-24	36-42	60-72	84	30-36	42-48	60-72	Displaced, cu ft*	Length, miles
B	180	1,445	750	14,710	--	2,085	3,240	50	20,000	4.25
D	140	1,470	3,720	9,900	--	300	400	2,340	14,000	3.46
F	--	--	2,605	--	--	470	2,300	350	2,900	1.08
H	350	1,090	--	4,400	--	--	--	--	4,400	1.11
K	6,010	410	6,725	5,380	2,600	--	--	835	16,400	4.16
									Total	14.06 miles

*Includes 30% for voids between pipes and miscellaneous material, if removed for disposal elsewhere.

C. Current Physical and Radiological Condition

1. Physical Condition

The effluent pipes are sealed to prevent the spread of residual radionuclides and personnel entry. The junction boxes are sealed or filled with gravel. The above-ground pipes at 100-F Area (only site designed with half the line exposed) are in the process of being removed and stored in the retention 107-F basin (see Figure 2-6). The remaining effluent pipes are presently buried, some to a depth of 4.6 m (15 feet). The current physical condition of the effluent pipe is generally good, with little evidence of extensive corrosion. The buried pipe can remain in place with minimal maintenance. The effluent pipe extending into the river may become a navigational hazard when anchorage deteriorates, allowing possible unpredictable movement to or near surface. The river pipe is presently being assessed for early dispositioning.

Ongoing maintenance and surveillance of the effluent lines and their leakage areas include security, radiological and industrial safety inspections, and routine (weekly, monthly and annual) maintenance inspections.

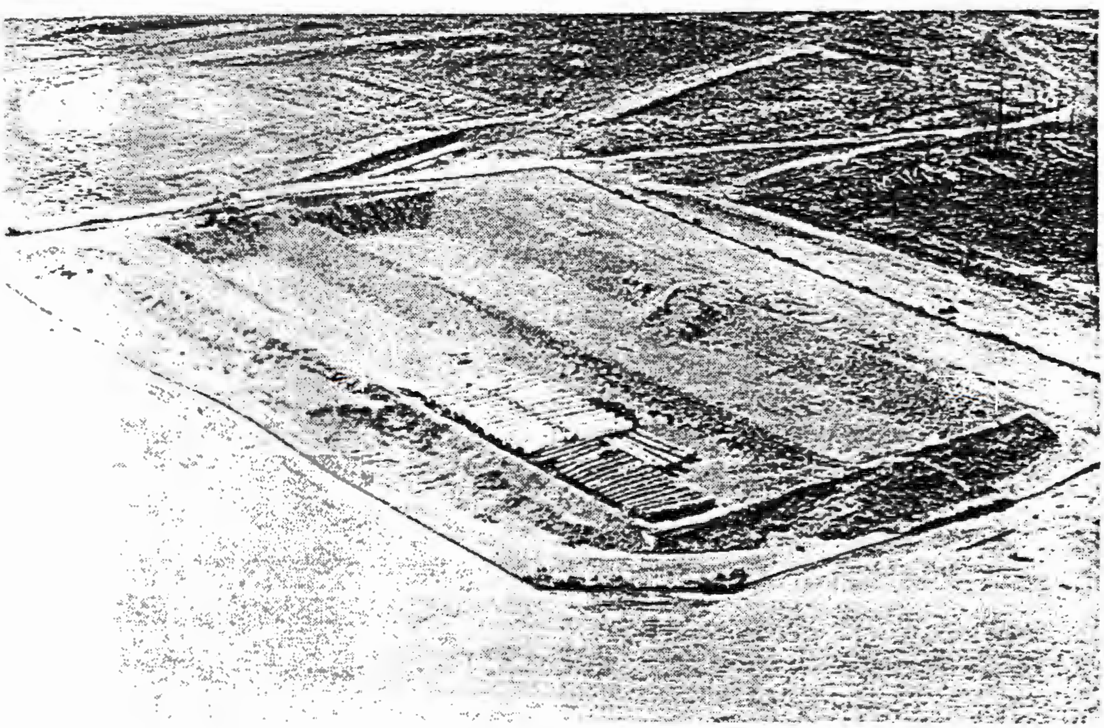

Figure 2-6. Sectioned Effluent Pipe Stored in 107-F Retention Basin.

2. Radiological Condition

Radiological surveys were taken in 1976 of the 100-B, 100-C and 100-F effluent lines. Direct readings of the bottom of the effluent lines averaged approximately 40,000 cpm with a GM probe. The majority of the contamination is in the form of rust scales and sludge. The radionuclides present are essentially the same as those listed for the 107 retention basins (see Table C-1 in "107 Retention Basins" Section).

Significant underground contamination due to coupling leaks at the joints has been characterized. Sample readings up to 2,500 cpm with a GM probe were taken at depths of 20 to 30 feet below grade in the immediate vicinity of a junction box. Some underground soil contamination, at depths of 20 to 30 feet below grade, extending 25 feet away from the lines, has been detected (approximately 1,000 cpm with a GM probe).

D. Capital Equipment and Tools

1. Capital Equipment

There is no anticipated capital expenditure for the in-situ decommissioning of the effluent pipe. This assumes that the present on-site equipment will be operational and available for this work and any schedule changes will not require obtaining additional equipment.

2. Tools

The demolition, backfill with rubble and slurry, and the earth barrier work will require only conventional equipment. This equipment is common to the majority of the in-situ work efforts and presently available on the Hanford Site. No additional capital equipment has been specifically identified for this work effort.

E. Research and Development (R&D)

The work will be engineered based on the use of available equipment. State-of-the-art tools may be required in order to meet specific job applications. However, special research and development is not anticipated for the in-situ decommissioning. Whenever explosive demolition is appropriate and cost effective for leveling above grade structures collapsing structures for void reduction, off-site professional services will be obtained. Also, the underwater river work requiring divers will be performed by off-site, professional divers.

F. Waste Volume Projections

The in-situ mode of decommissioning will require a minimum movement of contaminated waste. The effluent pipe system work will essentially produce no low-level radioactive waste requiring disposal elsewhere. However any waste that is determined to be inappropriate to be left in-situ will be removed, packaged, and transported for burial in the 200 Area solid waste burial ground.

G. Facility and Equipment Reuse

1. Facility Reuse

Some of the effluent pipe from the 100-F Area has been removed, sectioned, and is currently stored in the 107-F retention basin for later use as shipping and/or burial containers.

2. Equipment Reuse

No significant cost recovery opportunities through salvage and/or reuse have been specifically identified for any of the effluent pipe systems.

No significant amount of stainless steel is available in the effluent pipe systems.

H. Project Work Elements and Costs

Table 2-8 breaks down the estimated costs for the in-situ decommissioning of the effluent pipe. Costs include labor, special and normal tooling and equipment, waste disposal and facility overheads required for the project work.

116 LIQUID WASTE DISPOSAL FACILITIES

This Long-Range Plan covers the liquid waste disposal facilities identified below. The priorities listed apply to 116 facilities only. Overall priorities and schedules are in Sections 4 and 7, Part 1.

PRIORITY	SFMP	($ in k) TEC	EST PROJECT DURATION	DOE FUNDING DESIGNATION	DOE WBS NO.
1. 100-F (9) 116-F-1, -2, -3, -4, -5, -6, -7, -9, -10	Yes	$260	1.5 mo	AR	4.7.2
2. 100-H (4) 116-H-1, -2, -3, -4	Yes	$ 60	.3 mo	AR	4.7.5
3. 100-D/DR (9) 116-D-1, -1B, -2, -3, -4 116-DR-1, -2, -3, -4	Yes	$100	.6 mo	AR	4.7.10
4. 105-B/C (9) 116-B-1, -2, -3, -4, -5, (-6-1, -6-2)* 116-C-1, (-2, 2-1)* -2-2	No	$180	.9 mo	GE	1.1.4.1.4
5. 100-KE/KW (5) 116-K-1, -2** 116-KE-1, -2 116-KW-1	No	$800	3.1 mo	GE	TBD

*Extension of the same facility.
**Includes adjacent leakage area.

CATEGORY: Ground Disposal Facilities
FACILITY: 116 Liquid Waste Disposal Facilities

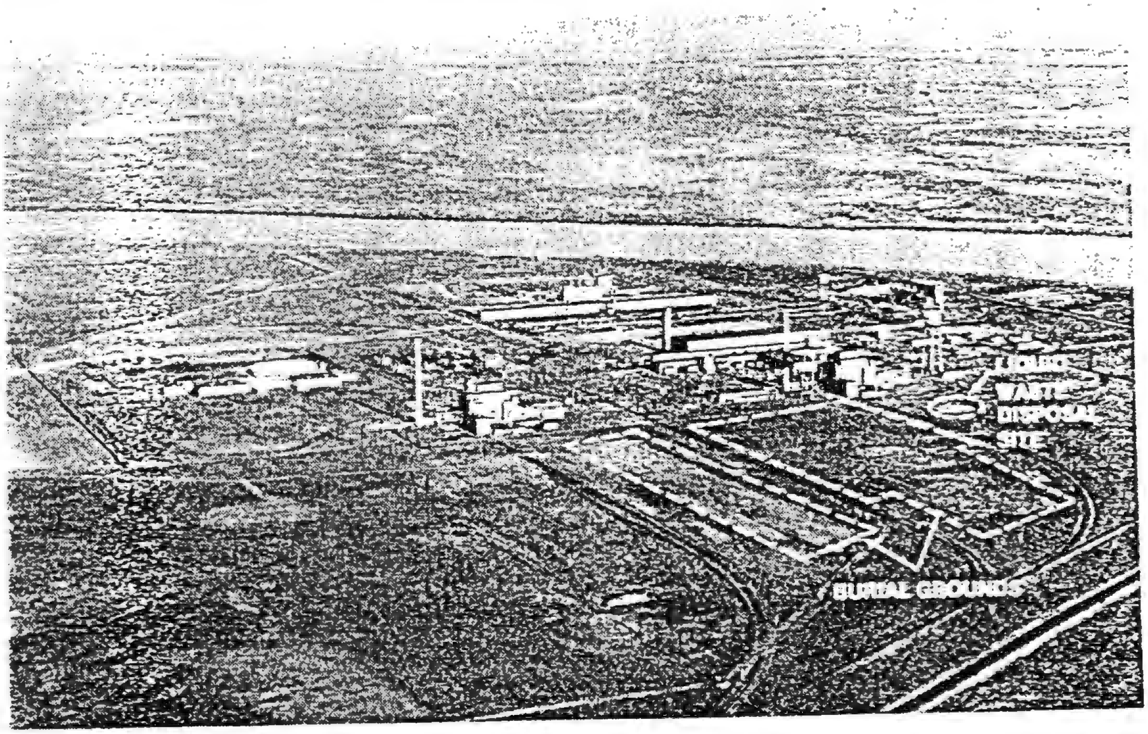

Figure 3-1. D Area Liquid Waste Disposal Facility

A. Operating History

The liquid waste burial sites were used primarily for the timely disposal of low-level and intermediate-level liquid wastes. The five 100 Area liquid waste disposal facilities were constructed and shut down with their associated reactors. (Appendix B lists the liquid waste site startup and shutdown dates.) No liquid waste disposal facility is currently in use, and all have been backfilled with clean earth to shield radioactive particles and to prevent their escape to the atmosphere.

CATEGORY: Ground Disposal Facilities
FACILITY: 116 Liquid Waste Disposal Facilities

B. Physical Description

The liquid waste disposal facilities include cribs, trenches, and canals, usually located within a few hundred feet of their associated reactors. A crib is a buried or covered liquid disposal facility, usually rock-filled and equipped with a liquid dispersion system. Various crib designs were used. A number of the earlier timbered cribs were boxes open only at the bottom and buried deep enough (14 to 30 ft) to preclude excessive radiation levels at the surface. Cribs of this type range from 100 to 200 ft^2 in area. The liquid waste was discharged into the ground inside the box, which was also equipped with a vent line. Some cribs were a dual structure, with a second cavity catching any overflow from the first via an overflow pipe. Tile fields were also used in conjunction with boxlike cribs to disperse the liquid wastes over a wider area. The water table lies generally from 55 to over 80 feet below the ground surface at the 100 B-C and D-DR Areas. At the 100-H burial ground sites the water table is about 42-44 feet below the ground surface. At F Area the water table is generally about 33 feet below the ground surface, except for burial grounds 118-F-1, and 118-F-6, where the water table is within a few feet of the burial trenches. Burial trench depths are approximately 20 feet deep.

Because of the arid climate at Hanford, water precipitated as rain or snow tends to evaporate rather than percolate to the water table. The current lysimeter data show that Hanford sediments, below a depth of about 27 feet, are extremely dry. In this desicated zone, the ability of sediments to transmit water is significantly reduced.

The 100 Area cribs and trenches fall into the following major categories:

Liquid Waste Facility	Associated Facility
Dummy/Perf Cribs	105 Building
Pluto Cribs	105 Building
Cribs	108, 115, 177 Building
Diversion Trenches	107 Retention Basin
Storage Basin Trenches	105 Building
Liquid Waste Trenches	1608 Pumping Station

The Lewis Canal, 100-F ball washer crib, and the 1706-KER crib are also within the scope of this Plan. Table 3-1 shows the liquid waste disposal site physical areas, including adjacent leakage areas, in acres. Figure 3-2 shows a typical crib. The following paragraphs describe the facilities identified above.

TABLE 3-1
ACREAGE OF LIQUID WASTE DISPOSAL FACILITIES

100 Area	Facility Designations	Facility Acres	Adjacent Leakage Acres
100-F	116-F-1, -2, -3, -4, -5, -6, -7, -9, -10	6.2	1.9
100-H	116-H-1, -2, -3, -4	1.4	1.8
100-D/DR	116-D-1, -1B, -2, -3, -4 116-DR-1, -2, -3, -4	2.6	4.4
100-B/C	116-B-1, -2, -3, -4, -5, (-6-1, -6-2) 116-C-1, (-2, -2-1), -2-2	3.3	6.2
100-KE/KW	116-K-1, -2 116-KE-1, -2 116-KW-1	23.5*	6.0

*123 acres of adjacent leakage areas in KE/KW sites have very low contamination levels and will require minimum decommissioning.

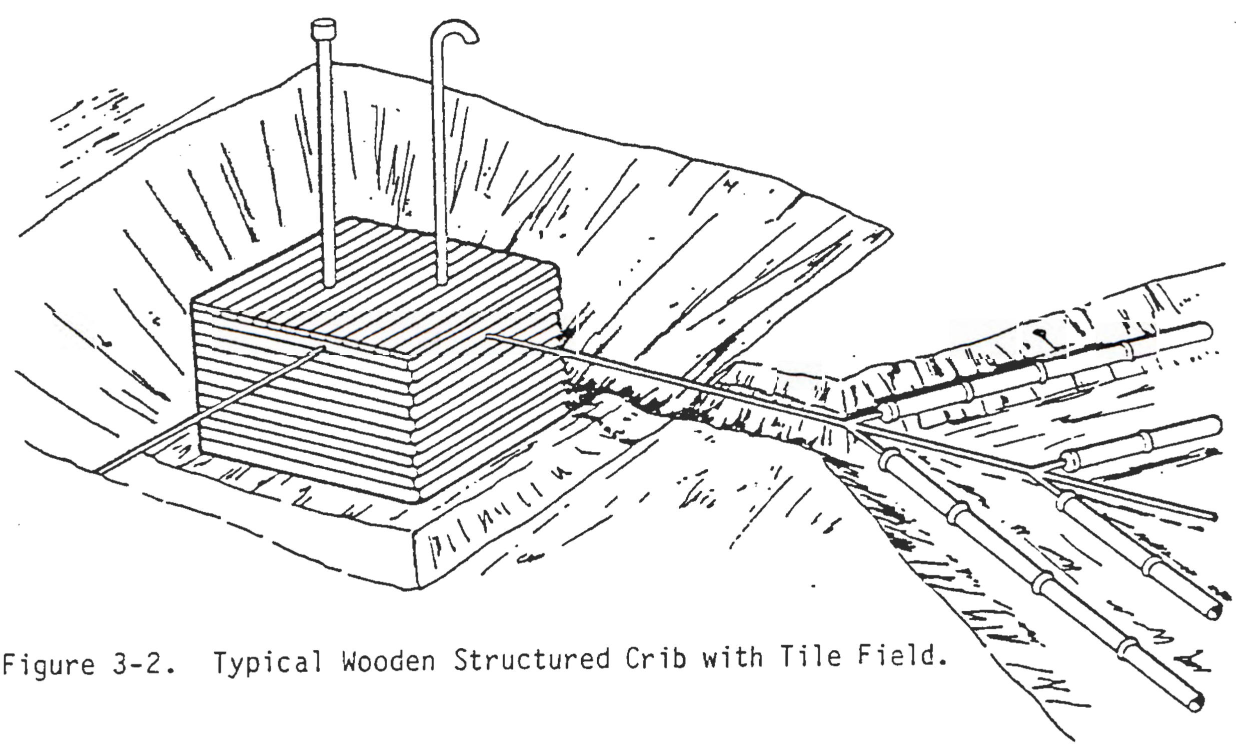

Figure 3-2. Typical Wooden Structured Crib with Tile Field.

CATEGORY: Ground Disposal Facilities
FACILITY: 116 Liquid Waste Disposal Facilities

1. 105 Building Dummy/Perf Decontamination Crib

   The 105-B, -F, and -H dummy decontamination cribs were used for the disposal of liquid wastes from the decontamination of process dummies.

2. 105 Building Pluto Cribs

   Pluto cribs were located at the 100-B, -C, -D, -DR, -F and -H Areas. They were typically 10-ft by 10-ft wooden structures, except for the 116-C-2 crib, which had bottom dimensions of 140 ft by 100 ft. In addition, the 116-C-2 crib was equipped with a sand filter. The sand filter was an open-bottomed concrete box partially filled with sand and gravel, through which effluent passed after leaving the crib.

3. 108 Building Cribs

   The cribs used with the 108 buildings were underground drains covered with about 8 feet of soil which received contaminated liquid effluents from the 108 buildings. The 116-D-3 and 116-D-4 cribs both received liquid wastes from a contaminated maintenance shop in the 108-D building. The 116-D-3 crib also received effluents from a cask decontamination pad in the 108-D building.

   The 108-B crib was dug in 1950 for the disposal of liquid tritium wastes. Only wastes with tritium concentrations of 1 Ci/cc were reportedly discharged to this crib.

4. 115 Building KE and KW Cribs

   The cribs used with the 115 KE/KW buildings were underground drains that received condensate and other liquid wastes from the reactor gas purification systems.

5. 117 Building Cribs

   The cribs used with the 117 buildings were constructed at 100-D, -DR, -F, and -H in 1960 to receive drainage from the confinement system 117 building seal pits. Radioactive effluents drained to these cribs had short half-lives; these cribs were released from radiological controls prior to 1967.

6. 107 Diversion Trenches

The 107 liquid waste trenches, usually located within a few hundred feet of a retention basin, received effluents containing debris from fuel cladding failures. During deactivation, water was pumped out of the 107 retention basin to its adjacent diversion trench. Basins DR and H drained to their diversion trenches by gravity.

Because of the 116-K-2 trench's (K trench) large size, the large volumes of contaminated water it received, and the fairly high inventory of radioactivity remaining in the facility, a discussion of the K trench (or mile-long trench as it was sometimes called) is included below.

The K trench extends eastward, parallel to the river for about 4,100 feet from the northeast corner of K Area. It served both K reactors. During trench operation, water was maintained at about 14 feet deep. The side slope of the trench was gradual, resulting in about a 50-foot width at the upper water line edge.

Normal flow to the K trench included:

- All contaminated floor drains in 105 buildings (low volume);
- About 500 gpm per K Reactor fuel storage basin overflow;
- Until KE and KW reactors were shut down, an undetermined amount of 107 effluent basin leakage through 42-inch butterfly valves in tank bottoms. Leakage was estimated between 10,000 - 20,000 gpm.

Other periodic sources of flow to the K trench included:

- Low-volume, neutralized dummy decontamination waste;
- Process cooling water during charge-discharge via fuel storage basin and cross-under line;
- Approximately 700 gpm fuel storage basin flow during charge-discharge to aid in keeping basin water clear for visibility purposes;
- Occasional (about one per year per reactor) rear face decontamination wastes automatically diluted with fuel storage basin flow;

- Occasional "special" disposal such as waste from a single cross header through-reactor decontamination experiment;
- Occasional tank of process cooling water collected after a fuel cladding failure.

7. 105 Building Storage Basin Trenches

These trenches were typically 100 feet long x 10 feet wide, and received water and sludge from their associated 105 fuel storage basin.

8. 1608 Building Liquid Waste Trenches

The 1608-F and H trenches received effluent water during the Ball 3X Project. Water from the 105 building was pumped via the 1608 pumphouse to the trench located outside the exclusion area fence.

9. Lewis Canal

Miscellaneous liquid wastes from the 105-F and 190-F buildings, as well as decontamination wastes from the 189-F building, were routinely released to this ditch. Occasionally, contaminated coolant from the reactor front and rear faces was also drained to the Lewis Canal.

10. 100-F Ball Washer Crib

This crib received wastes from the decontamination of boron-steel balls.

11. 1706-KER Building Crib

The crib used with the 1706-KER building received radioactive liquid wastes from cleanup columns in the 1706-KER loop.

C. Current Physical and Radiological Condition

1. Physical Condition

All of the 116 liquid waste disposal facilities have been backfilled with earth to shield radionuclides and to prevent release to the atmosphere. Soil sterilant is periodically added to prevent plant growth. Surveillance is maintained to detect migration of radionuclides to the surface. The wooden timbers of many cribs are rotting, creating the possibility of subsidence.

2. Radiological Condition

The radiological conditions of the liquid waste ground disposal facilities are based upon conditions as of April 1983.

The liquid waste disposal facilities contain a total of about 3,000 curies of radionuclides. About 2,100 curies of this activity is contained within the mile-long 116K-2 Trench. Other liquid waste disposal crib and trench inventories range from less than 1 mCi up to 300 curies.

Low-level Pu-238 and Pu-239/240 contamination is also present in the liquid waste disposal facilities. Plutonium concentrations up to 130 pCi/g remain in the K-Trench, and average 8.5 pCi/g of soil. The K-Trench contains about 5 curies of plutonium, the highest plutonium inventory of the liquid waste disposal facilities.

