GAF 000007

PC-000423/4

GENERAL ATOMICS
HOT CELL FACILITY
DECOMMISSIONING PLAN

prepared for

GA HOT CELL D&D PROJECT
CONTRACT NO. DE-AC03-95SF20798
PROJECT NO. 7340

JANUARY 1998

GENERAL ATOMICS

GA 2175 (REV. 9/89)

PROJECT CONTROL ISSUE SUMMARY

	DOC. CODE	PROJECT	DOCUMENT NO.	REV.
	RGN	0000	PC-000423	4

TITLE:

General Atomics Hot Cell Facility Decommissioning Plan

CM APPROVAL/ DATE	REV	PREPARED BY	APPROVAL(S) RESOURCE/ SUPPORT	APPROVAL(S) PROJECT	REVISION DESCRIPTION/ W. O. NO.
ISSUED 2 APR 1 5 1995	0	J. M. Sills 4-13-95	V. Nicolayeff 4/13/95	G. C. Bramblett 4/13/95; K. E. Asmussen	Initial Issue W. O. 7320.500.100 4/13/95
ISSUED 2 JUN 2 3 1995	1	J. M. Sills 6-21-95	V. Nicolayeff 6/21/95	G.C. Bramblett 6-21-95; K.E. Asmussen	Incorporated DOE Comments. W.O. 7320.500.100 6/22/95
ISSUED 2 NOV 1 4 1995	2	J. M. Sills 11-10-95	V. Nicolayeff 10 NOV 95	G.C. Bramblett 11-10-95; K.E. Asmussen	Incorporated NRC and CAL-DHS Comments. W.O. 7320.500.100 11/13/95
ISSUED 2 MAY 1 6 1996	3	J. M. Sills 5-15-96	V. Nicolayeff 5/15/96	G. C. Bramblett 5-15-96; K. E. Asmussen 5/15/96	Revised 3.3.3.4 (page 3-27) Old Project No. 7320 New Project No. 7340 W. O. 7350.400.400

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☐ GA PROPRIETARY INFORMATION

☒ NO GA PROPRIETARY INFORMATION

GENERAL ATOMICS

GA 2175 (REV. 9/89)

PROJECT CONTROL ISSUE SUMMARY (Continuation)

DOCUMENT NO.	REV.
PC-000423	4

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General Atomics Hot Cell Facility Decommissioning Plan

CM APPROVAL/ DATE	REV	PREPARED BY	APPROVAL(S) RESOURCE/ SUPPORT	APPROVAL(S) PROJECT	REVISION DESCRIPTION/ W.O. NO.
ISSUED 4 FEB 0 2 1998	4	A. J. Welch 1/21/98	V. Nicolayeff 1/21/98	G. C. Bramblett 1/21/98 K. E. Asmussen 1/26/98	Revised pages ix, 2-2, 2-23, 2-27, 2-52, 10-1 Project No. 7340 W. O. 07350.400.40000

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LIST OF ACRONYMS

AAL	Authorized Access List
ACBM	Asbestos Containing Building Material
ADS	Activity Data Sheets
ALARA	As Low As Reasonably Achievable
APPM	Accident Prevention Program Manual
ARWT	Advanced Radiological Worker Training
CA	Conditional Authorization
CAA	Clean Air Act
CAL-DHS	California Department of Health Services
CAL-DTSC	California Department of Toxic Substances Control
CAL-EPA	California Environmental Protection Agency
CAL-RHB	California Radiological Health Branch
CAL-OSHA	California Occupational Safety and Health Act
CCR	California Code of Regulations
CDE	Committed Dose Equivalent
CE	Conditional Exemption
CERCLA	Comprehensive Environmental Response and Liability Act
CFR	Code of Federal Regulations
CPR	Cardiopulmonary Resuscitation
CWA	Clean Water Act
D&D	Decontamination and Decommissioning
DDE	Deep-Dose Equivalent
DF	Decontamination Factor
DOE	Department of Energy
DOE-OAK	Department of Energy-Oakland Operations Office
DOT	Department of Transportation
EBOR	Experimental Beryllium Oxide Reactor
EDE	Eye Dose Equivalent
EH&S	Environmental, Health, and Safety
EPA	Environmental Protection Agency
ESTES	Engineering Scale Tritium Extraction System
GA	General Atomics
GERT	General Employee Radiological Training
GISO	General Industry Safety Orders
HCF	Hot Cell Facility
HCFA	Hot Cell Facility Area
HLC	High-Level Cell
HLW	High-Level Waste
HP	Health Physics
HTGR	High Temperature Gas-Cooled Reactor
HVAC	heating, ventilating and air conditioning
HWA	Hazardous Work Authorization
LDR	Land Disposal Restricted
LLC	Low-Level Cell
LLW	Low-Level Waste
LSA	Low Specific Activity
LS&NC	Licensing, Safety and Nuclear Compliance
MAP	Mixed Activation Products
MBA	Material Balance Area
MFP	Mixed Fission Products
MGCR	Marine Gas Cooled Reactor
MIWP	Metropolitan Industrial Waste Program

MLLW	Mixed Low-Level Waste
MSDS	Material Safety Data Sheets
MSHA	Mine Safety and Health Administration
MTRU	Mixed Transuranic
NIOSH	National Institute for Occupational Safety and Health
NPR	New Production Reactor
NRC	U.S. Nuclear Regulatory Commission
NWPF	Nuclear Waste Processing Facility
OSHA	Occupational Safety and Health Act
PaR	Programmable and Remote (Electromechanical Arm)
PCB	Polychlorinated Biphenyl
PPE	Personal Protective Equipment
QA	Quality Assurance
RCRA	Resource Conservation and Recovery Act
RWP	Radiation Work Permit
RWT	Radiological Worker Training
SD-DHS-HMMD	County of San Diego Department of Health Services Hazardous Materials Management Division
SDE	Shallow-Dose Equivalent
SDWA	Safe Drinking Water Act
SNM	Special Nuclear Material
TEC	Totel Estimated Cost
TEDE	Total Effective Dose Equivalent
TLD	Thermoluminescent Dosimeter
TRIGA	Training, Research, and Isotope Production, General Atomic reactor
TRU	Transuranic
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage and Disposal Facility
VSRA	Ventilation System Restricted Area
WA	Work Authorization
WAA	Waste Accumulation Area
WTRA	Waste Tanks Restricted Area

LIST OF ABBREVIATIONS

α	alpha
β	beta
BeO	beryllium oxide
BeO/UO_2	beryllium oxide/uranium oxide
$BeO/UO_2/ThO_2$	beryllium oxide/uranium oxide/thorium oxide
cfm	cubic feet per minute
Ci	curies (1 Ci = 2.22×10^{12} dpm)
cm	centimeter(s)
cpm	counts per minute
cps	counts per second
dpm	disintegrations per minute
γ	gamma
g	grams(s)
hr	hour
HT, T_2	HT = one atom hydrogen, one atom tritium; T_2 = both atoms tritium
HTO, T_2O	tritiated water (HTO = one atom hydrogen, one atom tritium) (T_2O = both atoms tritium)
kg	kilogram(s)
l	liter(s)
µCi	microcurie (1 µCi = 2.22×10^6 dpm)
µg	microgram(s)
µR	microRoentgen
m	meter(s)
mg	milligrams(s)
ml	milliliter(s)
mm	millimeter(s)
mR	milliRoentgen
mrad	millirad
mrem	millirem
mSv	milliSievert
NaI (Tl)	sodium iodide, thallium doped
pCi	picocuries (1 pCi = 2.22 dpm)
R	Roentgen
rem	Roentgen Equivalent Man
℃	degrees Celsius

INTRODUCTION AND SUMMARY

On December 14, 1994 (Ref. 1), General Atomics (GA) formally notified the Nuclear Regulatory Commission (NRC) of its intent to cease "principal activities" at its Hot Cell Facility (HCF) (Building 23) located on GA's main site in San Diego, California. In the referenced correspondence, GA also notified the NRC that due to technical feasibility and other site-specific considerations, the Decommissioning project would require longer than 24 months to complete. This Decommissioning Plan complies with the requirements contained in Title 10 of the Code of Federal Regulations, Section 70.38 (10 CFR 70.38), *Expiration and Termination of Licenses and Decommissioning of Sites, Separate Buildings, or Outdoor Areas*. This Decommissioning Plan also follows the guidance contained in Nuclear Regulatory Guide 3.65, *Standard Format and Content of Decommissioning Plans for Licensees Under 10 CFR Parts 30, 40, and 70* (Ref. 2), as well as that described in 10 CFR 70.38(f).

The HCF is located at GA's main site, a 60-acre complex on Torrey Pines Mesa in San Diego, California, just southwest of the convergence of US Interstate Highways 5 and 805. The GA main site is approximately 300 feet above sea level, 1 mile from the Pacific Ocean, and 13 miles northwest of downtown San Diego. The GA site is located in the center of Torrey Mesa Science Center, a 304-acre industrial park. The HCF construction was completed in 1959, and has approximately 7,400 $ft.^2$ of laboratory and remote operations cells. Licensed operations at the HCF included receipt, handling, and shipment of radioactive materials; remote handling, examination, and storage of previously irradiated fuel materials; engineering scale tritium extraction operations and other New Production Reactor development support activities; and development, fabrication, and inspection of UO_2-BeO fuel materials. GA has maintained the HCF in primarily a surveillance and maintenance mode in accordance with license conditions since 1991, when research and development activities at the Hot Cell essentially stopped.

Prior to developing this Decommissioning Plan, GA performed extensive radiological and hazardous materials characterization of the HCF and associated site. Utilizing this characterization data, GA carefully considered the alternatives for decommissioning (leave in place, entombment, dismantlement, or decommissioning in place) and determined that the most favorable alternative was complete facility dismantlement. Therefore, the final release survey for the HCF will consist of a direct radiation survey and the sampling and analysis of the HCF site/soils only. The wastes from HCF dismantlement and subsequent site/soil remediation will consist of soil, asphalt and concrete rubble, construction material debris, and facility equipment. Survey methods established in this Decommissioning Plan provide means to demonstrate compliance with criteria for release to unrestricted use allowing disposal at sanitary or commercial landfills. Where materials do not meet the criteria for release to unrestricted use, the Department of Energy (DOE) has committed to the removal of all project generated waste from the designated GA site to an approved federal and/or commercial site(s).

This Decommissioning Plan provides the following items:

- A detailed description of the present radiological status of the HCF
- A description of the planned approach to decommissioning the Facility
- Descriptions of the methods that will be utilized to ensure protection of the health and safety of the workers and to protect the environment and the public from radiological hazards associated with decommissioning activities
- A description of physical security and material accountability provisions that will be in place during the decommissioning
- A description of the intended final radiation survey

- A cost estimate for decommissioning the Facility and the source of funding for these activities
- A schedule for the decommissioning project.

The objective of the Hot Cell Decontamination and Decommissioning (D&D) Project is removal of radiological and other contamination leading to release of the site to unrestricted use. Based on data from the Hot Cell site and facility characterization and the decommissioning plan developed, the Project can be accomplished in 3 years. In performing Project activities, all applicable NRC and other Federal and State requirements will be met. The general approach is to remove all nonessential equipment, then address the Facility, working in areas of high radiological contamination and less contaminated areas. Following removal of the structure, the yard area will be remediated as required. Waste generated will be processed for free release where feasible or directed to the appropriate disposal sites in accordance with acceptance criteria. Soil release criteria are proposed based on similar projects to date. Under this Plan, an estimated total occupational exposure of less than 35 person-rem is expected.

The estimated cost to complete the project is $17.9 million over a five-year schedule. This project is a joint DOE/GA effort to which the DOE has committed to provide 76% of the necessary funds and GA the remaining 24%.

References

1 Correspondence K. E. Asmussen (GA) to R. M. Bernero (NRC Office of Nuclear Material Safety and Safeguards), dated December 14, 1994, Subject: "Docket No. 70-734; License No. SNM-696; Written Notification of Decision to Permanently Cease Principal Activities at GA's Hot Cell Facility."

2 US Nuclear Regulatory Commission Regulatory Guide 3.65 (Task CE 304-4), *Standard Format and Content of Decommissioning Plans for Licensees Under 10 CFR Parts 30, 40, and 70*, August 1989.

1. GENERAL INFORMATION

1.1 Licensee Name and Address

Licensee Name:

General Atomics

Address:

ATTN.:

Keith E. Asmussen, Director, Licensing, Safety and Nuclear Compliance
PO Box 85608
San Diego, California 92186-9784

1.2 License Number/Location/Licensed Activities Affected by Decommissioning Plan

NRC License Number:

SNM-696, Docket No. 70-734

State of California Radioactive Material License No.:

0145-80, Docket No. 121692-0145-80

Location:

General Atomics' main site is at 3550 General Atomics Court (formerly 10955 John Jay Hopkins Drive), San Diego, California.

Licensed Activities Affected by Decommissioning Plan:

This plan deals only with those activities authorized by NRC Special Nuclear Materials License SNM-696 and State of California Radioactive Materials License 0145-80 at General Atomics' Hot Cell Facility, Building 23.

2. DESCRIPTION OF PLANNED DECOMMISSIONING ACTIVITIES

2.1 Decommissioning Objective, Activities, Tasks, and Schedules

2.1.1 Decommissioning Objective, Activities, and Tasks

The objective of the Hot Cell D&D Project is to obtain regulatory release of the site to unrestricted use. Prior to developing this Decommissioning Plan, GA performed extensive radiological and hazardous materials characterization of the HCF and associated site. The results are documented in a detailed report and summarized herein). Utilizing this characterization data, GA carefully considered the four alternatives for decommissioning presented in NRC Regulatory Guide 1.86 (leave in place, entombment, dismantlement, or decommissioning in place) and determined that the most favorable alternative was complete facility dismantlement. The four alternative evaluations are summarized below.

- Leave in Place—Evaluated and not considered as an acceptable option due to the extensive contamination within the Facility requiring continued surveillance and maintenance and the development of other facilities in close proximity to the GA site. This alternative would not result in release to unrestricted use.

- Entombment—Evaluated and not considered as an acceptable option due to the contamination detected in the soil around the Facility requiring continued surveillance and access control. This alternative would not result in release to unrestricted use.

- Dismantlement—In this alternative, the dismantlement of the Facility would be performed, including removal of the Facility structure, and remediation of the soil around the Facility, as necessary, followed by NRC and State of California inspections and release of the site to unrestricted use. This alternative was the one selected.

- Decommissioning in Place—In this alternative, decommissioning of the Facility would be performed with the structure left in place, followed by NRC and State of California inspections and release to unrestricted use. This alternative was evaluated and was not considered as an acceptable option due to the extensive dismantlement required for access to areas that are contaminated. An example is the HEPA exhaust ducts that are buried under the walls of the hot cells. This process, when carried out in all necessary areas, would leave the building in an unusable condition.

Prior to the start of decommissioning and dismantlement of the Facility, a detailed Project Management Plan will be prepared and decommissioning procedures will be in place. Principal activities have ceased and the Facility will be unoccupied. Health Physics (HP) control points will be established outside of the building. Independent electrical power will be brought in to the HP, security, and administrative trailers. Selected materials and equipment will be removed from the Facility for salvaging or packaging for disposal. In addition, external electrical lines will be supplied to the systems essential for Facility operation as necessary to avoid interruption of service and hazards inside the building. These systems include the HEPA blowers, the air compressors, and the outlets for portable lighting and electrical equipment.

This preparation phase will be followed by the dismantlement activities. Contaminated systems will be removed, packaged, and shipped to a low-level radioactive waste disposal facility. Decontamination of the Facility will be performed concurrently with the system removal activity. The dismantlement process is outlined below. There will be two parallel tasks during dismantlement: one will be the decontamination and dismantlement of the rooms surrounding the main building structure and the other will be the decontamination of the hot cells. The decontamination of the rooms will include a variety of techniques; the predominant one will be abrasive cleaning of the concrete surfaces. The interior of the hot cells will be cleaned using remotely operated cleaning methods followed by abrasive cleaning.

Following decontamination of the facility, Health Physics will conduct a survey to verify preparedness for shutting down the HEPA system. After the HEPA system is shutdown, dismantlement of the structure will commence with removal of the roof.

The wastes from HCF dismantlement and subsequent site/soil remediation will consist of soil, asphalt and concrete rubble, construction material debris, and facility equipment. Survey methods established in this Decommissioning Plan provide means to demonstrate compliance with criteria for release to unrestricted use allowing disposal at sanitary or commercial landfills. Where materials do not meet the criteria for release to unrestricted use, the DOE has committed to removal to approved disposal facilities. Radioactively contaminated debris will include Low-Level Waste (LLW) and Mixed Low-Level Waste (MLLW). Although TRU is expected in trace amounts, threshold amounts for waste designation will not be exceeded. No Mixed Transuranic (MTRU) or High-Level Waste (HLW) will be generated. The radioactively contaminated debris will be packaged and shipped to a low-level radioactive waste disposal facility with due regard for waste minimization where practical. MLLW will be similarly addressed. Hazardous materials will be disposed of at a licensed hazardous waste depository. The remaining noncontaminated debris will be shipped to a local landfill.

After the Facility is dismantled, the affected soil surrounding the Facility will be remediated as necessary. Contaminated soil will either be shipped to an off-site or temporary processing facility or shipped directly to a low-level radioactive waste disposal facility.

Following removal of all contamination, a comprehensive final radiation survey will be conducted and documented in report form. The survey will verify that radioactivity has been reduced to sufficiently low levels allowing unrestricted release of the site. The final release survey for the HCF will consist of a direct radiation survey and sampling and analysis of the HCF site/soils only, as the facility will have been completely dismantled. After GA has surveyed the site and documented that it complies with approved criteria for release to unrestricted use, GA will submit the final report to the State and NRC requesting release. Confirmatory surveys may be performed by the NRC and/or the State of California.

The anticipated sequence for dismantlement is summarized in Table 2-1 (refer to Figure 2-1 for the room numbers). There will be two major tasks progressing in parallel. They are (1) the dismantlement of the rooms around the hot cells, and (2) the decontamination and dismantlement of the hot cells.

Table 2-1—D&D Approach

Period Beginning After Plan Approval	Room	Tasks
1st Quarter	Controlled Machine Shop and Weld Area (108, 108A)	Decon of walls, floor, and ceiling. Removal of added floor. Removal of filler material between added floor and original floor. Removal of original floor.
	Met Cell (112)	Removal of equipment inside cell. Decon of walls, floor, and ceiling.
2nd Quarter	Ladies and Men's Restrooms, Men's Change Room (116)	Removal of all equipment from rooms. Decon of walls, floor, and ceiling. Removal of internal, non-supporting walls. Removal of floor.
	Met Cell (112)	Complete removal of equipment inside cell. Decon walls, floor, and ceiling.
3rd Quarter	Dark Room (105A) Counting Room (106)	Removal of all equipment from room. Decon of walls, floor , and ceiling. Removal of internal, non-supporting walls. Removal of floor, showers, and drop ceiling. Removal of hot drains under floor. Capping of hot drain line going to Room 121.
	Met Cell (112)	Begin removal of walls.

Table 2-1—D&D Approach

Period Beginning After Plan Approval	Room	Tasks
4th Quarter	Counting Room (106) Warn Metallography Room (107)	Complete Room 106. Decon of Room 107 walls, floor, and ceiling. Removal of floor. Removal of hot drain line from under floor. Capping of hot drain as it leaves Room 121 and enters Room 122.
	Hot Cells (112, 115)	Complete removal of south and west walls of Met Cell. Remove Koll-Morgan from HLC and begin decon.
5th Quarter	Warm Metallography Room (107) Manipulator Repair Room (122)	Complete work in Room 107, remove abandoned underground duct. Removal of hot sink from Room 122. Decon of walls, floor, and ceiling. Removal of steel liner from walls. Removal of floor sink. Removal of floor. Removal of non-supporting wall. Removal of hot drain lines from under the floor. Capping of drain line leading to Room 109.
	Hot Cells (113, 115)	Complete decon of HLC, begin decon of LLC.
6th Quarter	Tritium Extraction Lab (109) Corridor, Ladies Change Room	Removal of equipment from rooms. Decon of walls, floor, and ceiling. Removal of floor. Removal of hot drain lines from under the floor. Capping of drain line leading to Room 119. Removal of buried ventilation under Corridor and Dark Room.
	LLC (113)	Complete decon of LLC. Remove manipulators, PaR, and remaining hot cell windows.
7th Quarter	Tritium Sample Prep. (120), Tritium Effluent ((119), and 117A and 116A	Decon of walls, floor and ceiling. Removal of non-supporting walls. Removal of slab from Rooms 120 and 119 and abandoned ventilation duct under Room 120.
	Hot Cells	Removal of steel liner and decon concrete walls.
8th Quarter	X-ray Lab (116) Tool Room (117) Pump Room (114) Decon Room (118) Service Gallery (111)	116 & 117 - Removal of fume hood. Decon of walls, floor and ceiling. Removal of ceiling. 114 - Removal of equipment. Decon of walls, floor, and ceiling. 118 - Decon of walls, floor and ceiling. Removal of non-supporting walls. 111 - Begin decon of walls, floor and ceiling.
	Yard	Shed - Decon of walls, floor and ceiling. Decon of exterior of shed. Dismantle shed. Removal of concrete slab. Service Yard - Old stack monitor room: decon of walls, floor and ceiling. Decon and removal of concrete slabs.
9th Quarter	Service Gallery (111) Boiler Room (121) Air Ducts Building Roof	111 - Complete decon. 121 - Decon floor, walls, and ceiling. Remove floor. Remove hot drain lines. Air Ducts - Remove air ducts from Facility. Roof - Begin removal of roof.
	Yard	Remove hot drain line. Begin decon of liquid waste storage area.
10th Quarter	Boiler Room (121) Building Roof Building Walls	121 - Complete demolition of room. Roof - Finish roof removal. Walls - Begin removal of building walls (except for old offices).
	Hot Cells	Begin removal of cell roof.
	Yard Outside HEPA System	Complete removal of hot drain lines and clearing of waste storage area. Begin removal of HEPA system.
11th Quarter	Hot Cells	Complete removal of Hot Cell roof. Remove Hot Cell doors. Begin removal of cell walls.
	Walls	Complete removal of building walls.
	HEPA System	Finish removing HEPA System and surrounding concrete slabs. Decon and remove Hot Cell HEPA pit.
12th Quarter	Building 23	Begin removal of remainder of slab.
	Hot Cells	Finish removing Hot Cell walls. Remove Hot Cell floor and hot drain beneath Hot Cells.
	Hot Drain Service Yard	Remove exterior hot drains. Begin soil remediation.
13th Quarter	Building 23	Complete removal of building slab.
	Hot Cells	Begin removal of Hot Cell foundation, pits, and HEPA ducts.
	Service Yard	Continue with soil remediation.
14th Quarter	Building	Remove pit from under Room 111.
	Hot Cells	Continue removal of HEPA ducts. Begin removal of Hot Cell wells.
15th Quarter	100, 102, 103, 104	Demolish remaining rooms.
	Hot Cells	Complete removal of HEPA ducts. Complete removal of Hot Cell wells.
16th Quarter	Yard	Begin soil remediation.
17th Quarter	Yard	Complete soil remediation.
18th through 20th Quarter	Site	Post Decon Surveys, additional remediation.

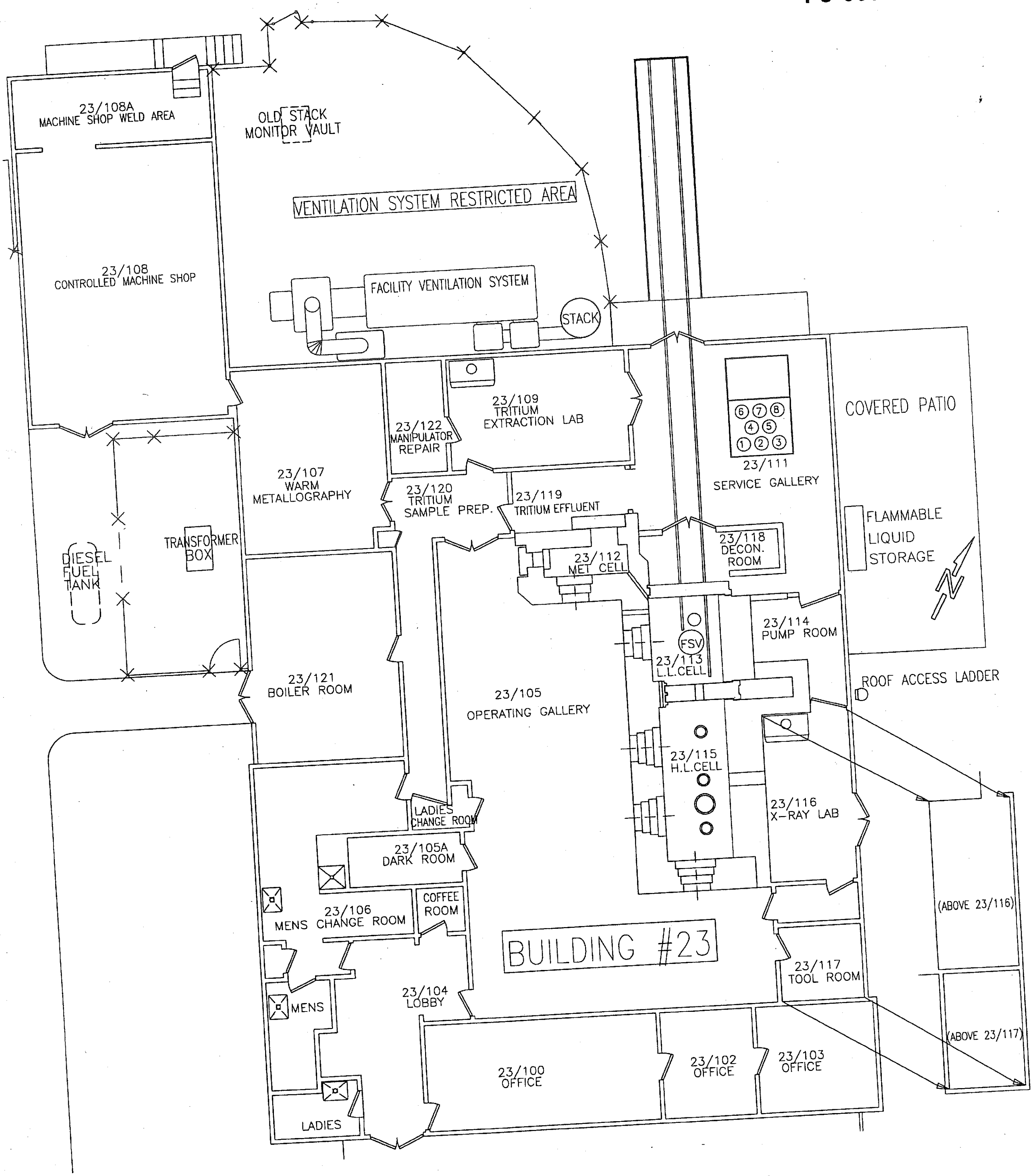

Figure 2-1—Hot Cell Facility (Building 23)

2.1.2 *Description/Analysis of Methods*

This section provides a description of the Facility and the operations conducted at the Facility and discusses the proposed techniques to be used in decommissioning.

2.1.2.1 *Facility Description*

The Hot Cell Facility Area (HCFA) being addressed includes the HCF, which refers to the building itself, the outdoor service yard, and the immediately adjacent area beyond the yard. The HCF is Building 23. The interior of Building 23 has approximately 7,400 ft.^{2} (690 m^2) of floor space consisting of office spaces, three hot cells, an Operating Gallery, and auxiliary areas.

Building 23 is surrounded by a 46,740 ft.^{2} (4,340 m^2) fenced service yard. The service yard includes several concrete pads for staging heavy equipment and making material transfer into and out of the HCF building. The remaining yard area is composed of asphalt, soil, and scattered small rocks. In the yard, there is a small 400 ft.^{2} (37 m^2) ancillary building and two above-ground portable liquid (200 gallon) waste storage tanks. Other outdoor equipment includes the ventilation filtration system and exhaust stack, and temporary storage areas. The yard is enclosed by a 7 ft. (2.13 m) high galvanized chain link fence. Access to the yard is controlled by physical barriers (fences and locked gates) and security personnel.

Some additional land in the immediate vicinity of the service yard completes the area being addressed here. This adjacent area beyond the yard, influenced by HCF operations, is included in this Plan and will be precisely defined by survey prior to the request for release.

The GA HCF and yard is situated on Lots 31 and 34, of Torrey Pines Science Center Unit No. 2, in the City and County of San Diego, State of California, as shown on map number 12845 filed in the office of the County Recorder on July 23, 1991. Figure 2-2 shows the physical layout of the HCF, Service Yard, and adjacent area. Figure 2-1 provides details of the main building (Building 23).

2.1.2.2 *Operations/Experiments Conducted at Hot Cell Facility*

Licensed operations included receipt, handling, and shipment of radioactive materials shipping casks and the remote handling, examination, and storage of previously irradiated fuel materials. During the period 1960 through 1972, the HCF was also licensed for work involving the development, fabrication, and inspection of UO_2-BeO fuel materials.

The primary purpose of the HCF was to facilitate remote inspection of irradiated highly radioactive High Temperature Gas-cooled Reactor (HTGR) fuel. The inspection of other types of irradiated fuel and materials was secondary to this function. The High-Level Cell (HLC) was utilized as a remotely operated "hot" machine shop, to cut open and section irradiated fuel samples according to the inspecting engineer's direction. The Metallography Cell was used for analytical inspection and research activities, including the preparation of samples, which entailed grinding, polishing, and mounting. The functions of the Metallography Cell were supported by tasks performed in two other areas, the Warm Metallography (Room 107) and the Tritium Extraction Lab (formerly the Physical Test Lab) (Room 109), during certain periods of operation. The Low-Level Cell (LLC) was used as the interface between the other "hot" cells and other areas of the building, and housed all shipping cask off-loading and packaging operations.

Activities in the Controlled Machine Shop, Manipulator Repair Rooms, Decontamination Room, Service Gallery, etc., supported the primary function of the HCF.

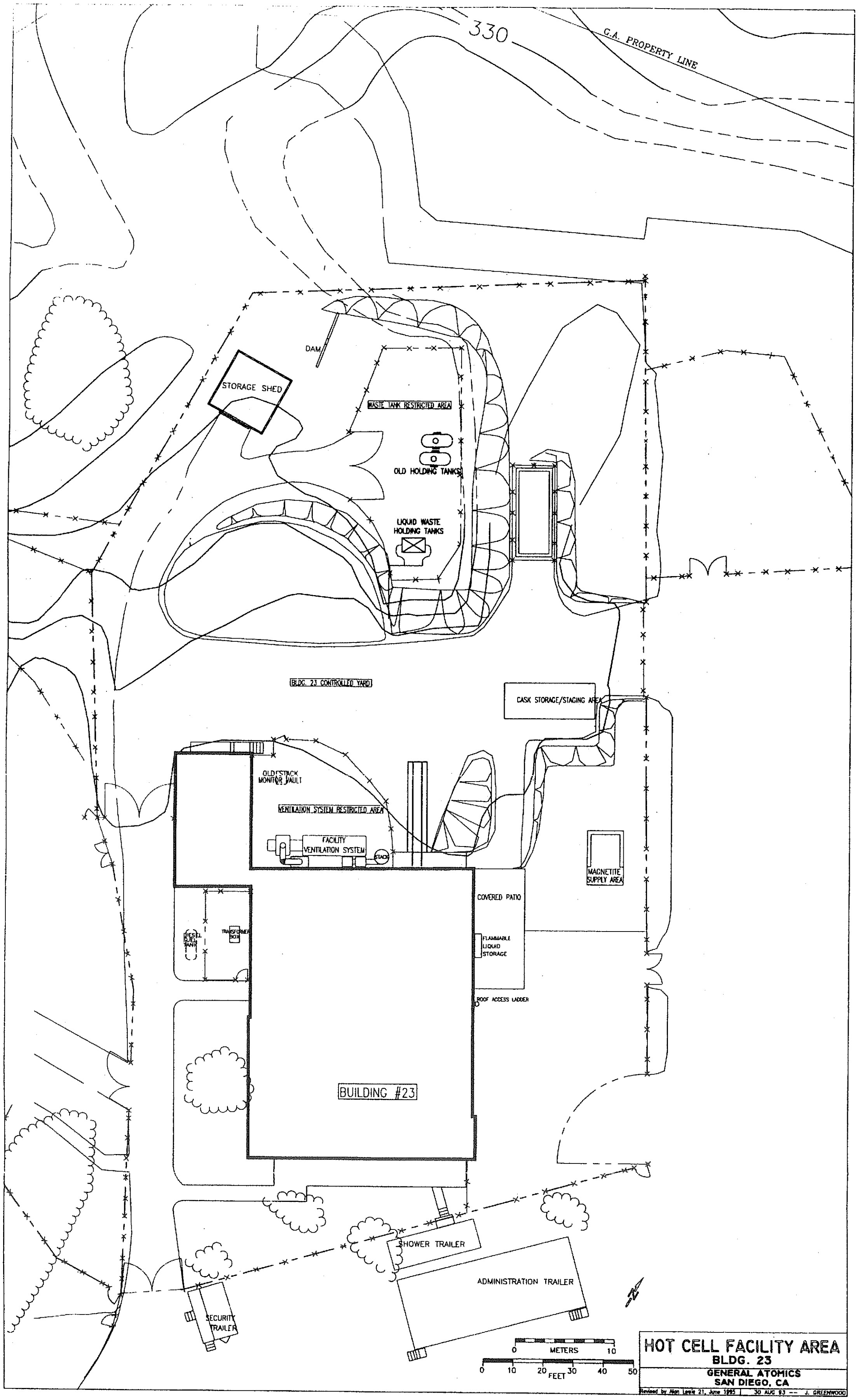

Figure 2-2—Hot Cell Facility Area

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Other programs were, at times, conducted within the HCF. What is now the Controlled Machine Shop and Weld Area (Room 108/108A) was previously used to develop and manufacture the Experimental Beryllium Oxide Reactor (EBOR) fuel. The Engineering Scale Tritium Extraction System (ESTES) utilizing Rooms 109, 120, and 119 demonstrated the ability to extract tritium from New Production Reactor (NPR) target compacts. The X-ray Lab (Room 116) was formerly used to perform plutonium transport experiments using plutonium oxide.

A detailed description of the processes performed in each individual room or area of the HCF is provided in the corresponding subsections of Section 3.1.

2.1.2.3 Facility Historical Information and Operational Occurrences – General

The property on which the GA Hot Cell Site is located was acquired in 1956 from the City of San Diego, (as part of a 290-acre tract), by the General Dynamics Corporation. This was done for the express purpose of establishing the John J. Hopkins Laboratory for Pure & Applied Science, later named the General Atomic Division of General Dynamics Corporation.

The GA Hot Laboratory, later named the GA Hot Cell Facility, was designed and built in 1958-1959 by the Bechtel Corporation, San Francisco, CA. Construction was initiated by the GA Metallurgy Department to support the expected company efforts in the nuclear industry, including HTGR and Training, Research, and Isotope Production, General Atomic (TRIGA) reactor fuel research and development.

In late 1959, during the final phase of construction, GA decided to expand the original building design by the addition of a 1200 ft.^{2} (111 m^2) laboratory space to accommodate the EBOR fuel fabrication facility.

The Hot Cell Facility Restricted Area where radiological material work was conducted consists of Building 23 and the immediate fenced area surrounding it, including the Restricted Area Outside Yard with ancillary shed and concrete pads, and the fenced area immediately south and west of the building structure.

The specific site and facility areas addressed are as follows:

- Restricted Area Outside Yard
- Restricted Area Outside Yard VSRA (Ventilation System Restricted Area)
- Restricted Area Outside Yard WTRA (Waste Tanks Restricted Area)
- Operating Gallery (Room 105)
- Dark Room and Change Room (Rooms 105A and 106)
- Warm Metallography (Room 107)
- Controlled Machine Shop and Weld Area (Rooms 108 and 108A)
- Tritium Extraction Lab (Room 109)
- Service Gallery (Room 111)
- Metallography Cell (Room 112)

- Low-Level Cell and High-Level Cell (Rooms 113 and 115)
- Pump (Room 114)
- X-Ray Lab (Room 116)
- Decontamination Room (Room 118)
- Tritium Effluent, Tritium Sample Prep. (Rooms 119 and 120)
- Boiler Room (Room 121)
- Manipulator Repair (Room 122)

A number of incidents occurred during operations. These were addressed at the time of occurrence by a decontamination crew which was an integral part of the work force. Occurrences having an impact on the Decommissioning Plan are discussed in the appropriate subsections of Section 3.1.

Disposal of wastes from the HCF that contain radioactive and/or hazardous constituents has been performed in accordance with existing requirements and established Company practices.

Information concerning operational levels of radiation and/or contamination as well as the possibility of residual contamination of radioactive and/or hazardous constituents at specific locations is given in Section 3.1.

2.1.2.4 *Assessment of Residual Radioactivity/Hazardous Material at Facility-Characterization Results*

This summary of the radiological characterization results is organized by grouping rooms according to similar radiological conditions and proximity to each other. See Figure 2-1 for aid in locating rooms or areas discussed below.

In the NRC Proposed Branch Technical Position on Radiological Characterization (Ref. 2-1) two main objectives of site characterization activities in support of decommissioning are given. These are:

(1) to determine the type and extent of radiological contamination of structures, residues, and environmental media, including the rates of migration in order to assess the scope of proposed decommissioning actions, ensure the safety of workers, evaluate potential environmental releases during the decommissioning process, and determine the adequacy of funding or financial assurance, and

(2) to determine the environmental conditions that could affect the rate and directions of radionuclide transport and potential human and environmental exposures to radionuclides to support evaluation of alternative decommissioning actions and detailed planning of a preferred approach for decommissioning, decontamination, and waste disposal.

The approach to Facility sampling and analysis was largely based upon recommendations described in NUREG/CR-5849. Survey results provide the data base in planning for decontamination and decommissioning, including decontamination techniques, schedules, costs, waste volumes, and health and safety considerations.

The characterization sampling activities served the following purposes:

- Quantify the physical and chemical characteristics of radiological and hazardous material contamination and the extent of contaminant distribution.
- Quantify environmental parameters that affect potential human exposure from existing and residual radiological contamination under the unrestricted use condition.
- Support evaluation of alternative decommissioning actions and detailed planning of a preferred approach for decommissioning, decontamination, and waste disposal.

The radiological and hazardous constituent characterization activities were developed, in principle, using the recommended methodology described in Refs. 2-1 through 2-7.

Historical records and Facility investigation reports were examined to determine potential locations of radioactive and hazardous contamination. This information was used to develop maps for each Facility room and the Restricted Area Outside Yard to identify the locations of potential contaminants on the maps. These maps were used during the Facility drawing review and the Facility walkdown to determine areas to be surveyed and sample media to be removed and analyzed. Characterization activities included determination of background levels of radioactivity with detection sensitivity and accuracy equivalent to that for the data obtained from field survey techniques.

Radiological contamination associated with the HCF and surrounding yard is not expected to have an impact on the groundwater associated with the site. The HCF is located within the southwestern portion of the Soledad Basin. The Soledad Basin makes up the northwestern part of the Los Penasquitos hydrographic subunit and has not been developed for water supply purposes. No groundwater wells are present at or immediately adjacent to the HCF. Based on regional hydrogeologic data, groundwater beneath the HCF is approximately 300 feet below ground surface. Three 9.1 m (30 ft.) test borings completed in conjunction with design of the HCF in 1958 did not encounter groundwater. In addition, no groundwater was observed in the shallow soil sampling excavations performed as part of the HCF characterization. Because the levels of activity in the soils beneath and surrounding the HCF are close to background activity levels, and the presence of groundwater at the HCF site is unlikely, there is no reason to suspect that the groundwater quality has been impacted by contaminants associated with operation of the HCF.

The site and Facility drawings were reviewed for locations of piping, drains, sewers, sumps, tanks, and other components of liquid handling systems and penetrations into floors and walls for piping, conduit, anchor bolts, wall and floor interfaces, and other similar building construction materials. These areas were potential sites for accumulation of contaminants and pathways for migration into subfloor soil and hollow wall spaces. Review of the Facility and yard drawings was followed by a Facility and site walkdown by a multi-disciplinary group to review field situations that could affect the survey plan.

In order to facilitate systematic selection of surveying and sampling locations, a Facility and Restricted Area Outside Yard grid system was established in accordance with Ref. 2-1. Each sample location was assigned a grid point designator and recorded on the survey map and the HCF Characterization Sample Media Chain of Custody Data Sheet. Surveys and sampling were performed by trained HP and Hazardous Materials technicians who followed standard written procedures and used properly calibrated instruments that were sensitive to the suspected contaminants. In addition, quality assurance audits were conducted for field and laboratory activities, with corrective actions implemented where required.

Field activities included the performance of direct (scanning) and indirect (smear) surveys for areas classified as either affected or unaffected. For the purposes of conducting radiological characterization, the interior of the Facility and the yard were classified as "affected" and the Facility exterior as "unaffected." Areas identified during direct and indirect sampling as having potential for subsurface contamination were sampled for construction media, which were removed and quantified in the laboratory by gamma spectroscopy. Core sampling was conducted where sample media indicated a high probability for subsurface contamination.

Hazardous contaminants, as defined by the Resource Conservation and Recovery Act (RCRA) and Title 22 of the California Code of Regulations (22 CCR), were also included in the characterization survey. Visual inspections were conducted for each area of the Facility using specialized checklists to identify all potential hazardous contaminants. Results of visual inspections and field screening techniques were used to determine areas where media and swipe samples should be taken. Samples of construction debris and subsurface soils were analyzed for hazardous constituents at a State-certified laboratory. The purpose of this analysis was to identify areas of the Facility and yard that would fall under regulatory consideration for clean-up, disposal and management as hazardous or radioactive mixed waste. For soil samples, the type of contaminants present and the extent and magnitude of contamination was estimated.

A certified asbestos contractor was hired to perform sampling of structures within the HCF that were suspected of containing asbestos-bearing materials. Samples were taken from areas most likely to contain asbestos in an effort to determine the volume of asbestos materials that would require removal prior to decommissioning.

The specific findings for each room are summarized from the HCF Characterization Report. The results presented in this section have been evaluated with regard to the level and types of contamination present for each room and to determine areas that will have potential for generating mixed wastes during decommissioning. In addition, this review includes an evaluation of the potential for subsurface contamination. Many floor areas within the noncontaminated areas had no positive results and may be free released. Also, minimal surveys and hazardous sampling were performed on the steel deck above the suspended ceiling and will require more detailed evaluation during decommissioning activities.

- Offices (Rooms 103, 102, 100), Lobby (104), and Bathrooms

  The Offices (Rooms 103, 102, 100) Lobby (104), and Bathrooms have some isolated areas on the floor and walls which showed positive radioactivity results from direct scans and may require removal of the contamination. In general, the rooms do not contain radioactive or hazardous contaminants, and most materials are expected to be releasable. Many floor areas within the noncontaminated areas had no positive results and may be free released. The rooms contain removable quantities of lead, asbestos, and polychlorinated biphenyl (PCB) in ballasts. All floor tiles will be removed as a precaution, and underlying surfaces carefully scanned.

- Change Room (106), Dark Room (105A), Coffee Room, Operating Gallery (105), and Boiler Room (121)

  The Change Room (106), Dark Room (105A), Coffee Room, Operating Gallery (105) and Boiler Room (121) will require that all asbestos floor tile and baseboards be removed where these are present. Floor materials removed from the Dark Room (105A) and the Boiler Room (121) will need to be segregated as mixed waste due to the presence of both radiological and chemical contaminants in the floor. The presence of alcohols and hydrocarbon contaminants (in mg/kg quantities) on the floors in both of these rooms will require additional sampling during decommissioning to ensure that chemicals did not penetrate the subsurfaces. Most of these rooms contain removable lead, asbestos, and PCB items.

The top 0.25 in. of the floor (some isolated areas may be contaminated deeper into the concrete) and 1-4 in. of the lower walls (measured above the floor grade) have contamination. Many discrete particles were found and a potential exists for discrete particles to have been shielded beneath floor tiles and along the floor/wall junctions; hence, all floor tiles and baseboards will be removed to facilitate survey/ decontamination. The cell wall penetrations from the Operating Gallery to the Hot Cells are contaminated. Some of these penetrations were added after initial Facility construction and operation, so it is very likely that contamination in the magnetite concrete around the penetrations will persist for the entire thickness of the wall penetration. The "clean" floor drain in the Men's Change Room (Room 106) has been posted as "Internally Contaminated" and direct scan of the area around the Operating Gallery "clean" drains suggests a potential for minor contamination inside the "clean" drains. Many locations with fixed activity, minor loose activity, and numerous discrete particles were identified within the subfloor grade concrete service pipe trench that traverses the Operating Gallery from east to west and passes through the Ladies Change Room and into the Men's Change Room (Room 106). This trench will also require remediation.

- Tool Room (Room 117), X-ray Lab (Room 116), Hallway, and Mezzanines Above

  In the Tool Room, X-ray Lab, Hallway, survey results confirmed that the top 1-1.5 in. of the concrete floor, lower portions of the walls, and isolated areas on the upper portions of the walls are contaminated. The Mezzanine above the Tool Room appears to have no contamination, but seams of corrugated steel floor will need further surveying during dismantlement. The Mezzanine above the X-ray Lab has some isolated wall contamination and hot spots around penetrations. No hazardous contaminants were found in these rooms that exceed the regulatory limits for disposal; however, the lead content of the paint in all of these rooms tested high, which will require that industrial hygiene requirements be implemented for the removal of paint in these rooms. All of these rooms contain removable lead, asbestos, and PCB items.

- Corridor (adjoins Ladies Change Room and Room 120), Tritium Effluent (Room 119), Tritium Sample Prep. (Room 120), and Tritium Extraction Lab (Room 109)

  The smearable levels in the corridor are generally less than 1,000 dpm/100 cm^2, though a single location of up to 5,000 dpm/100 cm^2 was discovered on the floor with fixed contamination levels of up to 150,000 dpm/probe area in the same area. The general exposure rate in the corridor is less than 0.2 mR/hr. Smearable contamination levels in the Tritium Effluent Room are up to 4,000 dpm/100 cm^2 on the floor and 24,000 dpm/100 cm^2 on the walls. Radiation levels in the Tritium Effluent Room range from 0.2 to 0.5 mR/hr. Smearable contamination levels in the Tritium Sample Preparation Room are up to 4,000 dpm/100 cm^2 on the floor and 7,000 dpm/100 cm^2 on the walls with exposure rates ranging from 0.2 to 1 mR/hr. Smearable contamination levels in the Tritium Extraction Lab were up to 18,000 dpm/100 cm^2 on the floor with 40,000 dpm/probe area fixed contamination on the floor. No smearable contamination was detected on the walls of the Tritium Extraction Lab, and exposure rates ranged from 0.3 to 1.8 mR/hr.

Most surfaces of the concrete floors and walls are contaminated. Discrete particles were found in the overhead utilities. Many discrete particles fixed in the floor paint of the corridor were also discovered. If any cracks exist in the floor (none were readily apparent during characterization due to multiple coats of paint on floors), concrete contamination will be more extensive. Based upon the core results, subsurface soil contamination exists beneath the Tritium Effluent (Room 119), and it is considered likely that portions of the adjacent Room 109 subsurface soils are also contaminated.

Room 109 has confirmed PCB and lead contamination in the floor. The walls of all of these rooms had a high lead content in the paint that is below regulatory concern for mixed waste, but will have to be considered for industrial hygiene protection during decommissioning. All of these rooms contain removable lead, asbestos (not 109), and PCB items.

- Pump Room (Room 114), Decontamination Room (Room 118), Service Gallery (Room 111), and Manipulator Repair (Room 122)

  Smearable contamination up to 3,000 dpm/100 cm^2 was identified on floor and walls of the Pump Room, with fixed contamination up to 100,000 dpm/probe area identified on the floor. Radiation levels in the Pump Room were generally less than 1 mR/hr. Smearable levels of up to 1,000,000 dpm/100 cm^2 on the floor and 120,000 dpm/100 cm^2 on the walls were identified in the Decontamination Room, with radiation levels on average of 20 mR/hr with peaks of up to 100 mR/hr on contact with the LLC door. Smearable contamination levels of up to 280,000 dpm/100 cm^2 were identified on the floor of the Service Gallery with radiation levels on average of 2 mR/hr and peaks of 100 mR/hr near the storage pit area. Smearable contamination of up to 220,000 dpm/100 cm^2 with fixed contamination levels of up to 2,800 mrad/hr (β) was identified in the Manipulator Repair Room. Manipulator Repair Room dose rates were approximately 15 mR/hr with peaks up to 100 mR/hr.

  Concrete floor contamination is up to 1.5 in. deep in many areas (based upon results of sections from the concrete cores) and wall contamination is extensive. The ceiling was not surveyed due to inaccessibility, but known instances of airborne radioactivity suggest that contamination of the ceiling is likely. Subsurface core results demonstrate that subsurface soil contamination is present. It is possible that the Decontamination Room or LLC may be the source of this subsurface soil contamination. Attempts were made to pinpoint the likely source of positive subsurface soil results, but these additional cores were not conclusive as to the point of origin for observed soil activity. Residual soil contamination is also evident from the former plutonium sump tank area in the yard outside of the X-ray Lab (Room 116) and Pump Room (Room 114). These soil contamination results suggest mixing of the soil due to excavation and removal of the plutonium sump tank.

  The floor of the Pump Room has subsurface contamination in the form of various tentatively identified semivolatile compounds in mg/kg concentrations including alcohols and hydrocarbons. PCBs and lead are also present in the Pump Room and the Manipulator Repair Room. All of these rooms contain removable lead, asbestos, and PCB items.

- Warm Metallography (Room 107) - Cold Side of Manipulator Repair

  Smearable contamination up to 20,000 dpm/100 cm^2 was identified on walls and up to 10,000 dpm/100 cm^2 on the floor of the Warm Metallography Room. Fixed contamination up to 100,000 dpm/probe area was identified on the Warm Metallography floor with general area exposure rates up to 1.5 mR/hr.

The concrete floor is contaminated and two samples taken from the east and south walls near the floor level were contaminated. It is likely that the lower three feet of the wall surface will have to be removed. Wall surfaces around the manipulator station openings are contaminated. The remaining fume hood ventilation ductwork is also highly contaminated. Subsurface soils from adjacent Room 122 (Manipulator Repair) were found to be contaminated during core sampling. Further exploration of subsurface soils in Room 120 was performed and also demonstrated existence of subsurface soil activity. Based upon these core results, it is likely that activity will also be discovered in the subsurface soils below Room 107.

Hazardous contamination was also confirmed in Room 107 in the form of semivolatile compounds including phenols, hydrocarbons, alcohols, and other organics. PCBs were also detected in µg/kg concentrations. Materials removed from this room during decommissioning will need to be segregated and evaluated for mixed waste analysis. Room 107 contains removable lead, asbestos, and PCB items.

- Machine Shop (Room 108) and Machine Shop Weld Area (Room 108A)

  Smearable contamination up to 3,000 dpm/100 cm^2 with fixed contamination up to 320,000 dpm/probe area was identified in the Controlled Machine Shop. The Machine Shop Weld Area had similar smearable contamination levels with fixed contamination levels of up to 600,000 dpm/probe area on the floor. Radiation exposure rates in Rooms 108 and 108A were from 0.2 to 0.4 mR/hr.

  The results obtained for the Machine Shop (108) and Machine Shop Weld Area (108A) indicate that the entire floor and large portions of the walls are contaminated with hazardous and radioactive materials. Core and floor samples analyzed for hazardous constituents confirmed the presence of hydrocarbon and other organics known to be used in machining oils. Both of these rooms contain removable lead, asbestos, and PCB items. Many discrete particles were found in the overhead utilities. A small quantity of Special Nuclear Material (SNM) (^{235}U only) was found in the northeast corner of the room, and the ventilation system must be sampled for SNM prior to dismantlement. Core results showed no subsurface soil contamination below Room 108, and minor subsurface soil contamination below Room 108A at the stairs. Several areas where process knowledge indicated the previous existence of a wash-down trench were sampled during coring with only low levels of activity seen in the concrete sections. This area will require additional sampling during decommissioning to ensure that the complete nature of this trench is well identified.

- Metallography Cell (Room 112)

  The Metallography Cell is presently inaccessible to personnel due to the dose rates inside the room. Most of the contents of the cell will be disposed of as radioactive waste. No information is available to determine if subsurface contamination has occurred. Concrete and subsurface cores were taken around the cells and the results do indicate that soil contamination is likely at least at the north end of the cell. Rudimentary radiation levels and gross contamination levels were obtained remotely to support planning efforts to remove cell contents and begin cell decontamination efforts. Dose rates of up to 5 R/hr and contamination levels of 2 million dpm/100 cm^2 were observed in preliminary measurements.

- Low-Level Cell (Room 113)

The steel plates for the LLC floor, walls, and ceiling are highly contaminated. Review of Facility drawings and records strongly suggests subsurface contamination within the concrete. The extent of the contamination will be determined during decommissioning activities. It is highly probable that up to 1 in. of wall and ceiling concrete behind the steel plates will require disposal as radioactive waste. Concrete and subsurface cores were taken around the cells and the results indicate soil contamination is certain below the LLC. Based upon all nearby core results, either the Decontamination Room or LLC is thought to be the most likely source for the identified subsurface soil contamination. Survey results from the used cell lead penetrations/plugs stored in the yard storage shed would indicate that the inside of the penetrations are contaminated. As was discussed elsewhere in this section, many of these penetrations were added after initial construction and operation of the Facility, increasing the probability of magnetite concrete contamination over the entire length of the affected penetrations. Further sampling will be necessary during decommissioning. The LLC is routinely accessed by Facility personnel in support of maintenance and waste characterization activities, and has been routinely decontaminated for safety purposes. External dose rates in the LLC are approximately 1 R/hour in the area near the conveyor to the HLC, and approximately 50–100 mrem/hr in the general area. Smearable contamination levels are approximately 100 mrad/hr/100 cm^2 (conveyor belt is approximately 3,000 mrad/hr/100 cm^2) whenever materials are being moved between the HLC and LLC. These contamination levels are generally decreased to approximately 25 mrad/hr/100 cm^2 (and 400 mrad/hr/100 cm^2 on the conveyor) following routine cell decontamination. Hot particles are frequently discovered in the LLC. Principal contaminants in the LLC are ^{137}Cs, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{94}Nb, ^{154}Eu, ^{208}Tl, ^{125}Sb, ^{155}Eu, and some transuranics in order of relative concentrations (highest to lowest).

- High-Level Cell (Room 115)

Rudimentary radiation levels and gross contamination levels were obtained remotely to support planning for cell decontamination efforts. Radiation levels measure were largely affected by the storage of highly radioactive waste in the HLC prior to shipment for disposal. Further radiation levels will be taken after those materials have been removed. The steel plates for the HLC floor, walls, and ceiling will be disposed of as radioactive waste. It is highly probable that up to 1 in. of the walls, floor, and ceiling concrete behind the steel plates will require disposal as radioactive waste. Industry experience with other Hot Cell Facility Decommissioning Projects is similar. Concrete and subsurface cores were taken around the three cells (Metallography, Low-Level, and High-Level) and the results indicate that significant soil contamination below the HLC is not likely due to leakage or floor cracks. However, based on process knowledge, there still exists the potential for soil contamination just below the concrete floor foundation of the HLC. This contamination is expected to be discovered in soil to a depth of 18 ft. below grade level around the storage wells due to the process of their installation into the HLC after initial Facility operation. Records show that contamination was observed in the soil during the well installation, and it is believed this was caused by excavating to install the wells. Survey results from the cell lead penetrations stored in the yard storage shed would indicate that the inside of the penetrations are contaminated.

- Building Exterior

The Facility's roof materials and most of the north Facility exterior wall contain radioactivity. The Room 108 east exterior wall appears to be contaminated extensively also. The remaining exterior walls appear to have only minor isolated areas of contamination. The outside ventilation unit is internally contaminated.

There were no hazardous contaminants identified for these areas with the exception of asbestos on the roof and exterior. There are small amounts of lead and removable PCB items present.

- Building Hazard Survey Results

  A total of forty-one (41) samples were collected and analyzed for the presence of asbestos. Twenty-one (21) of the samples analyzed, taken from both the radiologically controlled and noncontrolled regions of the HCF, tested positive for asbestos. Inaccessible portions of the HCF, deemed excepted areas, will have to be examined for asbestos construction materials and components during decontamination and decommissioning. Prior to dismantlement of the HCF, the asbestos-containing material will be removed from the HCF.

  The majority of the rooms have several types of lead and brass (which leaches lead) in the form of bricks, hardware on doors, sprinkler systems, pipe and drain fittings, and other fixtures. Larger brass and lead items that are easily removed from the Facility should be surveyed and released (if possible) prior to the start of large-scale decommissioning efforts (e.g., wall scabbling) to minimize the amounts of contaminated lead which would be generated as potential mixed waste.

- Core Results

  An extensive core sampling study was performed inside the HCF structure to evaluate the potential for subsurface soil radioactivity. Figure 2-3 shows the locations studied. Following receipt of the core sample results, there was some question regarding lateral and vertical extent and profile of subsurface activity below the Facility. GA performed additional cores to further evaluate those aspects. The additional cores taken by GA after the initial Facility core sampling study are identified by location numbers "GA-#" on Figure 2-3 and in Table 2-2 and Table 2-3. Results indicate that all sub-surface core samples were below the proposed release criteria presented in Table 4-3. The assessment of these core samples was discussed above in subsections on the respective sampled locations.

- HCF Restricted Area Outside Yard Soil Results

  The residual contamination in the Facility soils was characterized in detail during site and facility radiological characterization using the methodology specified in NUREG/CR-5849 and a 10 square meter grid. Table 4-4 summarizes the results of this characterization. Correlation of sample locations (e.g., A-5) to the site map may be determined from review of Figure 4-2, which has a horizontal (with respect to the page) alphabetic grid designator system (A-G) and a vertical numeric grid designator (0-10). A sample location of A-5 would represent a sample collected at the nodal intersection of grid lines A and 5. Other sample locations were selected based upon process knowledge of activities conducted or incidents that may have impacted the distribution of radiological contaminants. The highest activities at a specific sampling location were generally encountered in surface soils, with the exception of a single location that was denoted as "Drainage Path from Liquid Waste Tanks Area S06A," where the 3-9 in. sample was approximately 5 times greater concentration than the surface sample for the same location. This particular location is believed to have been biased against surface activity peaking due to deposition of silts and soil disturbance by runoff control measures that had been employed to prevent inadvertent release of activity from the Facility yard.