Tests show that most cations (most of the long-lived radionuclides) are readily held in the ground within a few yards of the cribs by ion exchange processes with soil particles, precipitation reactions and mineral reactions. Ion exchange capacity in sediments varies widely with the type of ion being sorbed. Certain ions such as tritium, iodine, and nitrate apparently are not sorbed but move with the solution (water). Some chemical types of ruthenium also move with water. Strontium, cesium and rare earths are retarded effectively by the sediments. Most of the plutonium is sorbed or oxidized and precipitated near the point of entry into the ground, and is thus relatively immobile.

D. Capital Equipment

There is no anticipated capital expenditure for in-situ decommissioning of the ground facilities. This assumes that the present, on-site equipment will be operational and available for this work and any schedule changes will not require obtaining additional equipment.

It is anticipated that the major work effort establishing the long-term barriers will be performed by a subcontractor familiar with and equipped for this type of work.

E. Research and Development (R&D)

Some additional site radiological characterization will be performed in order to provide more detailed inventories and radionuclide location information, which will be used in developing cost-effective barriers.

F. Waste Volume Projections

Ideally, in-situ decommissioning of the 116 liquid waste disposal facilities will require no movement of contaminated waste. However, any waste that is determined to be inappropriate to be left in place will be disposed of in the 200 Area.

G. Facility and Equipment Reuse

1. Facility Reuse

No functional cost-effective reuse of the 116 liquid waste disposal facilities has been identified.

2. Equipment Reuse

No significant cost recovery opportunities through salvage and reuse have been identified for any of the liquid waste disposal facilities. No significant amount of stainless steel is salvageable in the liquid waste disposal facilities.

H. Project Work Elements and Costs

Table 3-2 breaks down the estimated costs for the in-situ decommissioning of a typical liquid waste burial site. Costs include labor, special and normal tooling and equipment, waste disposal and facility overheads.

TABLE 3-2

COST SCHEDULE FOR IN-SITU DECOMMISSIONING OF GROUND DISPOSAL FACILITIES IN A TYPICAL 100 AREA[a]

(Costs in $000)[b]

PROJECT TASKS	PROJECT DURATION (1 mo | 2 mo | 3 mo)
Engineering/Planning/Supervision (includes characterization and closeout)	150
Site Preparation	74
Import Topsoil/Place	693
Amend/Mulch/Seed	54
Restore Radiological Monuments	31
FY Cost Total	$ 1,000

TOTAL ESTIMATED COST: $1,000
TOTAL ESTIMATED COST FOR ALL FIVE: $5,000

[a]Typically, liquid and solid waste facilities will be decommissioned as a single project for each 100 Area. Costs are for dense grass decommissioning approach.

[b]Dollars are FY85.

CATEGORY: Ground Disposal Facilities
FACILITY: 116 Liquid Waste Disposal Facilities

118 SOLID WASTE GROUND DISPOSAL FACILITIES

This Long-Range Plan covers the solid waste disposal facilities identified below. The priorities listed apply only to the 118 burial facilities. Overall priorities and schedules are in Sections 4 and 7, Part 1.

PRIORITY	SFMP	($ in K) TEC	EST PROJECT DURATION	DOE FUNDING DESIGNATION	DOE WBS NO.
1. 100-F (6) 118-F-1, -2, -3, -4, -5, -6	Yes	$550	3.0 mo	AR	4.7.2
2. 100-H (5) 118-H-1, -2, -3, -4, -5	Yes	$325	1.7 mo	AR	4.7.5
3. 100-D/DR (6) 118-D-1, -2, -3, -4, -5 118-DR-1	Yes	$860	4.9 mo	AR	4.7.10
4. 105-B/C (7) 118-B-1, -2, -3, -4, -5, -6 118-C-1	No	$770	3.7 mo	GE	1.1.4.1.4
5. 100-KE/KW (1) 118-K	No	$1,000	4.3 mo	GE	TBD

CATEGORY: Ground Disposal Facilities
FACILITY: 118 Solid Waste Disposal Facilities

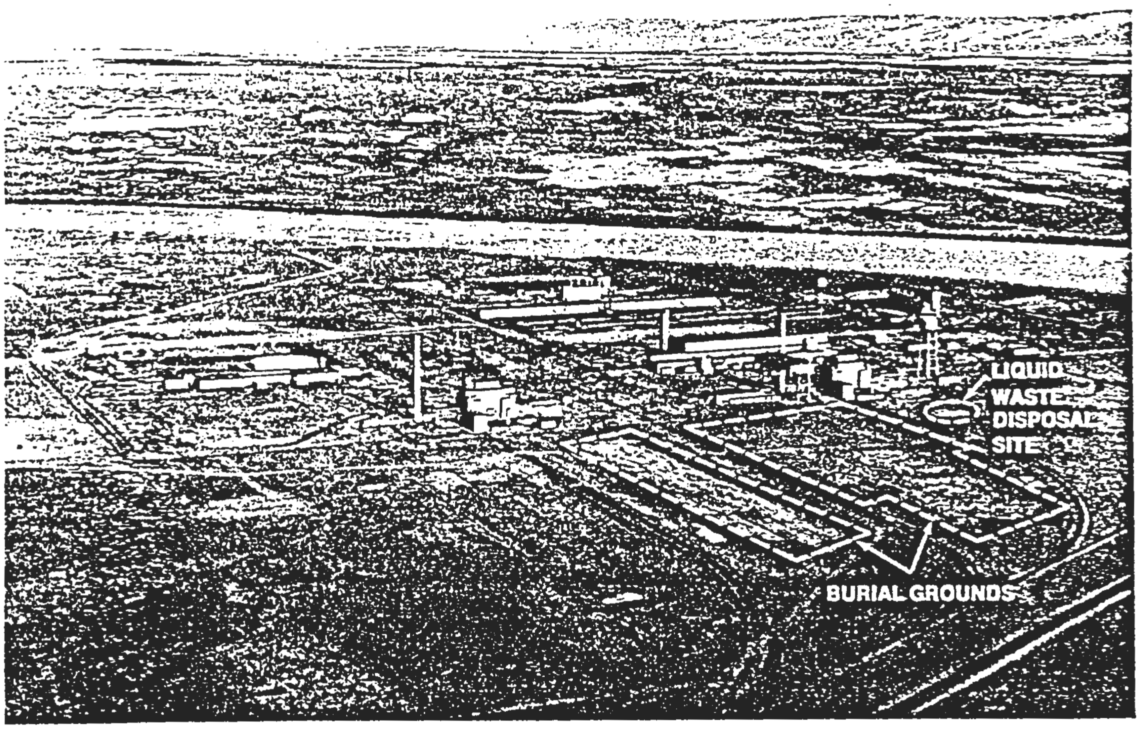

Figure 3-3. D Area Solid Waste Disposal Facilities.

A. Operating History

The five 100 Area solid waste disposal facilities were normally shut down with their associated reactors (see Appendix B for individual facility operating periods); however, some burial grounds continued to receive waste from operating plants after the local reactor shutdown. No solid waste burial ground is currently in use in any 100 Area, and all solid waste disposal sites have been backfilled with earth to shield retained radioactive materials and to prevent their escape to the atmosphere.

B. Physical Description

Burial grounds are excavated burial trenches and pits that contain solid wastes, with a backfill cover of clean earth.

A total of 25 radioactive solid waste burial grounds were used in the shutdown 100 Area facilities, including two in the 100-F Area for disposal of radioactive wastes generated by biology laboratories.

Ten of the twenty-five burial grounds near the reactor buildings were small, ranging in size up to a few feet wide and several feet long. The larger burial grounds, located either within or just outside the fenced reactor restricted area, generally consisted of pits or parallel trenches, 20 ft deep, 150 - 300 ft long, with a bottom width of 5 - 8 ft and a top width of 20 ft. The largest burial ground is the 118-K facility in the 100-K Area, which is approximately 1,200 ft x 600 ft. Equipment items having high dose rates (e.g., thermocouple stringers, horizontal control rod tips, etc.) are buried in narrow but deep trenches and pits.

Figure 3-4 shows a typical burial trench. Table 3-3 shows the approximate area of the solid waste burial grounds.

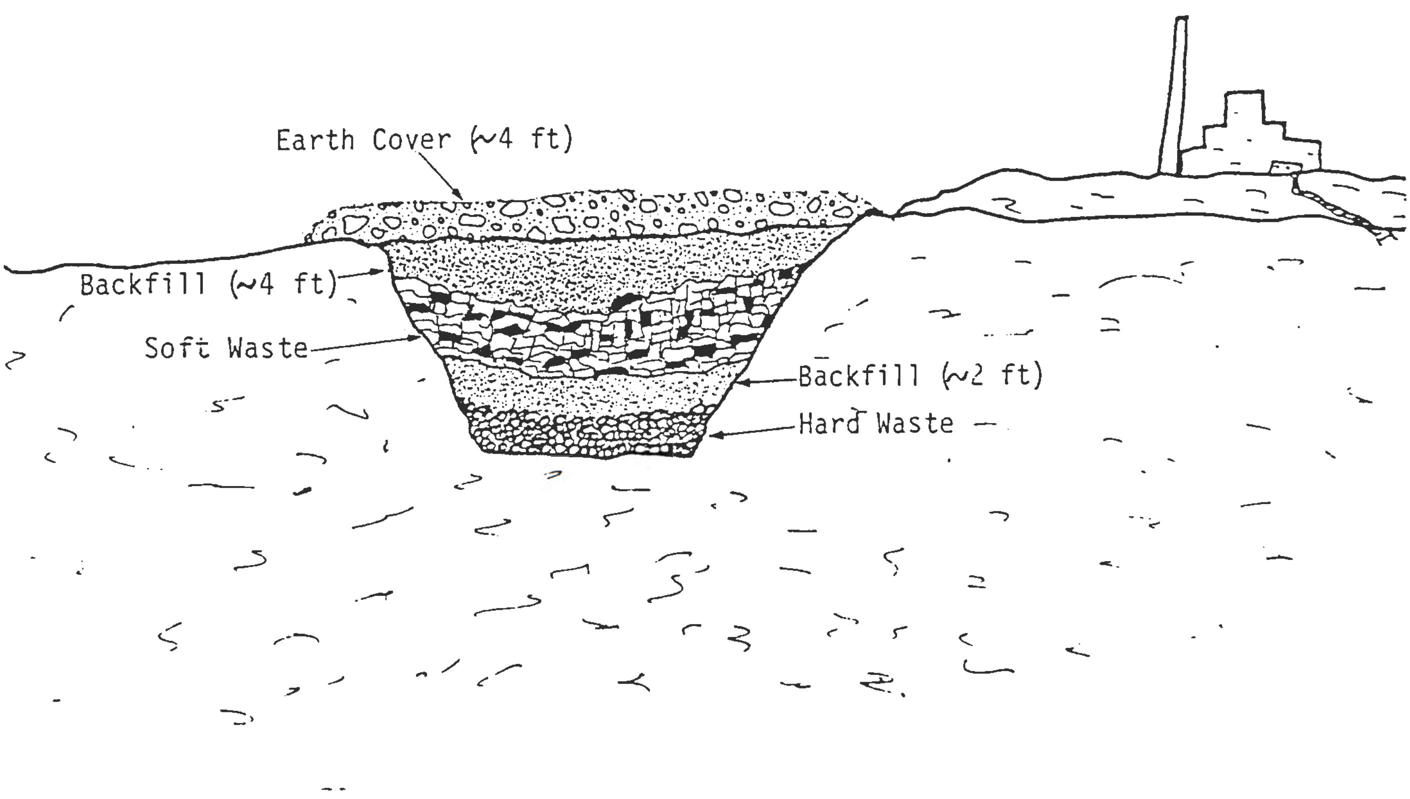

Figure 3-4. Cross Section of Typical Solid Waste Burial Trench.

CATEGORY: Ground Disposal Facilities
FACILITY: 118 Solid Waste Disposal Facilities

TABLE 3-3
ACREAGE OF SOLID WASTE DISPOSAL FACILITIES

100 Area	Facility Designations	Approximate Acres
100-F	118-F-1, -2, -3, -4, -5, -6	13.4
100-H	118-H-1, -2, -3, -4	7.3
100-D/DR	118-D-1, -2, -3, -4, -5 118-DR-1	21.0
100-B/C	118-B-1, -2, -3, -4, -5, -6 118-C-1	14.5
100-KE/KW	118-K	16.5

C. Current Physical and Radiological Condition

1. Physical Condition

All of the solid waste disposal sites have been backfilled with earth to shield radionuclides and to prevent release to the atmosphere. Soil sterilant is periodically added to each solid waste burial site to prevent plant growth. Surveillance is maintained to detect migration of radionuclides to the surface.

2. Radiological Condition

Most of the radioactivity in these burial sites is contained in metal components such as irradiated process tubes and fuel charge spacers. These "hard" wastes comprise less than 25% of the volume of buried wastes but contain more than 99% of the total radionuclide inventory. The hard wastes were usually placed in the bottom of the trenches, about 20 feet below the surface. "Soft" waste, consisting of contaminated paper, plastic, and clothing packed in cardboard cartons, makes up more than 75% of the volume in the trenches, but contains less than 1% of the total radionuclide inventory.

Table 3-4 provides an inventory of radioactive material in a typical solid waste burial trench.

TABLE 3-4
INVENTORY OF RADIOACTIVE MATERIAL IN A TYPICAL SOLID WASTE BURIAL TRENCH

Note: Inventories are best estimates based on available data and are typical of material discarded from one of eight production reactors.*
Radiological data calculated for March 1, 1985.

Type of Material	Approximate Quantity	Radionuclides Present	Approximate Inventory (Ci)
Aluminum process tubes, plus the tube film	33 tons	^{60}Co	750**
		^{152}Eu	4.8
		^{154}Eu	9.6
		^{90}Sr	0.4
		^{137}Cs	0.4
Aluminum spacers	120 tons	^{60}Co	78**
		^{152}Eu	13.0
		^{154}Eu	26.0
		^{90}Sr	1.8
		^{137}Cs	1.8
Control rods and miscellaneous steel components	1 ton	^{60}Co	10
Soft waste (plastic, paper, clothing)	100,000 boxes, 25 lb/box, 4.5 ft^3/box	^{60}Co	20

Typical Trench Approximate Total Ci Inventory: 920

*Pathway Analysis performed on the burial trench included the ^{63}Ni estimated inventory. The 100-B burial trench ^{63}Ni concentration is 16 nCi/g, calculated for March 1, 1985; approximately twice that of ^{60}Co, also calculated for March 1, 1985.

**Includes ^{60}Co induced into the metal and process tube film.

CATEGORY: Ground Disposal Facilities
FACILITY: 118 Solid Waste Disposal Facilities

D. Capital Equipment

There is no anticipated capital expenditure for in-situ decommissioning of the solid waste ground facilities. This assumes that the present on-site equipment will be operational and available for this work and any schedule changes will not require obtaining additional equipment.

It is anticipated that the major work effort establishing the long-term barriers will be performed by a subcontractor familiar with and equipped for this type of work.

E. Research and Development (R&D)

Some additional site radiological characterization will be performed in order to provide more detailed inventories and radionuclide location information, which will be used in developing cost-effective barriers.

F. Waste Volume Projections

Ideally, in-situ decommissioning of the solid waste disposal facilities will require no movement of contaminated waste. However, any waste that is determined to be inappropriate to be left in place will be disposed of in the 200 Area.

G. Facility and Equipment Reuse

1. Facility Reuse

No functional cost-effective reuse of the solid waste burial facilities has been identified.

2. Equipment Reuse

No significant cost recovery opportunities through salvage and resue have been identified for any of the solid waste burial facilities. No significant amount of stainless steel has been located for salvage in the solid waste burial grounds.

H. Project Work Elements and Costs

Table 3-5 breaks down the estimated costs for the in-situ decommissioning for a typical solid waste disposal facility. Costs include labor, special and normal tooling and equipment, waste disposal and facility overheads required for the project work.

TABLE 3-5

COST SCHEDULE FOR IN-SITU DECOMMISSIONING OF GROUND DISPOSAL FACILITIES IN A TYPICAL 100 AREA[a]

(Costs in $000)[b]

PROJECT TASKS	PERIOD OF WORK 1 mo | 2 mo | 3 mo
Engineering/Planning/Supervision (includes characterization and closeout)	150
Site Preparation	74
Import Topsoil/Place	693
Amend/Mulch/Seed	54
Restore Radiological Monuments	31
FY Cost Total	$ 1,000

TOTAL ESTIMATED COST: $1,000
TOTAL ESTIMATED COST FOR ALL FIVE: $5,000

[a]Typically, liquid and solid waste facilities will be decommissioned as a single project for each 100 Area. Costs are for dense grass decommissioning approach.

[b]Dollars are FY 85.

CATEGORY: Ground Disposal Facilities
FACILITY: 118 Solid Waste Disposal Facilities

103 FUEL ELEMENT STORAGE BUILDINGS

This Plan covers the 103 buildings identified below. The priorities shown apply only to these facilities. Overall priorities and schedules are in Sections 4 and 7, Part 1.

DECOMMISSIONING PRIORITY	SFMP	($ in K) TEC	EST PROJECT DURATION	DOE FUNDING DESIGNATION	DOE WBS NO.
1. 103-D	Yes	20.3	2 mo	AR	4.7.10
2. 103-B	No	20.3	2 mo	GE	1.1.4.1.4

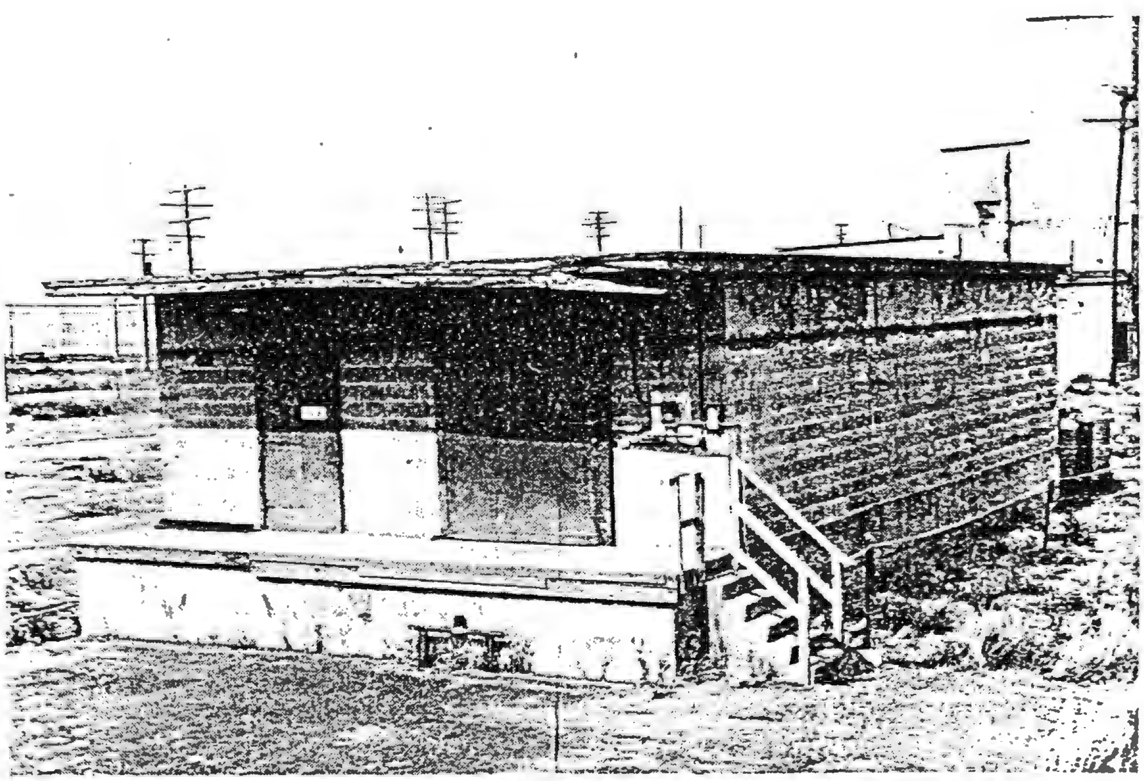

Figure 4-1. 103-D Fuel Element Storage Building.

CATEGORY: Ancillary Facilities
FACILITY: 103 Fuel Element Storage Building

A. Operating History

The buildings were used to store fuel elements before use in a reactor. The two remaining fuel element storage buildings were shut down with their associated reactors (see "Operating History" in the "Reactor Buildings" Section); however, the buildings remained open for fuel element storage for other operating plants. No fuel elements are currently being stored in the facilities, which are still used for storage of miscellaneous materials.

B. Physical Description

The 103 facility walls are constructed of concrete blocks up to the doortop level, with concrete construction above. The roof is constructed of reinforced concrete with a composition surface. The building is 14 feet above grade, 53 feet in length and 26 feet in width.

The 103 facility includes a large material handling dock, doors, and open interior with racks which accommodated forklift transport of palletized unirradiated fuel elements. The unirradiated fuel elements were stored on site in the facilities until needed for reactor refueling.

C. Current Physical and Radiological Condition

1. Physical Condition

Both the 103 fuel element storage buildings are in good structural condition - no roof leaks, doors functional, stairs and railings sound - and have been made available for material storage use.

2. Radiological Condition

The contaminated surfaces that are readily accessible to current storage activities and surveillance personnel have been cleaned to a nonsmearable status and zone readings are less than 1 mrem/hr. The buildings are essentially clean with only minor areas of contamination or potential contamination.

D. Capital Equipment

There is no anticipated capital expenditure for in-situ decommissioning of the fuel element storage buildings. This assumes that the present on-site equipment will be operational and available for this work and any schedule changes will not require obtaining additional equipment.

E. Research and Development (R&D)

No R&D is anticipated for in-situ decommissioning of the fuel element storage buildings.

F. Waste Volume Projections

In-situ decommissioning of the 103 fuel element storage buildings will require a minimum movement of contaminated waste. The storage facility work will essentially produce no low-level radioactive waste requiring disposal elsewhere. However, any waste that is determined to be inappropriate for use as fill material will be disposed of in the 200 Area.

G. Facility and Equipment Reuse

1. Facility Reuse

No functional cost-effective reuse of the 103 fuel element storage building has been identified.

2. Equipment Reuse

No significant cost recovery opportunities through salvage and reuse have been identified for any of the storage facilities. No significant amount of stainless steel is salvageable in the fuel element storage buildings.