The radiological characterization results showed areas that were most affected by residual radioactivity in the soils, and are the most likely areas to review for soil remediation activity. Figure 2-4 shows these areas and depicts the sample results for the entire yard are surveyed. Areas not marked were at or below background results. Soil concentrations discovered underneath the Facility during core sampling were generally much lower than the more elevated samples taken in the general yard area, and are not expected to require extensive remediation efforts. Soil waste volumes given in Table 3-3 include an allowance for contamination detected at the time of Facility modification to install additional wells under the cells and for undetected but possible floor cracks or hot drain system seepage. In general, soil concentrations will require only a moderate amount of soil remediation involving surface soils only. Asphalt locations that exceeded the proposed release criteria were those generally associated with the judgement sample locations.

In general, the radioisotope values detected in the node samples above can be associated with identified areas of special interest.

Hazardous constituent analyses included evaluation of all sampling locations associated with areas of special interest and is summarized in Table 4-4 (see also Figure 4-2). All discretionary non-grid (judgment) sampling locations and grid sampling locations potentially associated with each area were listed and summarized. Associations of grid sampling locations were based on general proximity and topography. The following general associations were observed.

- Beryllium was not detected in any of the surface samples collected from the sampling locations. Beryllium was detected in subsurface samples collected from 5 of the 34 node sampling locations. Beryllium was detected in samples from four of the nine judgment sampling locations.
- Cadmium was not detected in any of the surface or subsurface samples collected from grid sampling locations. Cadmium was detected in samples from 5 of the 9 judgment sampling locations.
- Lead was present in 10 of the 16 surface samples and 11 of the 16 subsurface samples collected from grid sampling locations. Lead was detected in samples from all 9 of the judgment sampling locations. In general, lead was present at elevated levels in samples that had elevated values for ^{137}Cs.

An extensive soil sampling and profile study was performed in the yard areas of the HCF. In summary, it was determined that a majority of the HCF yard included soil that approaches or slightly exceeds background activity values. In addition, a number of areas include radioactivity below the release criteria specified in this Decommissioning Plan. Most areas where remediation will be necessary do not show appreciable activity below the first 15 cm (6 in.) of the soil. Those areas were principally in the vicinity of the depression surrounding the liquid waste tank storage area and the HEPA ventilation and trestle areas (see shaded area of Figure 2-4). However, limited parts of those areas may require remediation up to a 2 to 3 foot depth.

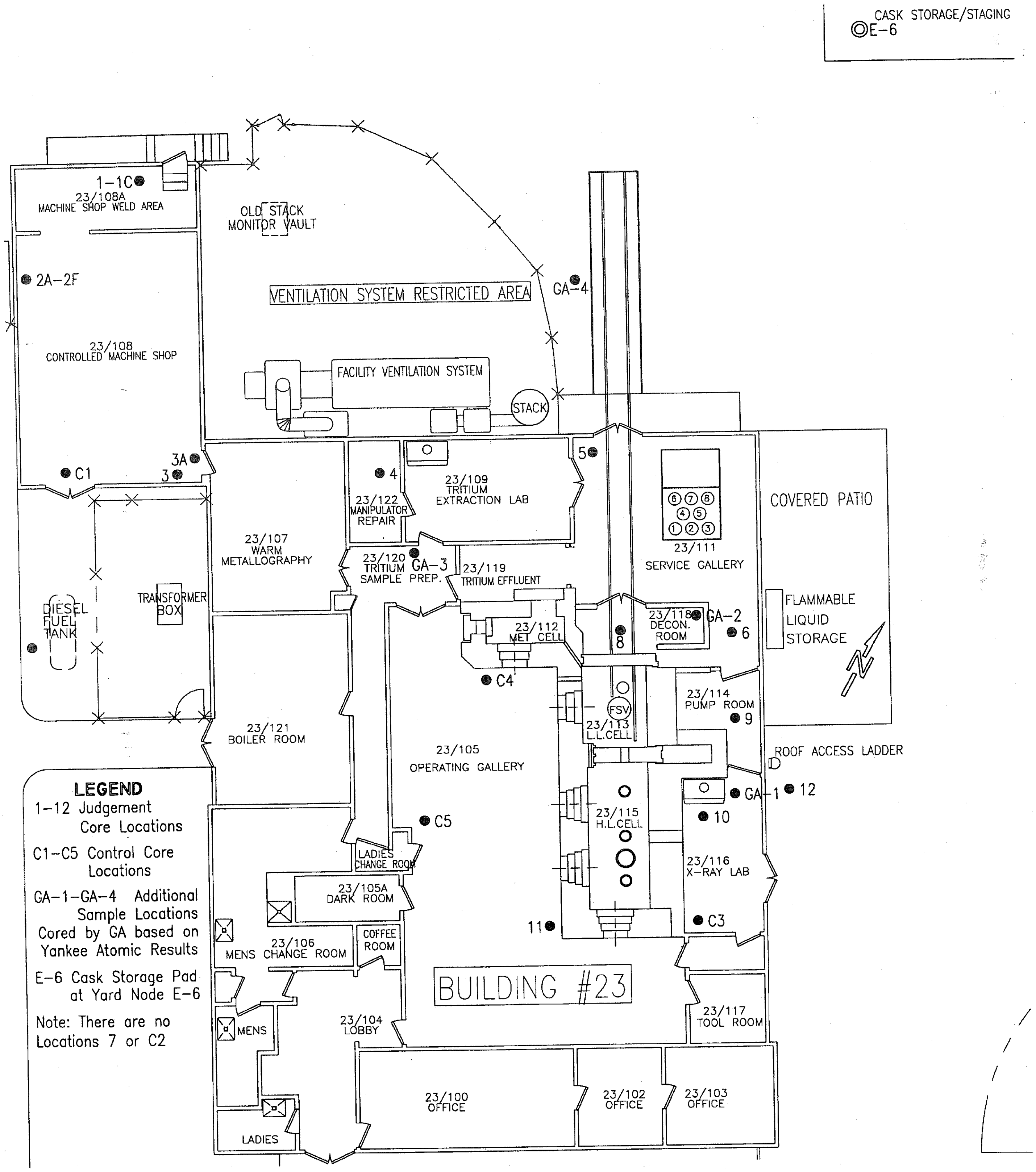

Figure 2-3—Hot Cell Facility Core Sampling Locations

Table 2-2—Positive Concrete Wafer Results

Core Location (Figure 2-3)	Depth (inches)	^{134}Cs (pCi/g)	^{137}Cs (pCi/g)	^{60}Co (pCi/g)
1B	0 - 0.4		1.734	
2E	0 - 0.4	0.064	7.96	0.212
2E	0.6 - 1.0		0.133	
3	0 - 0.4		0.148	
4	0 - 0.4	1.97	327.3	25.69
5	0 - 0.4	10.8	295.3	10.51
6	0 - 0.4	14.79	139.0	0.63
6	0.6 - 1.0		0.126	
8	0 - 0.4	103.2	8672	308.6
8	0.6 - 1.0	0.079	2.558	1.259
8	12.3 - 12.7		0.357	
9	0 - 0.4	26.7	1106.2	38.6
9	0.6 - 1.0		1.134	
9	11.6 - 12.0		0.074	
10	0 - 0.4	0.243	10.98	0.352
10	0.6 - 1.0		1.153	0.095
10	1.1 - 1.5		0.089	
C-1	0 - 0.4		0.405	
C-3	0 - 0.4	243.4	340.8	2.18
C-3	0.6 - 1.0	0.177	2.746	0.264
C-3	1.1 - 1.5		0.103	

Note: "GA-#" cores did not include evaluation of the concrete samples by gamma spectroscopy due to extensive data already available for those locations regarding concrete.

Table 2-3—Positive Soil Sample Results

Core Location (Figure 2-3)	Depth (inches)	^{134}Cs (pCi/g)	^{137}Cs (pCi/g)	^{60}Co (pCi/g)	^{235}U (pCi/g)
1B	4 - 24				0.0256
4	24 - 35		0.197		
6	12.5 - 21	0.104	0.161		
6	21 - 30	0.146	0.302		
8	13 - 24		0.207		
8	24 - 34		0.727		
8	39 - 46	0.308	4.84	0.252	
9	12 - 20	0.354	0.326		
9	20 - 27	2.061	1.624		
12	30 - 35		4.356	1.087	0.524
GA-1	12 - 18			0.23	
GA-2	6 - 12	0.11	0.98	0.37	
GA-2	12 - 18		0.82	0.20	
GA-2	18 - 24		0.50		
GA-2	24 - 30		0.18		
GA-2	30 - 36		0.41	0.09	
GA-2	36 - 42		0.52	0.22	
GA-2	42 - 48		0.57	0.12	
GA-3	6 - 12		0.17		
GA-3	42 - 48		0.11		
GA-3	48 - 54		0.08		
GA-4	18 - 24		0.09		

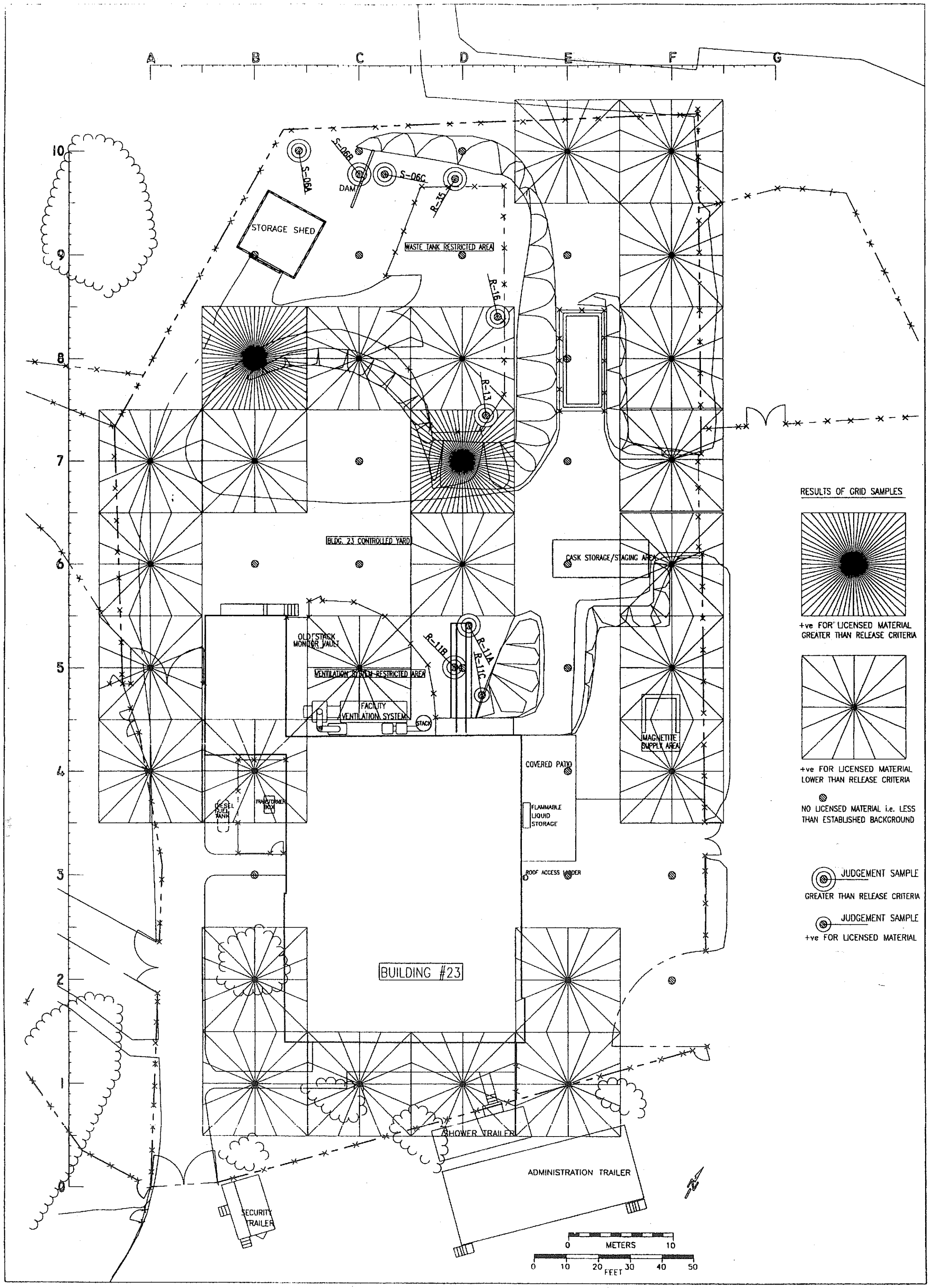

Figure 2-4—Soil Affected Areas

2.1.2.5 Potential Hazards that Could Affect Decommissioning Safety

The hazards associated with decommissioning are similar to those in the construction industry. Decontamination of the building exposes the workers to many hazards, e.g., electric power tools, industrial vehicles, and heavy lifting. Removal of pervasive contamination may affect structural components of the building. The use of temporary shoring will be evaluated in these cases. Operation may also lead to encounters with energy sources such as electrical lines or natural gas lines requiring shutdown and isolation prior to removal. Removal of contaminated components/systems under the building slab will require heavy lifting equipment.

Before any work is performed, all the tasks are evaluated for hazards. If hazard sources such as those listed below are identified, a GA Hazardous Work Authorization (HWA) may be required to be written and approved. The HWA will address the necessary precautions and define the safeguards required to minimize the effects of the hazard. Before work on that task commences, the workers will be trained to the specific HWA.

Motion Sources:
- Shears, sharp edges, pinch points
- Machinery
- Vehicles, fork lifts, trucks
- Mass in motion

Gravity-Mass Sources:
- Falling
- Falling objects
- Lifting
- Tripping, slipping
- Earthquakes

Pressure Sources:
- Chemical reactions
- Noise
- High Pressure Liquids
- Confined gases
- Extreme wind

Exposure to Heat/Cold from:
- Electrical
- Natural gas
- Friction
- Chemical reactions
- Spontaneous combustion
- Cryogenic material

Electric Sources:
- High voltage and current sources
- Transformers
- Static electricity

Release of Hazardous Chemicals:
- Corrosive materials
- Flammable materials
- Toxic materials
- Reactive materials
- Carcinogenic materials
- Oxygen deficiency

Special consideration will be given to Criticality Safety due to the possibility of finding significant amounts of SNM-bearing materials, particularly in air ducts and drain lines servicing the three cells, Rooms 112, 113, and 115. Criticality Safety will be ensured by following GA's Nuclear Safety Department's instructions given in the Work Authorization (WA) and reviews.

Special Nuclear Material License Specifications (SNM-696), Section 5.3-*Requirement for Waste and Scrap* stipulates that SNM-bearing materials shall be accrued on an ever-safe mass limit or ever-safe dimension limit basis, and the SNM content be verified by analysis methods maintained under statistical control in order to assure that the safe limits cannot be exceeded under the worst conditions of measurement error. Based on these guidelines, Nuclear Safety has proposed the following, which will be adhered to during Hot Cell D&D Project activities.

- The air ducts servicing the High-Level Cell (Room 115), Low-Level Cell (Room 113), and the Metallography Cell (Room 112) will be treated as the most probable location of accumulated SNM pockets. The ducts will be removed and sectioned in such a manner that the relocation of their contents, if any, is prevented. The sections will be capped to prevent the escape and further accumulation of SNM. Precautions will be taken to safeguard the ducts from water ingress while still in place or after sectioning. If the removal or sectioning of the ducts is not practical, e.g., when they are imbedded in concrete, it will be necessary to section them in place into specified lengths, clean/sweep the internal surfaces, and assay for SNM content. **Ducts will not be crushed or flattened prior to their characterization for SNM.**

- The liquid waste drain lines servicing the above mentioned cells and Room 108 (presently the Machine Shop, but previously the site of the BeO Laboratory where fuel for the EBOR reactor was manufactured) must also be treated as a potential location for the accumulation of SNM. All liquids/sludges removed from drains must be accumulated in safe-geometry containers, until the SNM concentration can be determined, so that the possibility of disposal in other types of geometry can be assessed by the GA Nuclear Safety Department.

- Any discovery of hidden tanks or containers or other types of storage devices that may not have been identified in advance will require the review and approval of Nuclear Safety on a case-by-case basis to determine the method of handling prior to proceeding. Containers suspected of containing SNM will not be moved or otherwise handled until reviewed and approved by Nuclear Safety.

- If, based on the SNM survey and/or sampling results, it can be conservatively projected that the surveyed area (or a unit of work) contains **less than a total of 35g of ^{235}U**, the decommissioning activities in that area may proceed without any further Nuclear Safety restrictions, provided that additional samples are taken when unforeseen situations are encountered (e.g., discovery of a deep crack that leads to a pocket of not obviously identifiable material).

- If, based on SNM survey and/or sampling results, it can be conservatively projected that the surveyed area contains **more than 35g, but less than 350g of ^{235}U**, the following conditions/restrictions must be observed: a) the Manager of Nuclear Safety must be promptly notified, b) the SNM-bearing material must be accumulated in favorable-geometry containers, and c) additional measurements of the SNM content must be made for a more accurate characterization of the accumulated material. The latter requirement is based on the present belief that the quantities of unaccounted SNM at the HCF are very small. The containers with SNM-bearing material, prior to their final characterization for SNM, must be stored in a linear array with a 12-inch surface-to-surface separation of containers in each row and a 24-inch separation of rows from each other. Stacking of containers is allowable, but only with the concurrence of Nuclear Safety for a given situation. If for some reason the accumulation of SNM-bearing material in favorable geometries is not possible, the decommissioning activities in the subject area will be halted until a procedure for the removal of material is developed and approved by Nuclear Safety. Since the existence of such relatively large quantities of SNM is not anticipated, Nuclear Safety will conduct a thorough review of the SNM sampling plan in these situations, and possibly impose additional safety requirements.

- If, based on the SNM survey and/or sampling results, it can be conservatively projected that the surveyed area contains **more than a total of 350g of ^{235}U**, the decommissioning activities in that area will be immediately halted. The SNM sampling and/or surveys will be increased in scope and number in order to confirm or deny the presence of a high SNM concentration. If the added measurements confirm this unanticipated situation, the management of the HCF, with the participation of Nuclear Safety, Statistics and Measurement Control, and Nuclear Material Accountability will undertake a thorough review and develop special procedures to address and resolve the situation.

2.1.2.6 Hot Cell Facility Equipment Disposition

The GA HCF, at the start of decommissioning, is being maintained in a safe shut-down condition. All required utility services (electrical service, water supply, natural gas supply) are active. Building air ventilation and HEPA-filtered exhaust systems, instrument air supply compressors, and effluent and criticality monitoring instrumentation systems are in continuous operation. All manually actuated and automated fire alarm/suppression systems are operational. All installed Facility security and radiological alarm systems are normal. All remote-handling mechanisms and auxiliary Facility support equipment are operational, or are available for activation and use.

This section describes the work methods for the dismantling process and process-support equipment and hardware in preparation for final disposition. These methods and approaches were determined from the characterization data and will facilitate both the decontamination operation, dismantlement process, and contamination surveillance required either to clear the equipment for unrestricted release or to identify its contamination status for disposal as radioactive waste. Based on these methods, detailed, room-by-room dismantlement procedures have been prepared. Log books will be maintained to document the dismantlement process.

Dismantling Considerations—Most of the equipment will be removed from the Facility prior to decommissioning activities. The only equipment remaining will be the items essential to the safety of the building and for contamination control. Caution will be used when working in areas that support the Facility HEPA, hot drain, and electrical systems. In addition, caution will be used during dismantling operations near the building's support structures. Many of the resultant pieces will be unwieldy and heavy, requiring approved special handling and rigging techniques. Work packages will include specific steps either to physically protect these systems or to establish safe load paths and protective zones around them. Specific techniques are discussed below.

Standard disassembly and segmenting methods will be used to the extent practical. These include powered and manual tools (e.g., portable band saws and abrasive cut-off wheels). Pneumatically actuated tools and flame actuated tools will be used only with the application of adequate contamination control measures. More specialized segmentation methods, such as plasma arc cutting, may be necessary for certain equipment items, particularly if their original assembly required welding.

Dismantlement activity planning will consider the impact of seismic events on components or structures that are affected by removal activities.

Electrical and pneumatic services will be isolated from systems, components, and structures prior to dismantlement. If dismantlement will include disrupting electrical service to necessary components, a separate, above-ground temporary electrical or pneumatic system will be set up. The following steps will be implemented:

- Pumps, fans, heaters, and instrumentation power sources will be isolated and disconnected from station electrical and control systems at the appropriate electrical control center.
- Pneumatically operated components and instrumentation will be isolated from the compressed air system at the root and equipment isolation valves and pressure will be relieved.
- Openings in components will be enclosed with a protective cover to confine internal contamination.
- Explosive methods will not be used during the decommissioning to prevent uncontrolled spread of contamination.

- Before removing contaminated systems, structures, and components, they will either be decontaminated or externally fixed to stabilize the contamination as appropriate.
- Hot Cell embedded contaminated piping, conduit, ducts, plates, sleeves, etc. will be removed or decontaminated during area and building structural decontamination activities.

Dismantling Techniques—Listed below is the planned approach for dismantling hot cells following initial cell contamination reduction efforts:

- The master-slave manipulators will be removed using the Facility's existing removal procedure. The contaminated ends of the manipulators will be protected with plastic and the manipulators packaged.
- A hydraulic table will be utilized in the removal of the lead-glass windows. The table will be used to pull the windows out, support them, and allow them to be moved to the Service Gallery.
- The Programmable and Remote (PaR) electromechanical crane manipulator will be removed using the existing eye-bolt in the cell roof and on the PaR as lifting points.
- The solid steel guillotine hydraulic operated door will be removed by crane using the existing access hatch through the roof.
- Lifting lugs will be added to existing drilled and tapped holes in the solid steel HLC door and the door removed with a crane.
- Cranes will be used to remove the solid steel horizontal sliding doors that provide access to the LLC and Metallurgical Cell.
- The penetration plugs in the hot cells will be cored-out as appropriate to make jackhammering easier.

Listed below is the planned approach for dismantling the HCF:

- Remaining fume hoods will be dismantled using saws or other appropriate dismantling equipment.
- The electrical system will remain in service until all contaminated process systems have been dismantled. Portions of the electrical system will be disconnected and isolated as the systems they support are dismantled. Prior to area and building dismantlement, the electrical system will be physically isolated from the power supply grid and a temporary electrical supply system installed to provide electrical power.
- The equipment in the Boiler Room consists of the boiler, air compressors, controls for the HEPA system, make-up air supply, office area heating, ventilating and air conditioning (HVAC), hot water heater, and main power panel. The systems are easily accessible from the outside of the building. They will be dismantled only when they are no longer needed to support decommissioning. They are not expected to be contaminated and will be dismantled using conventional techniques as appropriate and surveyed for release to unrestricted use.
- The main HEPA system will be dismantled only after it is no longer needed. Contamination control will be maintained under HP supervision. The HEPA unit will

be dismantled by either cutting the metal or unbolting the pieces and cutting the metal for waste compaction.

Decontamination Methods—The site and facility characterization has determined the extent of contamination throughout the Facility. The depth of contamination within the medium was defined based on the characterization analysis. Specific decontamination methods are shown in the room-by-room procedures prepared for the decommissioning of the Facility.

The majority of contamination removed from the equipment will be loose or semifixed particulate material contained on the interior and/or exterior surfaces. In some cases, contamination fixatives, such as paint, have been used on exposed surfaces.

When feasible, passive decontamination techniques will be used, as dictated by surface characteristics and previous work experience. These techniques include, but are not limited to, standard vacuuming, damp cloth wiping, strippable coatings, and, to a limited degree, hand washing/scrubbing operations. When passive methods will not reduce the surface contamination to the desired levels, more aggressive decontamination methods may be applied. Less aggressive (passive) techniques will generally be conducted in place, unless the work could adversely affect radiological conditions in the immediate work area affecting other workers or risking cross-contamination of areas that have already been decontaminated. In those situations, the decontamination would likely be performed in a more suitable location or moved to a contamination control enclosure. More aggressive decontamination efforts will generally be conducted in a suitable contamination control enclosure. Typical aggressive techniques include dry abrasive blasting, scabbling/scarification, steam cleaning, and hydrolasing. Table 2-4 lists the decontamination methods which will be considered for removing contamination from equipment. GA may become aware of other methods of decontaminating equipment during the decommissioning process and may utilize other methods than those presented herein, provided that the techniques do not pose hazards to workers or the public that have not been addressed in this plan. Those additional methods will be evaluated in the same way as the methods listed in Table 2-4.

Contamination Control Measures—To assure that the potential for cross-contamination is reduced to a minimum, careful consideration was given to the sequences in which the building will be dismantled. Prime consideration was given to assure that the main Facility HEPA system was in operation as long as practicable (roof removal).

The contamination control program relies on administrative controls and physical controls.

The administrative controls are:

Training: Worker training will incorporate methods and techniques for the control of radioactive material and contamination. Existing and new procedures will be used which describe how radioactive material will be handled and controlled.

Surveys: Routine and special radiological surveys will be scheduled and conducted by HP to monitor the effectiveness of contamination control procedures.

During decommissioning, certain work evolutions will result in disturbing loose and fixed contamination. Contamination control measures will be implemented to minimize the spread of contamination.

The physical controls are those of confinement. The major methods are:

Natural: The decontamination of individual rooms will occur within the enclosed wall of the room being decontaminated. This will assure that any airborne contamination generated will be confined to the room being decontaminated and collected in the Facility main HEPA unit.

Portable: Portable HEPA systems will be set up near the area being decontaminated if there is a potential for large amounts of airborne contamination to be generated. In this way, excessive contamination will be contained in the portable system.

Temporary: Plastic glove bags will be used whenever a duct or drain line is severed. This procedure entails sleeving the pipe, setting the cutting tool in the area to be severed, encasing the cutting tool with a plastic bag and sealing the ends of the bag on the pipe/duct. Detailed steps identifying when bagging is to be used are presented in the room-by-room procedures. The decontamination crews have been trained on the bagging procedure. This technique will collect all contamination from the ducts or drains into the bag for proper control.

Tents will be set-up to enclose areas where a potential for significant airborne contamination can be expected, or where Facility dismantlement has not permitted sufficient ventilation air exchanges in a work area.

2.1.2.7 Facility Disposition

The following section discusses the planned methods of disposing of the various materials from the HCF.

<u>Decontamination Methods</u>—Decontamination of the Facility will be approached in much the same way as Facility equipment. In general, decontamination will be attempted only if it is cost-effective, will reduce waste volume, and will not compromise ALARA.

The majority of contamination removed from the walls and floor will be loose or semifixed particulate material contained on or in the surface. In some cases, contamination fixatives, such as paint, have been used on exposed surfaces. Note that contamination refers to the presence of radioactivity or hazardous constituents as a result of Hot Cell Facility activities but may or may not require remediation depending on release limits.

When feasible, passive decontamination techniques will be used, as dictated by surface characteristics and previous work experience. These techniques include standard vacuuming, damp cloth wiping, strippable coatings and, to a limited degree, hand washing/ scrubbing operations. When passive methods will not reduce the surface contamination to the desired levels, more aggressive decontamination methods may be utilized. Aggressive techniques include dry abrasive blasting, scabbling/scarification, steam cleaning, and hydrolasing. For dry wall material in which only the paper covering is contaminated, the paper may be stripped away by mechanical means and the rest of the material released for unrestricted use following survey. Table 2-4 lists the decontamination methods which will be considered for removing contamination from Facility construction materials. GA may become aware of other methods of decontaminating equipment during the decommissioning process and may utilize other methods than those presented herein, provided that the techniques do not pose hazards to workers or the public that have not been addressed in this plan. Those additional methods will be evaluated in the same way as the methods listed in Table 2-4.

Table 2-4—Decontamination Methods

METHOD	ADVANTAGES	DISADVANTAGES
Vacuum Cleaning	Good on dry, porous surface. Avoids use of liquids.	Dust must be filtered out of exhaust. Generates bag of waste, which must be disposed of. Low Decontamination Factor (DF), generally less than 2 unless very loose powder. Some limitations on canister size, and shape when known or suspected SNM is involved.
Damp Cloth Wiping	Effective on loose contamination. Generates low volumes of liquid waste. Does not spread contamination in area of decontamination operation.	Generally requires personnel to contact handle contaminated item. Generates damp cloths, which must be dried before disposal.
Strippable Coatings	Easy to use, Good for fixing loose surface contamination. Minimal radioactive waste, limited airborne contamination generated. Reported DF of 10 - 1000, depending on application.	Limited to smooth nonporus surfaces. Potential exposure to irritant paint mists and fumes.
Hydro Blasting (Hydrolasing)	All water equipment may be utilized. Allows operation to be carried out from a distance. Water equipment may be used for solutions of other decontamination agents.	Spread of contamination in the area the water is being used. Generates large volumes of contaminated water, which must be processed before disposal.
Steam	Lower water volumes generated than using high pressure water. DF generally is up to 4, but in some circumstances can be as high as 10.	Spread of contamination in the area the steam is being used. Generates contaminated water, which must be processed before disposal. Large potential for airborne contamination.
Abrasive Blasting	Very effective for surface contamination.	Large waste volumes, spread of contamination in the area of blasting. Large potential for airborne contamination. (Use of Blastrac or Vacublast type systems supported by HEPA filters minimize waste volume and spread of contamination.)
Scabbling/Scarifying	Effective on coated and uncoated surfaces, removes concrete up to .25 in. deep per pass.	Cannot cut rebar, can spread contamination from the dust generated in the operation. (Dust and airborne contamination can be minimized by use of good HEPA unit.)
Spalling	Low airborne contamination.	Slow process, only good for limited access and small areas. Cannot cut rebar.
Complexing Agents/ Solvents/Acids/ Caustics	Removes contamination through chemical means, rather than scrubbing. Low airborne contamination.	Produces liquid wastes and mixed wastes, which may be regulated by the EPA and for which limited disposal options are available.
Co_2 Blasting	Removes contamination from surfaces with generation of dry or liquid wastes.	Effectiveness depends upon surface area. Can create airborne contamination.