H. Project Work Elements and Costs

Table 4-1 breaks down the estimated costs for the in-situ decommissioning of a 103 building. Costs include labor, special and normal tooling and equipment, waste disposal and facility overheads required for the project work.

TABLE 4-1

COST SCHEDULE FOR IN-SITU DECOMMISSIONING

OF ONE TYPICAL 103 FACILITY

(Costs in $000)[1]

PROJECT TASKS	PROJECT DURATION
	2 wk / 4 wk / 6 wk / 8 wk
Engineering/Planning/Supervision (includes characterization and closeout)	3
Site Preparation	7
Demolition	8
Site Restoration	2
FY COST TOTAL	$20

TOTAL ESTIMATED COST: $20
TOTAL ESTIMATED COST FOR TWO: $40

[1]Dollars are FY85

CATEGORY: Ancillary Facilities
FACILITY: 103 Fuel Element Storage Building

108-B AND 108-F LABORATORY BUILDINGS

This Long-Range Plan covers the 108 facilities identified below. The priorities shown apply only to these facilities. Overall priorities and schedules are shown in Sections 4 and 7, Part 1.

DECOMMISSIONING PRIORITY		SFMP	($ in K) TEC*	EST PROJECT DURATION	DOE FUNDING DESIGNATION	DOE WBS NO.
1.	108-B	No	89*	3 mo*	GE	1.1.4.1.4
	104-B-1 & 2**	No	46			
2.	108-F	Yes	333*	6 mo	AR	4.7.2

*Decommissioning work began in FY 1983.
**108-B has two small annexes (104-B-1 & 2).

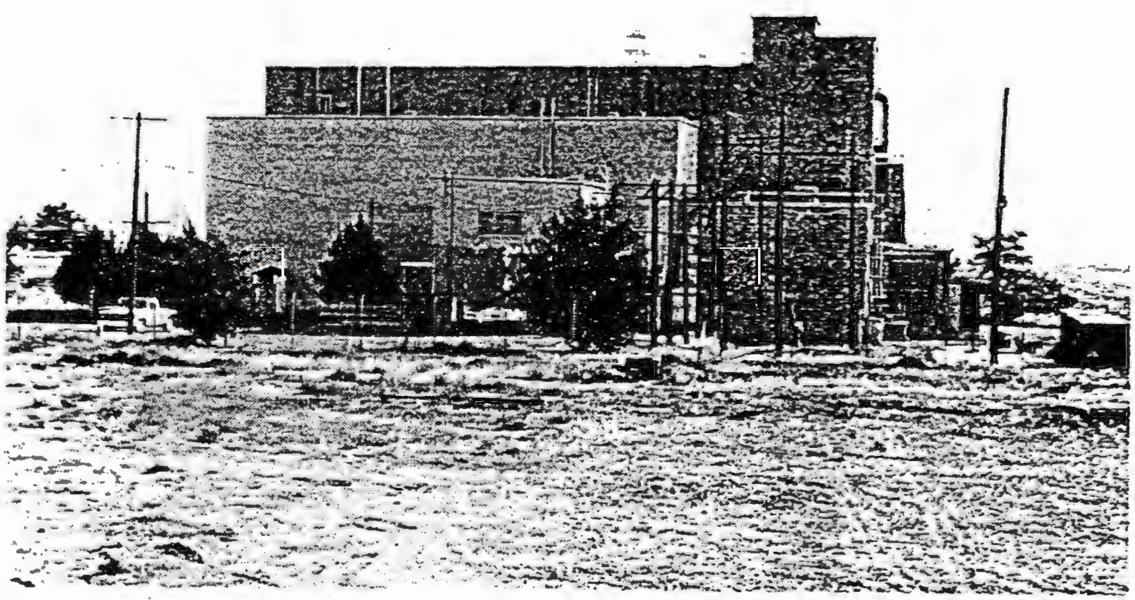

Figure 4-2. 108-F Biology Laboratory Building.

A. Operating History

The 108-B and 108-F laboratories were originally built as water treatment facilities, but were later converted to provide laboratory support for operations. The 108-B Building was converted to a tritium recovery processing facility.

The 108-F laboratory was originally the same size as the 108-B building, but was later expanded to approximately double its size for use in biology research. The two 108 buildings were constructed with their associated reactors (see "Operating History" in the "Reactor Buildings" section). Currently, 108 buildings are being decontaminated and equipment is being removed in preparation for demolition.

B. Physical Description

1. 108-B Special Processing Building

The facility's walls are constructed of concrete block and reinforced concrete. The roof has a composition surface. The building is 41 ft above grade, 12 ft below grade, 132 ft in length and 32 ft in width. The associated stack extended 250 ft above grade and was leveled in FY 1983.

The 104-B-1 Tritium Vault and 104-B-2 Tritium Laboratory are small annexes to the 108-B facility. The 104-B-1 vault is a 130 sq ft concrete block structure, placed in service in January 1950. The 104-B-2 laboratory is reinforced concrete about 365 sq ft, placed in service in December 1951.

2. 108-F Biology Laboratory Building

The original building has a newer addition of similar construction with concrete block and reinforced concrete walls. The newer roof has a metal deck, while the original structure has a reinforced concrete deck with a composition surface. The building is 50 ft above grade, 200 ft in length and 100 ft in width. The laboratory hot cells, and animal handling facilities have been decontaminated and/or removed from the biological wing of the building. Decommissioning Operations has established offices on the main floor of the original facility for local site work. The building has limited electrical services.

C. Current Physical and Radiological Condition

1. Physical Condition

The 108 buildings are being decontaminated and equipment is being removed in preparation for demolition. The general 108-F building condition is rated as poor. The 108-B building condition is rated as fair and the 104-B-1 and 2 annex facilities are rated as good.

2. Radiological Condition

Contamination levels in the 108-B laboratory are generally less than 200 cpm. Direct readings inside of the process cells and on process equipment and piping within the building are a few thousand counts per minute. The 108-B laboratory is contaminated with tritium and other radionuclides.

D. Capital Equipment

There is no anticipated capital expenditure for in-situ decommissioning of the 108 facilities. This assumes that the present on-site equipment will be operational and available for this work and any schedule changes will not require obtaining additional equipment.

E. Research and Development (R&D)

No R&D is anticipated for in-situ decommissioning of the 108 Laboratory buildings.

F. Waste Volume Projections

In-situ decommissioning of the 108 Laboratory buildings will require a minimum movement of contaminated waste. The storage facility work will essentially produce no low-level radioactive waste requiring disposal elsewhere. However, any waste that is determined to be inappropriate for use as fill material will be disposed of in the 200 Area.

The 108-F building has been decontaminated to unrestricted release levels except for low-level contamination in the drain lines and foundation.

G. Facility and Equipment Reuse

1. Facility Reuse

No functional, cost-effective reuse of the 108 Laboratory buildings has been identified.

2. Equipment Reuse

No significant cost recovery opportunities through salvage and reuse have been identified for any of the laboratory facilities. No significant amount of stainless steel is salvageable in the laboratory buildings.

H. Project Work Elements and Costs

Table 4-2 breaks down the estimated costs for the in-situ decommissioning for a typical 108 facility. Costs include labor, special and normal tooling and equipment, waste disposal and facility overheads required for the project work.

TABLE 4-2

COST SCHEDULE FOR IN-SITU DECOMMISSIONING
OF A TYPICAL 108 LABORATORY

(Costs in $000)[1]

PROJECT TASKS	PROJECT DURATION			
	2 mo	4 mo	6 mo	8 mo
Engineering/Planning/Supervision (includes characterization and closeout)	35			
Site Preparation	93			
Demolition		101		
Site Restoration		5		
FY COST TOTAL	$234			

TOTAL ESTIMATED COST: $234

TOTAL ESTIMATED COST FOR TWO: $468

[1] Dollars are FY85

CATEGORY: Ancillary Facilities
FACILITY: 108 Laboratory

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CATEGORY: Ancillary Facilities
FACILITY: 108 Laboratory

115 GAS RECIRCULATION BUILDINGS

This Long-Range Plan covers the 115 facilities identified below. The priorities shown apply only to these facilities. Overall priorities and schedules are shown in Sections 4 and 7, Part 1.

DECOMMISSIONING PRIORITY*		SFMP	($ in K) TEC	EST PROJECT DURATION	DOE FUNDING DESIGNATION	DOE WBS NO.
1.	115-F**	Yes	---	---	AR	4.7.2
2.	115-D/DR	Yes	884	12 mo	AR	4.7.10
3.	115-B/C	No	839	11 mo	GE	1.1.4.1.4
4.	115-KE	No	539	8 mo	GE	TBD
5.	115-KW	No	539	8 mo	GE	TBD

*The 100-H Area 115 facility is part of the 105 reactor building and will be decommissioned with that building.
**Decommissioning began in FY84. Estimated closeout September 1984.

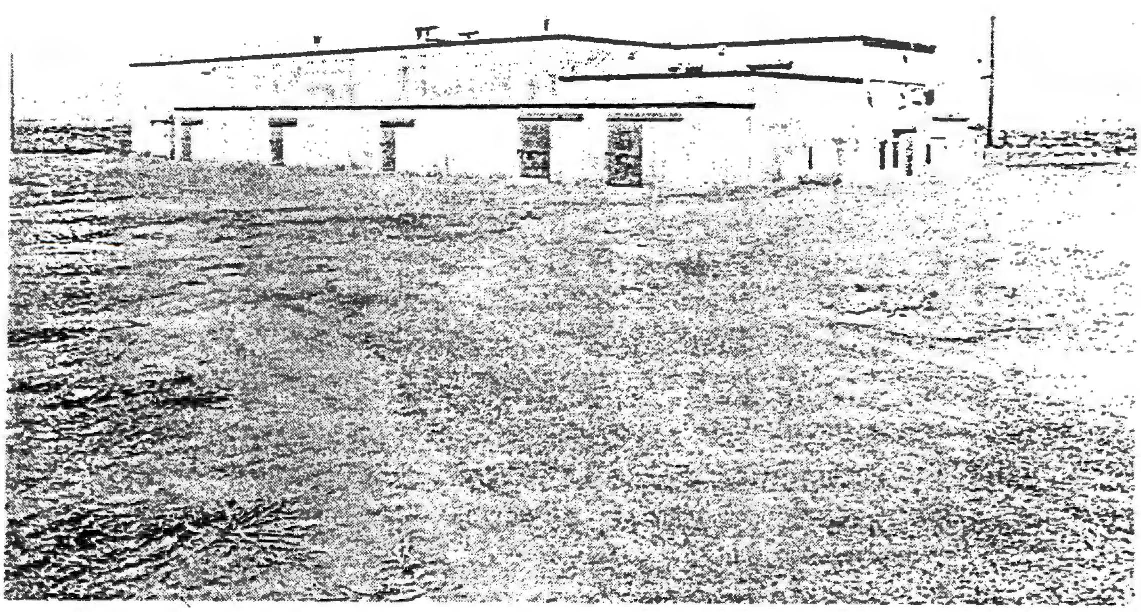

Figure 4-3. 115-F Gas Recirculation Building.

CATEGORY: Ancillary Facilities
FACILITY: 115 Gas Recirculation Building

A. Operating History

The recirculating gas system provided the reactor moderators (graphite) with an inert cover gas mixture of helium-carbon dioxide. The 105 KE/KW reactors used a helium-nitrogen mixture from 1961 to their shutdowns. The 115 buildings house the gas driers, injection and circulation equipment. At 100-H Area, the gas system is in a wing of the 105-H reactor building. The 105-B/C and 105-D/DR reactor facilities were each serviced by a common recirculating gas system, 115-B and 115-D respectively.

The recirculating gas facilities were constructed, started up and operated with their associated reactors (see "Operating History in the "Reactor Buildings" section). No recirculating gas facility is currently in use, and the entrances have been locked to prevent contamination spread and personnel entry. The 115-F building has been partially decontaminated, the equipment has been removed. This building is currently being demolished; no costs are shown on this Plan for decommissioning the 115-F building.

B. Physical Description

The 115 buildings include tunnels, seal pit annex and piping and equipment adjoining the associated 105 facility. The buildings walls are constructed of concrete block and reinforced concrete. The roofs are constructed with precast concrete slabs with composition surfaces. The physical dimensions for the buildings and tunnel lengths are presented in Table 4-3. An operating gallery extends down the center of the building, approximately 18 feet wide. The gallery is flanked on either side by cells which contain the gas processing equipment shown in Figure 4-4 and listed in Table 4-4. No entry to the equipment cells can be made from the operating gallery; cell entry is from outside of the building via a labyrinth. The equipment cell walls and floors are constructed of reinforced concrete and are approximately 3 feet thick. The service section of the building is located at a right angle to the operating gallery, extends the full width of the building, and contains the ventilation fan, air compressor, office, locker room, etc.

TABLE 4-3
GAS RECIRCULATION BUILDING AND TUNNEL DIMENSIONS AND STATUS

Facility	Above Grade (ft)	Below Grade (ft)	Length (ft)	Width (ft)	Tunnel Length (ft)	Status
115-B	20	20	113	34	1,400	Intact
115-D	16	17	168	98	700	Intact
115-F	20	12	168	98	200	Process of Decom.
115-KE	20	20	113	34	100	Intact
115-KW	20	20	113	34	100	Intact

A pipe tunnel approximately 36 feet wide by 8 feet high runs beneath the full length of each 115 building. The main gas lines to and from the 105 reactor buildings enter the 115 building through this tunnel.

The 115 seal pit depicted in Figure 4-4 consist of a small personnel entry structure above grade and a below-grade concrete structure. The walls and floors are constructed of reinforced concrete. The roof is constructed of either a wood frame or concrete deck with a composition surface. The buildings are approximately 12 ft above grade, 32 ft below grade, 37 ft in length and 34 ft in width. The gas inlet line, pressure seal tank and gas return line vacuum seal tank are contained within the seal pit facility.

C. Current Physical and Radiological Condition

1. Physical Condition

The current maintenance and surveillance program has been successful in controlling contamination in the gas recirculation facilities. There has been a gradual degradation of the roof structures, and cracking of the brick walls. Of the 115 facilities, the 115-F facility is the most deteriorated, and decommissioning began in FY84.

Ongoing maintenance and surveillance of the 115 gas recirculation facilities include security, radiological and industrial safety inspections, and routine (weekly, monthly, and annual) maintenance inspections. (References 9 and 10).

CATEGORY: Ancillary Facilities
FACILITY: 115 Gas Recirculation Building

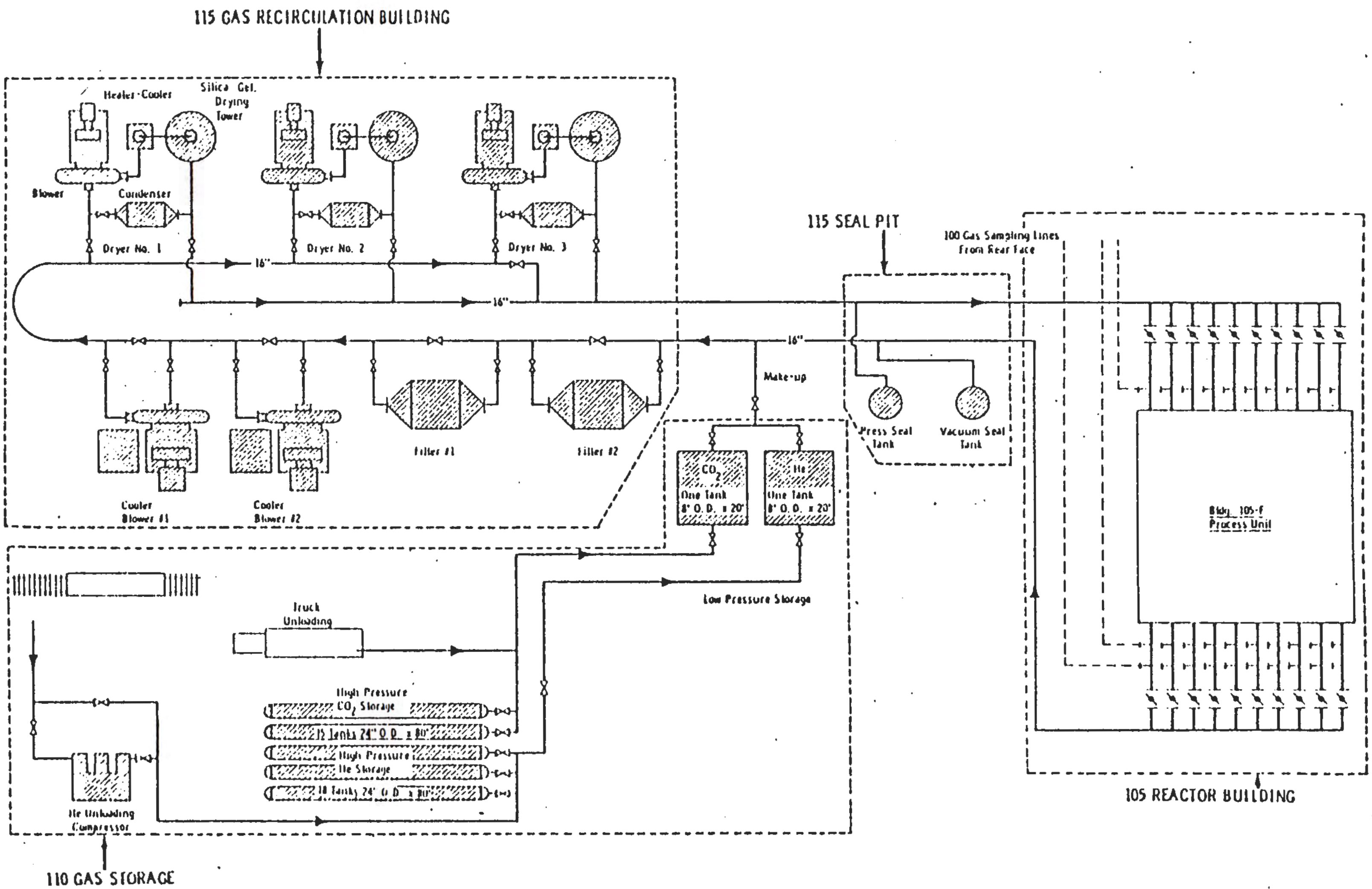

Figure 4-4. 115 Facility Process Flow and Major Equipment.

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TABLE 4-4

REACTOR GAS RECIRCULATION SYSTEM COMPONENTS

		Silica Gel Beds		Filters		Heaters/ Coolers		Coolers		Condensers		Blowers	
Reactor System	115 Building	No.	Approx. Size	No.	Approx. Filter Area	No.	Approx. Size	No.	Approx. Size	No.	Approx. Size	No.	Approx. Size
100 B-C	115-B: Concrete Block 16,500 ft^2	5	7 ft diam 7 ft high	2	6 ft x 6 ft	5	3 ft x 3 ft x 1.5 ft	2	2 ft diam 6 ft long	5	2 ft diam 6 ft long	8	6 ea 1800 cfm 2 ea 200 cfm
100 D-DR	115-D: Concrete Block 16,500 ft^2	5	7 ft diam 7 ft high	2	6 ft x 6 ft	5	3 ft x 3 ft x 1.5 ft	2	2 ft diam 6 ft long	5	2 ft diam 6 ft long	8	6 ea 1800 cfm 2 ea 200 cfm
100 F	115-F: Concrete Block 16,500 ft^2	3	7 ft diam 7 ft high	2	6 ft x 6 ft	3	3 ft x 3 ft x 1.5 ft	2	2 ft diam 6 ft long	3	2 ft diam 6 ft long	5	1800 cfm
100 H	-- (System in gas-wing of 105-H)	3	7 ft diam 7 ft high	2	6 ft x 6 ft	3	3 ft x 3 ft x 1.5 ft	2	2 ft diam 6 ft long	3	2 ft diam 6 ft long	5	1800 cfm
100-KE	115 KE: Concrete 5300 ft^2	2	5 ft diam 4.5 ft high	1	4 ft x 4 ft	2	2 ft diam 5 ft high	0	--	2	2 ft diam 6 ft long	3	4000 cfm
100-KW	115-KW: Concrete 5300 ft^2	2	5 ft diam 4.5 ft high	1	4 ft x 4 ft	2	2 ft diam 5 ft high	0	--	2	2 ft diam 6 ft long	3	4000 cfm

CATEGORY: Ancillary Facilities
FACILITY: 115 Gas Recirculation Building

2. Radiological Condition

The 115 gas recirculation buildings, along with the 117 filter exhaust buildings, are the major contaminated ancillary structures. Direct readings on piping, condensate drains, valves, turbine blowers, and condensers within the 115 Building drier rooms are typically on the order of 10,000 cpm, as measured with a GM probe. Direct radiation detection readings of the silica gel towers range from 1,000 to 15,000 cpm and average about 3,000 cpm. The 115-KE and KW building drier rooms have the highest radiation levels, with direct readings on condensers of about 50,000 cpm. Direct dose rate readings of the condensers within the 115-KE and KW drier rooms are 30 mR/hr. Background radiation levels within the 115 building drier rooms in general are about 1,000 cpm with a GM probe.

Smearable contamination on floors, walls, and equipment averages about 1,000 cpm and ranges from less than 200 cpm to 6,500 cpm with a GM probe.

Dose rates in the filter rooms are generally less than 1 mR/hr. Smearable contamination averages 300 cpm. The blower rooms are similarly low in dose rates and smearable contamination.

The gas piping tunnels have dose rates of about 1 mR/hr with a maximum direct dose rate of 20 mR/hr on piping at 115-KW building. Smearable contamination averages about 2000 c/m.

The major radioactive materials within the gas recirculation facilities are contained within the silica gel dryers (towers). Although the radionuclide inventories in the gel towers varies from facility to facility, the radionuclides remaining in the towers are primarily C-14 and H-3, both weak beta emitters. Lower concentrations of Co-60, Cs-137, Sr-90, Cs-134, Eu-152, Eu-154 and Eu-155 are present.

D. Capital Equipment

There is no anticipated capital expenditure for in-situ decommissioning of the 115 gas recirculation buildings. This assumes that the present on-site equipment will be operational and available for this work and any schedule changes will not require obtaining additional equipment.

E. Research & Development (R&D)

No R&D is anticipated for in-situ decommissioning of the gas recirculation buildings.