Building 23 Roof Removal—The HCF roof consists of two different materials of construction. One is the roof over the hot cells and the other, the roof over the remainder of the Facility.

Hot Cell Roof—The interior portion of the roof over the hot cells consists of 1/4 in. steel plate lining an approximately 3 ft. thickness of conventional steel-reinforced concrete. The interior surface is painted with epoxy paint. The exterior portion of the hot cell roof is covered with 1 in. of rigid insulation lined with paper and covered with a bituminous top dressing roofing material.

In association with cell decontamination, the paint on the interior may be removed and disposed of as radioactive waste. The steel plates will then be removed, followed by cleaning of the concrete. The concrete and steel will be surveyed and disposed of as radioactive waste if contaminated. After removal of the outside roofing material, the concrete will be cut into sections for disposal.

Hot Cell Facility Roof—The roof of the HCF is a steel deck roof consisting of a ribbed steel deck topped with a layer of rigid insulation, multiple layers of roofing felt, and a bituminous top dressing. The steel decking consists of sheets of corrugated steel, which are welded together. The bottoms (inside of building) are lined with sheet metal welded to the corrugated metal to give a flat surface. The tops (exterior) of the metal are covered with rigid insulation ranging in depth from 1 to 2 in. The rigid insulation is covered with multiple layers of roofing felt and a bituminous top dressing.

The removal process for the weather coating layers includes cutting the layers into sections, freeing the cut sections from the roof deck, gathering the material into rolls or stacks, and conveying it to the ground as appropriate. Because of the age of the material and the detected contamination during characterization, precautions will be taken to assure that the debris is contained on the roof during cutting. All removed material will be monitored for radiological contamination and dispositioned appropriately.

The steel deck will only be removed after the main HEPA system is no longer needed. The hot cells will have already been surface decontaminated, all floors and walls will have been either, cleaned of contamination, or the contamination fixed, the branch of the hot drains not located under the hot cells will have been removed. The roof of the general Facility must be removed prior to dismantlement of the LLC and HLC because the cells form half of the support structure for the roof.

The roof removal process will involve cutting the welds on the steel deck as appropriate, removing the sheets of decking, grouping them into bundles, and transferring them from the roof to the ground. If loose contamination is identified, appropriate measures (e.g., decontamination, applying a fixative, or wrappings) will be implemented to prevent its spread.

Until proven otherwise, the removed steel decking will be considered contaminated. The radiological controls will focus on preventing the spread of contamination during removal and handling. The contaminated decking will be decontaminated or prepared for containerization and shipment as radioactive waste. Radiological controls during this phase will focus on preventing the spread of contamination during the cutting and containerization operations.

If it is considered cost-effective to decontaminate the decking, or if contamination in the decking is not widespread, decontamination techniques will be utilized to prepare the material for unrestricted release.

Maintaining Building Containment—Containment controls will be implemented during and following roof removal operations. These controls will focus on 1) preventing any residual contamination inside the building from spreading to the building's exterior, and 2) preventing any contamination within the roof zone from spreading to the building's interior. These measures will also provide weather protection for the building's interior. As mentioned earlier, the roof will only be removed after all significant surface contamination within the building has been removed or fixed.

Any remaining contamination in the roof zone will be fixed prior to commencing dismantlement.

Once the roof is removed, temporary containment will be provided in areas where dismantlement is occurring.

HEPA-Filtered Exhaust Ductwork and HVAC—There are three (3) HEPA-Filtered exhaust systems and two (2) HVAC systems in the Facility. The HEPA systems and the planned dismantlement are described below.

Fume Hoods Exhaust—Exhaust from the fume hoods to the HEPA system. All duct work goes up through the roof, along easily accessible circular ducts and into the main HEPA system. With the HEPA system operating, cut the ducts, decontaminate as necessary, cap off roof penetrations, and cap off entrance to the HEPA system.

Room Exhaust—Exhaust from the rooms to the HEPA system. All duct work is along the ceilings of the rooms and into the main HEPA system and is easily accessible. With the HEPA system operating, cut the ducts, decontaminate as necessary, cap off room penetrations, and cap off entrance to HEPA system.

Booster Plenum Exhaust—Exhaust from the cells to the booster system and into the HEPA system. Ducts enter the walls of the cells and travel underground. Access is only available after the cells are removed. After the hot cells are decontaminated, the entrance to the ducts will be capped off. After the ceiling and walls of the hot cells are demolished, a negative pressure room will be built around the area being accessed, and the ducts excavated.

Supply System—A supply system from the Boiler Room that passes through dust filters and enters all but three (3) rooms. The system includes an air-to-water heat exchanger for heated air. Easy access is available along the ceiling of the rooms. Duct work is not expected to be contaminated. Ducts will be cut up, analyzed, and disposed of properly.

Closed Loop System—A closed-loop system floats with the supply and exhaust system. It supplies heated or cooled air to the three (3) office rooms (Rooms 100, 102 and 103). Access is along the ceiling of these rooms. Duct work is not expected to be contaminated. Ducts will be cut up, analyzed, and disposed of properly.

Sanitary Sewer System—The sanitary sewer system drains are all located beneath the concrete slab of the Facility. The vent lines are located within the walls of the Facility. The sanitary sewer system will not be used from the time decommissioning begins. Separate toilet and shower facilities will be available to decommissioning personnel outside the Facility.

The sanitary system drains will be dug up and the vents removed from the walls, surveyed, decontaminated if necessary, and segmented for transport to a local landfill. The system will be analyzed for lead content and disposed of as appropriate. If releasable levels cannot be achieved, the pipe will be disposed of as radioactive, mixed waste or hazardous waste.

Radioactive Waste System—Decommissioning of the Radioactive Waste System will only commence after the system is no longer needed for decontamination purposes. There are two branches in the system. The two lines merge prior to leaving the Facility. One branch line drains the hot cells and the second branch drains the Facility hot sinks, shower, and Manipulator Repair Drainage Pit. The second line will be removed first and sealed off to allow the hot cell drains to be used as long as necessary for hot cell decontamination.

The underground radioactive system consists of seamless stainless steel piping with welded connections. Its horizontal runs are several feet below the surface of the concrete slab of the building (except for the runs under the hot cells, which are embedded in the concrete slab).

The line that is outside of the HCF is encased in concrete from the point at which it leaves the building to the point at which it discharges into the waste storage tanks. Much of the system will be removed while the Facility HEPA system is still in operation. The lines under the hot cells will be removed after the hot cells are removed. Adequate portable HEPA ventilation will be provided to support final line removal.

Exposed/Above Ground Radioactive Waste System—Exposed radioactive piping and equipment, such as contaminated sinks, showers, and traps, will be isolated and cleaned to meet release levels, or subjected to volume-reduction methods and packaged for radioactive waste disposal. The piping and equipment will include (1) associated plumbing fixtures, (2) tile and sinks, (3) drain lines, and (4) vent lines. The plumbing fixtures will be analyzed for lead content and disposed of as appropriate.

Embedded/Underground Radioactive Waste System—The concrete slab over the drains will be removed first and the soil carefully removed from around the drains. The lines will be monitored for potential leaks into the soil. Convenient lengths of pipe will be measured off. The area under the pipe being cut will be protected with plastic liners. The ends of the pipe remaining in the soil will be capped off to prevent any release of contamination while soil is being dug from around it. A thorough radionuclide analysis of the pipe will be made to determine levels of SNM remaining in the pipes. The pipes will be disposed of as appropriate depending on the results of the SNM analysis. Decontamination of the pipes will occur only after the pipe is severed, in order to minimize liquid waste generated.

Magnetite Concrete—This material is not hazardous waste, therefore it can either be free released if not contaminated, or shipped as radioactive waste if contaminated. Magnetite concrete is located in the following locations within the HCF (the estimated volume of magnetite concrete for each area is provided in parentheses):

1) The front faces of the HLC and all faces of the Metallography Cell and LLC (3,330 $ft.^3$),

2) The end slab of the High-Low-Level Cell door enclosure (55 $ft.^3$),

3) The shielding around the wells in the pit (760 $ft.^3$),

4) Underneath the floor of the LLC and HLC surrounding the wells (134 $ft.^3$).

Hot Cell Walls—Within the face of the Hot Cells are hundreds of service penetrations that are lined with steel. Also, there are ten (10) large penetrations for the master-slave manipulators, two (2) penetrations for the periscopes, and five (5) penetrations for the leaded glass windows. In addition, there are four (4) penetrations for air inlet ducts that have lead bricks providing shielding along with various access areas with lined lead.

The contaminated interior sections will be cleaned. Once the walls are declared to be clean, the manipulators, periscope, and windows will be removed. Jackhammers or other means will be used to demolish the walls with appropriate dust control.

The end slab is a stand alone unit and is bolted to the side walls. It will be removed and the interior wall cleaned. Jackhammers or other means will be used to demolish the clean portion of the slab.

The shielding around the wells inside the hot cells will be cleaned. It is suspected that these sections will be heavily contaminated, and therefore will be jackhammered or otherwise dismantled and disposed of as radioactive waste.

The pit shielding will be one of the last items removed from the building. The wells project over 15 ft. below the finished floor elevation. The wells will be decontaminated first. Then soil will be removed from around the sides of the pit to allow the Magnetite Concrete to either be removed with jackhammers or other means of dismantlement with appropriate dust control.

Leaded Glass Windows—The windows consist of multiple layers of leaded glass with the gaps filled with a high quality mineral oil. Lead bricks are used to shield the areas near the operating side of the hot cell walls. These windows were inserted from the inside of the hot cells and will be removed in the same manner.

The inside of the windows will be decontaminated appropriately along with the mounting bolts. The mineral oil will be drained and the windows removed using a special handling table that will be bought, rented, or built. The mineral oil will be sampled for contamination and disposed of or recycled accordingly.

Several Hot Cell supply companies have expressed interest in procuring the hot cell windows from GA. These companies have licenses to possess radioactive material. If these windows are within their license limits, the windows will be boxed and shipped to their site. The supply companies have expressed interest in assisting with the window removal. If the windows cannot be sold to the supply companies, all efforts will be made to decontaminate them using appropriate methods. If the windows cannot be free released, they will be evaluated for disposal as mixed waste.

Hot Cell Concrete Flooring—The floor of the hot cells (Metallography Cell, LLC, HLC) consists of epoxy-painted 1/4 in. steel plate. There are four (4) drains and six (6) wells in these hot cells. Four (4) wells are 7 ft. deep, one is 12 ft. deep and one 16 ft. deep. Around each drain there is a 6 ft. x 9 ft. shop-fabricated section filled with standard concrete. These sections were lowered onto a pre-poured concrete floor and the edges welded to the walls. The six wells are surrounded by a 1/4 in. steel plate siting on magnetite concrete.

The floor will first have all loose debris removed as appropriate. The epoxy paint will be removed after the best achievable surface decontamination is completed. The prefabricated inserts will then be removed, followed by the remainder of the steel plates. Any further contamination in the concrete will be removed. The remainder of the flooring will then be crushed and removed in sections.

The paint is heavily contaminated and will be analyzed and evaluated for disposal as mixed waste. The steel is expected to be contaminated and will be analyzed and disposed of as appropriate. All debris created during the cleaning of the concrete floor will be collected and analyzed for proper disposal. The remainder of the concrete and steel rebar will be analyzed and disposed of appropriately.

The wells will be removed last by removing all of the surrounding soil, taking into consideration all safety requirements for deep excavations.

Conduits—The majority of the conduits are assumed to be externally noncontaminated or easily decontaminated. However, due to the relatively high differential pressures throughout the building, there is a potential for air flow within the conduits. Therefore the extent of internal contamination is unknown. Conduits that have no credible potential for internal contamination based upon technical judgment and/or process knowledge will be appropriately noted on surveys or release logs and evaluated for loose and fixed external contamination prior to release. If a cost-effective method for surveying the internals of the conduits is not identified, the conduits will be presumed to be contaminated and disposed of accordingly.

Piping/Tubing—Piping/Tubing that supplies natural or bottled gas, oil, domestic water, air, and steam ranges in size from 1/4 in. to 6 in. in diameter. The piping/tubing is expected to be noncontaminated or easily decontaminated. Since these lines have all been sealed, or have had clean fluids flowing through them, they are likely to be able to be released as nonradioactive waste. If some piping/tubing cannot be decontaminated, it will be disposed of as radioactive waste.

Concrete Flooring—The concrete flooring in the Facility consists of tiled concrete, painted concrete, and unfinished concrete. A summary of the contamination levels detected during the characterization task and the type of flooring for each of the rooms is shown in Table 2-5.

Tiled Floors—All floor tiles (except ceramic) contain asbestos and will be removed from the concrete by a state-certified asbestos abatement contractor. Upon removal, they will be analyzed for contamination and double bagged. If they are contaminated they will be shipped as low-level waste. The noncontaminated tiles will be free released for disposal as asbestos-containing material. Many of the tiles located in the Machine Shop are contaminated with oil on both top and bottom surfaces.

Following removal of the tiles, the floors will be surveyed for radiological contamination and the affected areas decontaminated using appropriate means.

Painted Floors—Most paint in the Facility contains detectable amounts of lead. Representative samples of all removed paint and concrete will be taken and analyzed.

Certain rooms have detectable contamination beyond depths of .25 in. and others beyond 1 in. These rooms are designated with single and double asterisks in Table 2-5. Decontamination methods such as scarifying and scabbling are suitable for concrete removal, but cannot remove rebar. Since there is a significant amount of rebar in the floors, the slabs in rooms designated with a double asterisk will probably be removed with very little surface treatment. Rooms with a single asterisk will have the concrete removed, but it may have to be removed in sections if rebar is encountered.

Radioactive subsurface contamination has been detected under certain areas of the HCF floor slab. The bottom of the floor slabs and soil directly under the slab will be surveyed for radioactive contamination. The removal process will involve saw cutting the slab in sections appropriate for fitting inside the selected shipping container and upturning the slab to analyze the underside.

Since there are buried electrical conduits directly under the slab, prior to cutting, all electrical lines unnecessary for Facility operation will be isolated and locked and tagged out. The slab cutting operation will be planned to minimize the effect on other decommissioning operations. If electrical power is necessary in a certain area, new, above-ground cables will be supplied.

The sections of slab to be cut will be carefully marked to assure that they leave sufficient structural support to the load-carrying walls. The locations of the cuts will be reviewed and approved by qualified personnel.

All contaminated floor material will pass into the Service Gallery for loading into a shipping container using the existing Facility crane. Upon being filled, the box will exit the building via the trolley system. All noncontaminated floor materials will exit the building and be disposed of appropriately.

Table 2-5—Type of Flooring and Detected Contamination for the Hot Cell Facility Rooms

Room	Contamination Detected?	Flooring
Office (Room 100)	No	Asbestos tile on Concrete
Office (Room 102)	No	Asbestos tile on Concrete
Office (Room 103)	No	Asbestos tile on Concrete
Lobby (Room 104)	Yes	Asbestos tile on Concrete
Coffee Room	Yes	Asbestos tile on Concrete
Men's Rest Room	No	Ceramic Tile on Concrete
Ladies' Rest Room	No	Ceramic Tile on Concrete
Operating Gallery (Room 105)	Yes	Asbestos tile on Concrete
Dark Room (Room 105A)	Yes	Asbestos tile on Concrete
Men's Change Room (Room 106)	Yes	Asbestos tile on Concrete
Counting Room (Room 106)	Yes	Asbestos tile on Concrete
Warm Metallography (Room 107)	Yes	Painted Concrete
Controlled Machine Shop and Weld Area (Room 108, 108A)	Yes**	Asbestos tile on Concrete
Tritium Extraction Lab (Room 109)	Yes	Painted Concrete
Service Gallery (Room 111)	Yes*	Painted Concrete
Pump Room (Room 114)	Yes**	Painted Concrete
X-ray Lab (Room 116)	Yes**	Asbestos tile on Concrete
Room above 116 (Room 116A)	No	Steel
Tool Room/Hallway (Room 117)	Yes**	Asbestos tile on Concrete
Room Above 117 (Room 117A)	No	Steel
Decontamination Room (Room 118)	Yes**	Concrete
Tritium Effluent (Room 119)	Yes	Painted Concrete
Tritium Sample Prep. (Room 120)	Yes	Painted Concrete
Boiler Room (Room 121)	Yes	Concrete
Manipulator Repair (Room 122)	Yes*	Painted Concrete
Corridor/Ladies' Change Room	Yes**	Painted Concrete
BeO Storage Shed	Yes	Concrete

* Contamination beyond .25 in.
** Contamination beyond 1 in.

Subfloor Soil—Floor materials removed from the Dark Room (105A) and the Boiler Room (121) will need to be segregated as potential mixed waste due to the presence of both radiological and chemical contaminants in the floor. The presence of alcohols and hydrocarbon contaminants on the floors in both of these rooms will require additional sampling during decommissioning to verify that chemicals did not penetrate the subfloors.

- Corridor (adjoins Ladies Change Room and Room 120), Tritium Effluent (Room 119), Tritium Sample Prep. (Room 120), and Tritium Extraction Lab (Room 109)

  Based upon the core results, subsurface soil contamination exists beneath the Tritium Sample Preparation Room (Room 120), and it is considered likely that portions of the adjacent Room 109 subsurface soils are also contaminated. Rooms 109 and 119 also has confirmed PCB and lead contamination in the floor material which may have penetrated the subsurface soil.

- Pump Room (Room 114), Decontamination Room (Room 118), Service Gallery (Room 111), and Manipulator Repair (Room 122)

Subsurface core results demonstrate that subsurface soil contamination is certain. It is possible that the Decontamination Room or LLC may be the source of this subsurface soil contamination. Attempts were made to pinpoint the likely source of positive subsurface soil results, but these additional cores were not conclusive as to the point of origin for observed soil activity. Residual soil contamination is also evident from the former plutonium sump tank area in the yard outside of the X-ray Lab (Room 116) and Pump Room (Room 114). These soil contamination results suggest mixing of the soil due to excavation and removal of the plutonium sump tank. The floor of the Pump Room has subsurface contamination in the form of various semivolatile compounds, including alcohols and hydrocarbons.

- Warm Metallography (Room 107)

  Subsurface soils from adjacent Room 122 (Manipulator Repair) were found to be contaminated during core sampling. Further exploration of subsurface soils in Room 120 was performed and also demonstrated existence of subsurface soil radioactivity. Based upon these core results, it is likely that radioactivity will also be discovered in the subsurface soils below Room 107. Hazardous contamination was also confirmed in Room 107 in the form of semivolatile compounds, including phenols, hydrocarbons, alcohols, and other organics. PCBs were also detected at very low levels.

- Controlled Machine Shop and Weld Area (Room 108/108A)

  Core results showed no subsurface soil contamination below Room 108, and minor subsurface soil contamination below Room 108A at the stairs. Several areas where process knowledge indicated the previous existence of a wash-down trench were sampled during coring with only low levels of radioactivity detected in the concrete sections. This area will have additional samples taken during decommissioning to ensure that impact of this trench is well identified. Core and floor samples analyzed for hazardous constituents confirmed the presence of hydrocarbon and other organics known to be present in machining oils used in this room.

- Metallography Cell (Room 112)

  Concrete and subsurface cores were taken around the cells and the results do indicate that soil contamination is likely at least at the north end of the cell.

- Low-Level Cell (Room 113)

  Concrete and subsurface cores were taken around the cells and the results indicate soil contamination is certain below the LLC. Based upon all nearby core results, either the Decontamination Room or LLC is thought to be the most likely source for the identified subsurface soil contamination.

- High-Level Cell (Room 115)

  Concrete and subsurface cores were taken around the three cells (Metallography, Low-Level, and High-Level) and the results indicate that significant soil contamination below the HLC is not likely. However, based upon process knowledge, there still exists the potential for soil contamination just below the concrete floor foundation of the HLC due to the process of installation of new storage wells into the HLC after initial Facility operation. With no known introduction of water into the soil near the storage wells, no migration of the contaminants should have occurred.

Hot Cell Structural Steel, Columns, and Roof Trusses—The majority of the HCF is constructed of reinforced, free standing block walls. The structural steel consists of the supports for the roof over the Offices (Rooms 100, 102, 103), Lobby (Room 104), and Service Gallery (Room 111). There is a set of support columns for the floor of Rooms 116A and 117A. The remainder of the roof is supported with trusses that span the distances from the support steel, the hot cells, and the free standing walls.

It is presumed in contaminated areas of the Facility that inaccessible, repainted, or recoated surfaces are radioactively contaminated. Structural steel will be decontaminated using passive hands-on techniques as appropriate. Follow-up surveys will either clear the items for release to unrestricted use or identify those surfaces requiring further decontamination.

Recoated steel surfaces and contaminated surfaces may be subjected to more aggressive cleaning techniques, to the extent that surface coatings are removed to the base metal. Subsequent surveys will identify those structural members that can be released to unrestricted use. If isolated surfaces cannot be cost-effectively cleaned, the affected volumes will be sectioned and packaged for disposal as radioactive waste.

These items will be removed only after the roof is removed. Removal techniques will be reviewed with a structural engineer prior to removal to assure proper safety precautions are followed.

Interior Walls—Interior walls consist of bare, painted, and plastered block, plaster walls, steel, and asbestos board. The wall mud in Room 105 contains asbestos and will be remediated using appropriate asbestos removal procedures. The walls under the windows are made of asbestos board (Transite) and will be disposed of using appropriate asbestos removal procedures. The walls of the showers and restrooms consist of ceramic tiles. They will be surveyed and disposed of as radioactive waste if found to be contaminated. The remaining interior walls are standard metal stud and two-surface drywall construction. The plaster board walls will be surveyed. Due to the absorbent nature of the material, if they are found to be contaminated, they will be disposed of as radioactive waste. Otherwise, they will be segmented for transport to a local landfill. The steel studs, due to their complex shape, are not easily decontaminated; therefore, they will be surveyed and disposed of as radioactive waste if found to be contaminated. Part of the walls in the Manipulator Repair Room are lined with stainless steel. They are known to be contaminated and will be disposed of as radioactive waste.

Ceilings—Ceilings of each room consist of the underside of the building's corrugated steel roof. Some rooms have acoustic tile suspended drop ceilings or tiles with asbestos-containing adhesive. The showers have tiled ceilings. The corrugated steel ceilings will be cleaned as appropriate and disposed of when the roof of the Facility is removed. Due to the absorbent nature of the ceiling tiles they will be surveyed and disposed of as radioactive waste if found to be contaminated. Appropriate asbestos abatement techniques will be used during the tile removal. The ceramic tiles will be surveyed and disposed of as radioactive waste if found to be contaminated.

Concrete Block Construction—Interior building surfaces that are constructed of cinder or concrete block and exhibit surface contamination may first be cleaned to remove the paint. The remainder will be vacuumed or coated with fixative and disposed of as radioactive waste if contamination is identified beneath paint.

Exterior Concrete and Block Walls—Exterior building surfaces that are constructed of cinder or concrete block and exhibit surface contamination may first be cleaned to remove loose contamination and paint. The remainder will be vacuumed or coated with fixative and disposed of as radioactive waste if contamination is identified beneath paint.

Beryllium-Oxide Storage Shed—This is a small storage shed located outside Building 23. The building is of corrugated metal design, attached to a concrete slab, with two large sliding doors for access.

Contamination was detected on the surface of the concrete floor and within the foam that forms a seal between the metal walls and the concrete. GA plans to remove the surface contamination using appropriate means while the building is still standing in order to assure the containment of any airborne activity during the cleaning process.

The electrical power will then be isolated to the building. The side walls will be reinforced and the roof removed. The side walls will then be removed, paying close attention to the foam along the bottom. The bottom supports of the walls will be processed as low-level waste.

The foam on the concrete will be removed. The remainder of the concrete will be removed, and, if clean, disposed of in a local landfill. Soil samples will be taken to assure the soil under the shed has not been contaminated.

2.1.3 Procedures

All decommissioning work will be performed in accordance with written, approved procedures with training given prior to initiation of work. Many tasks are already described in HP or Project Procedures. Additional procedures will be prepared and released as required.

All Decommissioning Project procedures are prepared using a standard format. Each procedure, including changes, is reviewed for adequacy. After all comments are resolved, the procedure is approved by the responsible functional manager, Project Quality Assurance, and the Project Manager, and is released by the Records Management Coordinator.

Each issue of a Decommissioning Project procedure is uniquely identified and dated. Each procedure is distributed to the location where the activity is performed and to personnel on a Controlled Distribution List. Organizations and personnel on this distribution list receive copies of all changes to the procedures. The Records Management Coordinator maintains an up-to-date index of procedures. After release and distribution, a copy of the procedure, the review package, the distribution list and a copy of the index are sent to the Quality Assurance Records Center for microfilming.

Revisions to Decommissioning Project procedures are reviewed, approved, and processed in the same manner as the initial document. Field changes to existing approved procedures are made in accordance with current procedure control requirements.

HP procedures are developed by Project and GA HP personnel and approved by GA HP and Licensing, Safety, and Nuclear Compliance (LS&NC) management. Quality Assurance procedures are developed by Project and GA Quality Assurance personnel and approved by GA Quality Assurance management.

2.1.4 Schedule

The work described in this Decommissioning Plan will commence upon NRC and State approval of the plan and authorization to proceed by the Department of Energy (DOE). Decommissioning activities have been scheduled to complete in the year 2000 in accordance with the DOE Project Baseline funding profile. The scheduled activities are shown in Figure 2-5.

2.2 Decommissioning Organization and Responsibilities

GA is committed to and retains ultimate responsibility for full compliance with the existing NRC and State licenses and the applicable regulatory requirements during decommissioning. Company principles, policies, and goals will be followed to ensure high standards of performance in every facet of the Hot Cell D&D Project.

The DOE has contracted with GA in a cost sharing arrangement for GA to act as the Prime Contractor and Site Manager of the Hot Cell D&D Project. The DOE provides full support to the Project through its Oakland Operations Office (DOE-OAK).

2.2.1 Hot Cell D&D Project Organization

GA has established an organization specifically to accomplish decommissioning of the HCF. The functions of the organization staff are described below. (Note that while functions will be maintained, actual organization and individuals performing the functions may vary over the Project duration.)

2.2.1.1 Description of Overall Organizational Structure

In preparing for decommissioning, GA already has in place D&D organization of experienced and knowledgeable employees. This Project team has worked together on the initial decommissioning tasks (under the existing NRC License SNM-696 and State Byproduct Materials License 0145-80) in the removal of radiologically contaminated waste materials, planning for the transfer from the Hot Cell of irradiated fuel materials, and the characterization of the site and facility. These tasks were performed by GA under a cost sharing contract with the DOE, known as the Hot Cell D&D Project Phase 1. Many of these employees will continue to serve in the organization during decommissioning. Specialized staff and support personnel may be added as the Project progresses. The GA staff will be complemented by subcontractors for specific tasks requiring special skills on an as-needed basis. Figure 2-6 presents the organization structure.

2.2.1.2 Functional Description/Minimum Requirements for Principal Project Management and Staff Positions

Project Manager—The Project Manager has the overall responsibility for successful completion of the Project and will work in close liaison with the DOE-OAK Project Manager. The Project Manager functions include:

- Control and safety of decommissioning activities and protection of the environment
- Determining project staffing and organization
- Assuring performance to cost and schedule
- Reporting of performance
- Approval of Project plans and Project procedures
- Approval of subcontracts
- Approval of budgets and schedules
- Ensuring, with the assistance of the Licensing, Safety, and Nuclear Compliance organization, that the conduct of decommissioning activities complies with all the appropriate regulations and is in accordance with the GA licenses

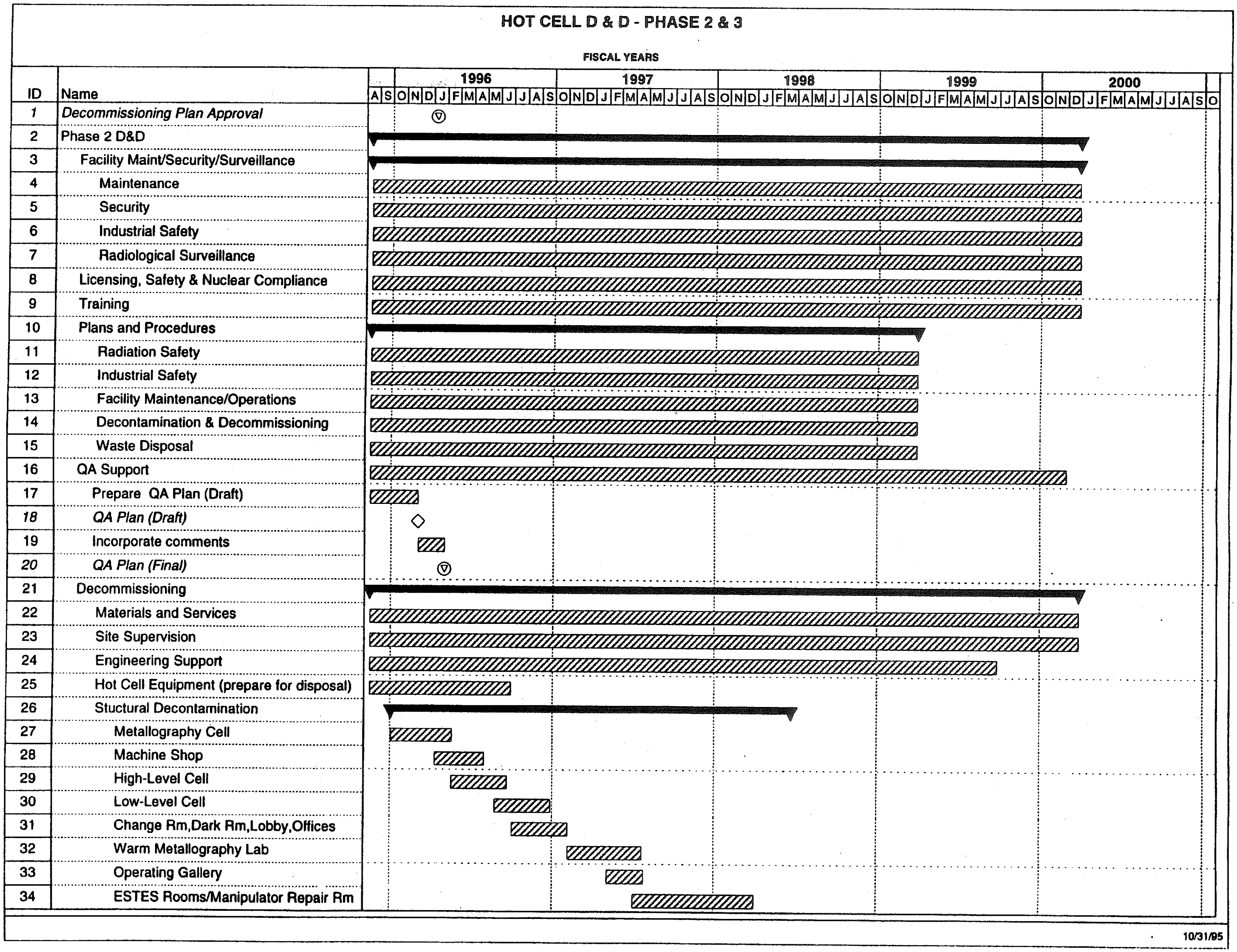

Figure 2-5—Decommissioning Schedule (page 1 of 4)

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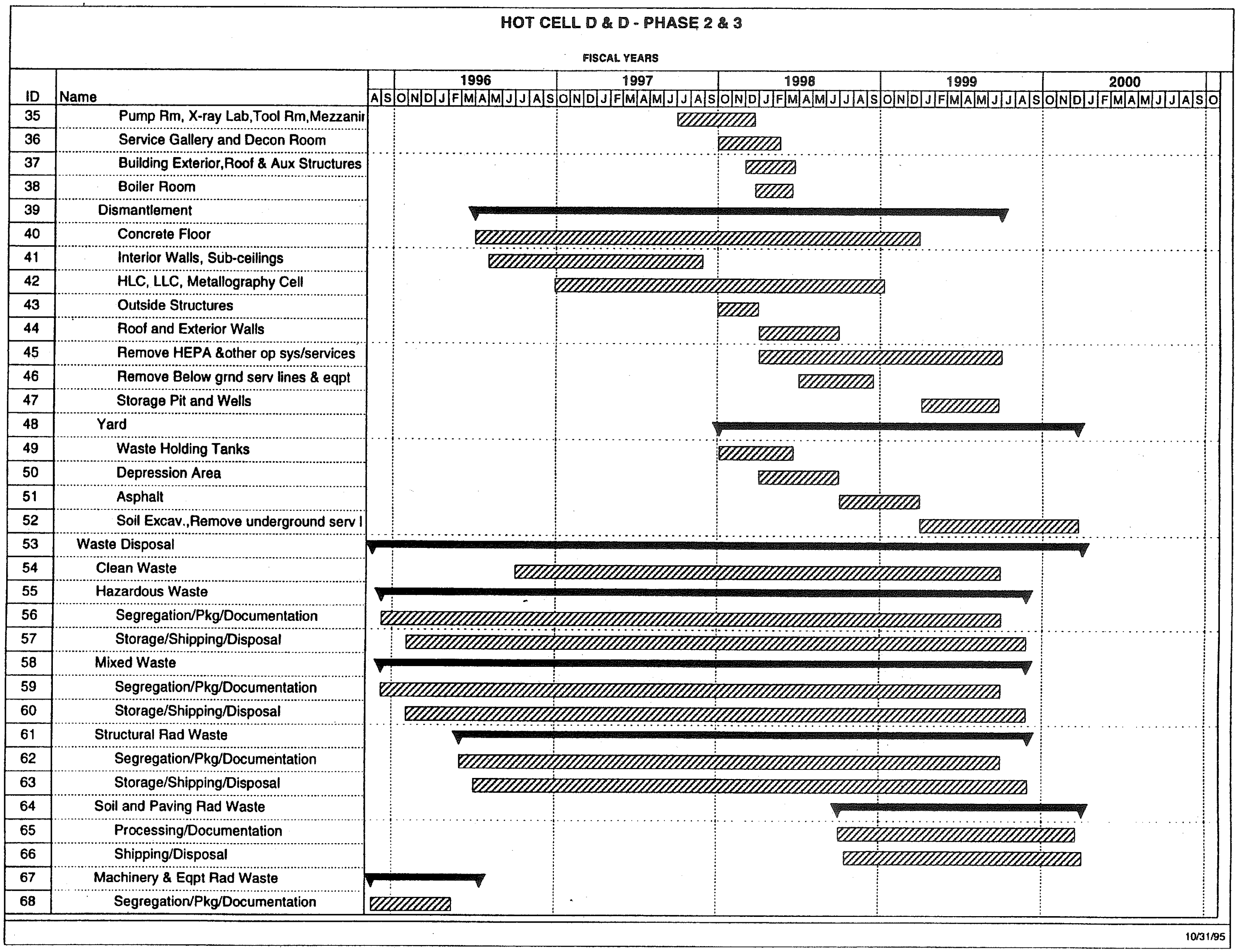

Figure 2-5—Decommissioning Schedule (page 2 of 4)

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HOT CELL D & D - PHASE 2 & 3

ID	Name
69	Storage/Shipping/Disposal
70	Phase 2 Project Management
71	Project Management
72	Project Coordination
73	*Operational Readiness Rvw (ORR)*
74	*ORR Report*
75	Operations Support
76	PP/PMP
77	*Final PP/PMP*
78	Administrative Procedures
79	DOE Requirements Support
80	Contract Support
81	PTS
82	EM-40 Requests
83	Track and Trend Act. and H&S Plan
84	Prepare Health & Safety Plan
85	*H&S Plan (Draft)*
86	Incorporate comments
87	*H&S Plan (Final)*

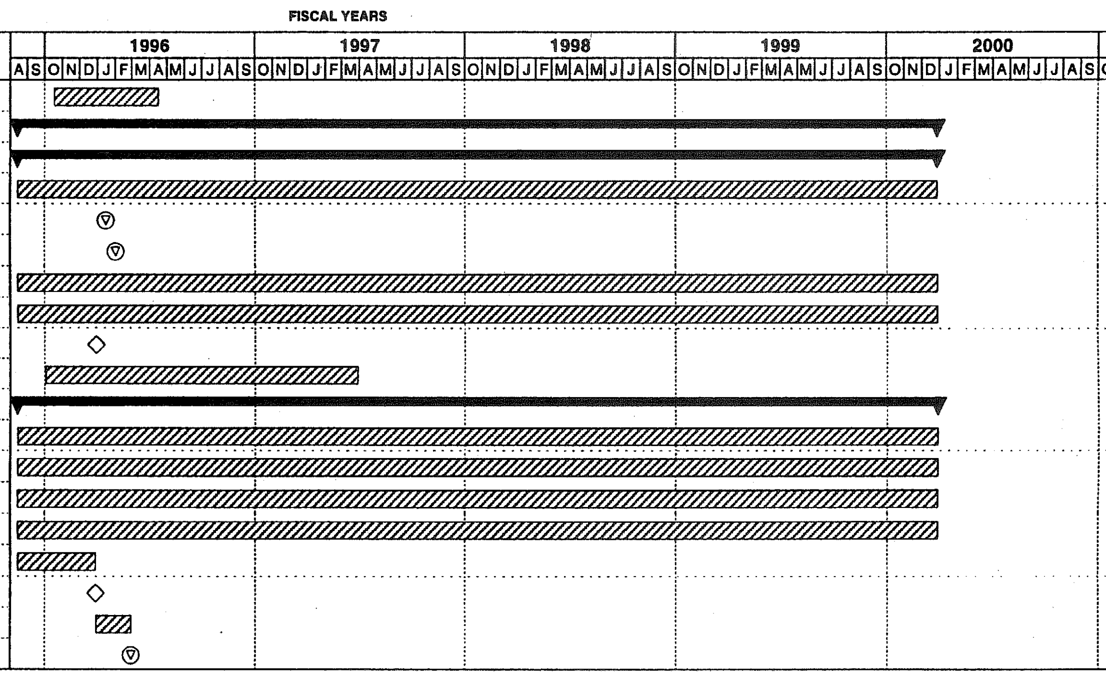

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Figure 2-5—Decommissioning Schedule (page 3 of 4)

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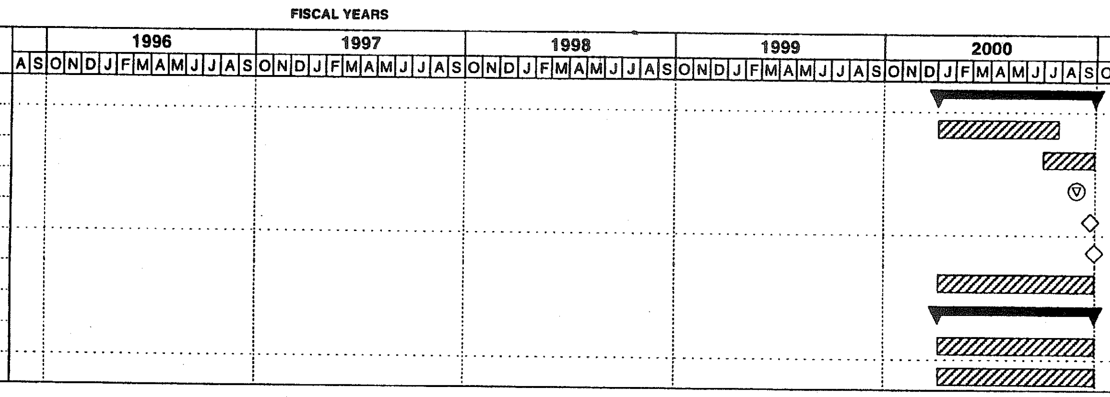
HOT CELL D & D - PHASE 2 & 3

ID	Name
88	Phase 3 - Site Release
89	Confirmatory Survey
90	Final Report
91	*Draft Closure Report*
92	*Final Closure Report*
93	*Release Report*
94	NRC Coordination/Support
95	Phase 3 - Project Management
96	Project Management
97	DOE Requirements Support



Summary — Sched Milestone Date TBD ⓥ

Scheduled Activity

Scheduled Major Milestone ◇

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Figure 2-5—Decommissioning Schedule (page 4 of 4)

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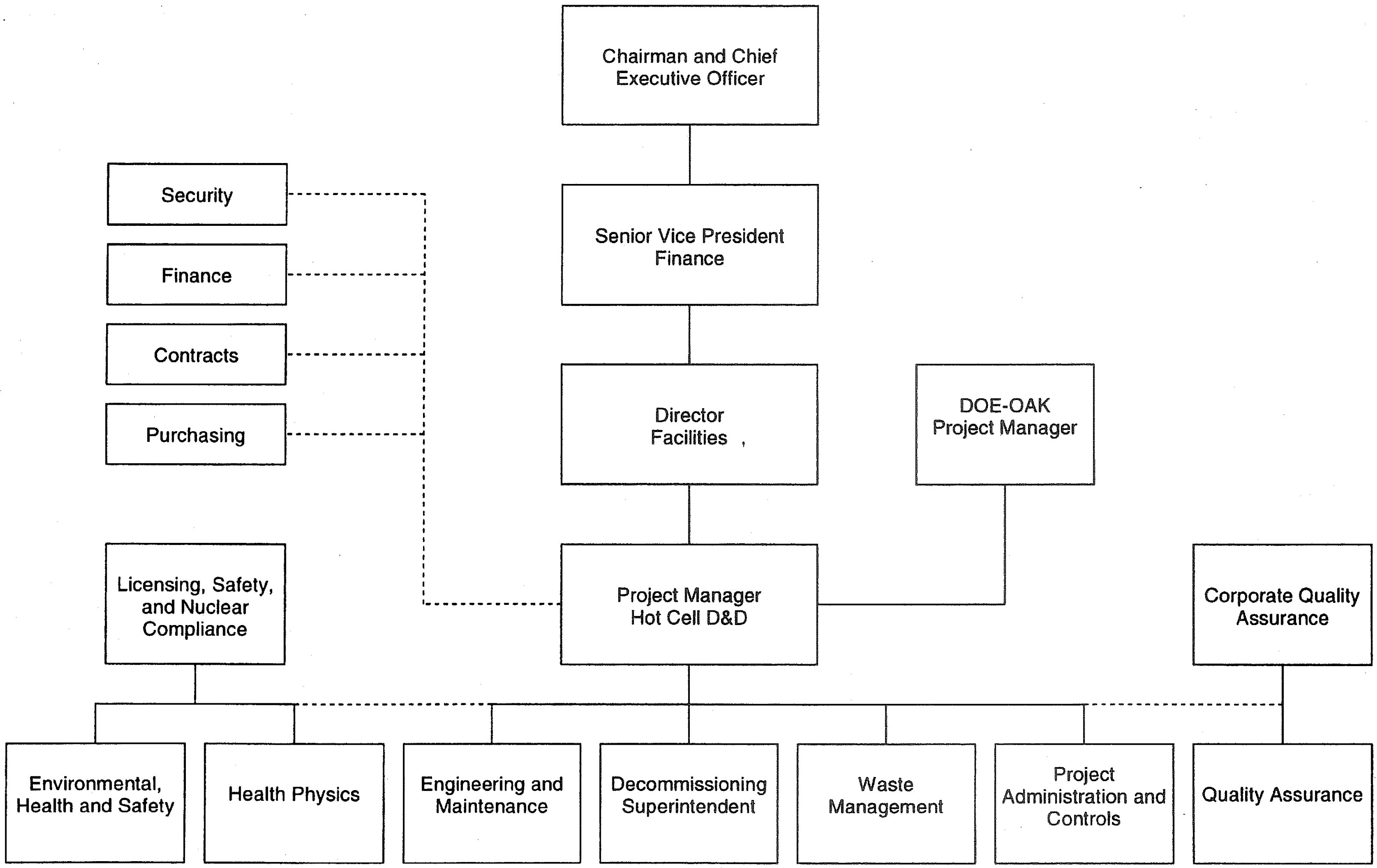

Figure 2-6—Decommissioning Organization

PC-000423/4

The minimum qualifications for the Project Manager are:

- A four year degree in engineering or science
- Ten years of project management experience in the nuclear industry
- Substantial knowledge of the GA HCF
- Appropriate training in radiation protection, nuclear safety, hazardous communication, and industrial safety

General Atomics Director, Licensing, Safety, and Nuclear Compliance—The GA Director of LS&NC administers licenses and reviews and approves all WAs for compliance with applicable regulations and license conditions. The Director also provides GA site licensing and regulatory oversight and coordinates the preparation and processing of applications for any licensing actions. The LS&NC organization is responsible for; Nuclear Safety, Nuclear Material Accountability, HP, EH&S, and Statistics and Measurement Control.

The minimum qualifications for this position are:

- An advanced degree in nuclear science or engineering
- Ten years experience in nuclear industry management in related fields
- Appropriate training in licensing, radiation protection, nuclear safety, hazardous constituents and industrial safety

Manager of Engineering and Maintenance—The function of the Manager of Engineering and Maintenance is to:

- Maintain the HCF equipment and services in a safe operating condition
- Develop decommissioning procedures
- Provide engineering support for the decommissioning activities

The minimum qualifications for this position are:

- A four year degree in Engineering
- Five years of management experience in a nuclear facility
- Knowledge of the GA HCF operating equipment and services

Decommissioning Superintendent—The Decommissioning Superintendent supervises the daily activities of the on-site labor force and subcontractors. This position will be responsible for maintaining the decommissioning activities at the hot cell site on schedule.

The minimum qualifications for this position are:

- Two years' experience in a supervisory position at a nuclear facility involving decontamination and decommissioning
- Training in radiation protection, nuclear safety, hazardous constituents, and industrial safety
- Experience in worker training in a nuclear environment
- Training and experience in construction technology

Health Physics Manager—The HP Manager is responsible for providing radiological safety support in the decommissioning of the Facility. This function ensures that activities involving potential radiological exposure are conducted in compliance with the GA licenses, Federal and State regulations, and GA procedures. The position includes responsibility for maintaining a surveillance program and identifying, quantifying, and classifying radioactive waste. The development of HP procedures is also included in this function.

The minimum qualifications for this position are:

- A four year degree in HP or a related field
- Three years' supervisory experience in HP
- Ten years' total experience related to radiation safety
- Certification as Health Physicist, or equivalent education and professional experience in HP desirable; familiarity with HCF also desirable

Environment, Health, and Safety Manager—The Environment, Health, and Safety (EH&S) Manager is responsible for compliance with Federal Occupational Safety and Health Acts (OSHA) and California Occupational Safety and Health Act (CAL-OSHA), and health and safety aspects of GA procedures. Specific responsibilities during decommissioning include:

- Conducting a training program to instruct employees in safe work practices
- Performing periodic inspections of work areas to identify and correct any unsafe work practices and conditions
- Providing industrial hygiene services
- Advising project management on industrial safety issues

The minimum qualifications for this position are:

- A four-year degree in a related field
- Three years' experience in Industrial Safety in the nuclear industry
- Demonstrated experience in conducting an Industrial Safety training program

Quality Assurance Manager—The Quality Assurance (QA) Manager is responsible for implementing and managing the QA program for this Project in accordance with the applicable requirements of ASME-NQA-1, *Quality Assurance Program Requirements for Nuclear Facilities* and 10 CFR 71, Subpart H, *Quality Assurance for Packaging and Transportation of Radioactive Material*, and for certification of nuclear waste for compliance with the Acceptance Criteria of the Waste Disposal Facility.

The minimum qualifications for this position are:

- A four-year degree in engineering or related field
- Five years' experience in nuclear quality assurance
- Two years' experience in nuclear decommissioning and waste processing

Waste Manager—The function of the Waste Manager is to address all requirements and actions required in the treatment and removal of waste resulting from project activities. All types of waste including radiological, mixed waste, and hazardous waste will be characterized, packaged, and shipped to the appropriate disposal site in compliance with applicable acceptance criteria or free released.

The minimum qualifications for this position are:

- A four-year degree in a related specialty
- Experience and training in radiological and hazardous waste management
- Appropriate training in radiation protection, nuclear safety, hazards communication, and industrial safety

Project Administration and Controls Manager—The function of the Project Administration and Controls Manager is to support the Project Manager in management of project activities including development of project performance reports, monitoring cost and schedule against plans, supporting project related regulatory and customer requests, and monitoring progress of staff activities.

The minimum qualifications for this position are:

- A four-year degree in engineering or related field
- Five years' of project operations experience in the nuclear industry
- Appropriate training in radiation protection, nuclear safety, hazards communication, and industrial safety

2.2.1.3 Résumés of Principal Staff

The following are résumés for the principal staff members.

DR. KEITH E. ASMUSSEN
Director, Licensing, Safety and Nuclear Compliance

QUALIFICATIONS

- Ten years in federal and state licensing activities involving the use of radioactive materials
- More than 25 years of experience in nuclear design, analysis, and management
- Registered Professional Nuclear Engineer

EDUCATION

Ph.D., Nuclear Engineering, Iowa State University of Science and Technology
M.S., Nuclear Engineering, Iowa State University
B.S., Engineering Operations (Industrial Engineering), Iowa State University

EXPERIENCE

GENERAL ATOMICS: 1969 to present

1985 to present. Director, Licensing, Safety and Nuclear Compliance. Responsibilities include administering licenses, liaison with regulatory agencies, and reviewing and approving all work involving radioactive material for compliance with applicable regulations and license conditions. In addition, coordinates and administers special nuclear material control, nuclear safety, health physics, and industrial safety programs.

1979 to 1985. Manager, Fort St. Vrain (FSV) Fuel Engineering. Directed all the technical analyses required to design, manufacture, and license FSV reload segment fuel. Other responsibilities included fuel accountability, core reactivity monitoring and monitoring the performance of the core and fuel. Revised technical specifications for the FSV reactor and obtained NRC release for unrestricted full power operation. Worked closely with licensing personnel from the Public Service Company of Colorado on a variety of issues involving personnel interaction with NRC staff.

1973 to 1979. Site Physicist, High Temperature Gas-cooled Reactor (HTGR) Fuel Engineering. Responsibilities involved planning, coordinating, and participating in the initial fuel loading, subcritical testing, zero power physics testing and rise-to-power testing. Coordinated all testing (in-pile and out-of-pile) related to resolving the FSV core temperature fluctuation problem.

1969 to 1973. Senior Reactor Physicist. Performed nuclear fuel management analyses, reactor physics calculations, and thermal and fuel performance calculations.

VIRGIL J. BARBAT
Manager, Engineering and Facility Maintenance

QUALIFICATIONS

- Thirty-two years experience in engineering, research, technical management, and program management using multiple engineering disciplines including developing designs, test programs, and testing a variety of rotating machinery components. Management experience includes operations, field installation, testing, and commissioning of complex systems. Proficient in program management software packages.
- Registered Professional Mechanical Engineer, California

EDUCATION

M.S., Nuclear Engineering, University of California at Berkeley, 1963
B.S., Engineering Physics, University of Michigan, Ann Arbor, 1961

EXPERIENCE

Engineering and Maintenance Manager, Hot Cell Facility Decontamination and Decommissioning (D&D) Project. Responsible for engineering tasks during the D&D Characterization Phase and facility maintenance. Tasks included logistics planning for all tasks at the Hot Cell Facility.

Assistant Director, Radiation Services, TRIGA Group. Licensed Senior Reactor Operator. Supervised nine senior nuclear reactor operators performing all facets of nuclear research reactor operations and maintenance. Prepared emergency procedures for reactor facility, NEPA/OSHA Compliance Plan for fuel fabrication facility, and contributed to reactor facility standard operation procedures.

Project Manager, TRIGA Projects, TRIGA Group. Site Manager responsible for installation and acceptance testing of equipment at the Radioisotope/Radiopharmaceutical Facility in Jakarta, Indonesia. Supervised GA and GA's subcontract engineers and craft workers from Indonesia. Provided guidance to the staff in Health Physics compliance procedures. Site Manager responsible for installation and acceptance testing of non-destructive inspection equipment for military aircraft at the McClellan Air Force Base Nuclear Radiation Center. Extensive customer and subcontractor interface required for task.

Section Manager, Manufacturing Engineering Section, Defense Logistics Support Division. Managed 15 engineers responsible for verifying the manufacturing capabilities of alternate sources of supply for jet engine parts for the Air Force.

Project Manager, Torrey Pines Technology Division. Managed a wide variety of engineering services contracts for utilities with nuclear reactors, including: human factors reviews of control room design and power plant standard and emergency operating procedures, and motor operated valve assessment.

Staff Engineer, Systems Engineering, Fort St. Vrain (Nuclear Power Plant) Project. Technical responsibility for analyzing primary and secondary side power plant performance during plant start-up.

Staff Engineer, Rotating Machinery, Power Reactor Projects. Responsible for testing rotating machinery components. Managed a small group of test engineers.

GEORGE C. BRAMBLETT
Project Manager, Hot Cell D&D

QUALIFICATIONS

- Thirty-six years of experience in project and engineering management, plant systems engineering, thermodynamic systems analysis and simulation.
- Twenty-three years of nuclear experience at General Atomics (GA).
- Registered Professional Engineer - Mechanical and Nuclear, California

EDUCATION

Certificate, Executive Program for Engineers and Scientists, University of California at San Diego, 1990
M.S., Engineering, University of California at Los Angeles, 1964
B.S., Engineering, University of California at Los Angeles, 1959

EXPERIENCE

Project Manager, Hot Cell Facility Decontamination and Decommissioning (D&D) Project, responsible for planning and direction of waste removal and D&D of the GA Hot Cell Facility under a cost-shared contract with U.S. Department of Energy (DOE).

Director, Commercial MHTGR Project, responsible for engineering, project, and support functions under the DOE contract for the modular high temperature gas-cooled reactor power plant design.

Manager, HTGR Project Operations, responsible for meeting HTGR program objectives under the DOE contract. Planned, organized, and directed work to develop a design which meets requirements in a manner consistent with company policies.

Manager, Systems Engineering Department, responsible for HTGR plant systems analysis, safety analysis, and design of the primary coolant system as well as systems integration.

Project Manager, responsible for Fort St. Vrain plant-related engineering services.

Section Leader, responsible for performance studies and emergency cooling analysis for the Fort St. Vrain plant. Also performed HTGR power plant cycle optimization, system performance, and transient analysis for large plant designs.

Staff Engineer, responsible for rocket engine system performance and transient analysis supporting the SATURN-APOLLO project and other advanced rocket engines at Rockwell International, Inc.

VLADIMIR NICOLAYEFF
Manager, Environmental Quality Assurance

QUALIFICATIONS

- Twenty-three years of experience in nuclear quality assurance and engineering
- Registered Civil Engineer, State of California No. C 23142, since 1973
  Certified Quality Engineer, American Society for Quality Control No. 7949, since 1980
  Certified ASME NQA-1 Lead Auditor, by GA, since 1983

EDUCATION

M.S., Civil Engineering, University of California, Berkeley, 1968
B.S., Civil Engineering, University of California, Berkeley, 1967

EXPERIENCE

GENERAL ATOMICS 1972 to present:

1993 to present: Manager of Environmental Quality Assurance (QA). Responsible for managing QA activities on several projects to the requirements of ASME-NQA-1, 10 CFR 50 Appendix B, and 10 CFR 71, Subpart H. Principal projects include the following:

- Decontamination and Decommissioning of GA Hot Cell. Responsible for development and maintenance of the QA and waste certification programs for the project including preparation of the QA Plan and review of all project documents. Responsible for maintaining a training program for project personnel, QA inspections, audits and surveillances, and for certification of waste shipments.
- Decontamination and Decommissioning of GA SVA Fuel Fabrication Facility. Took over QA responsibilities for this project during the dismantlement phase, which included demolition of the building, sampling analysis of potentially contaminated soil and ground water, and shipping of nuclear waste to the Nevada Test Site and to Hanford, Washington.
- Processing and Disposal of Waste from New Production Reactor Fuel. Responsible for QA and Waste Certification Program for the project including sampling, analysis, characterization, and stabilization of waste, preparation of working procedures, characterization reports, and shipment of waste.
- Legal Weight Truck Cask. Responsible for QA during design, fabrication of half-scale model, and qualification testing of a modern cask-tractor-trailer system used for transportation of highly radioactive spent fuel from nuclear plants to repositories.

1972 to 1993: Manager of Reactor Quality Assurance and other QA and Engineering positions. Responsible for managing QA activities pertaining to design, fabrication, and testing of fuel and components for nuclear reactors, and construction of nuclear facilities. Responsible for QA during design, fabrication, construction, and acceptance testing of a neutron radiography facility. Responsible for QA on many nuclear projects. Performed design, analysis and testing of structural components for nuclear power plants.

UNIVERSITY OF CALIFORNIA, BERKELEY 1968 and 1971 TO 1972. Development Engineer at the Structural Materials Laboratory. Assisted faculty with research on concrete and soils.

JUDD M. SILLS
Manager, Health Physics

QUALIFICATIONS

- Twenty-three years of experience in the area of Health Physics management, research, and technical support
- Certified Health Physicist, Comprehensive, by the American Board of Health Physics

EDUCATION

NRC Workshop on Site Characterization for Decommissioning
M.S., Radiological Physics and Health Physics, Colorado State University, 1980
B.S., Biological and Physical Science, Colorado State University, 1974

EXPERIENCE

GENERAL ATOMICS, SAN DIEGO, CA: 1993 to Present. Health Physics Manager, Hot Cell Facility Decommissioning Project. Provides management and professional direction for all aspects of Health Physics for the decommissioning of the General Atomics Hot Cell Facility. Responsible for the Decommissioning Plan, the facility radiological characterization, direction of the project Health Physics staff, and development of all Health Physics procedures for the project. Also provides technical assistance to the corporate Health Physics program.

ARIZONA PUBLIC SERVICE COMPANY, PALO VERDE NUCLEAR GENERATING STATION, PHOENIX, AZ: 1987 to 1993. Directed the activities of Unit Health Physics staff in provision of radiation protection services for all aspects of nuclear power plant operation. Interfaced with regulatory agencies in aspects regarding the Unit radiological performance. Coordinated and performed corporate Health Physics program assessments.

PUBLIC SERVICE COMPANY OF COLORADO, FORT ST. VRAIN NUCLEAR GENERATING STATION, PLATTEVILLE, CO: 1981 to 1987. Supervised the Technical Services Unit and directed the site activities in the areas of reactor engineering, license regulatory compliance review, computer services, operating experience review, and emergency preparedness. Conducted the reactor startup testing program, core physics, accountability of all source and special nuclear material.

STONE AND WEBSTER ENGINEERING CORPORATION, DENVER, CO: 1980 to 1981. Conducted the occupational radiation protection program for the Denver Operation Center and provided emergency planning consulting services and emergency plan development assistance to several nuclear utilities and to the State of California.

SCIENCE APPLICATIONS INC., SCHAUMBERG, IL: 1979 to 1980. Developed large-scale software modifications to the Consequences of Reactor Accident Code (CRAC). Also responsible for initial siting studies for the Waste Isolation Pilot Plant.