F. Waste Volume Projections

In-situ decommissioning of the 115 gas recirculation buildings will require a minimum movement of contaminated waste. The decommissioning work will essentially produce no low-level radioactive waste requiring disposal elsewhere. However, any waste that is determined to be inappropriate for use as fill material will be disposed of in the 200 Area.

G. Facility and Equipment Reuse

1. Facility Reuse

No functional cost-effective reuse of any 115 gas recirculation building has been identified.

2. Equipment Reuse

No significant cost recovery opportunities through salvage, and reuse have been identified for any of the 115 gas recirculation facilities. No significant amount of stainless steel is salvageable in the gas recirculation buildings.

H. Project Work Elements and Costs

Table 4-5 breaks down the estimated costs for the in-situ decommissioning for a typical 115 building. Costs include labor, special and normal tooling and equipment, waste disposal and facility overheads required for the project work.

TABLE 4-5

COST SCHEDULE FOR IN-SITU DECOMMISSIONING OF A TYPICAL 115 BUILDING

(Costs in $000)[1]

PROJECT TASKS	PROJECT DURATION			
	3 mo	6 mo	9 mo	12 mo
Engineering/Planning/Supervision (includes characterization and closeout)		105		
Site Preparation	326			
Demolition			198	
Site Restoration				71
FY COST TOTAL	$700			

TOTAL ESTIMATED COST: $ 700

TOTAL ESTIMATED COST FOR ALL FOUR: $2800

[1]Dollars are FY85

CATEGORY: Ancillary Facilities
FACILITY: 115 Gas Recirculation Building

116 REACTOR EXHAUST STACKS

This Long-Range Plan covers the 116 stacks identified below. The priorities shown apply only to these stacks. Overall priorities and schedules are shown in Sections 4 and 7, Part 1.

DECOMMISSIONING PRIORITY	SFMP	($ in k) TEC	EST PROJECT DURATION	DOE FUNDING DESIGNATION	DOE WBS NO.
1. 116-D	Yes	289	1 mo	AR	TBD
2. 116-DR	Yes	289	1 mo	AR	TBD
3. 116-B*	No	289	1 mo	GE	TBD
4. 116-KE	No	289	1 mo	GE	TBD
5. 116-KW	No	289	1 mo	GE	TBD

*116-B may remain if the 105-B reactor building becomes a historical museum.

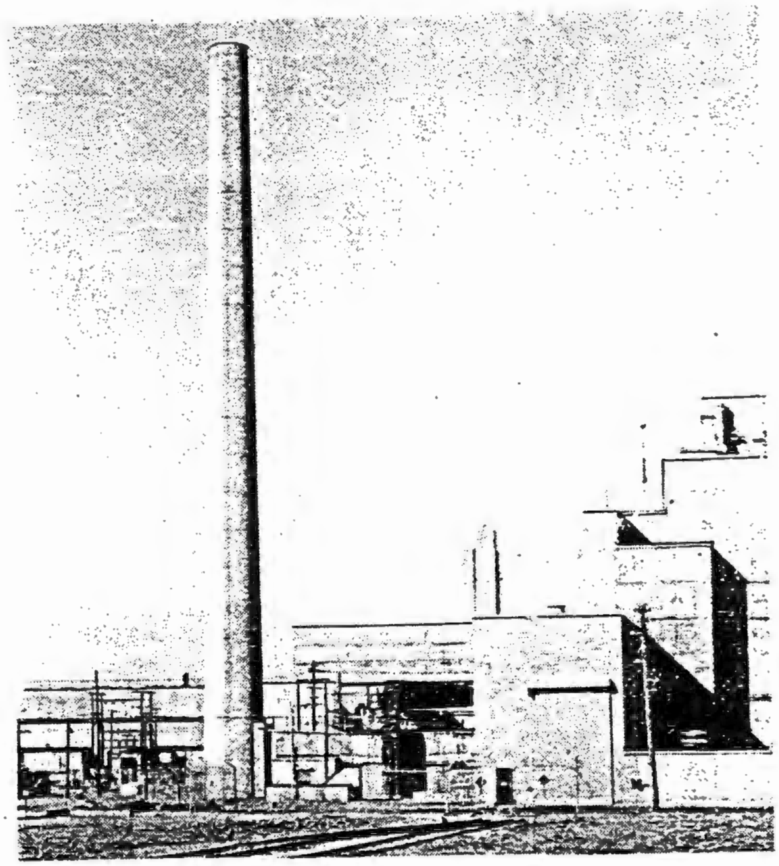

Figure 4-5. 116-D Reactor Exhaust Stack.

CATEGORY: Ancillary Facilities
FACILITY: 116 Reactor Exhaust Stack

A. Operating History

The reactor exhaust stacks, ranging in height from 200-300 ft, dispersed the reactor 105 building exhaust air into the atmosphere. The stacks were constructed, started up and shut down with their associated reactors (see "Operating History" in the "Reactor Buildings" section). The ventilation systems in the reactor facilities moved fresh, uncontaminated air from the least contaminated zones through zones with increasing levels of contamination and finally through an exhaust system for discharge from the stack. The 116-DR reactor stack is currently in use by Westinghouse, for the exhaust from the HEDL sodium/lithium burning experimentals being conducted in the 105-DR building. The entrances have been sealed and the bottom ladder rungs removed to prevent personnel from climbing the stacks. All remaining shutdown reactor building stacks are currently being maintained in a safe storage mode.

B. Physical Description

The stacks are monolithic, reinforced concrete structures. The physical dimensions for the stacks are given in Table 4-6. In general, the wall thickness is 1-1/2 ft at the base and 1 ft at the top. An opening at the bottom with a steel door cover provides access to the interior of the stack. The stack is supported on a solid concrete base which is in turn supported by a solid concrete, octagonal-shaped foundation. The octagonal base measures 18-1/2 ft side to side, and is 11-1/2 ft thick. The bottom octagonal foundation measures 27 ft side to side, and is 6 ft thick.

TABLE 4-6
116 REACTOR STACK DIMENSIONS

Stack	Above Grade (ft)	Below Grade (ft)	Outside Diameter (ft)
116-D	200	10	16
116-DR	200	10	16
116-KE	200*	16	16
116-KW	200*	16	16
116-B	200	15	16

*Stacks were decontaminated and reduced from 300 ft in FY 1982.

CATEGORY: Ancillary Facilities
FACILITY: 116 Reactor Exhaust Stack

Exhaust air flowed through concrete ducts from the 105 building to the base of the exhaust stack. The air was then diverted via underground, reinforced concrete ducts to the 117 filter building. After flowing through the filters, the air went through below-grade and above-grade concrete ducts into the exhaust stack.

C. Current Physical and Radiological Condition

1. Physical Condition

The 116 reactor stacks are in good condition. The ongoing maintenance and surveillance of the stacks include security, radiological and industrial safety inspections, and routine (weekly, monthly, and annual) maintenance inspections.

2. Radiological Condition

Dose rates at the base of the reactor stacks are less than 1 mR/hr. General background levels within the bottom of the stacks are approximately 1,000 cpm with a GM probe. Low level smearable alpha contamination is present up to 130 dpm/100 cm^2, and averages about 30 dpm/100 cm^2. Smearable beta contamination ranges from 100 to 5,000 dpm/100 cm^2.

In FY 1982, the interior of the 116-KE and KW stacks were decontaminated by sandblasting and their overall heights were reduced from 300 ft to 200 ft.

D. Capital Equipment

There is no anticipated capital expenditure for in-situ decommissioning of the 116 exhaust stacks. This assumes that the present on-site equipment will be operational and available for this work and any schedule changes will not require obtaining additional equipment.

The in-situ decommissioning of the 116 stacks is accomplished by use of explosives (see Figure 6-5 in Part 1 of this Plan). The explosive work will be performed by an expert subcontractor.

E. Research and Development (R&D)

No R&D in anticipated for in-situ decommissioning of the 116 exhaust stacks.

F. Waste Volume Projections

In-situ decommissioning of the 116 exhaust stacks will require a minimum movement of contaminated waste, essentially producing no low-level radioactive waste requiring disposal elsewhere. However, any waste that is determined to be inappropriate for in-situ decommissioning will be removed and disposed of in the 200 Area.

G. Facility and Equipment Reuse

1. Facility Reuse

No functional cost-effective reuse of the 116 exhaust stacks has been identified.

2. Equipment Reuse

No significant cost recovery opportunities through salvage and reuse have been identified for any of the 116 exhaust stacks. No significant amount of stainless steel is salvageable in the 116 exhaust stacks.

H. Project Work Elements and Costs

Table 4-7 breaks down the estimated costs for the in-situ decommissioning for a typical 116 exhaust stack. Costs include labor, special and normal tooling and equipment, and facility overheads required for the project work.

TABLE 4-7

COST SCHEDULE FOR IN-SITU DECOMMISSIONING OF A TYPICAL REACTOR STACK

(Costs in $000)[1]

PROJECT TASKS	YEAR OF WORK			
	1 wk	2 wk	3 wk	4 wk
Engineering/Planning/Supervision (includes characterization and closeout)	43			
Site Preparation		66		
Demolition			125	
Site Restoration				55
FY COST TOTAL	$289			

TOTAL ESTIMATED COST: $ 289

TOTAL ESTIMATED COST FOR ALL FIVE: $1445

[1] Dollars are FY85

CATEGORY: Ancillary Facilities
FACILITY: 116 Reactor Exhaust Stack

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CATEGORY: Ancillary Facilities
FACILITY: 116 Reactor Exhaust Stack

117 FILTER EXHAUST BUILDINGS

This Long-Range Plan covers the 117 filter buildings identified below. The priorities shown apply only to these facilities. Overall priorities and schedules are shown in Section 4 and 7, Part 1.

DECOMMISSIONING PRIORITY	SFMP	($ in K) TEC	EST PROJECT DURATION	DOE FUNDING DESIGNATION	DOE WBS NO.
1. 117-D	Yes	142	10 mos	AR	4.7.10
2. 117-DR	Yes	142	10 mos	AR	4.7.10
3. 117-C*	No	36	3 mos	GE	1.1.4.1.4
4. 117-B	No	142	10 mos	GE	1.1.4.1.4
5. 117-KE	No	142	10 mos	GE	TBD
6. 117-KW	No	142	10 mos	GE	TBD

*Decommissioning commenced FY 1984. Cost and duration shown are for remaining work.

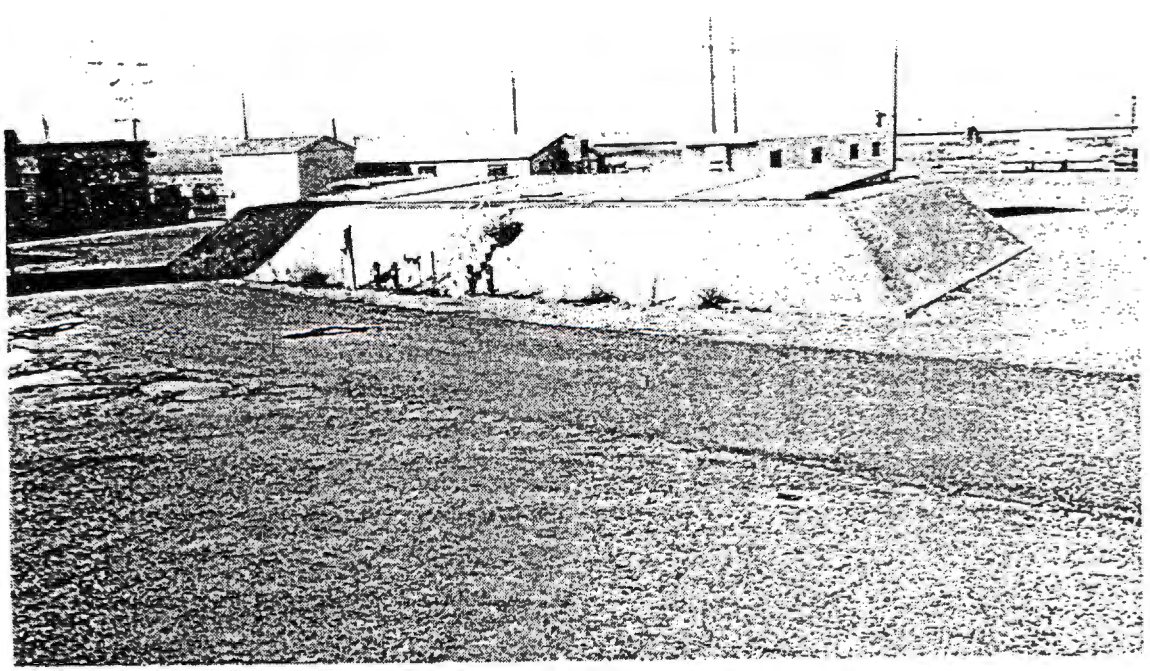

Figure 4-6. 117-KW Exhaust Filter Building.

CATEGORY: Ancillary Facilities
FACILITY: 117 Filter Exhaust Building

A. Operating History

The 117 exhaust filter buildings house the reactor building exhaust air filters and air flow control system. Reactor building exhaust gases (primarily ventilation gases) were directed to the exhaust filter building where the air passed through "absolute" (particulate) and "halogen" (activated charcoal) filters and was then discharged to the atmosphere through the 116 reactor stack. The 117 buildings were installed in the reactor ventilation exhaust systems between 1957 to 1960 and the associated reactors operated with the exhaust filters until they were shutdown (see Operating History" in the "Reactor Buildings" section).

The 117-F filter building was decommissioned in 1983 (see Figure 6-4 in Part 1).

The 117-DR filter building is currently being used by Westinghouse (HEDL) for the exhaust from Sodium/Lithium Burning Experiments being performed in the 105-DR Building. All remaining shutdown exhaust filter-buildings are currently being maintained in a safe storage mode. The entrances have been sealed to prevent contamination spread and personnel entry.

B. Physical Description

Each exhaust filter building contains two identical filter cells (see Figure 4-7) separated by a two-story operating gallery, which is almost entirely below grade with bermed, side walls of earth and gunite. Large steel hatch coveres serve as the roof. The walls are constructed of reinforced concrete. The buildings are about 59 ft long, 39 ft wide and 35 ft high, with about 8 ft being above grade.

Only a small amount of equipment and piping remain in the filter buildings. A sump pump is located at the lowest point in the building. An inline axial vane fan is contained in a small concrete cell adjacent to the filter building. The ventilation ducts are approximately 5 ft wide by 11-1/2 ft high. The inlet and exhaust tunnels have large turning vanes to deflect air into or out of the filter cells. Building piping includes a minimum amount of small-diameter pipes for service water, compressed air, and instrument lines. A small amount of electrical wiring and switchgear was required for building lighting and electrical power service.

Concrete covers are provided for each filter frame location. The interior surfaces of the buildings have been coated with polyvinyl (Ply-On) to seal cracks and imperfections in the concrete.

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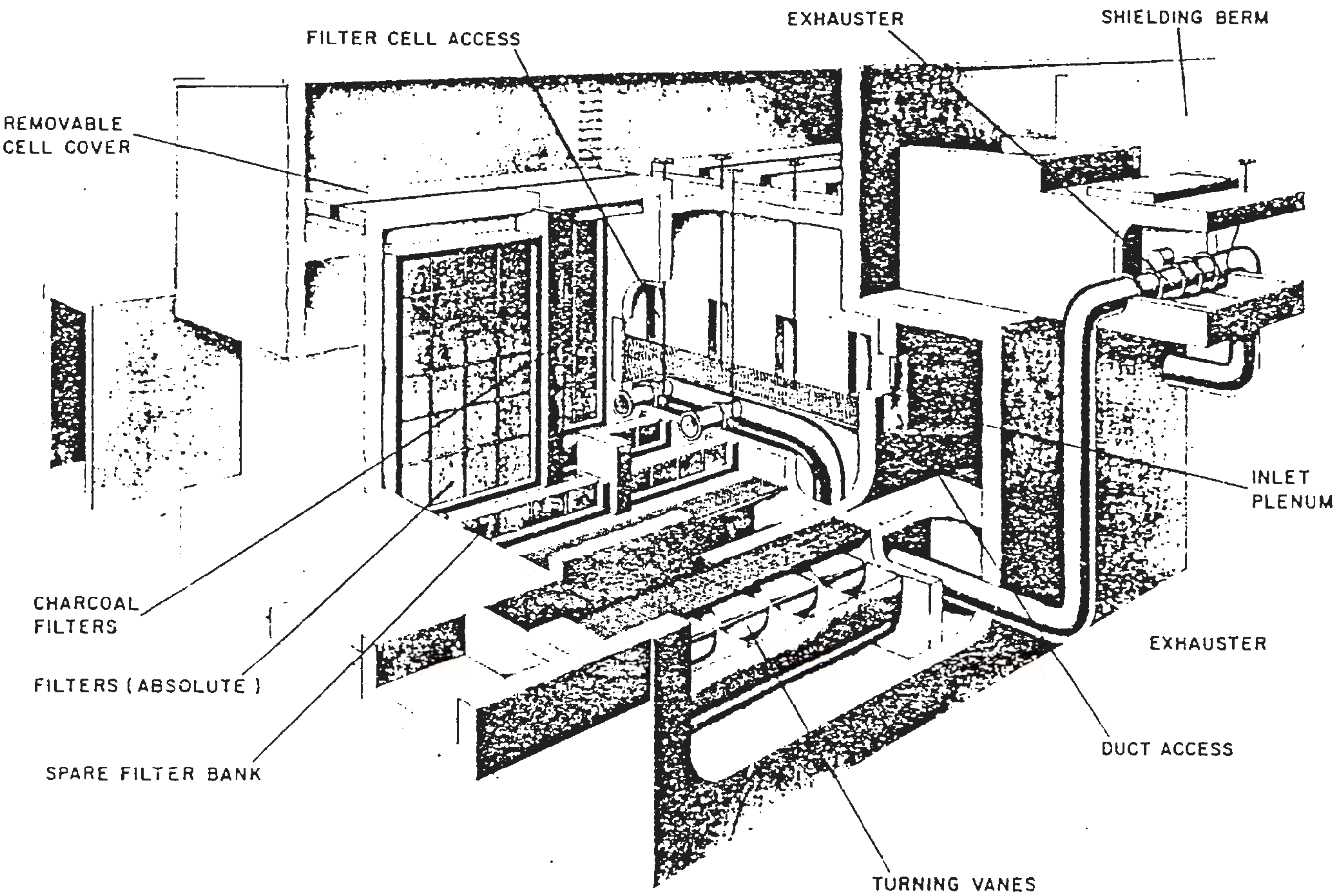


Figure 4-7. 117 Filter Building.

CATEGORY: Ancillary Facilities
FACILITY: 117 Filter Exhaust Building

C. Current Physical and Radiological Condition

1. Physical Condition

The building conditions are rated as fair for 117-D and C, and good for 117-B, DR, KE and KW. Most of the exhaust filter building quipment remains in place as installed. Only 117-DR is being used by Westinghouse (HEDL) for exhaust from the Sodium/ Lithium Burning Experiments being performed in the 105-DR building.

The ongoing maintenance and surveillance of the filter building include security, radiological and industrial safety inspections, and routine (weekly, monthly, and annual) maintenance inspections.

2. Radiological Condition

The 117 Building filter cell dose rates range from less than 1 mR/hr to a maximum of 5 mR/hr. Smearable contamination is generally 1000-2000 cpm.

Dose rates in the inlet tunnels running from the 105 buildings to the 117 buildings are on the order of 1 mR/hr up to a maximum of 2.5 mR/hr (in the inlet tunnel to 117-KW). Floors and walls within the inlet tunnels to the 117 buildings are dusty, with accumulations up to 1/16-inch thick. Low-level smearable contamination on floors, walls, and turning vanes average from 3,000 to 10,000 cpm.

As would be expected, contamination levels are lower in the exhaust tunnels running from the 117 building to the stacks. Direct GM readings on qualitative smears are generally a few hundred counts per minute, up to a maximum of 600 cpm.

D. Capital Equipment

There is no anticipated capital expenditure for in-situ decommissioning of the exhaust filter buildings. This assumes that the present on-site equipment will be operational and available for this work and any schedule changes will not require obtaining additional equipment.

E. Research and Development (R&D)

No R&D is anticipated for in-situ decommissioning of the 117 buildings.

CATEGORY: Ancillary Facilities
FACILITY: 117 Filter Exhaust Building

F. Waste Volume Projections

In-situ decommissioning of the 117 buildings will require a minimum movement of contaminated waste producing little or no low-level radioactive waste requiring disposal elsewhere.* However, any waste that is determined to be inappropriate for use as fill material will be disposed of the 200 Areas.

G. Facility and Equipment Reuse

1. Facility Reuse

No functional cost-effective reuse of the 117 exhaust filter buildings has been identified.

2. Equipment Reuse

No significant cost recovery opportunities through salvage and reuse have been identified for any of the 117 filter buildings. No significant amount of stainless steel is salvageable in the exhaust filter buildings.

H. Project Work Elements and Costs

Table 4-8 breaks down the estimated costs for the in-situ decommissioning for a typical 117 building. Costs include labor, special and normal tooling and equipment, and facility overheads required for the project work.

*The remaining filters may be the only material removed for disposal in the 200 Area, in order to facilitate void reduction and eliminate a costly and complex filter flattening process.

TABLE 4-8

COST SCHEDULE FOR IN-SITU DECOMMISSIONING OF A TYPICAL 117 BUILDING

(Costs in $000)[1]

PROJECT TASKS	PROJECT DURATION (3 mo / 6 mo / 9 mo / 12 mo)
Engineering/Planning/Supervision (includes characterization and closeout)	19
Site Preparation	70
Demolition	26
Site Restoration	9
FY COST TOTAL	$ 124

TOTAL ESTIMATED COST: $124
TOTAL ESTIMATED COST FOR ALL SIX: $746

[1]Dollars are FY85

CATEGORY: Ancillary Facilities
FACILITY: 117 Filter Exhaust Building

119 EXHAUST AIR SAMPLING BUILDINGS

This Long-Range Plan covers the 119 sampling buildings identified below. The priorities shown apply only to these facilities. Overall priorities and schedules are in Sections 4 and 7, Part 1.