COLORADO STATE UNIVERSITY, DEPARTMENT OF RADIOLOGY AND RADIATION BIOLOGY, FORT COLLINS, CO: 1976 to 1979. Conducted research in the area of latent effects from radiation.

1972 to 1974. Laboratory Technician on latent radiation effects project.

U. S. NAVY - MARE ISLAND NAVAL SHIPYARD, VALLEJO, CA: 1974 to 1976. Senior Health Physics Technician.

2.2.2 Decommissioning Safety Responsibilities

2.2.2.1 Industrial Safety/Hygiene

Project Industrial Safety personnel, supported by GA Industrial Safety personnel and GA's Industrial Hygienist, shall implement the Project Health and Safety Plan to meet occupational health and safety requirements of Project personnel and the general public. Primary functional responsibility is to ensure compliance with the OSHA of 1973 as implemented by California Labor Code Section 6400 and the General Industry Safety Orders (GISO 3203). Specific responsibilities include conducting an industrial training program to instruct employees in general safe work practices; reviewing Project procedures to verify adequate coverage of industrial safety concerns and requirements; performing periodic inspections of work areas and activities to identify and correct any unsafe conditions and work practices; providing industrial hygiene services as required; administering the Hazardous Work Authorization Program; and advising Project management on industrial safety matters and on the results of periodic safety inspections. The Project is staffed with an Industrial Safety Engineer (Project Health and Safety Manager) and supported by a GA Industrial Safety and Industrial Hygiene.

2.2.2.2 Radiological Safety

Primary functional responsibility is to ensure compliance with Title 10 CFR, Parts 19 and 20 and with license-imposed radiological safety requirements. This responsibility includes review and approval of proposed activities involving radioactive material, monitoring/auditing of such activities, and providing services such as personnel and environmental monitoring, dose rate measurement, radioactive material detection and assay, and radiation safety training. Services include review and approval of WAs and the preparation of Radiological Work Permits (RWPs), and identification and quantification of radioactivity in waste materials. GA HP maintains a laboratory containing a gamma-ray spectrometer, alpha/beta/gamma counting systems, and a VAX Station 4000 VLC (Canberra Genie). An emergency van is equipped with self-contained breathing apparatus, portable air samplers, portable radiation monitoring equipment, and protective clothing. An environmental monitoring program evaluates the effectiveness of the radiological effluents control program and provides information to assist in timely corrective action in the event of accidental releases. The Program includes environmental sampling of particulates in air, water sampling (including sewage), and sampling of soil and vegetation in and around the GA site. Film and thermoluminescent dosimeters (TLDs) are situated at various locations within the GA site as well as the site boundary and off-site locations to determine the external integrated radiation exposure.

The Project is staffed with a Project HP Manager, and HP Technicians. This Project Staff is supported by a GA HP Department comprised of management and HP Technicians. The Project HP staff reports to the Project HP Manager.

2.2.2.3 Nuclear Safety

This function reviews and approves proposed activities involving SNM for nuclear safety consideration. Activities include: inspections, monitoring, operations, determination of criticality limits, and approval of training program content for nuclear safety. The Project is supported in this position by the GA Nuclear Safety Department reporting to the Director of LS&NC. The Nuclear Safety function reviews for adequacy all determinations of criticality limits and provides and/or obtains independent verification thereof as well as approves the content of training programs in nuclear criticality safety for the company as a whole. The GA Nuclear Safety Department also establishes the external and internal reporting requirements for upset or potentially upset situations involving SNM.

2.2.2.4 *Hazardous Materials Handling*

Project hazardous materials personnel, supported by GA Licensing, Safety and Nuclear Compliance personnel, implement the Hazardous Materials Management Program per 22 CCR (Hazardous Waste Characterization), 29 CFR (OSHA), 40 CFR (EPA-Hazardous Waste Management), 49 CFR (Transportation) and disposal site waste disposition criteria. The Program includes identification, characterization, segregation, material handling, temporary storage, packaging and shipment of asbestos, hazardous constituents and mixed waste. The GA hazardous materials program provides hazardous material and hazardous waste product management services including waste accumulation, packaging, load consolidation, and contracting for shipment off-site to authorized off-site waste management facilities for recycling, treatment and/or disposal. Mixed (radioactive hazardous) waste will be transferred to a mixed waste management facility for waste accumulation, treatment, packaging, load consolidation and contracting for shipment to authorized off-site waste management facilities for recycling, treatment and/or disposal. The LS&NC Division applies for and maintains permits for laboratory equipment that comes under the Air Pollution Control District or the City of San Diego waste water discharge regulations. Industrial waste (sewage) is routinely monitored with regard to pH, suspended solids, biochemical demand and selected metals in accordance with GA's City of San Diego Industrial Waste Discharge Permit. GA is registered with the State of California Department of Health Services (CAL-DHS) and the Environmental Protection Agency (EPA) as a generator of hazardous wastes and possesses a San Diego County DHS Hazardous Materials Management Permit.

2.2.2.5 *Worker Health and Safety Training*

All personnel working at the HCF receive Health and Safety training in order to recognize and understand the potential risks involving personnel health and safety associated with the work at the HCF. The Health and Safety training implemented at GA is to ensure compliance with the requirements of the NRC (10 CFR), the EPA (40 CFR), and both OSHA and CAL-OSHA (29 CFR and CCR Title 8). Workers and regular visitors are familiarized with plans, procedures, and operation of equipment to conduct themselves safely. In addition, each worker must be familiar with procedures that provide for good quality control. Section 2.3, Training, provides information on the Training Program.

2.2.2.6 *Use, Control, and Management of Subcontractors*

Subcontractors may be used at the discretion of Project Management to either fill organizational positions or perform specific decommissioning tasks. Specialist contractors will be utilized from time to time on an as-needed basis. Such services will be procured utilizing GA's purchasing system, which has been approved by the DOE and is in accordance with FAR 44.3 and DEAR 944.3. All suppliers will have undergone the GA Quality Assurance approval process. Wherever subcontractors are used, they will: 1) comply with all provisions of GA licenses and permits, and 2) be trained in accordance with GA's commitments. Section 2.4, Contractor Assistance During Decommissioning, provides additional information.

2.3 Training

Training is conducted and controlled in accordance with an established Training Program procedure for the Hot Cell D&D Project. A training matrix is maintained and training reports are issued periodically.

2.3.1 Radiological Safety Training/Retraining

General Employee Radiological Training (GERT 4 Hour)—Training will be provided to personnel required to enter Restricted Areas (with the exception of visitors and infrequent support personnel), including Radiation Areas and some Radioactive Materials Areas, but not perform "hands-on work" or who may perform limited work with radioactive material. If the worker requires entry into any of the above special areas or if the job requires any of the "hands-on" work mentioned, then the worker must attend Radiological Worker Training.

Radiological Worker Training (RWT 16 Hour)—Training will be provided to personnel who require unescorted access to Restricted Areas and who may perform more complex radiological job functions.

Periodic Advanced Radiological Worker Training (ARWT)—Training will be provided to personnel who require unescorted access to Restricted Area(s) of the HCF (Building 23) and who may perform complex radiological job functions. This training is provided to address specific aspects of radiological work that may be encountered at the Hot Cell D&D Project. This training is provided to further improve specific radiological work skills and practices. Specific content of ARWT modules will vary according to specific needs of the Project.

GERT and RWT are required initially. Both are effective for 2 years except when a change of visitor status (GERT) to worker status occurs, in which case RWT is required.

ARWT is provided periodically at the discretion of HCF HP Management and according to special needs.

2.3.2 Health Physics Technician Training

HP Technicians must successfully complete Radiological Worker Training as described in Section 2.3.1. In addition, HP Technicians must review and understand procedures according to the HP Technician Training Plan. HP Technicians will also review applicable procedure revisions in a timely manner. HP Technicians will also be familiarized with the site and facility characterization results.

2.3.3 Equipment Operator Training

All equipment operators will have proper training completed and documented prior to working with the equipment.

2.3.4 Safety/Accident Prevention Training

GA has an Accident Prevention Program which is defined in the Accident Prevention Program Manual (APPM). All employees are required to abide by the requirements of this Manual. Additional specific Project requirements are specified in the plans and procedures for this Project. These additional requirements arise because of the nature of the work to be performed.

Hazard Communication Training—A hazard communication training program has been developed for this Project in accordance with OSHA 1910.1200 and the GA APPM. This program promotes awareness of chemical hazards that are present at this Facility, and provides means to communicate those hazards to employees. A designated person will maintain the hazardous material inventory and Material Safety Data Sheets (MSDS) for on-site hazardous materials, and provide all Project personnel with information advising them of the potential for hazardous constituents in the work place. A list of such materials for this Project is maintained at the job site, and copies of the appropriate MSDS are available to site workers upon request. The MSDS form provides more detailed information about the chemical than a label does. A hazardous chemical inventory is maintained which reflects the current supplies located in the work area. Any chemicals not previously located and identified or new chemicals received on the job site will be added to the inventory list.

Contamination Control Training—Personnel will be trained in contamination control together with boundary control, ventilation control, etc. Cross contamination will be limited by the use of training and radiological controls. Radiological and hazardous material contamination will be strictly controlled during all decommissioning work. This control will be accomplished using qualified workers to perform work identified in approved work procedures. In some instances, special briefings and dry-runs will be used to perfect, demonstrate, and qualify the workers.

Respirator Training—Each individual who may be expected to need the use of a respirator will be required to receive respiratory protection training, be medically qualified to use respirator protection, and receive a quantitative fit test for each specific device that they are qualified to use. Training will meet the requirements of the U.S. Department of Health, Education, and Welfare, National Institute for Occupational Safety and Health (NIOSH), and ANSI Z88.2-1980, *Practices for Respiratory Protection*. Respirator fit tests will be administered before initial assignments to jobs requiring the use of a respirator, and will be conducted annually thereafter. Medical qualification will be assessed annually.

As Low As Reasonably Achievable (ALARA) Training—Addressing ALARA means taking into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety, and other societal and socio-economic considerations. It is GA's policy to maintain exposures to radiation and hazardous chemical agents at ALARA levels. Radiological ALARA levels are achieved through proper training of employees, adequate work procedures, adequate engineering controls, good work practices, and when required, the use of protective equipment. Each individual working in a restricted area is required to adhere to established ALARA rules, regulation, and concepts. ALARA training is incorporated into both the Radiological Work Practices training/retraining and the Advanced Radiological Work Practices training. In addition, ALARA measures are discussed in each RWP and discussed in specific RWP briefings by HP personnel.

Confined Space Entry Training—Employees required to enter confined or enclosed spaces will be trained to the OSHA confined space entry requirements. They will be instructed as to the nature of the hazards involved, the necessary precautions to be taken and the use of required emergency and protective equipment, as prescribed by the Health and Safety Manager or designated person. A confined space permit must be issued by GA Industrial Hygiene prior to access into the confined space.

Emergency Response Training—GA has a Site General Emergency Plan and a GA Site Radiological Contingency Plan, as required by the NRC and the State of California. The HCF has specific procedures supporting these plans. Selected HCF personnel have had CPR and Emergency First Aid training.

2.3.5 *Hazardous Materials Training*

Training for hazardous materials is dependent on the job description for each individual and the types and amounts of hazardous materials or hazardous wastes being handled as specified in the position's training plan. In general, the training specified for workers and supervisors directly involved with decommissioning includes some or all of the following training requirements:

HAZWOPER Training Course—OSHA 1910.120, 40 hour classroom and 24 hour on-the-job training specific to hazardous materials handled in the HCF. An annual update is provided.

Hazardous Materials Packaging—Reviews the requirements for handling and shipping hazardous materials and wastes as required by 49 CFR, the Department of Transportation (DOT) regulations. A refresher update is required every two years.

Waste Acceptance Criteria—Training is provided to the requirements established in the Hanford Site Solid Waste Acceptance Criteria WHC-EP-0063 or other site acceptance criteria as appropriate. An annual training update is provided.

Dangerous Waste Regulations—Training to familiarize hazardous waste technicians and supervisors with state of Washington and other appropriate hazardous waste requirements for waste designations. A refresher is provided annually or as regulations are updated.

GA Emergency Response Training—Training to familiarize emergency response personnel with actions to be taken in responding to an unplanned release of hazardous or radioactive material from the HCF. Hands-on training in this area includes conducting drills to evaluate response capabilities.

Hazard Communication Training—Intended to meet the OSHA 1910.1200 "Right to Know" requirements, the classes consist of reviewing MSDS and hazardous properties of hazardous chemicals associated with work performed at the HCF.

RCRA Facility Standards Overview Training—This class covers the requirements established under 40 CFR 264.16 for personnel who handle hazardous wastes within the HCF Facility and Restricted Area Outside Yard. The class covers the Federal Standards and discusses compliance requirements for generators of hazardous and mixed wastes. An annual update is provided.

In addition to the training listed above, workers and supervisors receive hands-on training on hazardous and mixed waste material sampling and analysis procedures used in the field. Personnel training also consists of documented reviews of procedures and plans specific to each job function as outlined in the training matrix established for the HCF D&D Project (Figure 2-7).

2.3.6 Training Records

The training records for the Project are maintained by the Training Coordinator. A Training Plan, Figure 2-8, is prepared and approved by Management for each person assigned to the Project. The Training Plan shown was used for Phase 1. Training requirements and the training status of each person are recorded on the Training Matrix, (see Figure 2-7 for an example). Training is documented on training certificates, on attendance sheets, or on form GA 2162, Record of Training, Figure 2-9.

The Training Coordinator periodically submits the training records to the QA Records Center for microfilming.

HOT CELL TRAINING MATRIX

	Medical Exam for Respirator Qualification		Radiological Safety Training (Annual)		HAZWOPER Training Course (Annual)		8-Hour Supervisors Safety Training	HAZWOPER 24-hour OJT	Crane Qualification (Annual)		Fork Lift Qualification (Every 2 Years)		Hanford Waste Shipments (QAPD 7320-01)		Respirator Fit Test and Qualification		Radioactive Material Packaging/ Refresher (Every 2 Years)		Hazardous Material Packaging/ Refresher (Every 2 Years)	
Rev./Issue Date ---->	N/A		N/A		N/A		N/A	N/A	N/A		N/A		B/6-14-94		N/A		N/A		N/A	
	C:	R:	C:	R:	C:	R:			C:	R:	C:	R:	C:	R:	C:	R:	C:	R:	C:	R:
Instructor ----------->	Sills		Sills		Lewis		Lewis	Lewis	Lewis		Lewis		Massey		Sills		Sills		Aycock	
Aycock, M (2)	11/93	11/94	11/93	11/94	02/94	02/95	C: 5/89	C: 9/94	Not Qualified		Not Qualified		07/94	07/95	11/93	11/94	08/94	08/96	08/94	08/96
Barbat, V (3) *	Not Qualified		08/94	08/95	01/95	01/96	C: 11/94	C: 9/94	Not Qualified		Not Qualified		[illegible]	07/95	Not Qualified		NR	NR	NR	NR
Bennett, J *	07/94	07/95	07/94	07/95	01/95	01/96	NR	C: 9/94	03/95	03/96	10/93	10/95	[illegible]	[illegible]	09/94	09/95	08/94	08/96	08/94	08/96
Boshoven, J *	10/93	10/94	02/94	02/95	01/95	01/96	NR	C: 9/94	Not Qualified		Not Qualified		[illegible]	06/95	[illegible]	10/94	03/94	03/96	03/94	03/96
Bramblett, G (4)	Not Qualified		08/94	08/95	03/95	03/96	NR	NR	Not Qualified		[illegible]		10/94	[illegible]	Not Qualified		NR	NR	NR	NR
Butler, Preston	07/94	07/95	07/94	07/95	08/94	08/95	NR	C: 9/94	Not Qualified		[illegible]		NR	NR	12/93	12/94	NR	NR	NR	NR
Coppinger, D	07/94	07/95	08/94	08/95	05/94	05/95	NR	C: 9/94	Not Qualified		10/93	[illegible]	[illegible]	07/95	09/94	09/95	07/93	07/95	07/93	07/95
Dupray, M	07/94	07/95	07/94	07/95	01/95	01/96	NR	C: 9/94	[illegible]		[illegible]		NR	NR	09/94	09/95	03/94	03/96	NR	NR
Elliott, K	Not Qualified		07/94	07/95	05/94	05/95	NR	C: 9/94	[illegible]		Not Qualified		07/94	07/95	Not Qualified		NR	NR	NR	NR
Fleming, M	01/94	01/95	02/94	02/95	01/95	01/96	NR	C: 9/94	[illegible]		[illegible]		NR	NR	01/94	01/95	03/94	03/96	03/94	03/96
Flowers, S *	07/94	07/95	08/94	08/95	01/95	01/96	NR	C: 9/94	[illegible]	[illegible]	Not Qualified		06/94	06/95	09/94	09/95	06/93	06/95	06/93	06/95
Gomez, J *	07/94	07/95	07/94	07/95	01/95	01/96	NR	C: 9/94	[illegible]	[illegible]	03/94	03/96	NR	NR	09/94	09/95	03/94	03/96	03/94	03/96
Greenwood, J (5) *	Not Qualified		08/94	08/95	02/95	02/96	C: 11/94	[illegible]	[illegible]		10/93	10/95	06/94	06/95	10/93	10/94	08/94	08/96	08/94	08/96
Hunter, B	08/94	08/95	08/94	08/95	11/94	11/95	[illegible]	[illegible]	[illegible]		Not Qualified		NR	NR	09/94	09/95	NR	NR	NR	NR
Johnson, N *	Not Qualified		01/94	01/95	01/95	01/96	[illegible]	[illegible]	03/95	03/96	Not Qualified		NR	NR	Not Qualified		NR	NR	NR	NR
Lewis, A (6)	Not Qualified		07/94	07/95	11/94	[illegible]	[illegible]	[illegible]	03/95	03/96	03/94	03/96	NR	NR	Not Qualified		NR	NR	NR	NR
Nicolayeff, V (7)	Not Qualified		08/94	08/95	03/95	03/96	[illegible]	NR	Not Qualified		Not Qualified		01/95	01/96	Not Qualified		Not Completed		Not Completed	
Partain, K *	03/94	03/95	08/94	08/95	[illegible]	[illegible]	[illegible]	C: 9/94	03/95	03/96	03/94	03/96	06/94	06/95	03/94	03/95	03/94	03/96	03/94	03/96
Sills, J (8)	Not Qualified		08/94	08/95	[illegible]	[illegible]	[illegible]	NR	Not Qualified		Not Qualified		06/94	06/95	Not Qualified		03/94	03/96	03/94	03/96
Steidley, D	Not Qualified		08/94	08/95	NR	NR	NR	NR	Not Qualified		Not Qualified		NR	NR	Not Qualified		NR	NR	NR	NR
Taylor, C	09/94	09/95	02/94	02/95	08/94	[illegible]	NR	C: 9/94	Not Qualified		Not Qualified		06/94	06/95	09/94	09/95	08/94	08/96	08/94	08/96
Tinnin, D (1)	Not Qualified		NR	NR	NR	NR	NR	NR	Not Qualified		Not Qualified		NR	NR	Not Qualified		NR	NR	NR	NR
Tomlin, R *	07/94	07/95	07/94	07/95	05/94	05/95	C: 11/94	C: 9/94	03/95	03/96	10/93	10/95	06/94	06/95	03/94	03/95	03/94	03/96	03/94	03/96
Warner, P (9)	Not Qualified		08/94	08/95	02/95	02/96	NR	NR	Not Qualified		Not Qualified		06/94	06/95	Not Qualified		08/94	08/96	08/94	08/96
Welch, A (10)	Not Qualified		05/94	05/95	02/95	02/96	NR	NR	Not Qualified		Not Qualified		07/94	07/95	Not Qualified		NR	NR	NR	NR
Woodhouse, D *	10/93	10/94	08/94	08/95	01/95	01/96	C: 11/94	C: 9/94	Not Qualified		10/93	10/95	06/94	06/95	12/93	12/94	03/94	03/96	03/94	03/96

NR=Not Required; R: = Date Required; C: = Date Completed; P = Training Planned; (W) = "Worker"; (F) = "Frequent"; (V) = "Visitor";
Numbers in parenthesis represent Control Copy Numbers for HCD && HCP manuals. Asterisk(*) represents Hot Cell Operator.

Figure 2-7—Example Training Matrix

GA HOT CELL D&D PROJECT
TRAINING PLAN

Name: ______________________ **Responsibility:** ______________________

Organization No.: ______________ **Location:** ______________ **Phone** ______________

Italics indicate that training is "D&D Project-Specific"

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	Required Indoctrination and Training *(Check if Required)*
	MEDICAL SURVEILLANCE PROGRAM
☐	*Radiological Exposure Evaluation (GA HP-135)—Classification:* ☐ W ☐ F ☐ V
☐	*Task-Specific Hazardous Substance Exposure Monitoring (Baseline and Periodic)*
☐	*Medical Exam for Respirator Qualification*
	COMPLIANCE-RELATED INDOCTRINATION AND TRAINING
☐	GA License SNM-696 (NRC)
☐	GA License 0145-80 (CAL-DHS)
☐	*Hot Cell Work Authorization (WA #3020)*
☐	*GA Emergency Response Training*
☐	Radiological Contingency Plan
☐	General and Site-Specific Hazard Communication Training (29 CFR 1910.1200)
☐	16-Hour Radiological Safety Training (NRC: 10 CFR 19); 4-Hour Refresher (Annual)
☐	40-Hour HAZWOPER Training (29 CFR 1910.120); 8-Hour Refresher (Annual)
☐	Crane Qualification
☐	Fork Lift Qualification
☐	RCRA Facility Standards Overview Training (EPA: 40 CFR 265.16/CCR 22-66265.16)
☐	*Respirator Fit Test and Qualification*
	QUALITY ASSURANCE INDOCTRINATION AND TRAINING
☐	GA Quality Assurance Manual
☐	*Quality Assurance Project Plan (QAPP-7320)*
	TRAINING FOR FUEL AND WASTE DISPOSITION
☐	*GACP 633-050 (A039)—GA Proposal for Fuel and Waste Disposition (Volume I - Technical)*
☐	*GA-D 21493: Hot Cell Site and Facility Investigation Report*
☐	*Hazardous Waste Identification*
☐	Radioactive Material Packaging (DOT: 49 CFR 172.700); Refresher (Every 2 Years)
☐	Hazardous Material Packaging (DOT: 49 CFR 172.700); Refresher (Every 2 Years)
☐	*Waste Acceptance Criteria: WHC-EP-0063*
☐	*Washington State Dangerous Waste Regulations: WAC 173-303*
☐	*QAPD 7320-01 (Hanford Waste Shipments)*
☐	*Hot Cell D&D Waste Certification Plan/SDARs*
	SUPPLEMENTARY TRAINING FOR SITE AND FACILITY CHARACTERIZATION
☐	*GACP 633-036 (A038 Only)—GA Proposal for Hot Cell D&D (Volume I - Technical)*
☐	*NUREG CR-5849 (Guidelines for Survey Methods, Techniques, and Documentation)*
☐	*GA Hot Cell Site, Facility, Fuel Material, and Waste Characterization Plan*
☐	*GA Hot Cell Site, Facility, Fuel Material, and Waste Characterization Report*

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Figure 2-8—Training Plan

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GA HOT CELL D&D PROJECT
TRAINING PLAN

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Italics indicate that training is "D&D Project-Specific"

Required Indoctrination and Training *(Check if Required)*
PROJECT PLANS AND REPORTS
☐ *Project Plan/Project Management Plan*
☐ *NRC Regulatory Guide 3.65 (Decommissioning Plan Requirements)*
FUNCTION-SPECIFIC PROCEDURES TRAINING
☐ *Hot Cell D&D Project Administration Procedures (HCD-1.xx)*
☐ *Hot Cell D&D Project ES&H Procedures (HCD-2.xx)*
☐ *Hot Cell D&D Project Operations Procedures (HCD-3.xx)*
☐ *Hot Cell D&D Project Decommissioning Procedures (HCD-4.xx)*
☐ *Hot Cell Facility Procedures (HCD-x-xx)*
☐ *Nuclear Waste Processing Facility Procedures*
☐ *Health Physics Procedures*
☐ *Quality Division Instructions*
☐ *Quality Control Procedures*

NOTES: Indoctrination and training topics not covered on this checklist are included on the Training Matrix. "Function-Specific Procedures Training" is required only for specific procedures issued to the individual.

______________________________ Date ____________

Prepared By
V. Nicolayeff

______________________________ Date ____________

Environmental Engineering
M. T. Aycock

______________________________ Date ____________

Industrial Health and Safety
A. C. Lewis

______________________________ Date ____________

Health Physics Manager
J. M. Sills

______________________________ Date ____________

Project Manager
G. C. Bramblett

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Figure 2-8—Training Plan

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GENERAL ATOMICS

RECORD OF TRAINING

☐ **GROUP/PRESENTATION TRAINING. Complete Boxes (A), (B) if applicable, and (C). Signatures below acknowledge attendance.**

☐ Training material provided for presentation (attach a copy)

Date of Session: ______________ Length of Session (Hrs.): ______________

☐ **DOCUMENT REVIEW TRAINING. Complete Boxes (D), (E), and if applicable (F).** Dated signatures below indicate understanding of document contents.

(A) SUBJECT: **(B) PROJECT NO(S):** ______________

(C) INSTRUCTOR(S):

(D) DOCUMENT TITLE: **(E) REV. NO./DATE:** ______________

(F) PROJECT NO(S): ______________

Enter name, sign (date when document review), org., and include ext. and location.

PRINT NAME	SIGNATURE	DATE—(Required Only for Document Review)	ORG.	EXT.	LOCATION

CONTINUED ON REVERSE

Figure 2-9—Record of Training, Form GA2126

2.4 Contractor Assistance During Decommissioning

2.4.1 Contractors

Contractors will be used on an as needed basis during decommissioning. The use of contractors will be complementary to the GA staff and will normally provide specialty support.

Tasks where contractors may be used include but are not limited to:

- Shipment and disposal of radioactive and nonradioactive waste materials
- Laboratory testing and analysis
- Concrete cutting
- Asbestos removal and disposal
- Design and fabrication of specialty dismantling tooling and equipment
- Specialty engineering and design services
- Temporary staff augmentation

Potential contractors for each identified task will be required to provide a statement of qualifications as part of their bid submittal. The qualifications required will emphasize the following:

- Experience with similar work in a radioactive environment
- Adequacy of qualified workers
- Ability to meet schedule

The Quality Assurance organization at GA maintains an approved supplier list and has an extensive approval process which ensures that contractor qualifications are adequate to the need.

2.4.2 Subcontractor Licensees Utilized

No nuclear licensed subcontractors are anticipated to participate in the decommissioning activities except selected outside analytical laboratories. GA will verify that these licensees are authorized to receive/handle applicable radioactive materials prior to transfer of specimens.

2.5 References

2-1 NUREG/CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination, Draft report for comment (draft for comment), June 1992.

2-2 NRC Branch Technical Position on Site Characterization for Decommissioning Sites, draft July 1992.

2-3 U.S. Nuclear Regulatory Commission Regulatory Guide 4.15, Quality Assurance for Radiological Monitoring Programs (Normal Operations)-Effluent Streams and the Environment, Rev. 1, February 1979.

2-4 EPA-600/7-77-144, Quality Control for Environmental Measurements using Gamma Ray Spectrometry, December 1977.

2-5 EPA-600/4-83-004, QAMS 005/80, Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, February 1983.

2-6 EPA SW-846, Third Edition, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 1986.

2-7 EPA 600/2-80-018, Samples and Sampling Procedures for Hazardous Waste Streams, 1980.

3. DESCRIPTION OF METHODS USED FOR PROTECTION OF OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

3.1 Facility Radiological History Information

3.1.1 Restricted Area Yard

The HCF Restricted Area Outside Yard is protected by a security fence extending around the entire yard perimeter. Within the HCF Restricted Area Outside Yard, seven identifiable areas exist for physical and administrative control and separation of activities conducted therein. These seven areas are discussed separately in the following sections.

3.1.1.1 Radioactive Materials that were Used/Handled at this Location

- Liquid Waste Holding Tank Restricted Area

  The materials handled, containerized, and stored included radioactive waste water received via the HCF radioactive drainage ("hot" drain) system. This liquid waste is primarily comprised of water containing Mixed Activation Products (MAP), Mixed Fission Products (MFP), and possibly small quantities of transuranic (TRU) elements, in solution and as suspended solids.

- Ventilation System Restricted Area

  Materials handled include solid and particulate contaminants. These contaminants were generally composed of MFP, MAP, and small quantities of TRU.

- Hot Drain Clean-Out Vault

  Radioactive materials encountered in this area are the same as discussed with respect to the Liquid Waste Holding Tank Restricted Area.

- High-Rad Material Storage Area

  Materials stored in this area include packaged, containerized, radioactive solid and liquid waste, both of which may contain radioactive contaminants composed of MFP, MAP, and small quantities of TRU.

- BeO Storage Shed

  Materials handled include solid particulate radioactive contaminants composed of MFP, MAP, and small quantities of TRU, boron compounds, and BeO.

- Shipping Cask Storage Pad

  The materials packaged and transported in the shipping casks included neutron-activated target materials (e.g., graphite, metals), and irradiated fissile fuel entities.

- General Yard/Service Dock/Trolley Trestle

  Materials stored/handled in these areas include, but were not limited to, solid materials, hardware, and equipment (e.g., radioactive material shipping casks, radioactive waste containers) contaminated with MAP, MFP, and possibly small quantities of TRU materials in a limited number of cases. In addition, this area of the Restricted Area

Outside Yard has been utilized for the short- and long-term storage of miscellaneous radioactive or radiologically contaminated equipment and waste materials, including items such as an 18,000 lb. capacity fork lift, a HEPA filtering unit removed from service, and various types of reactor-related mechanical tooling and fixtures.

3.1.1.2 Typical Operations Conducted at this Location

The HCF Restricted Area Outside Yard has been used since original building construction (1959) for the receipt, use, handling, storage, and shipment of many types of packaged or otherwise contained radioactive or radiologically-contaminated materials.

- Liquid Waste Holding Tank Restricted Area

  Two waste liquid storage tanks are located in the north end of the Restricted Area Outside Yard in the Liquid Waste Holding Tank Restricted Area. The primary activities conducted in this area include the passive collection and subsequent pump/transfer and containerization of HCF liquid radioactive waste. In addition, the area has been routinely utilized for the staging and short-term storage of containerized items with high contact dose rates. This area was re-engineered in 1993 to facilitate the control of yard area stormwater runoff and to relocate waste storage areas.

- Ventilation System Restricted Area

  The ventilation system, including the exhaust stack, is located in the yard, just north of Building 23. Ventilation filter change-out/replacement activities are conducted in this area.

- Hot Drain Clean-Out Vault

  This shallow vault is located just north of the exhaust stack and within the perimeter fence surrounding the Ventilation System Restricted Area. The vault measures approximately 24 in. x 18 in. x 12 in. deep, and is protected by a steel diamond plate cover above and concrete below. The vault was used for access to the HCF hot drain system plumbing, for the purposes of cleaning out the system lines.

- High-Rad Material Storage Area

  This area of the Restricted Area Outside Yard is protected by a locked, gated perimeter fence, and is surrounded with a concrete block shield wall. The area, which has been utilized only since 1994, was established for the safe, shielded storage of packaged or otherwise containerized highly radioactive materials.

- BeO Storage Shed

  The storage shed in the northwest corner of the yard has been used for storage of radiologically contaminated hardware, neutron poisons and BeO materials, in various physical forms.

- Shipping Cask Storage Pad

  This Restricted Area Outside Yard area was used for the long-term storage of radioactive material shipping cask units used at the HCF for both on- and off-site transport. The shielded construction of the casks staged in these area incorporated integral quantities of lead and depleted uranium metal.

- General Yard/Service Dock/Trolley Trestle

  Activities conducted in these areas included the receipt and transfer of casks to and from the transport vehicles, decontamination of casks, and preparation of casks for hot cell entry and fuel loading/unloading. Examples of the types of operations conducted in this location are the handling and inter-facility transport of shielded transfer casks containing test fuel materials and thermionic devices to and from the GA TRIGA Reactors Facility, Building 21.

3.1.1.3 Typical Radiation and Contamination Levels During Operations

A review yielded the following radiological measurement data for the areas of the HCF Restricted Area Outside Yard:

- Liquid Waste Holding Tank Restricted Area

  The prevailing area radiation levels in the vicinity of the Liquid Waste Holding Tank Restricted Area have varied as a function of the radiological content of the waste water volume contained in the tanks, and the emitted radiation dose from any containerized items staged/stored in the area. The area has frequently been identified, controlled, and posted as a High Radiation Area, which would indicate the possible presence of radiation levels within the area in excess of 100 mR/hr at 12 in. from the source. HCF and HP record entries include radiation measurement data for the holding tanks and various staged/stored items in this area, up to 15 R/hr (γ) at the surface of the specific radiation source(s). Records indicate that the general area radiation within this restricted area ranged up to 1 R/hr (γ) and higher during periods of HCF operations. Typically, general area dose rates ranged between <0.2 and 10 mR/hr, with an average of approximately 0.4 mR/hr. This area is posted as a Radiation Area at the time of initial plan submittal. Subsurface contamination has been detected below the asphalt/shotcrete surfaces in this area.

- Ventilation System Restricted Area

  The absolute filters in service in the HCF ventilation system main plenum and booster plenum are the primary source of radiation in this specific area. Operational radiation levels measured at the exterior surfaces of the filter housing are generally maintained below 200 mR/hr (γ); records indicate that this dose rate has been exceeded on occasion, with documented data ranging up to 1 R/hr (γ) area dose rate in the filter plenum vicinity. Typically, general area dose rates ranged between 0.2 and 50 mR/hr, with an average of approximately 2 mR/hr. The asphalt in this area contains low levels of fixed contamination.

- Hot Drain Clean-Out Vault

  The contaminant materials present in the vault as a result of operations include radioactive waste water received via the HCF radioactive drainage system. This aqueous waste is primarily comprised of water containing MAP, MFP, and small quantities of TRU, in solution and as suspended solids. These contaminants were introduced to the vault interior from incidental waste water spillage during drain cleaning operations. Beryllium is also present in the silt removed from this vault.

  Area radiation dose rate surveys inside the hot drain clean-out vault indicate levels of 5 - 10 mR/hr β-γ at the surface, and 2 - 3 mR/hr β-γ at 30 cm (12 in.).

- High-Rad Material Storage Restricted Area

  Area radiation dose rate surveys inside the High-Radiation Material Storage Restricted Area indicate levels of 100-500 mR/hr γ at the surface of stored items, and perimeter levels of 2 - 10 mR/hr (outside of shield walls). The area immediately surrounding the storage area fence is presently posted as a Radiation Area due to stored materials.

- BeO Storage Shed

  During the period (1960-1972) of actual BeO storage use in this area, surface wipe samples taken from the concrete deck of the storage shed showed an average contamination level of 1.1 mg Be/100 cm^2, with the highest wipe result of 7.2 mg Be/100 cm^2. Recent surveys of this shed show a peak general area dose rate of 0.2 mR/hr due to currently stored materials, and fixed activity of up to 30,000 dpm/100 cm^2 in the concrete floor.

- Shipping Cask Storage Pad

  Concrete cores of this storage pad did not identify any contaminants in storage pad concrete, nor was subsurface contamination discovered. This thick, reinforced pad is presently used for storage of heavy casks that have no smearable contamination.

- General Yard/Service Dock/Trolley Trestle

  Typically, general area dose rates ranged between <0.2 and 10 mR/hr, with an average of approximately 0.4 mR/hr.

3.1.1.4 *Operational Occurrences Affecting Decommissioning Planning and the Potential Impacts of those Occurrences*

Several releases of mixed fission products, mixed activation products, and minuscule amounts of actinides have occurred into the yard area since the Facility became operational. Prior to 1992, contaminated lead bricks and casks were routinely stored in the back yard, from which contaminants could have been washed off from the rain. The Liquid Waste Holding Tank Restricted Area has been affected by several spills of small quantities of liquid waste, and subsurface soils are contaminated. The area of the Service Dock and Trestle has experienced several minor incidents. Periodically, hot particles have been discovered in this area.

3.1.1.5 *Known or Expected Radiological Conditions of Contaminated Systems, Structures, and Components*

Several areas of the yard were sampled as part of the site and facility characterization effort. Several areas of subsurface soil contamination were confirmed in the yard. In particular the soil below the depression around the liquid waste holding tanks was found to be contaminated with ^{134}Cs, ^{137}Cs, ^{60}Co, ^{154}Eu and ^{241}Am. The soil samples showed ^{134}Cs levels up to 2.5 pCi/g, ^{137}Cs levels up to 127 pCi/g, ^{60}Co levels up to 107 pCi/g, ^{154}Eu levels up to 0.82 pCi/g, and ^{241}Am levels up to 0.44 pCi/g. Contamination was also found on and in the asphalt in the yard. Several hot particles were found and removed and it is expected that some may remain. The asphalt samples showed ^{134}Cs levels up to 158 pCi/g, ^{137}Cs levels up to 217 pCi/g, and ^{60}Co levels up to 9.4 pCi/g under the trestle, which is also contaminated. In the rest of the yard, the contamination levels are much lower in the asphalt. The storage shed is also contaminated. The concrete pad samples showed ^{134}Cs levels up to 8.6 pCi/g, and ^{137}Cs levels up to 23 pCi/g. The foam insulation samples showed ^{137}Cs levels up to 184 pCi/g, and ^{60}Co levels up to 17 pCi/g. The yard also has a shielded high radiation storage area. Once the sources of the high radiation (boxes and drums) are removed, however, the area will return to normal.

The Facility yard has several areas that must be addressed. The underground drain lines leading to the liquid waste holding tanks have the potential to contain fissile material. When the drain lines are cleaned out and/or removed, critical safe geometries will be maintained to assure criticality safety. The fenced outside HEPA unit area contains the old Facility ventilation system (packaged), the current Facility ventilation system, stack sampling pit, the ventilation exhaust pit, and liquid waste pit. The old Facility ventilation system is stored in a large metal container in the yard adjacent to Room 108. The condition of the ventilation system stored in the box and the contamination levels must be confirmed. The HEPA filters were not removed from the system before it was packaged because of the high contamination levels. The current Facility ventilation system will also present risks as a result of the high internal contamination when it is disassembled after it is no longer needed for the Facility. The stack sampling pit concrete floor samples showed ^{137}Cs levels up to 54.5 pCi/g, and ^{60}Co levels up to 17 pCi/g. The debris and soil on top of the floor showed ^{137}Cs levels up to 172 pCi/g, and ^{60}Co levels up to 104 pCi/g. The ventilation exhaust pit has general area dose rates of 5-30 mR/hr due to plated out activity in the ventilation duct. Samples of the debris and soil inside the pit showed ^{134}Cs levels up to 3.7 pCi/g, ^{137}Cs levels up to 376 pCi/g, ^{60}Co levels up to 343 pCi/g, and ^{154}Eu levels up to 2.3 pCi/g. The liquid waste pit provides access to the liquid waste drain system for clean-out. The silt samples taken in the pit show ^{134}Cs levels up to 12 pCi/g, ^{137}Cs levels up to 6,958 pCi/g, ^{60}Co levels up to 3,697 pCi/g, ^{154}Eu levels up to 10 pCi/g, ^{235}U levels up to 72 pCi/g, and ^{241}Am levels up to 13 pCi/g. Subsurface cores taken next to the waste clean-out pit do not demonstrate any significant leakage from the pit to subsurface soils.

3.1.2 Operating Gallery, Dark Room, Change Room

3.1.2.1 Radioactive Material(s) that were Handled/Used at this Location

- Room 105—Operating Gallery

  The radioactive materials handled in the Operating Gallery were limited to the quantities of tactile contamination present on certain items stored or utilized in this area. Operations that may have introduced radioactive materials into this area include the change-out, withdrawal from cell, and conveyance of the master-slave manipulators through this area to the Warm Metallography (Room 107) and the staging, handling, segregation, and packaging of spent Personal Protective Equipment (PPE) laundry. The radioactive surface contamination present in these examples would be composed of particulate MFP, MAP, and possibly small quantities of TRU.

- Dark Room (Room 105A)

  The Dark Room has been used as a storage place for radioactive material such as gamma counting collimator fixtures from the cell shield wall penetrations contaminated with solid contamination containing MFP/MAP and trace TRU.

- Change Room (Room 106)

  The Change Room contains personnel decontamination facilities including a hot sink and decontamination shower, both of which are connected to the Facility radioactive liquid waste drain system. Radioactive material handled would be in the form of solid contamination containing MFP/MAP and/or liquid containing MFP/MAP in solution or as suspended solids.

3.1.2.2 Typical Operations Conducted at this Location

- Operating Gallery (Room 105)

  1959-1995 Operating Gallery for hot cells

  1959-1992 Experimental assembly

  1980-1992 Nuclear utility emergency support laboratory

  1993-1995 Primary personnel entry/exit point to HCF Controlled Areas

  Room 105 was originally designed, and has been primarily utilized, as the operational control center for all in-cell remote-handling work conducted at the HCF. The main function of the Operating Gallery is to support the operation of the "master" side of the remote-handling master-slave manipulator devices used in the hot cells, but was also affected by operations involving removal/replacement of inoperable manipulators. Also housed in this room is the Manipulator Practice/Experimental Mock-Up Station, which has been routinely used for assembly and checkout of in-cell systems and for hot cell operator training. Generally, the handling of radioactive materials in the Operating Gallery has been limited to those activities which have directly supported operations in other areas of the Facility, such as staging of contaminated protective clothing, removing samples and/or wipes from the cells, or movement of materials from outside the HCF to the interior areas of the Facility, etc. During the period of approximately 1959 through 1975, the Operating Gallery was utilized in a limited manner as a physical test laboratory. From 1980 to 1992, this room was utilized under a service contract arrangement between GA and various nuclear-electric utility companies as the operational venue of the GA Emergency Support Laboratory. Since 1993, this room has been utilized as the primary entry point to the radiologically controlled areas of the HCF.

- Dark Room (Room 105A)

  1959-1992 Photographic dark room

  1959-1993 Limited radioactive materials storage

  Room 105A was originally designed and primarily utilized as a photographic dark room laboratory, and housed the equipment, reagents, and supplies necessary for the development, processing, and inspection of x-ray plates, metallographic images, and standard photographic film. This room was also utilized on a limited basis as a storage location for certain cell-related, contaminated equipment items, (e.g., the various collimator penetration plug assemblies used for in-cell γ-ray spectroscopy).

- Change Room (Room 106)

  1959-1993 Personnel change room

  1959-1995 Personnel decontamination station

  1959-1993 Personnel first aid station

  1993-1994 Primary personnel entry/exit point to HCF Restricted Areas

  Room 106 was primarily used for donning and doffing protective clothing, decontamination of personnel, minor decontamination of equipment and hardware, and radiological survey counting activities. The room is equipped with a pair of sinks and showers, one each of which is connected to the HCF hot drain system (the remaining "cold" sink and shower drains are connected to domestic sewage). This HCF room also housed a supply of first aid equipment, and until 1993, served as the primary personnel decontamination and first aid station for all GA site laboratories.

3.1.2.3 Typical Radiation and Contamination Levels During Operations

- Operating Gallery (Room 105)

  The primary usage of Room 105, i.e., the actuation and control of the various remote handling devices serving the three shielded cells, must be generally considered to be an operation with a low risk of contamination dispersal, assuming proper Facility ventilation and cell isolation factors are in place. During operations involving the removal from cell and change-out of master-slave manipulator units, HCF staff have established an appropriate preparatory protocol and precautionary measures to reduce the risk of introducing contamination into the Operating Gallery environment, and to minimize and remediate the effects of incidental contamination dispersal. Generally, the Operating Gallery floor contamination levels were kept below the minimum detectable activity.

- Operating Gallery, Dark Room, and Change Room (Rooms 105, 105A, 106)

  Typically, general area dose rates were less than 0.2 mR/hr, but would increase when radioactive materials were handled or stored in the areas.

3.1.2.4 Operational Occurrences Affecting Decommissioning Planning and the Potential Impacts of those Occurrences

The Operating Gallery contains the clean side of the manipulators and penetration plugs which go into the HLC, LLC and Metallography Cell. Penetrations have been removed and replaced many times during the life of the Facility for access to in-cell instrumentation etc. Failed manipulators are also removed from the cells and pulled into the Operating Gallery for transfer to the Manipulator Repair Rooms. This operation on some occasions resulted in spread of contamination if sleeving on the hot side of the manipulator was damaged. The Dark Room was used to develop pictures taken with the Metallograph. Hot particles are likely, as they were probably transferred to the Dark Room on the film canisters etc.

3.1.2.5 Known or Expected Radiological Conditions of Contaminated Systems, Structures, and Components

No smearable contamination was found in the Dark Room and, with the exception of the penetrations into the cells, only a few isolated locations in the Operating Gallery showed any smearable contamination. One location on the floor had smearable contamination of 6,000 dpm/100 cm^2, and the other location on the north wall had a smearable contamination level of 3,000 dpm/100 cm^2. The penetration plugs in the three cell walls are contaminated as expected. Intermittent locations on both the Operating Gallery and Dark Room walls contain fixed contamination. Floor tile samples taken in both rooms show ^{134}Cs levels up to 2.2 pCi/g, ^{137}Cs levels up to 5.9 pCi/g, and ^{60}Co levels up to 7.4 pCi/g. Concrete samples taken from the floor show ^{134}Cs levels up to 2 pCi/g, ^{137}Cs levels up to 10 pCi/g, and ^{60}Co levels up to 0.9 pCi/g. Many hot particles were found and removed from the Dark Room though others may still be in the room. Hot particles could also exist under the tile and at the floor/wall junction in the Service Gallery. Drains in the pile chase are believed to be "cold" drains, but based on process knowledge and the concrete samples taken near the drains, contamination inside the drains is probable. The general area dose rates in both rooms are <0.2 mR/hr.

3.1.3 Warm Metallography (Room 107)

3.1.3.1 Radioactive Material(s) that were Handled/Used at this Location

Radioactive materials handled included solid contamination containing MFP, MAP, and trace quantities of TRU; irradiated fuel samples or neutron-activated reactor target materials for metallographic examination; and aqueous and/or organic solutions containing ^3H as tritiated water.

3.1.3.2 Typical Operations Conducted at this Location

1959-1972	Controlled Machine Shop
1972-1995	Manipulator Repair Station, master side
1978-1993	Warm Metallography Laboratory
1990-1993	ESTES Tritium Waste Storage/Staging Area

This room was originally intended, and until 1972 utilized, as the HCF Controlled Machine Shop. Routine operations included the mechanical sectioning/machining of contaminated and/or irradiated hardware. In 1972, the machine tools housed in this room were relocated to the adjacent Controlled Machine Shop (Room 108). At that same time, Room 107 was reconfigured as the master-side of the HCF manipulator repair station, a usage which continues to the present time. In 1978, three laboratory fume hoods and appropriate metallographic equipment were installed in this room to allow for the physical inspection of irradiated specimens of reactor fuels and other target materials, the radioactivity levels of which did not warrant fully remote inspection analysis in the Metallography Cell. Typical metallographic operations conducted in this room included sample preparation, mounting, cutting, grinding, polishing, and macro/micro inspection processes. In support of the ESTES operations, this room was used between 1990 and 1993 for the handling, storage, and staging of ESTES-related tritium-bearing samples and process waste materials.

3.1.3.3 Typical Radiation and Contamination Levels During Operations

Typically, general area dose rates ranged between <0.2 and 10 mR/hr, with an average of approximately 0.4 mR/hr.

3.1.3.4 Operational Occurrences Affecting Decommissioning Planning and the Potential Impacts of those Occurrences

Room 107 was used to house the Facility Controlled Machine Shop until 1972. In 1972 it became a storage location for manipulators and a repair shop for the clean side of the manipulators. In 1978 three fume hoods were added which housed warm metallography equipment. Routine metallographic operations were conducted in the fume hoods such as sample preparation, mounting, cutting, grinding and polishing processes. The three hoods were removed in late 1994. Only the closed off ducting from the fume hoods remains in the room.

3.1.3.5 Known or Expected Radiological Conditions of Contaminated Systems, Structures, and Components

The concrete floor and the lower portions of the wall (1 meter) contain fixed contamination. The areas around and inside the manipulator storage and repair openings are expected to be contaminated. The ventilation ducting for the removed fume hoods is contaminated. Smearable contamination on the floor is as high as 10,000 dpm/100 cm^2. Smearable contamination near the manipulators is as high as 20,000 dpm/100 cm^2, but is generally much lower, 1,000 to 4,000 dpm/100 cm^2 elsewhere in the room. Concrete samples taken from the floor show ^{134}Cs levels up to 164 pCi/g, ^{137}Cs levels up to 2624 pCi/g, ^{60}Co levels up to 100 pCi/g, and ^{154}Eu levels up to 14 pCi/g. The sample taken from the lower portions of the wall show ^{137}Cs levels up to 2.43 pCi/g. Based on the cores taken in Room 122, it appears likely that at least a portion of the subsurface soil may be contaminated. The general area dose rates are 0.2-1.0 mR/hr.

3.1.4 Controlled Machine Shop and Weld Area (Room 108/108A)

3.1.4.1 Radioactive Material(s) that were Handled/Used at this Location

Radioactive materials handled in this area include nonirradiated, experimental reactor fuel comprising BeO/UO_2, irradiated fuel samples or neutron-activated reactor component or target materials containing MAP, MFP, and small quantities of TRU; and materials with solid, particulate surface contamination containing MFP, MAP, and trace quantities of TRU. Materials machined in this area include metals, plastics, and other miscellaneous items, (e.g., aluminum, stainless steel, Incoloy, PVC, polymethylmethacrylate, phenolics, graphite, copper, brass, cast iron, molybdenum, tantalum, cadmium, and others).

3.1.4.2 Typical Operations Conducted at this Location

1960-1972 Beryllium Oxide Laboratory

1972-1995 Controlled Machine Shop And Weld Area

Construction of this added room was completed in late 1959, which followed the initiation of HCF operations by approximately 6 months. This laboratory was utilized from 1960 through 1972 as a nuclear fuel fabrication laboratory, supplying BeO/UO_2 nuclear fuel to the EBOR, sponsored by the Maritime Gas-Cooled Reactor (MGCR) program. Fuel fabrication operations conducted in this area included mixing, molding, pressing, machining, milling, surface grinding, etc. of fuel component materials. In 1972, beryllium oxide laboratory operations were terminated, and all of the installed equipment related to that project was removed from Room 108 for disposal. It was decided at that time to relocate the HCF Controlled Machine Shop equipment and operations from Room 107 to Room 108. Controlled Machine Shop activities conducted in this area since 1972 include machining, sectioning, grinding, milling, cutting, turning, welding, etc., primarily of clean, noncontrolled materials, but also a limited number of activated and/or radiologically contaminated materials. The rooms were surrounded by moats, and featured a pitched floor design to facilitate routine floor washdown with hoses.

3.1.4.3 Typical Radiation and Contamination Levels During Operations

Typically, general area dose rates ranged between <0.2 and 0.3 mR/hr, with an average of approximately 0.2 mR/hr.

A typical reading of water from the trenches:

<$1x10^{-8}$ μCi/ml (α)

<$3x10^{-8}$ μCi/ml (β)

$32x10^{-8}$ μg/l (Be)

3.1.4.4 Operational Occurrences Affecting Decommissioning Planning and the Potential Impacts of those Occurrences

Added to the Facility in late 1959, these two rooms originally housed the Beryllium Oxide Laboratory. This laboratory was used to fabricate beryllium and beryllium oxide parts and other material such as maritime reactor fuel ($BeO/UO_2/ThO_2$). The original floor had two perimeter drainage trenches (moats) used to collect the water used to clean the laboratory. In 1962 a new concrete floor was poured, covering up the trenches. The Beryllium Oxide Laboratory was decommissioned in 1972 and the rooms were converted to the Controlled Machine Shop. The Controlled Machine Shop has been used to work on contaminated equipment.

3.1.4.5 Known or Expected Radiological Conditions of Contaminated Systems, Structures, and Components

The entire concrete floor and intermittent locations on the walls contain fixed contamination. The ventilation ducting in the rooms is expected to contain SNM, but the extent is unknown. Further analysis for SNM will be required before the ducting can be disturbed. The area around the closed drain line in the back corner of Room 108A also contains SNM, leading one to believe that the drain line may contain SNM and will have to be dealt with accordingly. Smearable contamination on the floor is as high as 3,000 dpm/100 cm^2. Smearable contamination on the walls is as high as 2,000 dpm/100 cm^2, but in general is below 1,000 dpm/100 cm^2. Concrete samples taken from the floor show ^{134}Cs levels up to 2 pCi/g, ^{137}Cs levels up to 158 pCi/g, and ^{60}Co levels up to 13 pCi/g. In the area near the "hot" drains, concrete and floor tile samples showed ^{235}U levels up to 46.6 pCi/g. Many hot particles were found and removed from the rooms, and others may still be in the room. The general area dose rates are <0.2 mR/hr except along the east wall of Room 108 where the dose rates are 0.3-0.4 mR/hr. Attempts to detect SNM from the previous trenches were made during coring activities, but no evidence was found. The perimeter of the room will be carefully evaluated again during decommissioning.

3.1.5 Tritium Extraction Lab (Room 109)

3.1.5.1 Radioactive Material(s) that were Handled/Used at this Location

Burn-back of highly irradiated fuel rods was performed in Room 109. Rods were burned-back one at a time. Dose rates on the rods ranged from 10 to 50 R/hr.

This space was later used as the ESTES Lab from 1987 to late 1991. Radioactive material used in this lab includes Tritium in gaseous form (HT, T_2), aqueous form (HTO, T_2O), and/or in compounded form (^3H in solid hydride).

3.1.5.2 Typical Operations Conducted at this Location

1958 - 1969	Equipment Storage
1969 - 1987	Materials Testing
1981	Burn-back of Fuel Rods

1987 - 1991 Engineering Scale Tritium Extraction Experiment

From 1958 to 1969 Room 109 was used as an equipment storage room.

From 1969 to 1987 Room 109 was used as a Tritium Extraction Lab for the preparation and testing of irradiated fuel samples. Standard metal testing evaluations such as tensile strength, shear strength, compression, hardness, bending, fatigue testing, etc., were done at this location. Testing was done on a variety of irradiated metals as well as fuel.

The equipment was located in the south wall of the lab. The Instron compression tester sat on a lab bench in the south-east corner of the room.

To the west of the Instron was the Tinius-Olsen tensile/strength-compression test unit. Next to the Tinius-Olsen was a cut-off saw.

In 1981 one irradiated fuel rod was burned-back to obtain fuel particles for Core Heatup Simulation Testing (accident testing). The general procedure for the burn-back of fuel rods was to flow oxygen through a quartz furnace tube containing the fuel rod at 750 to 900°C for several hours. Effluent gases were captured in the fission gas release trap cooled in liquid nitrogen. The furnace was set up in front of the hood, at the west end of the room. The oxygen bottle was situated to the east of the furnace. A fission gas release trap was located at the west end of the furnace, next to the east wall of Room 122, which at this time was the Manipulator Repair Shop.

In 1987 to 1991 the ESTES was used to show that more than 99.7% of the tritium produced in the full-sized NPR target compacts could be safely extracted.

Target compacts were composed of enriched lithium-6 carbon-coated particles compressed with matrix material. The matrix was composed mainly of graphite flour, pitch and shim. The lithium-containing targets were irradiated in the INEL reactor to produce tritium, then sent to GA for testing. Upon receipt, targets were inspected and stored in a locked cabinet in Room 107.

The ESTES equipment used to extract the tritium from the compacts was inside a secondary enclosure. The secondary enclosure was a large glove box made of a welded steel frame, plastic windows with glove ports and 1/4 in. thick steel plate for the floor, walls and ceiling.

Tritium targets were taken from the storage cabinet, placed in the transfer feeder cask, taken to Room 109, and placed on top of the secondary enclosure. The target was then fed into the primary crusher through the compact feeder assembly. In the extraction process, a two-stage roll crusher broke the compacts into particles and crushed the silicon carbide layer of the particles. The crushed product was dropped into a crucible in a furnace. The vacuum furnace then heated the crushed material to drive off the bound tritium and combined with 45 H_2/He gas to produce tritiated water. The water was collected by oxidizer/sorber units. A radiochemical assay determined the amount of tritium in each unit.

3.1.5.3 Typical Radiation and Contamination Levels During Operations

The primary system transfer cask/feeder assembly produced radiation levels of <5 mR/hr at one foot. Typical tritium contamination levels ranged from 180 to 800,000 dpm/100 cm^2 in the secondary enclosure and 75 to 200 dpm/100 cm^2 in the occupied portions of the room itself.

During the test program, no significant amount of tritium was unaccounted for due to unknown sinks or traps. Of a total of 1,100 Ci processed, an estimated one Ci or less remained in the primary system at the time of primary system dismantlement. Interior surfaces of the secondary enclosure (outside the primary system) contained <.05 Ci based on the analysis of a set of about 20 wipes taken at various locations within the secondary enclosure in June 1993.

The primary system and secondary enclosure were dismantled in October 1994 and packaged as waste. Comprehensive decontamination of the room was conducted following dismantlement, resulting in tritium concentrations generally less than 200 dpm/100 cm^2 with a maximum of 600 dpm/100 cm^2.

3.1.5.4 *Operational Occurrences Affecting Decommissioning Planning and the Potential Impact of those Occurrences*

There are no recorded abnormal occurrences for Room 109 during Facility operation. The room was extensively surveyed in October–November of 1994, when the ESTES equipment was removed from the Facility and packaged as waste. All contamination survey results of the room at that time demonstrated very low levels of smearable contamination on the floors (generally less than 1,000 dpm/100 cm^2) with up to 258,000 dpm/100 cm^2 fixed in the painted surfaces of the floor. In addition, tritium smears were also less than 1,000 dpm/100 cm^2. There has only been limited usage of the room since that time as a radioactive material storage area.

3.1.5.5 *Known or Expected Radiological Conditions of Contaminated Systems, Structures, and Components*

All systems have been removed from Room 109 with the exception of the ventilation system and the fume hood. The area behind the fume hood was not able to be surveyed during Facility characterization though is not expected to pose any undue hazards. The painted surfaces of the floor are generally less than 1,000 dpm/100 cm^2, though the highest detected smearable contamination was 18,000 dpm/100 cm^2. The painted surfaces of the floor are contaminated up to 258,000 dpm/100 cm^2 fixed activity. No contamination was detected in drywall or concrete block structural material samples in the room, with the exception of a single plaster sample with trace activity of ^{137}Cs detected. The floor concrete did reveal moderate levels of mixed fission products (primarily ^{134}Cs, ^{137}Cs, and ^{60}Co) in the surface layer. These concrete samples showed ^{134}Cs ranging from approximately 1 pCi/g to 4 pCi/g, ^{137}Cs ranging from approximately 80 pCi/g to 400 pCi/g, and ^{60}Co ranging from approximately 2 pCi/g to 13 pCi/g.