DECOMMISSIONING PRIORITY	SFMP	($ in K) TEC	EST PROJECT DURATION	DOE FUNDING DESIGNATION	DOE WBS NO.
1. 119-DR	Yes	9.5	1 mo	AR	TBD
2. 119-KE	No	9.5	1 mo	GE	TBD
3. 119-KW	No	9.5	1 mo	GE	TBD

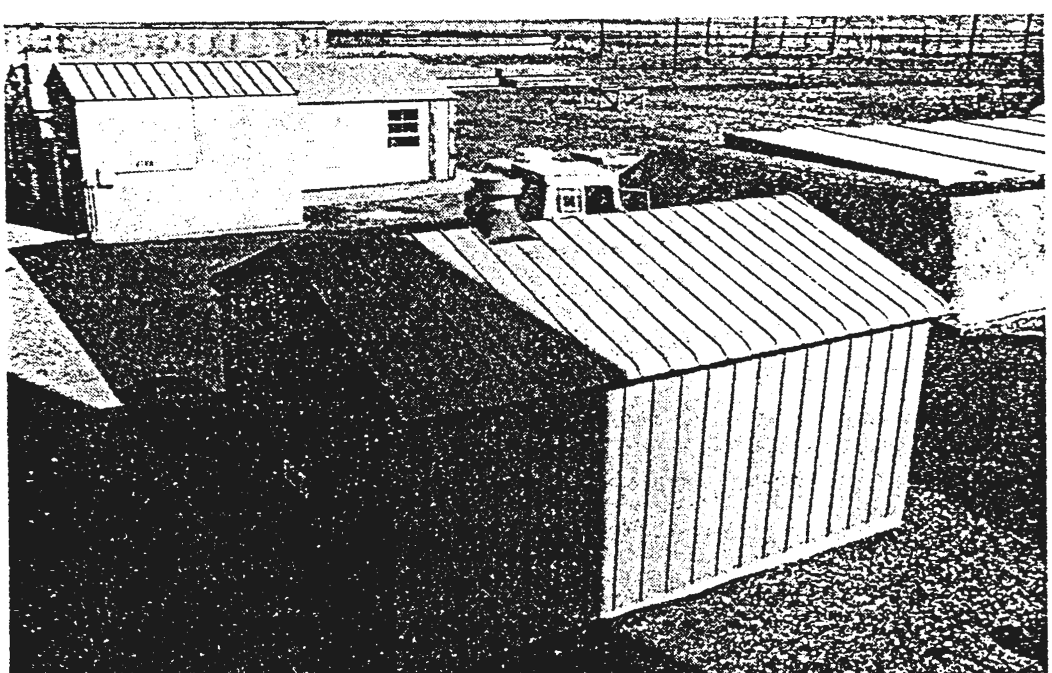


Figure 4-8. 119-KW Exhaust Air Sampling Building.

CATEGORY: Ancillary Facilities
FACILITY: 119 Exhaust Air Sampling Building

A. Operating History

The 119 exhaust air sampling buildings housed most of the instrumentation for the exhaust air system. A sample stream of the exhaust air was routed through a counting system in the building for monitoring radioactivity. The 119 buildings were constructed, started up and operated with their associated reactors (see "Operating History" in the "Reactor Buildings" section). All remaining exhaust sample buildings, except for the 119-DR, are currently being maintained in a safe storage mode. The entrances have been sealed or locked to prevent contamination spread and personnel entry. The 119-DR exhaust sample building is currently being used by Westinghouse for the HEDL sodium/lithium burning experiments.

B. Physical Description

The 119 building is a small metal structure placed on a grade-level concrete slab. They are located over the ventilation ducts leading to the 117-filter buildings. The buildings' interior surfaces are painted wallboard.

C. Current Physical and Radiological Condition

1. Physical Condition

The 119 buildings are in good condition. The instrumentation and associated sampling equipment have been removed from the buildings, with only capped pipe remaining. The 119-DR building is being used by Westinghouse (HEDL) for part of the sodium/lithium burning experiments.

The ongoing maintenance and surveillance of the filter buildings include security, radiological and industrial safety inspections, and routine (weekly, monthly, and annual) maintenance inspections. (References 9 and 10).

2. Radiological Condition

The contaminated surfaces that are readily accessible to surveillance personnel have been cleaned to a nonsmearable status and no zones read greater than 1 mrem/hr. The majority of the activity is in or adjacent to the sample tubes, which are cut off and capped at floor level, and is not easily dispersible. The buildings are essentially clean, with only minor areas of contamination or potential contamination.

D. Capital Equipment

There is no anticipated capital expenditure for in-situ decommissioning of the 119 exhaust air sampling buildings. This assumes that the present on-site equipment will be operational and available for this work and any schedule changes will not require obtaining additional equipment.

E. Research and Development (R&D)

No R&D is anticipated for in-situ decommissioning of the 119 exhaust air sampling buildings.

F. Waste Volume Projections

In-situ decommissioning of the 119 exhaust air sample buildings will require a minimum movement of contaminated waste, essentially producing no low-level radioactive waste requiring disposal elsewhere. However, any waste that is determined to be inappropriate for use as fill material will be disposed of in the 200 Area.

G. Facility and Equipment Reuse

1. Facility Reuse

No functional cost-effective reuse of the 117 exhaust air sample building has been identified.

2. Equipment Reuse

No significant cost recovery opportunities through salvage and reuse have been identified for any of the sample buildings. No significant amount of stainless steel is salvageable in the exhaust air sample buildings.

H. Project Work Elements and Costs

Table 4-9 breaks down the estimated costs for the in-situ decommissioning for a typical 119 building. Costs include labor, special and normal tooling and equipment, waste disposal and facility overheads required for the project work.

TABLE 4-9

COST SCHEDULE FOR IN-SITU DECOMMISSIONING

OF A TYPICAL 119 BUILDING

(Costs in $000)[1]

PROJECT TASKS	PROJECT DURATION			
	1 wk	2 wk	3 wk	4 wk
Engineering/Planning/Supervision (includes characterization and closeout)	1.5			
Site Preparation		2.5		
Demolition			5	
Site Restoration				1
FY COST TOTAL	$ 10			

TOTAL ESTIMATED COST: $ 10

TOTAL ESTIMATED COST FOR ALL THREE: $ 29

[1]Dollars are FY85

CATEGORY: Ancillary Facilities
FACILITY: 119 Exhaust Air Sampling Building

1706 REACTOR LOOP TESTING FACILITIES

This Long-Range Plan covers the 1706 loop testing facilities identified below. Overall priorities and schedules are shown in Sections 4 and 7, Part 1.

DECOMMISSIONING PRIORITY	SFMP	($ in K) TEC	EST PROJECT DURATION	DOE FUNDING DESIGNATION	WBS NO.
1. 1706-KE/KEL/ KER*	No	404	8 mo	GE	TBD

*All the 1706-KE facilities are interconnected and will be decommissioned together.

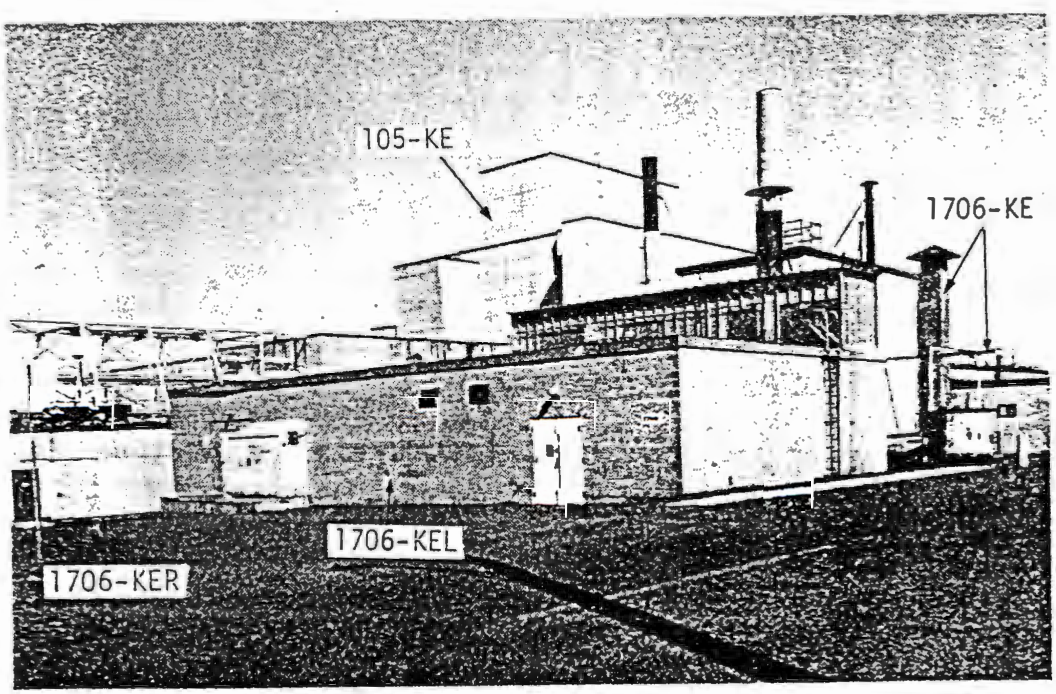


Figure 4-9. 1706-KE Reactor Loop Testing Facilities.

CATEGORY: Ancillary Facilities
FACILITY: 1706 Reactor Loop Testing Facilities

A. Operating History

The 1706 buildings operated from 1955 to 1971, with the 100-KE reactor. The loop testing was conducted mainly on 100-K reactor fuel material, although 100-N reactor fuel material was tested prior to that plant's startup. The UNC Chemical and Waste Treatment Technology group is currently using all three facilities to support N Reactor Operations.

The three 1706 facilities have a common entrance, are interconnected by hallways and below-grade tunnels, and will be decommissioned together. The facilities' major functions are:

1706-KE Reactor Loop Corrosion Testing Facility

The facility supplies demineralized water to 105-KE and KW fuel storage basins, where N Reactor spent fuel is currently being stored. UNC uses the laboratory's heavily reinforced test enclosures to conduct pressurization and corrosion testing. 1706-KE has a control room for remote equipment operation.

1706-KEL Coolant System Development Laboratory

The facility is primarily equipped for radiological laboratory services with HEPA ventilated hoods, shielded storage caves, etc.

1706-KER Reactor Loop Corrosion Testing Facility

The facility contains four shielded cells below grade. Each cell houses water treatment, heat exchanger, pumping, and remote instrument equipment for each of the four 105-KE in-reactor loops. The loop piping travels through a tunnel to the reactor, approximately 300 ft from the shielded cells.

B. Physical Description

The 1706-KE, KEL and KER buildings are adjacent to the 105-KE Reactor, and are all connected to the reactor by tunnels.

1706-KE Reactor Loop Corrosion Testing Facility

This facility is a conglomerate of various building additions, mostly of concrete block construction. The upper levels are of transite panel over steel-frame construction. The roof is a reinforced concrete, precast slab. The foundation and floor at grade and below grade are reinforced concrete. The walls extend 20 ft above grade, 20 ft below grade, 100 ft in length and 56 ft in width.

1706-KEL Coolant System Development Laboratory

This is a one-story annex to the 1706-KE facility. The laboratory floor space is approximately 2,700 ft^2. The majority of walls are concrete block. The roof is a reinforced concrete, precast slab. The foundation and floor are reinforced concrete.

1706-KER Reactor Loop Corrosion Testing Facility

This upper level is transite panel over steel-frame construction. The roof is metal or transite deck. The foundation and floor are reinforced concrete. The walls extend 20 ft in length, 27 ft in width above grade, and 66 ft in width below grade, with the shielded cells located at the lowest level (-27 foot).

The facility contains control room instrumentation, cabinets and equipment, laboratory, piping, pumps, pressurized heat exchangers, demineralizers, filters, chemical tanks, lab benches with hoods, sinks, ducts, switchgear, and clearwells with associated pumps, etc. The tunnels connected to the 105-KE/KW reactor have security barricades. The shield cells and related equipment are locked and have no ongoing activity. Otherwise, most of the other areas in the 1706-KER facility are in use.

C. Current Physical and Radiological Condition

1. Physical Condition

The 1706 facilities are in good condition; no major maintenance repairs are required. The majority of the equipment remains in place.

2. Radiological Condition

The contaminated surfaces that are readily accessible to operation and surveillance personnel have been cleaned to a nonsmearable status and zones reading greater than 1 mR/hr have been identified. The majority of the activity is in or adjacent to the laboratory equipment and pipes and is not easily dispersible.

D. Capital Equipment

There is no anticipated capital expenditure for in-situ decommissioning of the reactor loop testing buildings. This assumes that the present on-site equipment will be operational and available for this work and any schedule changes will not require obtaining additional equipment.

E. Research and Development (R&D)

No R&D is anticipated for in-situ decommissioning of the reactor loop testing buildings.

F. Waste Volume Projections

In-situ decommissioning of the 1706 loop testing buildings will require a minimum movement of contaminated waste, essentially producing no low-level radioactive waste requiring disposal elsewhere. However, any waste that is determined to be inappropriate for use as fill material will be disposed of in the 200 Area.

G. Facility and Equipment Reuse

1. Facility Reuse

No cost-effective reuse of the 1706 reactor loop testing buildings has been identified beyond the projected termination of their current use.

2. Equipment Reuse

No significant cost recovery opportunities through salvage and reuse have been identified for any of the 1706 loop testing facilities. No significant amount of stainless steel is salvageable in the reactor loop testing buildings.

H. Project Work Elements and Costs

Table 4-10 breaks down the estimated costs for the in-situ decommissioning of the 170-C facilities. Costs include labor, special and normal tooling and equipment, waste disposal and facility overheads required for the project work.

TABLE 4-10

COST SCHEDULE FOR IN-SITU DECOMMISSIONING OF THE 1706 FACILITIES

(Costs in $000)[1]

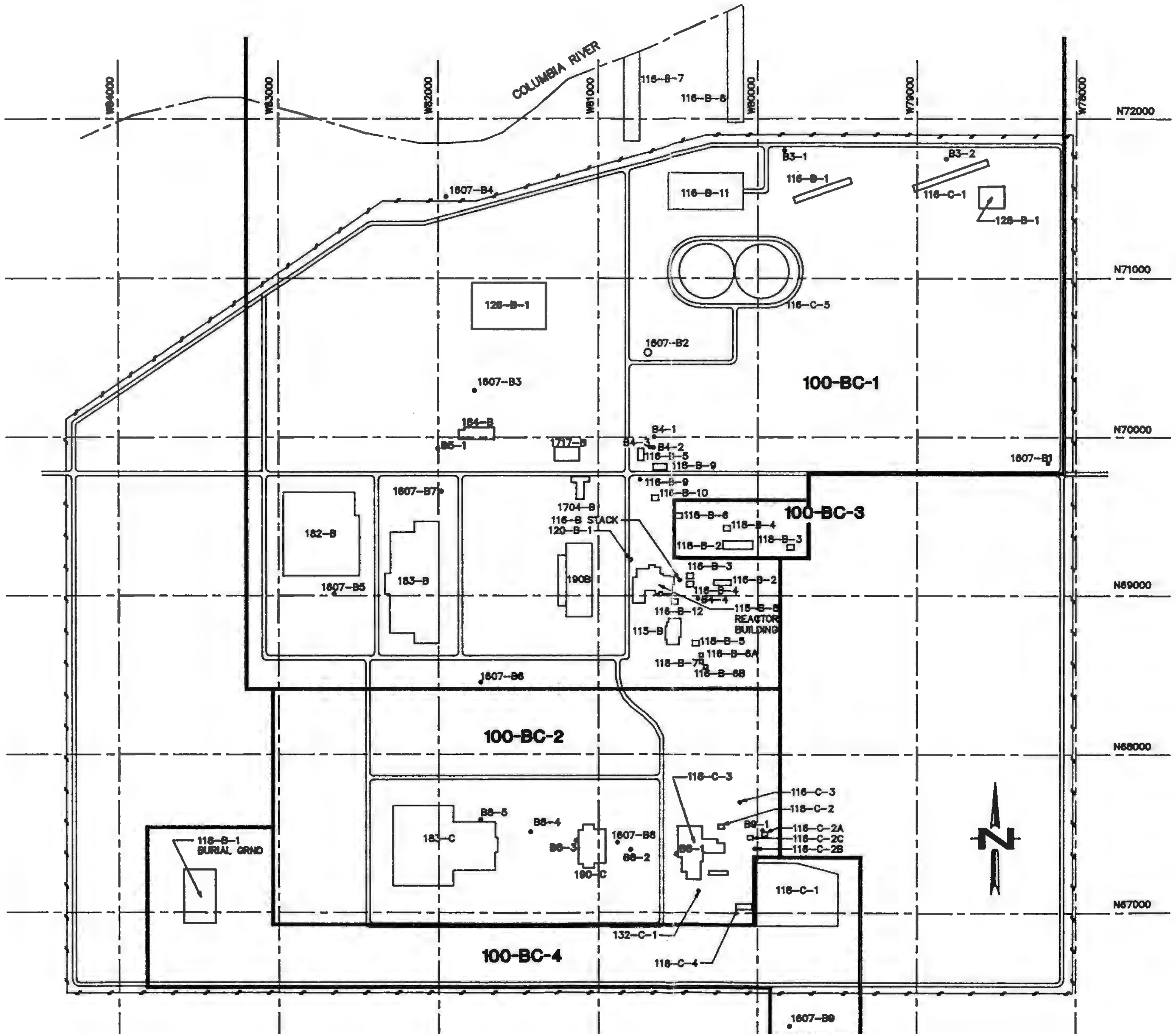
PROJECT TASKS	YEAR OF WORK			
	2 mo	4 mo	6 mo	8 mo
Engineering/Planning/Supervision (includes characterization and closeout)		60		
Site Preparation		160		
Demolition			160	
Site Restoration				20
FY COST TOTAL	$ 400			

TOTAL ESTIMATED COST: $ 400

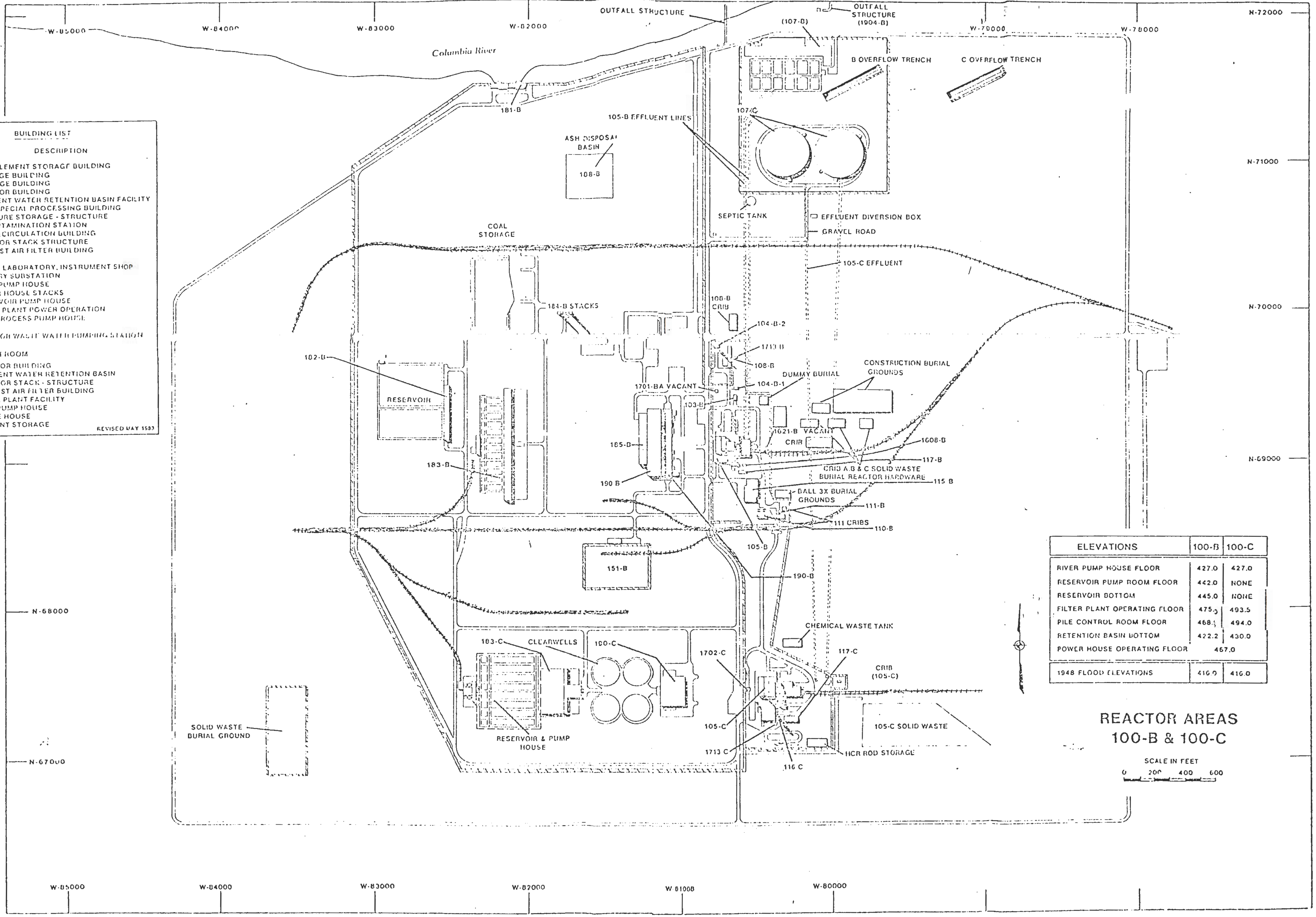
[1]Dollars are FY85

CATEGORY: Ancillary Facilities
FACILITY: 1706 Reactor Loop Testing Facilities

APPENDIX A CONTENTS
100 AREA SITE MAPS


COLUMBIA RIVER
W84000
W83000
W82000
W81000
W80000
W79000
W78000
N72000
N71000
N70000
N69000
N68000
N67000
100-BC-1
100-BC-2
100-BC-3
100-BC-4
116-B-7
116-B-6
B3-1
B3-2
116-B-1
116-C-1
128-B-1
116-B-11
1607-B4
116-C-5
1607-B2
1607-B3
184-B
1717-B
B5-1
B4-1
B4-2
116-B-5
118-B-9
116-B-9
116-B-10
1607-B1
1607-B7
182-B
183-B
1607-B5
190B
1704-B
116-B STACK
120-B-1
118-B-6
118-B-4
118-B-2
118-B-3
116-B-3
116-B-2
116-B-4
B4-4
116-B-12
116-B-8
REACTOR BUILDING
115-B
118-B-5
116-B-6A
118-B-7
116-B-6B
1607-B6
116-C-3
116-C-2
B9-1
116-C-2A
116-C-2C
116-C-2B
118-B-1 BURIAL GRND
183-C
B8-5
B8-4
B8-3
190-C
1607-B8
B8-2
B8-1
118-C-1
132-C-1
118-C-4
1607-B9
N

100-BC AREA



BUILDING LIST

BUILDING NUMBER	DESCRIPTION
103 B	FUEL ELEMENT STORAGE BUILDING
104 B 1	STORAGE BUILDING
104 B 2	STORAGE BUILDING
105 B	REACTOR BUILDING
107 B	EFFLUENT WATER RETENTION BASIN FACILITY
108 B	MINT-SPECIAL PROCESSING BUILDING
110 B	PRESSURE STORAGE - STRUCTURE
111 B	DECONTAMINATION STATION
115 B	GAS RECIRCULATION BUILDING
116 B	REACTOR STACK STRUCTURE
117 B	EXHAUST AIR FILTER BUILDING
185 B	WATER LABORATORY, INSTRUMENT SHOP
151 B	PRIMARY SUBSTATION
181 B	RIVER PUMP HOUSE
184 B	POWER HOUSE STACKS
182 B	RESERVOIR PUMP HOUSE
183 B	FILTER PLANT POWER OPERATION
190 B	MAIN PROCESS PUMP HOUSE
1608 B	REACTOR WASTE WATER PUMPING STATION
1621 B	
1701 BA	LUNCH ROOM
105 C	REACTOR BUILDING
107 C	EFFLUENT WATER RETENTION BASIN
116 C	REACTOR STACK - STRUCTURE
117 C	EXHAUST AIR FILTER BUILDING
183 C	FILTER PLANT FACILITY
190 C	MAIN PUMP HOUSE
1702 C	BADGE HOUSE
1713 C	SOLVENT STORAGE

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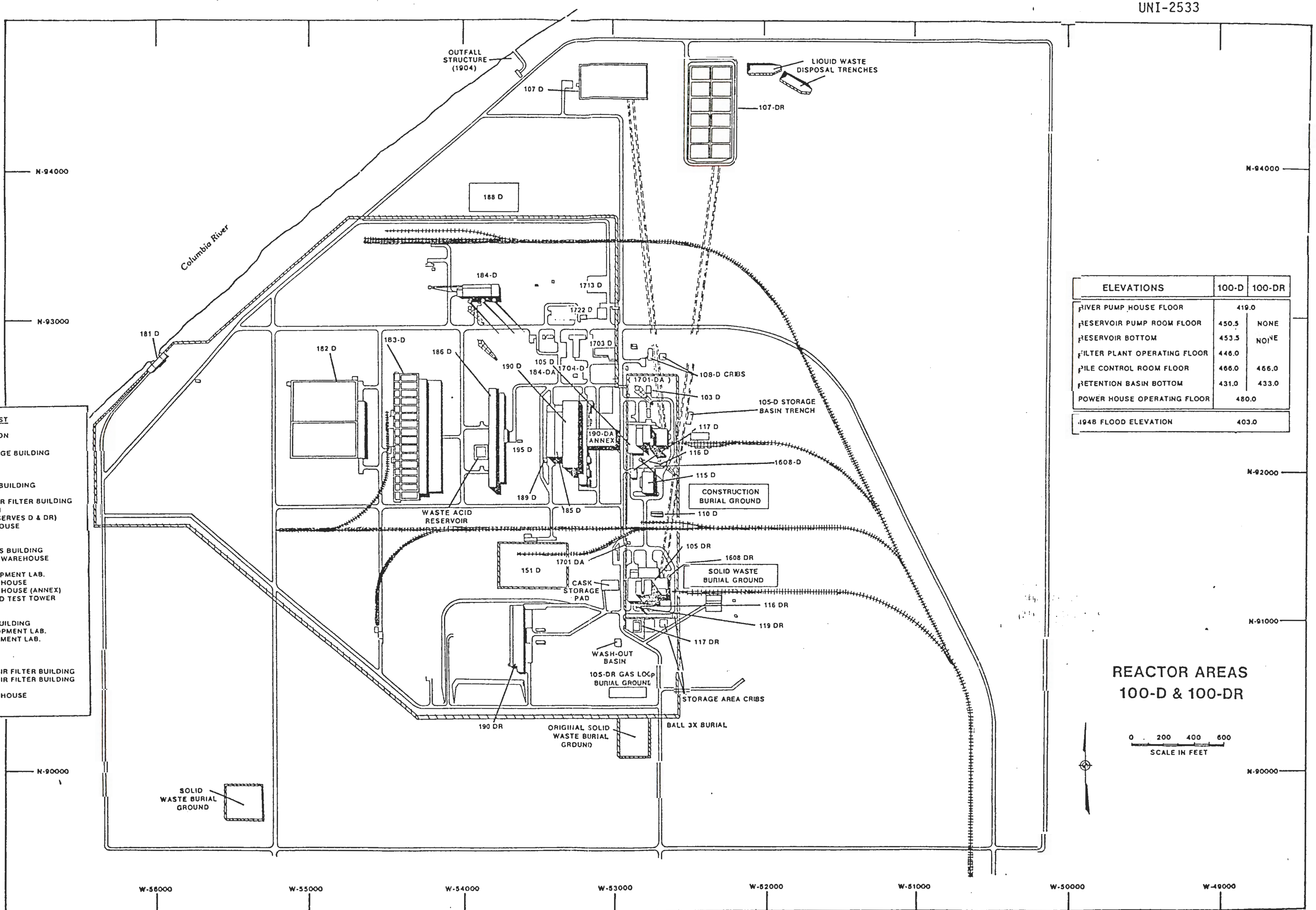
ELEVATIONS	100-B	100-C
RIVER PUMP HOUSE FLOOR	427.0	427.0
RESERVOIR PUMP ROOM FLOOR	442.0	NONE
RESERVOIR BOTTOM	445.0	NONE
FILTER PLANT OPERATING FLOOR	475.0	493.5
PILE CONTROL ROOM FLOOR	468.5	494.0
RETENTION BASIN BOTTOM	422.2	430.0
POWER HOUSE OPERATING FLOOR	467.0	
1948 FLOOD ELEVATIONS	416.0	416.0

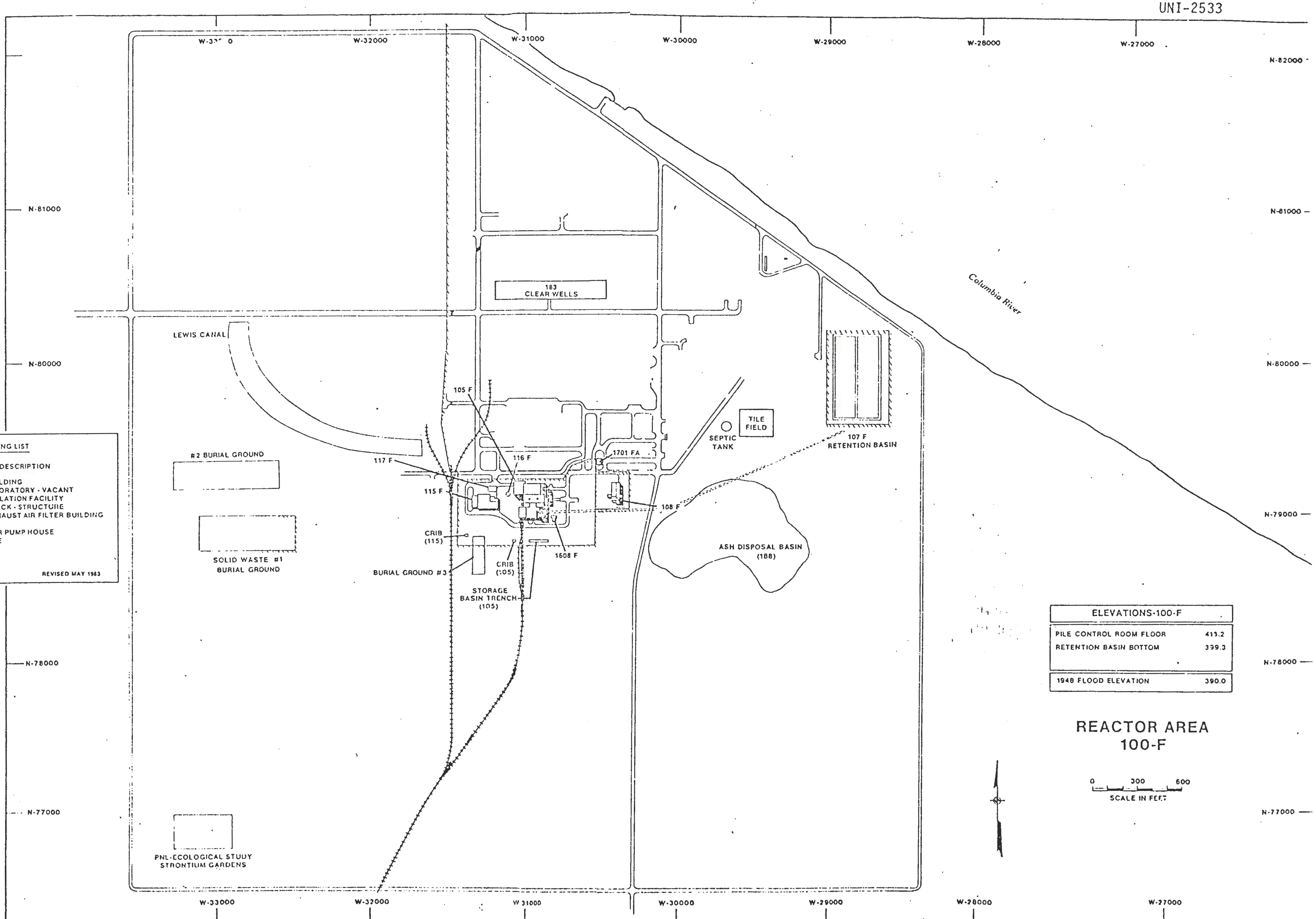
REACTOR AREAS 100-B & 100-C



BUILDING LIST

BUILDING NUMBER	DESCRIPTION
103 D	FUEL ELEMENT STORAGE BUILDING
105 D	REACTOR BUILDING
107 D	RETENTION BASIN
110 D	HELIUM STORAGE
115 D	GAS RECIRCULATION BUILDING
116 D	REACTOR STACK
117 D	REACTOR EXHAUST AIR FILTER BUILDING
151 D	PRIMARY SUBSTATION
181 D	RIVER PUMP HOUSE (SERVES D & DR)
182 D	RESERVOIR & PUMP HOUSE
183 D	FILTER PLANT
184 D	POWER HOUSE
185 D	THERMAL HYDRAULICS BUILDING
186 D	MATERIALS STORAGE WAREHOUSE
188 D	ASH DISPOSAL BASIN
189 D	MECHANICAL DEVELOPMENT LAB.
190 D	MAIN PROCESS PUMP HOUSE
190 DA	MAIN PROCESS PUMP HOUSE (ANNEX)
195 D	VERTICAL SAFETY ROD TEST TOWER
1608 D	PUMPING STATION
1701 DA	OFFICE BUILDING
1703 D	TECHNICAL OFFICE BUILDING
1713 D	INST. & ELEC. DEVELOPMENT LAB.
1722 D	EQUIPMENT DEVELOPMENT LAB.
105 DR	REACTOR BUILDING
107 DR	RETENTION BASIN
116 DR	REACTOR STACK
117 DR	REACTOR EXHAUST AIR FILTER BUILDING
119 DR	REACTOR EXHAUST AIR FILTER BUILDING
190 DR	MAIN PUMP HOUSE
1608 DR	WASTE WATER PUMP HOUSE
1702 DR	BADGE HOUSE

ELEVATIONS	100-D	100-DR
RIVER PUMP HOUSE FLOOR	419.0	
RESERVOIR PUMP ROOM FLOOR	450.5	NONE
RESERVOIR BOTTOM	453.5	NONE
FILTER PLANT OPERATING FLOOR	446.0	
PILE CONTROL ROOM FLOOR	466.0	466.0
RETENTION BASIN BOTTOM	431.0	433.0
POWER HOUSE OPERATING FLOOR	480.0	
1948 FLOOD ELEVATION	403.0	



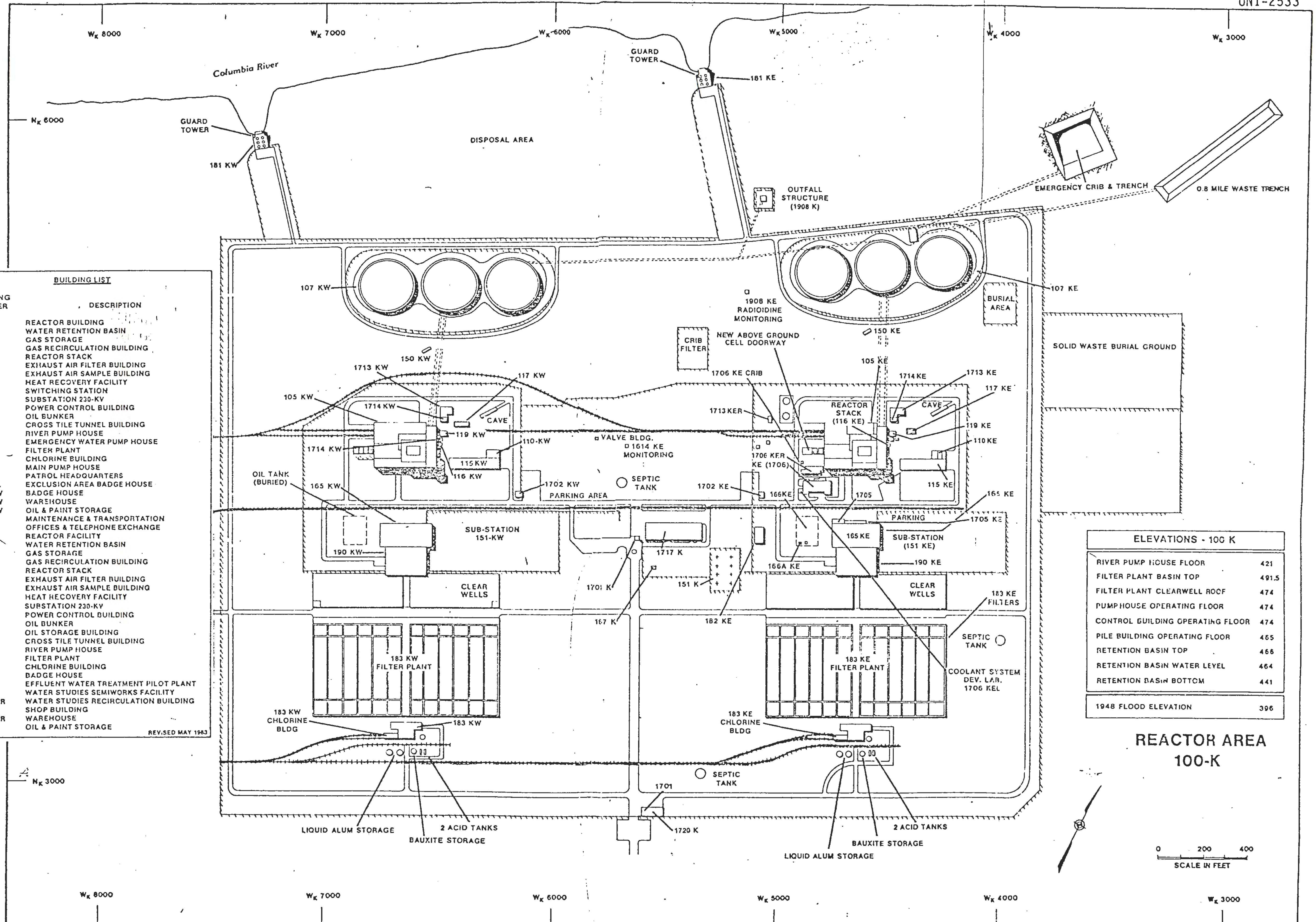
BUILDING LIST

BUILDING NUMBER	DESCRIPTION
105 F	REACTOR BUILDING
108 F	BIOLOGY LABORATORY - VACANT
115 F	GAS RECIRCULATION FACILITY
116 F	REACTOR STACK - STRUCTURE
117 F	REACTOR EXHAUST AIR FILTER BUILDING
183 F	CLEAR WELLS
1608 F	WASTE WATER PUMP HOUSE
1701 FA	SMALL OFFICE

REVISED MAY 1983

ELEVATIONS-100-F	
PILE CONTROL ROOM FLOOR	413.2
RETENTION BASIN BOTTOM	399.3
1948 FLOOD ELEVATION	390.0

9516354.0306



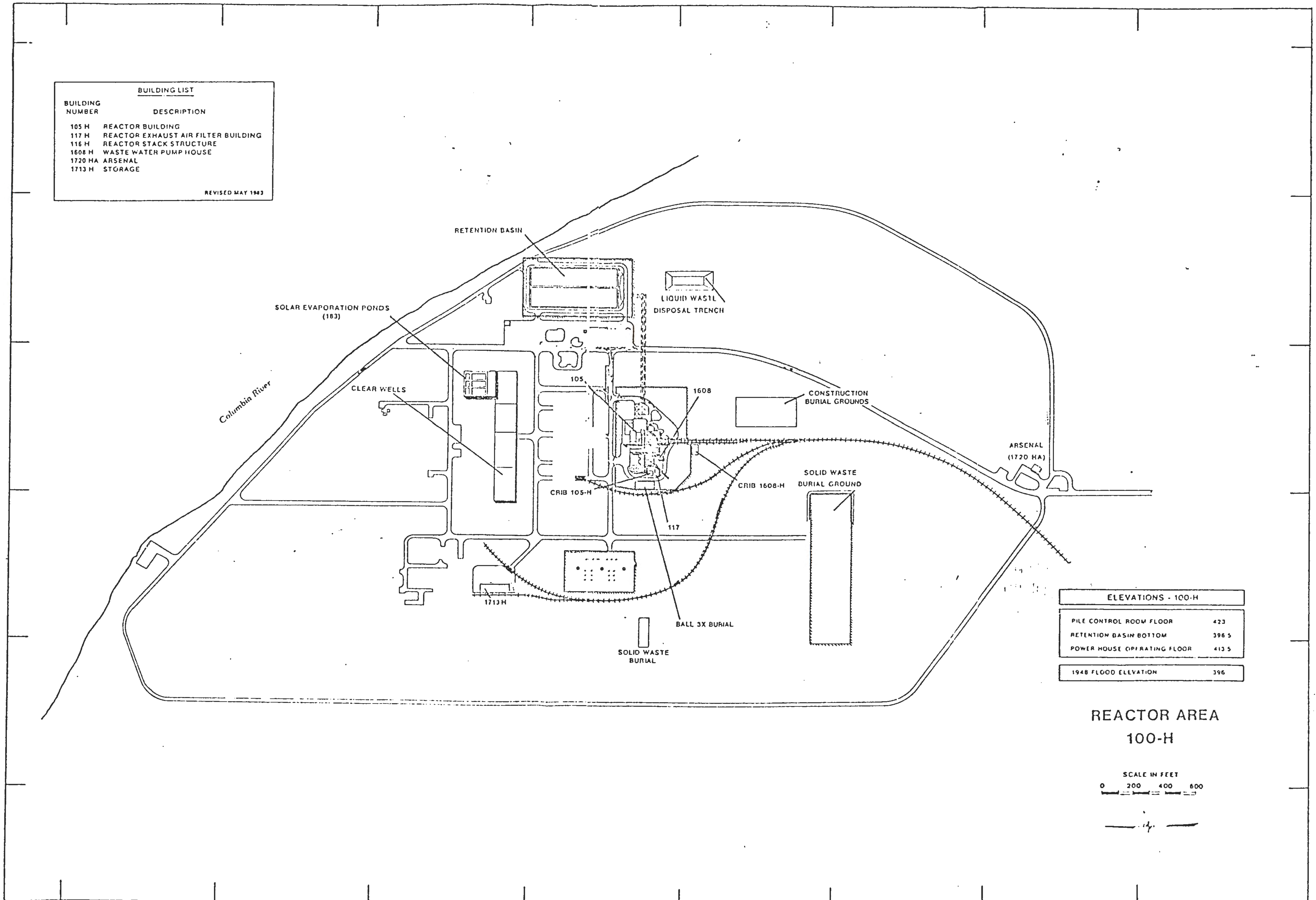
BUILDING LIST

BUILDING NUMBER	DESCRIPTION
105 KW	REACTOR BUILDING
107 KW	WATER RETENTION BASIN
110 KW	GAS STORAGE
115 KW	GAS RECIRCULATION BUILDING
116 KW	REACTOR STACK
117 KW	EXHAUST AIR FILTER BUILDING
119 KW	EXHAUST AIR SAMPLE BUILDING
150 KW	HEAT RECOVERY FACILITY
151 K	SWITCHING STATION
151 KW	SUBSTATION 230-KV
165 KW	POWER CONTROL BUILDING
166 KW	OIL BUNKER
167 K	CROSS TILE TUNNEL BUILDING
181 KW	RIVER PUMP HOUSE
182 K	EMERGENCY WATER PUMP HOUSE
183 KW	FILTER PLANT
183 KW	CHLORINE BUILDING
190 KW	MAIN PUMP HOUSE
1701 K	PATROL HEADQUARTERS
1701 KA	EXCLUSION AREA BADGE HOUSE
1702 KW	BADGE HOUSE
1713 KW	WAREHOUSE
1714 KW	OIL & PAINT STORAGE
1717 K	MAINTENANCE & TRANSPORTATION
1720 K	OFFICES & TELEPHONE EXCHANGE
105 KE	REACTOR FACILITY
107 KE	WATER RETENTION BASIN
110 KE	GAS STORAGE
115 KE	GAS RECIRCULATION BUILDING
116 KE	REACTOR STACK
117 KE	EXHAUST AIR FILTER BUILDING
119 KE	EXHAUST AIR SAMPLE BUILDING
150 KE	HEAT RECOVERY FACILITY
151 KE	SUBSTATION 230-KV
165 KE	POWER CONTROL BUILDING
177 KE	OIL BUNKER
166 KE	OIL STORAGE BUILDING
167 KE	CROSS TILE TUNNEL BUILDING
181 KE	RIVER PUMP HOUSE
183 KE	FILTER PLANT
183 KE	CHLORINE BUILDING
1702 KE	BADGE HOUSE
1705	EFFLUENT WATER TREATMENT PILOT PLANT
1706 KE	WATER STUDIES SEMIWORKS FACILITY
1706 KER	WATER STUDIES RECIRCULATION BUILDING
1713 KE	SHOP BUILDING
1713 KER	WAREHOUSE
1714 KE	OIL & PAINT STORAGE

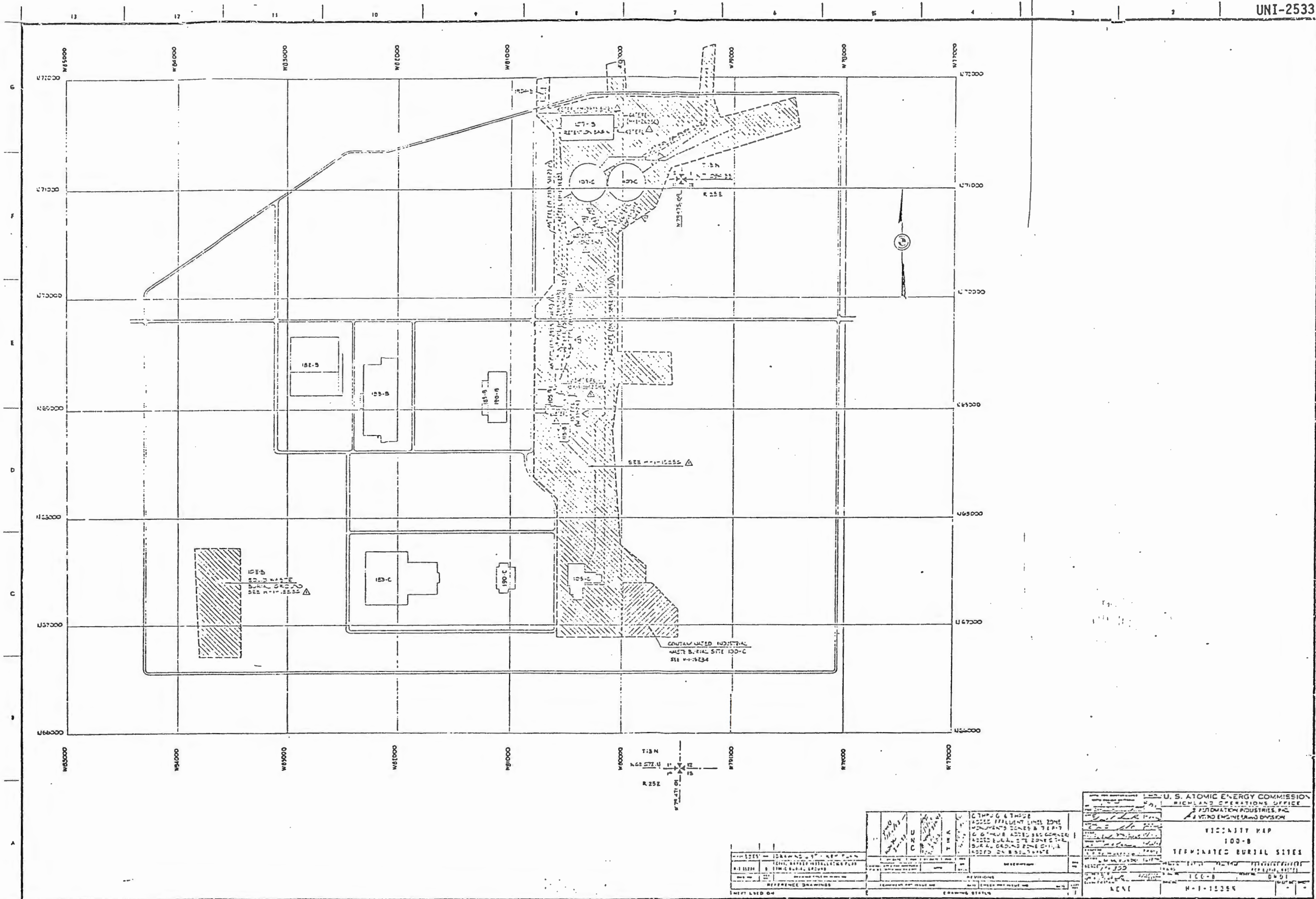
REVISED MAY 1983

ELEVATIONS - 100 K

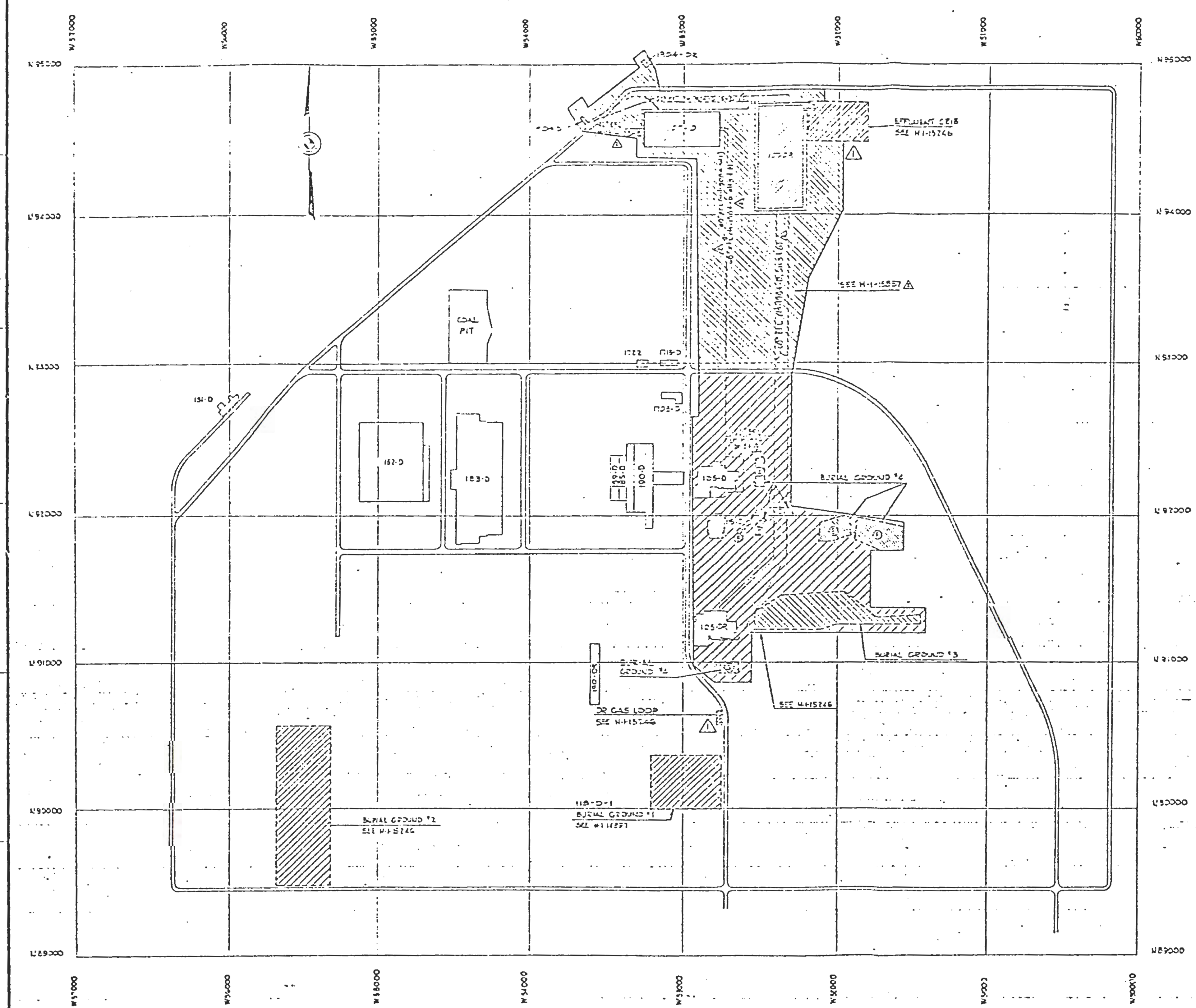
RIVER PUMP HOUSE FLOOR	421
FILTER PLANT BASIN TOP	491.5
FILTER PLANT CLEARWELL ROOF	474
PUMPHOUSE OPERATING FLOOR	474
CONTROL BUILDING OPERATING FLOOR	474
PILE BUILDING OPERATING FLOOR	465
RETENTION BASIN TOP	466
RETENTION BASIN WATER LEVEL	464
RETENTION BASIN BOTTOM	441
1948 FLOOD ELEVATION	396



REACTOR AREA
100-H


U. S. ATOMIC ENERGY COMMISSION
RICHLAND OPERATIONS OFFICE
VICINITY MAP
100-B
TERMINATED BURIAL SITES
NONE
H-1-15255
105-B SOLID WASTE BURIAL GROUND SEE H-1-15252
CONTAMINATED INDUSTRIAL WASTE BURIAL SITE 100-C SEE H-1-15234
SEE H-1-15252
182-B
183-B
183-C
190-C
105-C
T13N
R25E

UNI-2533



U. S. ATOMIC ENERGY COMMISSION
RICHLAND OPERATIONS OFFICE
AUTOMATION INDUSTRIES INC.
VITRO ENGINEERING DIVISION

VICINITY MAP
100-DR
TERMINATED BURIAL SITES

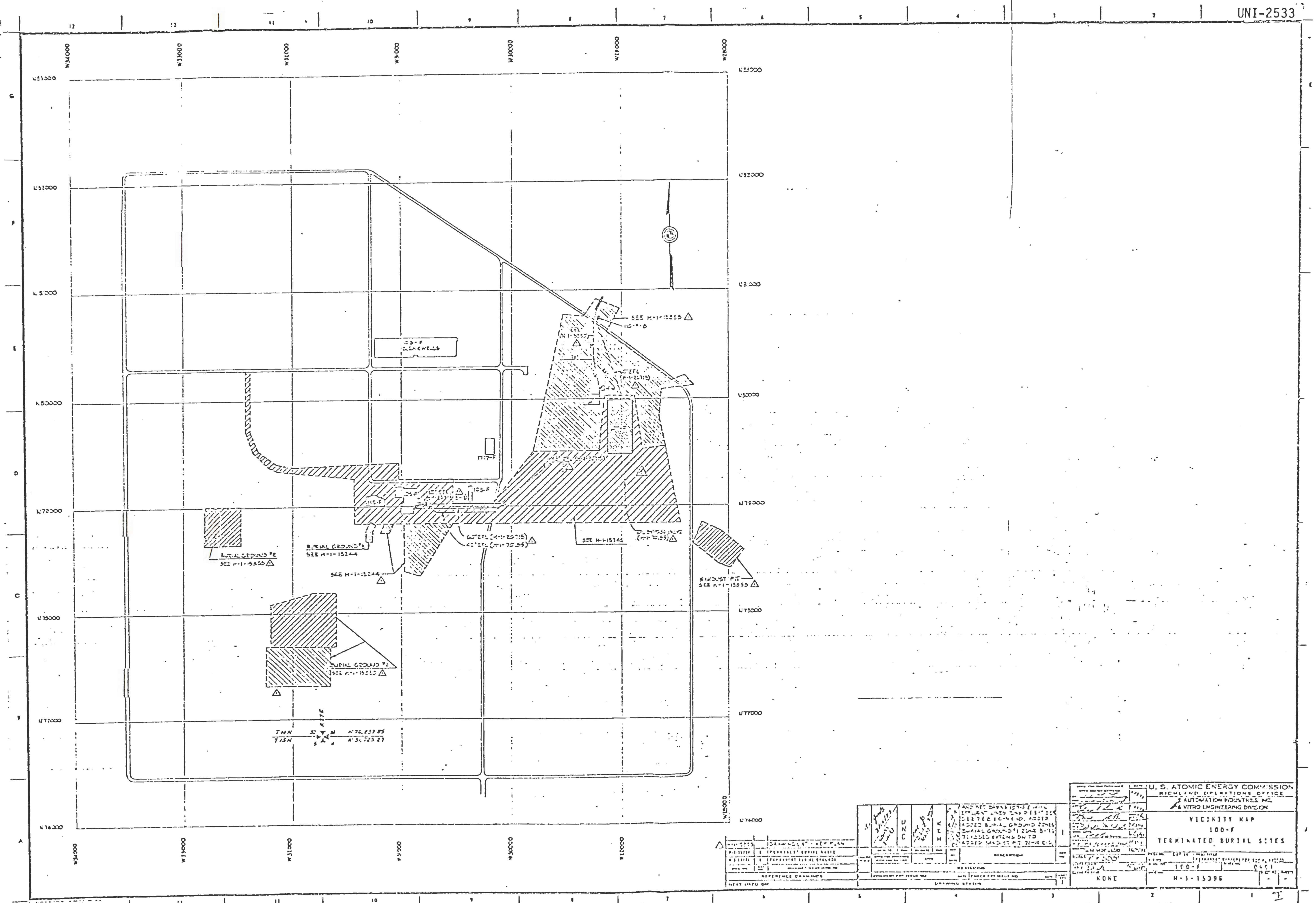
SCALE 1" = 300'

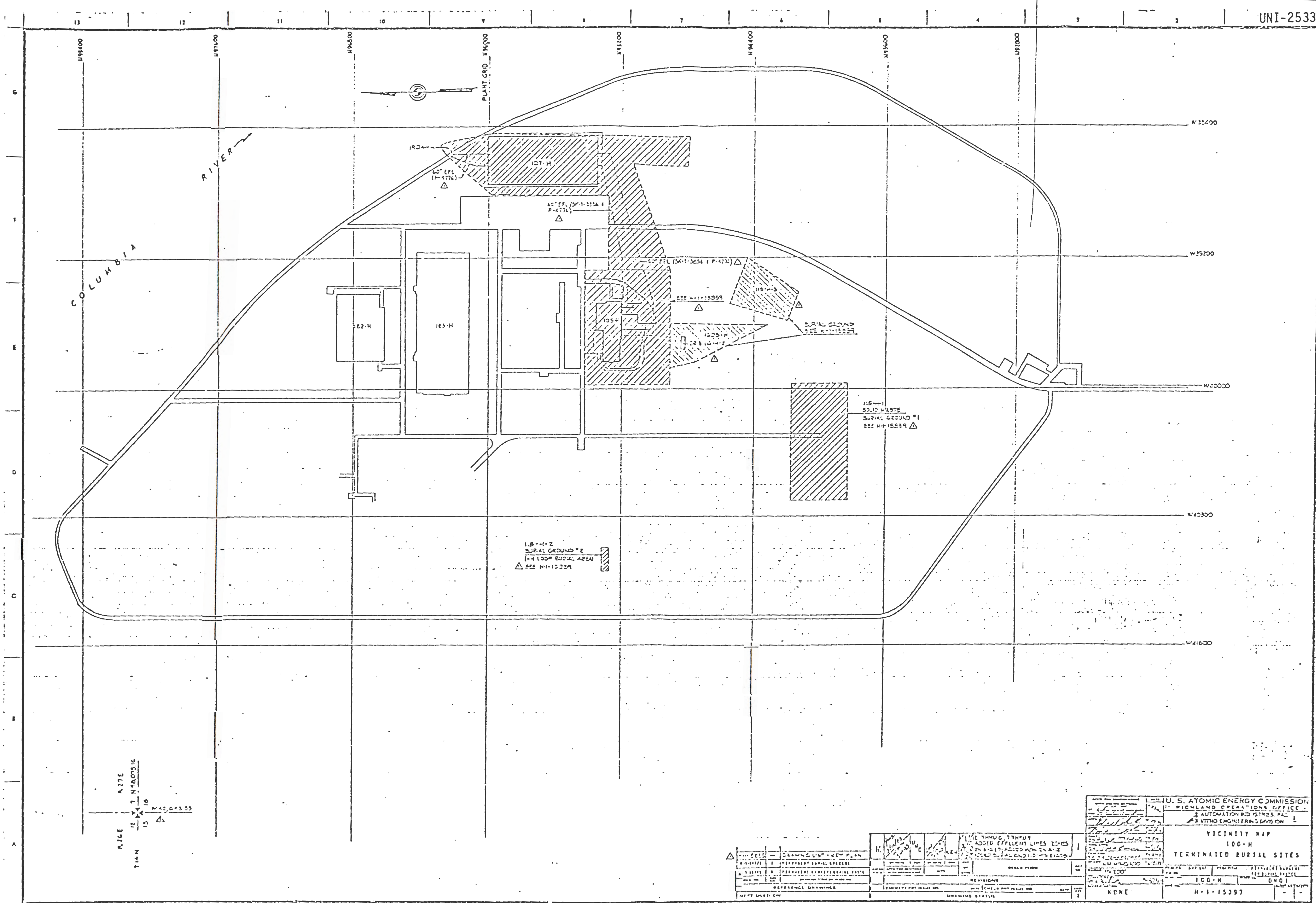
100-D

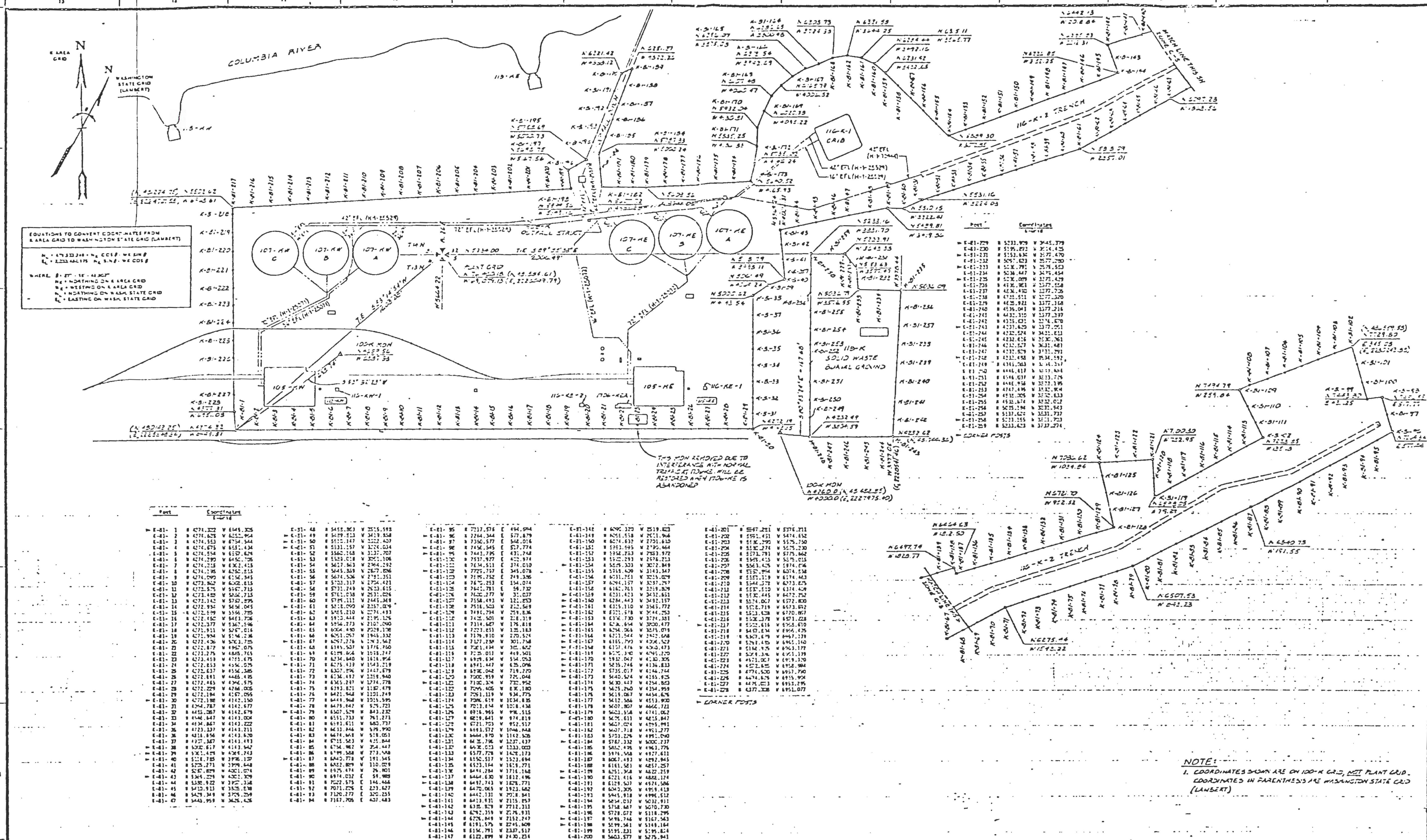
H-1-15395

9513359.0510

UNI-2533




UNI-2533
COLUMBIA RIVER
PLANT GRID
107-H
182-H
183-H
105-H
118-H-1
SOLID WASTE
BURIAL GROUND #1
SEE H-1-15359
BURIAL GROUND #2
SEE H-1-15359
U. S. ATOMIC ENERGY COMMISSION
RICHLAND OPERATIONS OFFICE
VICINITY MAP
100-H
TERMINATED BURIAL SITES
NONE
100-H
0401
H-1-15397



NOTE:
1. COORDINATES SHOWN ARE ON 100-K GRID, NOT PLANT GRID. COORDINATES IN PARENTHESIS ARE WASHINGTON STATE GRID (LAMBERT)

U. S. DEPARTMENT OF ENERGY
Richland Operations Office
KAISER ENGINEERS HANFORD COMPANY

H-538
PERM MARKERS
BURIAL WASTE 100-K SITE

CONTAMINATED ZONE MARKERS

NONE | NOT REQ'D | H-1-15560 | 1 | 1 | 0

FACILITIES ADDRESSED IN THIS DOCUMENT

REACTORS

Area	Facility Number	Description	Approximate Size (ft)	Operating History
B	105-B	Reactor Building, Reactor Block, and Fuel Storage Basin	42,500 ft^2	1944-1968
	105-C	Reactor Building, Reactor Block, and Fuel Storage Basin	65,000 ft^2	1952-1961
D	*105-D	Reactor Building, Reactor Block, and Fuel Storage Basin	42,500 ft^2	1944-1967
	*105-DR	Reactor Building, Reactor Block, and Fuel Storage Basin	42,500 ft^2	1950-1964
F	*105-F	Reactor Building, Reactor Block, and Fuel Storage Basin	42,500 ft^2	1945-1965
H	*105-H	Reactor Building, Reactor Block, and Fuel Storage Basin	62,000 ft^2	1949-1965
K	105-KE	Reactor Building, Reactor Block, and Fuel Storage Basin	60,000 ft^2	1955-1971
	105-KW	Reactor Building, Reactor Block, and Fuel Storage Basin	60,000 ft^2	1955-1970

*Facilities decommissioned under DOE Surplus Facilities Management Program (AR funding designation). Other facilities are managed by UNC Operations Division, with decommissioning funded under DOE GE funding designation.

EFFLUENT SYSTEMS

Area	Facility Number	Description	Approximate Size (ft)	Operating History
B	107-B	Effluent Water Retention Basin (concrete)	230 x 467 x 20	1943-1968
	1904-B2	Effluent Water Outfall Structure	27 x 14 x 25	1943-1968
	1904-B3	Effluent Water Outfall Structure	27 x 14 x 25	1943-1968
C	107-C	Effluent Water Retention Basin (open steel tanks)	330 dia x 18 ft high	1951-1969
D	*107-D	Effluent Water Retention Basin (concrete)	467 x 230 x 20	1943-1967
	*107-DR	Effluent Water Retention Basin (concrete)	600 x 273 x 20	1947-1964
	*1904-D	Effluent Water Outfall Structure	27 x 14 x 25	1944-1967
	*1904-DR	Effluent Water Outfall Structure	27 x 14 x 25	1947-1964
	*1608-D	Pumping Station	34 x 36 x 34	1944-1967
	*1608-DR	Pumping Station	36 x 34 x 34	1950-1964
F	*107-F	Effluent Water Retention Basin	467 x 230 x 21	1944-1965
	*1904-F	Effluent Water Outfall Structure	27 x 14 x 25	1944-1965
	*1608-F	Pumping Station	36 x 34 x 34	1945-1965

*Facilities decommissioned under DOE Surplus Facilities Management Program (AR funding designation). Other facilities are managed by UNC Operations Division, with decommissioning funded under DOE GE funding designation.

EFFLUENT SYSTEMS - contd.

Area	Facility Number	Description	Approximate Size (ft)	Operating History
H	*107-H	Effluent Water Retention Basin	600 x 273 x 20	1949-1965
	*1904-H	Effluent Water Outfall Structure	27 x 14 x 25	1949-1965
	*1608-H	Pumping Station	36 x 34 x 44	1949-1965
K	107-KE	Effluent Water Retention Basin (3 steel tanks)	250 x 29	1955-1971
	107-KW	Effluent Water Retention Basin (3 steel tanks)	250 x 29	1955-1971
	1904-K	Effluent Water Outfall Structure	30 x 40 x 40	1955-1971
All Areas	N/A	Effluent Water Piping System (average 1.75 miles for each Area)	14 miles, 58,000 cu ft	

*Facilities decommissioned under DOE Surplus Facilities Management Program (AR funding designation). Other facilities are managed by UNC Operations Division, with decommissioning funded under DOE GE funding designation.

LIQUID WASTE DISPOSAL FACILITIES

Area	Facility Number	Description	Approximate Size (ft)	Operating History
B	116-B-1	Liquid Waste Disposal Trench	100 x 10	1946-1955
	116-B-2	B Reactor Storage Basin Trench	100 x 10	1946-1955
	116-B-3	B Reactor Pluto Crib	10 x 10 x 10	1951-1952
	116-B-4	Liquid Waste Crib	40 x 40	1944-1968
	116-B-5	108-B Laboratory Pluto Crib	100 x 50	1944-1968
	116-B-6-1	111-B Crib #1	25 x 25	1944-1968
	116-B-6-2	111-B Crib #2	20 x 20	1944-1968
C	116-C-1	Liquid Waste Disposal Trench	50 x 500	1946-1955
	116-C-2	C Reactor Pluto Crib	50 x 90	1951-1952
	116-C-2-1	C Reactor Pluto Crib	50 x 50	1951-1952
	116-C-2-2	C Reactor Pluto Crib Sand Filter	50 x 60	1951-1952
D	*116-D-1	D Reactor Storage Basin Trench No. 1	150 x 40	1946-1955
	*116-D-1B	D Reactor Storage Basin Trench No. 2	150 x 40	1946-1955
	*116-D-2	D Reactor Pluto Crib	10' diam	1950-1952
	*116-D-3	108-D Crib No. 1	10' diam	1944-1967

*Facilities decommissioned under DOE Surplus Facilities Management Program (AR funding designation). Other facilities are managed by UNC Operations Division, with decommissioning funded under DOE GE funding designation.

LIQUID WASTE DISPOSAL FACILITIES - contd.

Area	Facility Number	Description	Approximate Size (ft)	Operating History
D	*116-D-4	108-D Crib No. 2	3' diam	1944-1967
	*116-DR-1	107-DR Liquid Waste Trench	300 x 150	1950-1964
	*116-DR-2	107-DR Liquid Waste Trench	100 x 40	1950-1964
	*116-DR-3	DR Reactor Storage Basin Trench	60 x 40	1946-1955
	*116-DR-4	DR Reactor Pluto Crib/ 117-DR Crib	30 x 30	1950-1952
F	*116-F-1	Lewis Canal	1,500 x 100	1953
	*116-F-2	Hazardous Waste Trench	550 x 200	
	*116-F-3	F Reactor Storage Basin Trench	100 x 40	1945-1965
	*116-F-4	F Reactor Pluto Crib	30 x 30	1950-1952
	*116-F-5	Ball Washer Crib	30 x 30	1945-1965
	*116-F-6	1608-F Liquid Waste Disposal Trench	300 x 100	1945-1965
	*116-F-7	117-F Trench	15 x 15	1945-1965
	*116-F-9	Leaching Trench	15 x 500	1945-1965
	*116-F-10	Perf Decontamination Soil Column	15 x 15	1945-1965

*Facilities decommissioned under DOE Surplus Facilities Management Program (AR funding designation). Other facilities are managed by UNC Operations Division, with decommissioning funded under DOE GE funding designation.

LIQUID WASTE DISPOSAL FACILITIES - contd.

Area	Facility Number	Description	Approximate Size (ft)	Operating History
H	*116-H-1	107-H Liquid Waste Trench	1,000 x 75	1949-1965
	*116-H-2	1608-H Trench	250 x 75	1949-1965
	*116-H-3	H Reactor Dummy Decontamination Drain	15 x 15	1949-1965
	*116-H-4	H Reactor Pluto Crib	10 x 10	1950-1952
K	116-K-1	Liquid Waste Crib	400 x 400	1955-1971
	116-K-2	Liquid Waste Crib	4,000 x 45	1955-1971
	116-KE-1	115-KE Crib	10 x 10	1955-1971
	116-KE-2	1706-KER Crib	80 x 80	1955-1971
	116-KW-1	115-KW Crib	20 x 20	1955-1970

*Facilities decommissioned under DOE Surplus Facilities Management Program (AR funding designation). Other facilities are managed by UNC Operations Division, with decommissioning funded under DOE GE funding designation.

SOLID WASTE DISPOSAL FACILITIES

Area	Facility Number	Description	Approximate Size (ft)	Operating History
B	118-B-1	B Reactor Solid Waste Burial Ground	1,000 x 321	1944-1973
	118-B-2	Construction Burial Ground No. 1	60 x 30	1954-1956
	118-B-3	Construction Burial Ground No. 2	350 x 275	1956-1960
	118-B-4	B Reactor Dummy Storage Burial Ground	50 x 30	1956-1968
	118-B-5	Ball 3X Burial Ground	50 x 50	1953
	118-B-6	108-B Solid Waste Burial Ground	40 x 40	1950-1953
D	*118-D-1	100-D Burial Ground No. 1	450 x 375	1944-1967
	*118-D-2	100-D Burial Ground No. 2	1,000 x 360	1949-1970
	*118-D-3	100-D Burial Ground No. 3	1,000 x 250	1956-1973
	*118-D-4	Construction Burial Ground	600 x 200	1953-1967
	*118-D-5	Ball 3X Burial Ground	20 x 20	1954
	*118-DR-1	DR Reactor Gas Loop Burial Ground	125 x 75	1963-1964
C	118-C-1	C Reactor Burial Ground	510 x 400	1953-1969

*Facilities decommissioned under DOE Surplus Facilities Management Program (AR funding designation). Other facilities are managed by UNC Operations Division, with decommissioning funded under DOE GE funding designation.

SOLID WASTE DISPOSAL FACILITIES - contd.

Area	Facility Number	Description	Approximate Size (ft)	Operating History
F	*118-F-1	Solid Waste Burial Ground No. 2; Minor Construction Burial Ground No. 2	600 x 500	1954-1965
	*118-F-2	Burial Ground No. 2; Solid Waste Burial Ground No. 1	365 x 325	1945-1965
	*118-F-3	Burial Ground No. 3; Minor Construction Burial Ground No. 1	175 x 50	1952
	*118-F-4	115-F Pit	10 x 10	1949
	*118-F-5	PNL Sawdust Repository	500 x 150	1954-1975
	*118-F-6	Solid Waste Burial Ground	400 x 200	1965-1973
H	*118-H-1	100-H Burial Ground No. 1	700 x 350	1949-1965
	*118-H-2	100-H Burial Ground No. 2 (H-1 Loop Burial Ground)	140 x 50	1955-1965
	*118-H-3	Construction Burial Ground	300 x 200	1953-1957
	*118-H-4	Ball 3X Burial Ground	150 x 30	1953-1965
	*118-H-5	H Reactor Thimble Pit	30 x 2	1953
K	118-K	K Burial Ground	1,200 x 600	1955-1971

WP#1758F

*Facilities decommissioned under DOE Surplus Facilities Management Program (AR funding designation). Other facilities are managed by UNC Operations Division, with decommissioning funded under DOE GE funding designation.

ANCILLARY FACILITIES

Area	Facility Number	Description	Approximate Size (ft)	Operating History
B	103-B	Fuel Element Storage Building	53 x 26 x 14	1944-1968
	108-B	Mint Special Processing Building	132 x 32 x 53	
	115-B/C	Gas Recirculation Building	113 x 34 x 40	
	116-B	Reactor Exhaust Stack		1944-1968
	117-B	Filter Exhaust Building	59 x 39 x 35	1944-1968
D	*103-D	Fuel Element Storage Building	53 x 26 x 14	1944-1967
	*115-D/DR	Gas Recirculation Building	168 x 98 x 32	1944-1967
	*116-D	Reactor Exhaust Stack	200 ft high, 16 ft O.D.	1944-1967
	*116-DR	Reactor Exhaust Stack	200 ft high, 16 ft O.D.	1950-1964 (currently in use for HEDL experi-ments)
	*117-D	Filter Exhaust Building	59 x 39 x 35	1944-1967
	*117-DR	Filter Exhaust Building	59 x 39 x 35	1950-1964
	*119-DR	Exhaust Air Sampling Building		1950-1964 (currently in use for HEDL experi-ments)

*Facilities decommissioned under DOE Surplus Facilities Management Program (AR funding designation). Other facilities are managed by UNC Operations Division, with decommissioning funded under DOE GE funding designation.

ANCILLARY FACILITIES - contd.

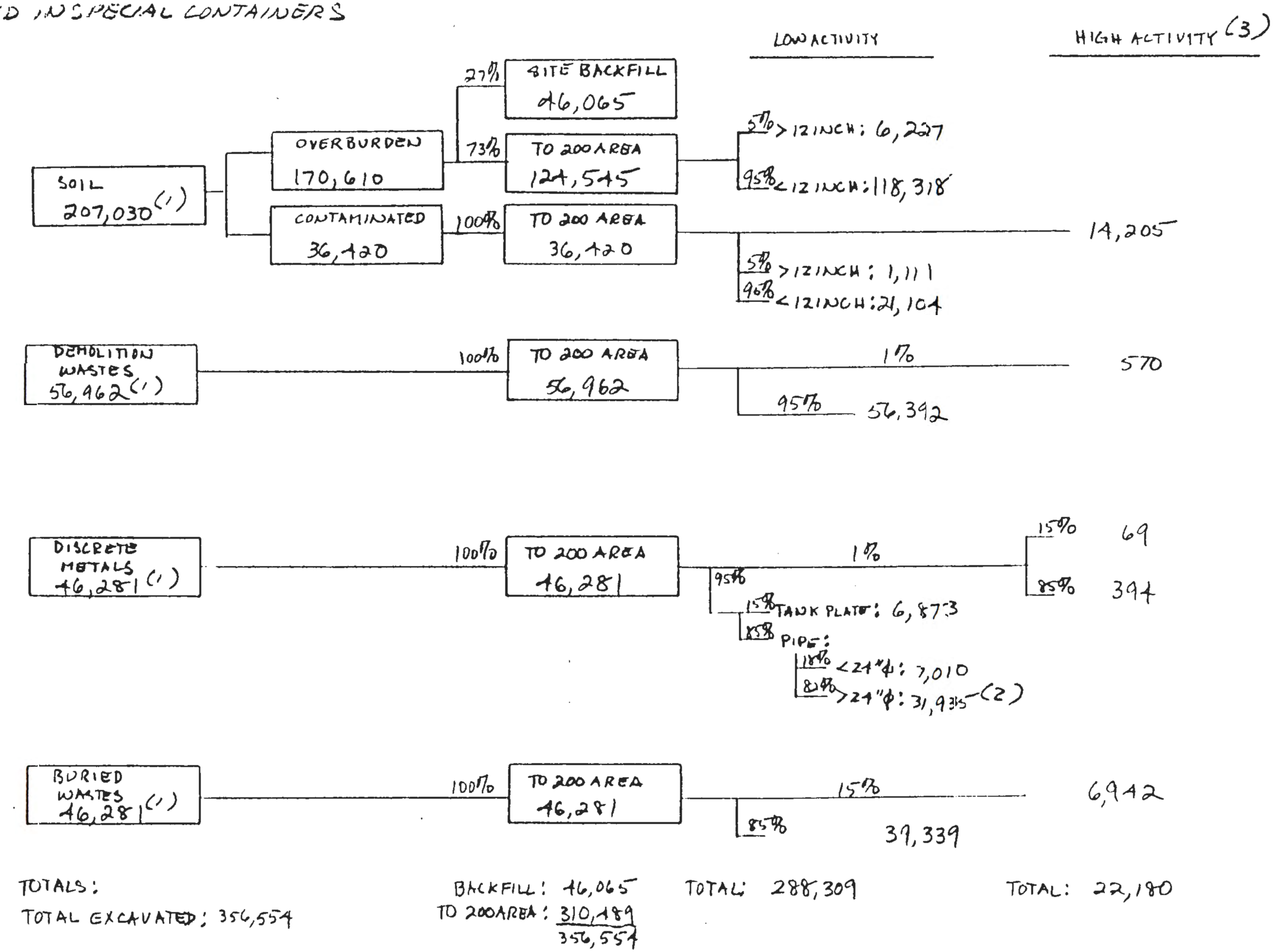
Area	Facility Number	Description	Approximate Size (ft)	Operating History
F	*108-F	Biology Laboratory	200 x 100 x 50	1945-1965
	*115-F	Gas Recirculation Building	168 x 98 x 32	1945-1965
K	115-KE	Gas Recirculation	113 x 34 x 40	1955-1970
	116-KE	Reactor Exhaust Stack	200 ft high, 16 ft O.D.	1955-1971
	116-KW	Reactor Exhaust Stack	200 ft high, 16 ft O.D.	1955-1970
	117-KE	Filter Exhaust Building	59 x 39 x 35	1955-1971
	117-KW	Filter Exhaust Building	59 x 39 x 35	1955-1970
	119-KE	Exhaust Air Sampling Building		1955-1971
	119-KW	Exhaust Air Sampling Building		1955-1970
	1706-KE/KEL/KER	Reactor Loop Testing	~ 9,000 ft^2	1955-1971 facilities are currently in use by UNC

*Facilities decommissioned under DOE Surplus Facilities Management Program (AR funding designation). Other facilities are managed by UNC Operations Division, with decommissioning funded under DOE GE funding designation.

NOTES:

1. ALL VALUES IN THOUSANDS OF LOOSE CUBIC FEET
2. TRANSPORTED ON RACKS
3. PACKAGED IN SPECIAL CONTAINERS

FIGURE 7-2
WASTE VOLUME DISTRIBUTION
INDUSTRIAL USE OPTION



PRELIMINARY

9513354.0323

7.0 PROPERTIES OF WASTE DELIVERED TO THE 200 AREAS

7.1 WASTE CHARACTERISTICS

This section describes the characteristics of the 100 Area excavated wastes which will be transported to the 200 Areas for disposal under both the General Use and Industrial Use Options. General categories to be shipped are listed as follows.

Low activity wastes (<200 mR/hr and <10nCi/g alpha)

- Soil, <12 inch particle size
- Soil, >12 inch particle size
- Burial ground wastes
- Demolition wastes including steel retention basins
- Steel pipe

High activity wastes (>200 mR/hr or >10nCi/g alpha)

- Soil, all particle sizes
- Burial ground wastes
- Demolition wastes including steel retention basins
- Steel pipe

Three packaging methods are specified as follows:

High activity wastes:

All high activity wastes will be packaged in single-use, shielded containers. Containers are described in Section 3.0. It is anticipated that the shielding will be sufficient to allow for contact handling of the container at the 200 Areas.

Low activity steel pipe, >24 inch diameter:

Low activity metal pipe will be cut into lengths suitable for transport (e.g., between 20 and 60 feet in length). Steel pipe with a diameter greater than 24 inches will be shipped on rail car racks. If necessary, contamination will be contained by such means as crimping the ends of the pipe, grouting the inside of the pipe, and/or wrapping the outside of the pipe.

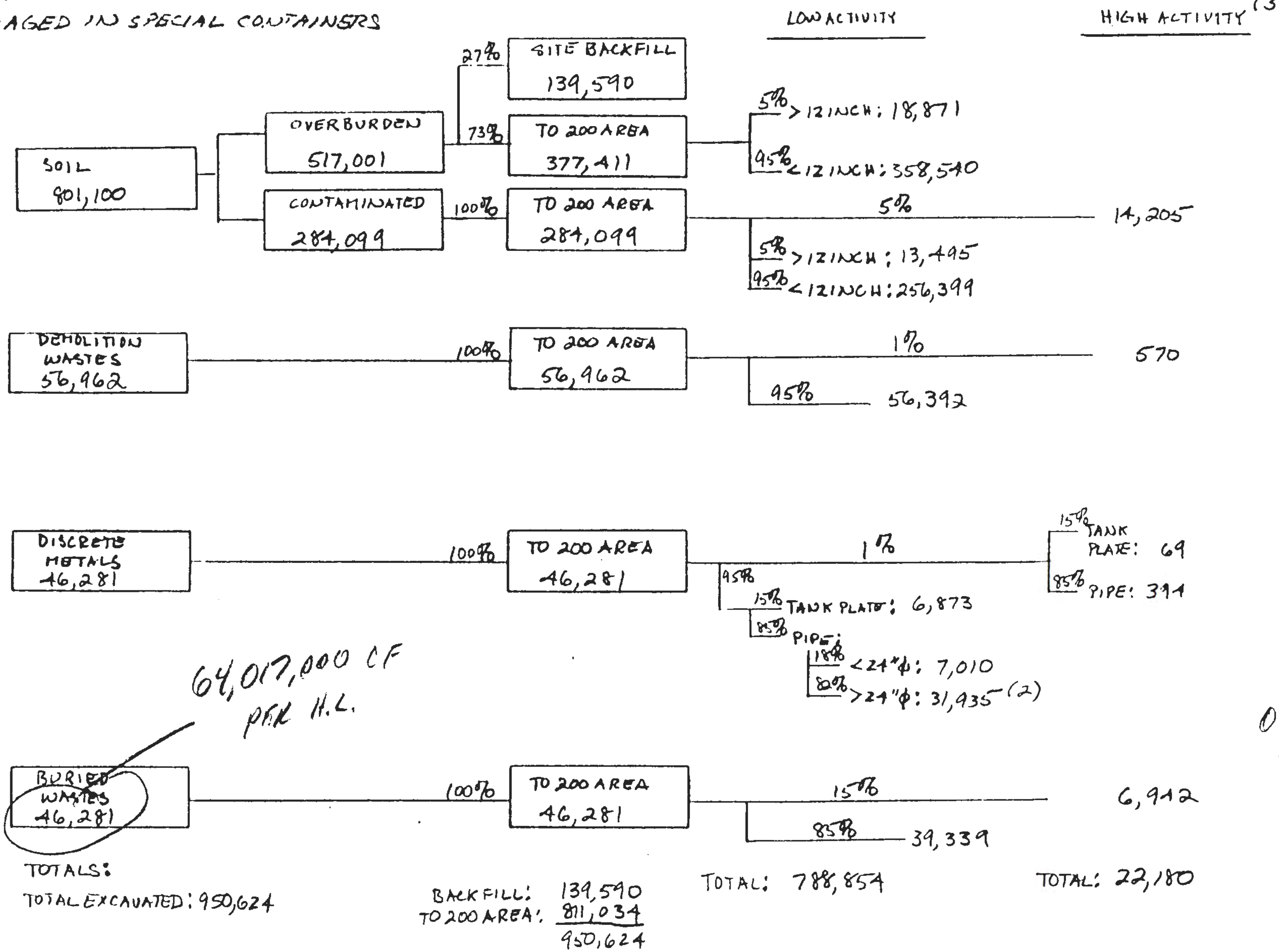
All other low activity wastes:

All other low activity wastes will be packaged in reusable, 50 yd^3 containers.

Secondary wastes such as HEPA filters, contaminated clothing, and failed equipment parts will be shipped in the same types of containers (appropriate for the type and level of waste) as the excavated wastes.

NOTES:
1. ALL VALUES IN THOUSANDS OF LOOSE CUBIC FEET
2. TRANSPORTED ON RACKS
3. PACKAGED IN SPECIAL CONTAINERS

FIGURE 7-1
WASTE VOLUME DISTRIBUTION GENERAL USE OPTION



LOOSE VOLUME VS BANK VOLUME

CHART 8 ASSUMPTIONS

APP A.4 CALC BRIEF
ALT SHOW SUPPL & EXPLAIN 46 M
STEP 4 - ALUMINUM 8 - ALUM
7-9 [illegible]

OVERBURDEN ADDED TO SOIL VOLUME

9513354.0325

PRELIMINARY