3.1.6 *Service Gallery (Room 111)*

3.1.6.1 *Radioactive Material(s) that were Handled/Used at this Location*

Radioactive materials handled in the Service Gallery included containerized irradiated fuel; activated reactor components; and particulate radiological contamination comprising MFP, MAP, SNM, and small quantities of TRU in solid oxide form.

3.1.6.2 *Typical Operations Conducted at this Location*

The Service Gallery has been used since original HCF construction as the primary link between the environment of the hot cells and the environment outside the Facility. In general, all radioactive materials received at the HCF packaged in shipping casks were brought into the hot cells via Room 111. For HCF outgoing radioactive materials, this room physically houses all related material shipping activities. The broad range of activities conducted in this area includes the following:

- Receipt, inspection, survey, handling, preparation for cell entry, decontamination upon cell exit, and shipment of shielded radioactive materials packages/shipping casks, containing irradiated/neutron-activated nuclear fuel materials.
- Handling and storage of irradiated nuclear fuel materials in specially designed shielded below-ground storage wells.
- Receipt, inspection, survey, handling, decontamination, repair, staging, and return-shipment of neutron-activated radioactive or radiologically contaminated reactor components, equipment, and hardware.
- Receipt, handling, survey, repair, and short- or long-term storage of miscellaneous laboratory systems, equipment, hardware, instrumentation, apparatus, etc., for past or future use in the HCF.
- Handling, inspection, survey, analysis, processing, packaging, storage, staging, and shipment of radioactive and/or radiologically contaminated waste materials.

3.1.6.3 Typical Radiation and Contamination Levels During Operations

Typically, general area dose rates ranged between 2 and 50 mR/hr, with an average of approximately 8 mR/hr.

3.1.6.4 Operational Occurrences Affecting Decommissioning Planning and the Potential Impacts of those Occurrences

The Service Gallery usage includes cask receipt, preparation for cell entry, and decontamination activities; equipment/hardware decontamination; storage/handling of highly radioactive and/or grossly contaminated fuel, hardware and equipment. The highly radioactive equipment was stored in the shielded wells or in the shielded pit. All of the material and equipment that has been brought into and out of the HLC, LLC and Metallography Cell has passed through the Service Gallery. The Decon Room (Room 118) was added after Facility operation had begun, therefore the potential for trapped contamination under the Decon Room walls exists. Other modifications to the Facility include the addition of the shielded wells at one end of the pit, and the east wall and doors between Room 119 and the Service Gallery.

3.1.6.5 Known or Expected Radiological Conditions of Contaminated Systems, Structures, and Components

The wall surfaces are contaminated with smearable contamination up to 23,000 dpm/100 cm^2 and the floor underneath the herculite has smearable contamination levels up to 280,000 dpm/100 cm^2. The ceiling was not surveyed during characterization due to inaccessibility, however it is expected to be contaminated given the nature of the work which is performed in the room. All of the wall and floor samples taken during characterization were contaminated. The samples taken from the walls showed ^{137}Cs levels up to 40.5 pCi/g, and ^{60}Co levels up to 16.3 pCi/g. Concrete samples taken from the floor showed ^{134}Cs levels up to 10.8 pCi/g, ^{137}Cs levels up to 1103 pCi/g, ^{60}Co levels up to 57.1 pCi/g, and ^{241}Am levels up to 28.7 pCi/g. Subsurface soil samples also show subsurface contamination. Additional subsurface sampling (2 locations) in adjacent Room 118 suggests a broad lateral extent of low-level subsurface soil contamination below the Service

Gallery. The areas of particular importance in the Service Gallery are the pit and the wells. The shield blocks are currently over the pit and the wells also have the shield plugs in place. The dose rates in the pit from stored materials are in the tens of R/hr range. The materials stored in the wells/pit will be disposed of prior to decommissioning work in this area. Several areas were not surveyed during characterization because they could not be accessed for various reasons. These areas include the Decon Room HEPA system duct work and return vents, under the tracks on the floor, the storage pit, and the storage wells. The general area dose rates range from 0.2-8 mR/hr, and the area over the pit has dose rates up to 100 mR/hr.

3.1.7 Metallography Cell (Room 112)

3.1.7.1 Radioactive Material(s) that were Handled/Used at this Location

Radioactive materials handled in the Metallography Cell included irradiated, neutron-activated nuclear fuel materials and reactor component material samples; and contamination containing MFP, MAP, TRU, and SNM.

3.1.7.2 Typical Operations Conducted at this Location

Remote metallographic operations such as the preparation, mounting, cutting, grinding, etching, encapsulating, and polishing of previously irradiated, highly radioactive material specimens were conducted. In addition, remote physical analysis of material specimens was conducted, including microscopic visual inspection, micro/macro-photography, and materials hardness testing.

3.1.7.3 Typical Radiation and Contamination Levels During Operations

Area dose rates vary widely, due to the nature of activities performed and materials stored in the cell.

3.1.7.4 Operational Occurrences Affecting Decommissioning Planning and the Potential Impacts of those Occurrences

None.

3.1.7.5 Known or Expected Radiological Conditions of Contaminated Systems, Structures, and Components

Dose rates up to 5 R/hr were detected during recent surveys. Dose rates appear to be higher near the floor.

3.1.8 Low-Level Cell (Room 113) and High-Level Cell (Room 115)

3.1.8.1 Radioactive Material(s) that were Handled/Used at this Location

Radioactive materials handled in the LLC and HLC included irradiated, neutron-activated nuclear fuel materials and reactor component material samples; contamination containing MFP, MAP, TRU, and SNM; and particulate radiological contamination containing MFP, MAP, TRU, and SNM, primarily in solid, oxide form.

3.1.8.2 Typical Operations Conducted at this Location

Typical operations included receipt, remote off-loading, survey, remote mechanical sectioning, cutting, disassembly, measurement, analysis, and comprehensive physical examination of previously irradiated, highly radioactive nuclear fuel materials and reactor components. Source of subject materials included advanced-design HTGR fuel test capsules, fuel performance test elements, thermionic fuel elements, TRIGA reactor fuel elements, and various metallic and/or graphitic reactor component materials.

3.1.8.3 Typical Radiation and Contamination Levels During Operations

Due to the nature of the materials handled and the work conducted therein, the internal environment of the hot cells, especially the HLC, has typically been radiologically hostile, with routine measured dose rates, resulting from specific radioactive material sources and existent gross contamination levels, exceeding 100,000 mR/hr and higher. Specific radiation survey measurement data for the interior environment of the HLC has not been routinely recorded due to the high intensity of the unshielded sources handled therein. However, the prevailing radiation levels present in the cells during the periods of post-irradiation examination tasks HCF operation may be inferred from the estimated activity levels of the specimens examined. Examples of the various previously irradiated highly radioactive fuel or reactor component materials processed and handled in the LLC and HLC are identified in Table 3-1, with the typical radioactivity levels of the entities, estimated at the time of material receipt at the GA HCF.

Table 3-1—Activity Levels of Materials Examined in the Low- and High-Level Cells

Subject Material Entity or Material Type Handled in the Metallography and High- and Low-Level Cells	HCF Post-Irradiation Examination Dates		Estimated Activity Level at Time of Receipt at HCF (Total Curies)
	From	To	
PB Fuel Test Elements	~7/71	~12/75	~10,000.
P13-Series Fuel Test Capsules	~3/75	~12/78	~7,500.
HRB-Series Fuel Test Capsules	~12/76	~6/82	~10,000.
FSV Surveillance Elements	~9/79	~1/84	~50,000.
FSV Fuel Test Elements	~3/84	~12/86	~100,000.
TRIGA Elements	~7/86	~7/87	~2,000.
RERTR Fuel Test Elements	~6/87	~6/88	~175,000.
Hot Cell Facility Administrative Limit	---	---	1,500,000.

3.1.8.4 Operational Occurrences Affecting Decommissioning Planning and the Potential Impacts of those Occurrences

A domestic water leak that began in Room 118 allowed a small volume of water to enter the HLC and collect inside some of the empty storage wells. This water is highly radioactive due to debris that was on the floor at the time of the incident. This water will be dispositioned prior to HLC decontamination.

3.1.8.5 Known or Expected Radiological Conditions of Contaminated Systems, Structures, and Components

Gamma dose rates of >1 R/hr are expected from residual surface and subsurface contamination. There is a potential for contamination of soil beneath the cells (up to 18 feet below grade level) due to cross-contamination from the installation of the storage wells after initial operation. Transport/migration of contaminants is possible. Cells are contaminated with particulate graphite, SiC, and fuel sectioning debris. Fissures and cracks in the concrete may have collected significant amounts of contamination, giving rise to localized areas of high radiation levels

3.1.9 Pump Room (Room 114)

3.1.9.1 Radioactive Material(s) that were Handled/Used at this Location

The Pump Room has occasionally been utilized for the storage of highly radioactive and/or contaminated hardware.

3.1.9.2 Typical Operations Conducted at this Location

The Pump Room houses the hydraulic pump serving the vertical HLC shield door. No operations other than radioactive materials storage were conducted in this area.

3.1.9.3 Typical Radiation and Contamination Levels During Operations

Typically, general area dose rates ranged between 1 and 20 mR/hr, with an average of approximately 4 mR/hr.

Early records (late 1962) show wipes reading <3 pCi/ft.^{2} α. Recent HP surveys show <2 mR/hr dose rates, with wipe surveys of 3-5k dpm/cm^2.

3.1.9.4 Operational Occurrences Affecting Decommissioning Planning and the Potential Impacts of those Occurrences

The Pump Room houses the hydraulic pump system serving the vertical door which is installed between the HLC and LLC. The Pump Room also contains the electric motor and reduction gear used to drive the main door between the HLC and LLC and the back wall contains a small passageway to the LLC for passing relatively small items into the cell. Occasionally this room has been used as temporary storage area for highly radioactive and/or contaminated hardware and equipment.

3.1.9.5 Known or Expected Radiological Conditions of Contaminated Systems, Structures, and Components

The wall surfaces are contaminated with smearable contamination up to 8,000 dpm/100 cm^2 and the floor underneath the herculite has smearable contamination levels up to 60,000 dpm/100 cm^2. Most of the wall and all of the floor samples taken during characterization were contaminated. The samples taken from the walls showed ^{134}Cs levels up to 0.85 pCi/g, ^{137}Cs levels up to 3.1 pCi/g, and ^{60}Co levels up to 1.8 pCi/g. A wall sample which was taken were the HLC door passes when it is opened showed ^{134}Cs levels up to 63.8 pCi/g, ^{137}Cs levels up to 3,115 pCi/g, ^{60}Co levels up 68.3 pCi/g, ^{154}Eu levels up to 29.3 pCi/g, and ^{125}Sb levels up to 31.1 pCi/g. Concrete samples taken from the floor showed ^{134}Cs levels up to 3504 pCi/g, ^{137}Cs levels up to 23,700 pCi/g, and ^{60}Co levels up to 911 pCi/g. The subsurface soil samples from this and adjacent rooms indicate the subsurface contamination exists as well. The general area dose rate is 2 mR/hr.

3.1.10 X-ray Lab (Room 116)

3.1.10.1 Radioactive Material(s) that were Handled/Used at this Location

Materials handled included plutonium oxide, in small amounts (no more than 20 mg at a time.)

3.1.10.2 Typical Operations Conducted at this Location

Typical operations included plutonium transport experiments and X-radiography.

3.1.10.3 Typical Radiation and Contamination Levels During Operations

Generally, radiation levels were less than 1 mR/hr except during periods when radioactive materials were stored or handled in the immediate area. Contamination levels were generally less than 1,000 dpm/100 cm^2 until a water ingress incident left persistent contamination in the floor tiles of approximately 5,000 dpm/100 cm^2.

3.1.10.4 Operational Occurrences Affecting Decommissioning Planning and the Potential Impacts of those Occurrences

This area was impacted by a domestic water supply rupture originating in Room 118 that also affected Room 116.

3.1.10.5 Known or Expected Radiological Conditions of Contaminated Systems, Structures, and Components

All systems have been removed from Room 116 with the exception of the air vent between Room 116 and the Hall Way, the HLC plug and the fume hood. Dose rates and contamination levels are higher than expected behind the fume hood. The HLC plug is probably very contaminated as it leads to the HLC. The floor tile, currently under a herculite cover, has smearable contamination up to 3,000 dpm/100 cm^2. The floor tiles are contaminated up to 100,000 dpm/probe area (15.5 cm^2) fixed activity. No contamination was detected in the walls of the room with the exception of a single concrete block sample which showed a ^{137}Cs level of 0.3 pCi/g. The floor concrete did reveal contamination levels of up to 27 pCi/g ^{134}Cs, 40 pCi/g ^{137}Cs and 4.2 pCi/g ^{60}Co. Results indicate that at least the lower 3 in. of wall, floor tile, and concrete floor are contaminated to at least 1 in. depth. The areas behind baseboards were not sampled due to the strong possibility of exposing hot particles. In general, subsurface soil taken during core sampling had no positive results. Subsurface soil cores did not yield positive radiological results, but subsurface samples taken at the X-ray Lab to Pump Room door and to the north of the outside double doors were positive, suggesting limited potential for low-level radioactive contamination in some areas. General area dose rates are between <0.2-0.8 mR/hr.

3.1.11 Decon Room (Room 118)

3.1.11.1 Radioactive Material(s) that were Handled/Used at this Location

Materials handled included contamination containing MFP, MAP, TRU, SNM, fuel, and irradiated metals.

3.1.11.2 Typical Operations Conducted at this Location

The Decon Room is used for the routine decontamination of various items, including equipment, hardware, tools, and especially shipping casks, upon exit from the cells. The area was also used for the cleaning of irradiated/activated reactor components such as the Fort St. Vrain helium circulators.

3.1.11.3 Typical Radiation and Contamination Levels During Operations

Typically, general area dose rates ranged between 5 and 1000 mR/hr, with an average of approximately 10 mR/hr.

3.1.11.4 Operational Occurrences Affecting Decommissioning Planning and the Potential Impacts of those Occurrences

The Decon Room (Room 118) was added after initial operation by modification to the Service Gallery. This area has been used for routine decontamination of various items, including equipment, hardware, tools, and shipping casks, upon exit from the LLC. All materials/personnel entering/exiting the LLC do so through Room 118. The area has also been utilized for the cleaning of irradiated/activated reactor components.

3.1.11.5 Known or Expected Radiological Conditions of Contaminated Systems, Structures, and Components

Floor contamination may be up to 1.5 in. deep in many areas and wall contamination is extensive. Hot particles were found throughout the room and will continue to be a consideration. The smearable contamination on the walls is between 3,000 and 120,000 dpm/100 cm^2. The ceiling has smearable contamination of 42,000 dpm/100 cm^2 and the floor 100,000 dpm/100 cm^2. Results from the wall samples taken show ^{134}Cs levels up to 120 pCi/g, ^{137}Cs levels up to 689 pCi/g, ^{60}Co levels up to 345 pCi/g, ^{154}Eu levels up to 3 pCi/g, and ^{241}Am levels up to 1.5 pCi/g. Results from the concrete floor samples show ^{134}Cs levels up to 1,085 pCi/g, ^{137}Cs levels up to 16,250 pCi/g, and ^{60}Co levels up to 613 pCi/g. The Core results demonstrate that subsurface soil contamination is identified. General area dose rates in Room 118 vary considerably depending on whether the LLC door is open, and what is being stored in the room from the HLC or LLC. With the LLC door closed, and no material being stored in the room from the HLC or LLC, the general area dose rates are typically 2-5 mR/hr.

3.1.12 Tritium Effluent (Room 119) and Tritium Sample Prep./General Corridor (Room 120)

3.1.12.1 Radioactive Material(s) that were Handled/Used at this Location

Materials handled in this area include tritium effluent and tritium samples in the low pCi/g range.

3.1.12.2 Typical Operations Conducted at this Location

1959-1978	Manipulator Repair
1978-1987	Equipment Storage
1987-1993	ESTES Operations

Rooms 119 and 120 were used for manipulator repair from 1959 to 1978. From 1978 to 1987 the rooms were used for equipment storage. The ESTES effluent system was set up in Room 119 from 1987 to 1993. The ESTES equipment was completely removed in 1994. Operations in Rooms 119 and 120 supported the tritium extraction process in Room 109. As noted in Section 3.1.2.1, Room 119 was used to clean up the tritium effluent stream, and to process radiochemistry samples for ESTES. Room 120 was used as a preparation area for the oxidizer/sorber traps.

3.1.12.3 Typical Radiation and Contamination Levels During Operations

Area dose rates ranged between 0.2 and 10 mR/hr, with an average of approximately 0.4 mR/hr.

3.1.12.4 Operational Occurrences Affecting Decommissioning Planning and the Potential Impacts of those Occurrences

None identified.

3.1.12.5 Known or Expected Radiological Conditions of Contaminated Systems, Structures, and Components

The concrete floor surfaces show extensive contamination in all locations sampled for both Rooms 119 and 120. Concrete samples taken show ^{134}Cs levels up to 13.8 pCi/g, ^{137}Cs levels up to 1463 pCi/g, and ^{60}Co levels up to 22.1 pCi/g. All of the walls of both rooms have hot particles, loose and fixed contamination. The walls have smearable contamination up to 24,000 dpm/100 cm^2. Samples taken from the walls show ^{137}Cs levels up to 255 pCi/g, and ^{60}Co levels up to 61.1 pCi/g. Fixed contamination was difficult to quantify because of the high background in the rooms; however, one spot on the wall in Room 120 is reading 3 mR/hr. The rooms have many penetrations and inaccessible items that were not surveyed during characterization. A potential exists that some penetrations will have contamination throughout the penetration opening. Hot particles are prevalent in the overhead utilities and in the case of Room 119, fixed within the floor paint. Based upon the core drilling results, subsurface soil contamination beneath portions of Room 120 is likely. The general area dose rates in these rooms is 0.2-1.0 mR/hr.

3.1.13 Boiler Room (Room 121)

3.1.13.1 Radioactive Material(s) that were Handled/Used at this Location

There were no radioactive materials used or handled at this location. The building was constructed with a door leading to this room from the building corridor. The corridor connected the "hot" (potentially contaminated) section of the Change Room to the back of the Facility. Personnel entering this room from the corridor could have tracked radioactive contamination on their feet.

This door is currently locked and sealed to prevent personnel access to this room from the corridor. The corridor has also been decontaminated, and is now a "clean" area.

3.1.13.2 Typical Operations Conducted at this Location

External Air Supply—The source of filtered external air to the Facility is ducted through this room. Filters in the duct are replaced on a regular basis.

Boiler—A boiler providing heat to the building is located in this room. The boiler was originally fired with heating oil and later converted to natural gas. The boiler is wrapped in asbestos-bearing material for insulation. The heating coils are within the external air supply ducts.

Air Conditioning—There was no air conditioning when the building was built. Air conditioning was added to the office areas. A portion of the duct work leading to the offices was diverted in this room, and a separate blower, electrical heating element, and air conditioning coils were added to this new duct. The air conditioning unit is installed outside of the room. A filter housing was included in this duct. Activities involve maintenance of the air conditioning coils, heating elements, controllers, and regularly scheduled filter changes.

Instrument Air—Two air compressors are located in the room for supplying air to the following: the dampers controlling the differential pressures throughout the Facility, the service air hoses, and the Facility emergency breathing air system. The air compressors operate in tandem, i.e., Compressor A will run until proper plenum pressure is supplied and it will shut off. As pressure drops, Compressor B will come on line and run until proper plenum pressure is supplied. Operations include maintenance on the compressors and their controllers.

Facility Air Controllers—All of the facility's damper controllers are located on the east wall of the room. Operations included maintenance of the controllers.

Breathing Air—A separate pipe from the compressors passes through several filters (oil, water, carbon monoxide) to assure proper quality breathing air. Operations included changing out the filters.

Water Softener—There was a water softener unit located on the north wall of the room for domestic water. This has been removed. Operations included changing out the water filters and adding salt to the water softener.

Electrical Power—The main electrical power to the Facility passes into this room. All power enters a panel on the south wall of the room. Operations included maintenance on the electrical panel.

Hot Water Heater—A hot water heater is located in this room for domestic water. Operations included maintenance on the heater.

Sanitary Drain—The bleed lines from the water softener, air compressors, and boiler all feed into a trench within the room that feeds into the sanitary drain system.

3.1.13.3 Typical Radiation and Contamination Levels During Operations

There were no radiation levels or contamination detected above background during operations in this room. There is, however, a significant amount of asbestos-containing material in the room.

3.1.13.4 Operational Occurrences Affecting Decommissioning Planning and the Potential Impacts of those Occurrences

The original entrance to this room was from the potentially contaminated corridor. Contamination has been detected in the concrete slab in the immediate area of the door. The "hot" drain line runs beneath the room. This line is several feet beneath the surface of the slab.

3.1.13.5 Known or Expected Radiological Conditions of Contaminated Systems, Structures, and Components

The large electrical panels along the walls, internal and top surface of large ventilation duct traversing ceiling, air compressors, motor and pump for boiler, cabinets mounted to the walls (lower east end), boiler (internal and beneath) and all associated piping, and the bottom of trench which contains standing oil and water were not surveyed as part of characterization. No smearable contamination was found on the walls or floor of the room. Large sections of the concrete floor, however, were found to be contaminated. Concrete samples take showed ^{137}Cs levels up to 13.7 pCi/g, and ^{60}Co levels up to 1.1 pCi/g. An asphalt sample taken just outside the exterior entrance door also had positive results, indicating some of the surrounding asphalt may also be contaminated. The general area dose rates are < 0.2 mR/hr.

3.1.14 Manipulator Repair (Room 122)

3.1.14.1 Radioactive Material(s) that were Handled/Used at this Location

Materials handled in this area include contamination containing MFP, MAP, TRU, and SNM.

3.1.14.2 Typical Operations Conducted at this Location

This room was utilized for routine hot manipulator decontamination and repair activities.

3.1.14.3 Typical Radiation and Contamination Levels During Operations

Typically, general area dose rates ranged between 5 and 400 mR/hr, with an average of approximately 25 mR/hr.

3.1.14.4 Operational Occurrences Affecting Decommissioning Planning and the Potential Impacts of those Occurrences

Routine manipulator repair activities in this room involved the decontamination of highly contaminated remote handling equipment, which were taken out of service from the HLC, LLC, and Metallography Cell. The deep sink and large floor drain are connected to the hot drain system, and were used as part of the decontamination efforts. These drains were also used for disposing of most of the contaminated liquids (e.g., mop water) generated in the Facility.

3.1.14.5 Known or Expected Radiological Conditions of Contaminated Systems, Structures, and Components

The room contains three highly contaminated manipulator units, some shelving, and drop lights from the ceiling. The wall surfaces and floor are grossly contaminated with smearable contamination up to 220,000 dpm/100 cm^2 on the floor underneath the herculite. The ceiling was not surveyed during characterization, however it is expected to be contaminated, given the nature of the work which is performed in the room. The samples taken from the walls showed ^{137}Cs levels up to 3.73 pCi/g and ^{60}Co levels up to 22.3 pCi/g. Concrete samples taken from the floor showed ^{134}Cs levels up to 65.2 pCi/g, ^{137}Cs levels up to 4,319 pCi/g, ^{60}Co levels up to 7,113 pCi/g, and ^{154}Eu levels up to 35.3 pCi/g. Debris taken from the large floor drain showed ^{134}Cs levels up to 5,729 pCi/g, ^{137}Cs levels up to 85,220 pCi/g, ^{60}Co levels up to 5,126 pCi/g, ^{94}Nb levels up to 48.2 pCi/g, ^{154}Eu levels up to 200 pCi/g, and ^{241}Am levels up to 13.2 pCi/g. Subsurface soil samples taken under and around Room 122 also suggest subsurface contamination. The general area dose rates range from 2.5-15 mR/hr and the area over the floor drain has dose rates up to 100 mR/hr (γ) and 2800 mrad/hr (β-γ).

3.2 Ensuring that Occupational Radiation Exposures are As Low As Is Reasonably Achievable

Decommissioning activities at GA HCF involving the use and handling of radioactive materials will be conducted such that radiation exposure will be maintained as low as is reasonably achievable, taking into account the current state of technology and economics of improvements in relation to the benefits.

3.2.1 ALARA Program

Current practice is as follows:

- A documented ALARA evaluation will be required for specific tasks if a Health Physicist determines that 5% of the applicable dose limits for the following may be exceeded:
  - Total Effective Dose Equivalent (TEDE)
  - The sum of the Deep-Dose Equivalent (DDE) and the Committed Dose Equivalent (CDE) to any individual organ or tissue other than the lens of the eye
  - Eye Dose Equivalent (EDE)
  - Shallow-Dose Equivalent (SDE)
- A documented ALARA evaluation will be required if a Health Physicist determines that HCF effluent averaged over one year is expected to exceed 20% of applicable concentration in 10 CFR 20, Appendix B, Table 2, Columns 1 and 2.

3.2.2 Management Positions Responsible for Radiation Protection and Maintaining Exposures ALARA During Hot Cell Decommissioning

The management positions responsible for radiation protection and maintaining exposures ALARA during Hot Cell decommissioning include the Project Manager, Director LS&NC, GA HP Manager, and Hot Cell D&D Project HP Manager.

3.2.3 Methods for Occupational Exposure Reduction

Various methods will be utilized during decommissioning to ensure that occupational exposure to radioactive materials is kept ALARA. The methods include WA, RWP, special equipment, techniques, and practices as described in the following subsections.

3.2.3.1 Work Authorization Approval

Authorization for work to be performed in accordance with Facility licenses and/or the Decommissioning Plan must be obtained through the LS&NC Department, by preparation and maintenance of a WA. The WA identifies the proposed work scope and activities, quantity and form of radioactive materials involved, individuals authorized to perform the work, and applicable work procedures. An estimate of the isotope(s), physical and chemical form, and quantity of radioactive material generated as waste during a twelvemonth period is included in the WA. An assessment of the magnitude and significance of estimated releases of radioactivity to the environment is also provided. Implementation of operating procedures is contingent upon approval of the WA. Work is performed in strict accordance with the methods and precautions provided in the approved WA.

3.2.3.2 Radiation Work Permits

RWPs are used at the HCF as the primary means of defining specific HP requirements to perform work within the HCF Restricted Area in support of the Facility WA, as an ALARA tool for pre-job planning, and as the principal means of interfacing with the computerized access control/electronic dosimetry system for worker access control. RWPs are prepared by the HCF HP staff and include pre-job briefings as appropriate to the work being performed. For very specific tasks, RWPs are terminated at the conclusion of the task. RWPs are reviewed by the Project HP Manager prior to issuance and also receive approval of the Project Principal Investigator prior to issuance. Work performed at the HCF will be conducted in accordance with an appropriate RWP. Workers may only enter the Restricted Area after reading the respective RWP and signing an authorization sheet acknowledging review and understanding of the requirements stated in the RWP.

The RWP, as utilized for the Hot Cell D&D Project serves several purposes. The RWP provides a detailed description of requirements to perform radiological work (whether simple or complex) in the Restricted Area of the HCF based upon general requirements from the Facility WA. The RWP interfaces with the SAIC Electronic Dosimetry System in use at the HCF for making setpoint changes to the electronic dosimetry according to the type of work that is to be performed. The RWP facilitates exposure tracking and exposure history and job history compilation for both general tasks and specific, complex tasks. This exposure and work task experience information makes the Project better equipped to plan for future work, and provides a tool for consideration of how much external radiation exposure might be received by HCF personnel if related work is performed again in the future. Most importantly, the RWP represents the cooperative ALARA efforts of both the HP group and the various work groups to plan for radiological work (1) so that workers are adequately protected from radiological hazards, (2) to ensure that unusual occurrences or contingencies are considered before beginning a task so that prevention and response are planned, (3) to ensure that effective pre-job planning is employed to keep exposures ALARA, (4) to promote good communication between workers and their HP coverage personnel both before and during the job, (5) to make certain that all involved parties in the work (HP staff and radiological workers) know what to expect during the task and who will be responsible for various activities, and (6) to ensure that HP personnel covering the work are aware of when their management would consider the task's radiological conditions to be beyond what was expected and planned for, and thus in need of further review before proceeding. The extent of detail and degree of formality applied to RWPs is directly related to the complexity of the task and degree of hazard involved with the work.

3.2.3.3 Special Equipment, Techniques, and Practices to be Employed

The areas of greatest contamination in the Facility are the interior of the hot cells, the storage wells in the hot cells, and the storage pits in the Service Gallery (Room 111).

It is anticipated that a major portion of the cleaning in the hot cells can be done with the aid of the manipulators and PaR (Electromechanical Manipulator). The use of manipulators will allow the operator to be protected (shielded/physically isolated) by the walls of the hot cells.

Extensive use of temporary shielding will also limit the exposure to personnel. The HCF has an extensive supply of high density, flat concrete blocks that provide excellent shielding. Also available is a movable shield consisting of a lead wall with a leaded glass window to allow the operator to observe directly the decon effort. A cylindrical, lead-filled shield that can be lowered over a 55 gallon drum will be used to shield personnel from high exposure rate drums loaded with solids or liquids.

Use of "hot sticks," long-handled tongs, or other specialized tools to maximize worker distance from high exposure rate sources will be employed where practical.

Prior to beginning each unique task involving potential significant radiation exposure, a briefing will be held with involved workers. This briefing will assure a complete understanding of the scope of work to be performed. This will minimize the time workers spend in a radiation field. Dry runs, mock-ups, or table-top sessions will also be instituted where applicable so that workers and HP personnel may acquaint themselves with the equipment being used in high exposure rate applications. This training will also shorten the exposure time.

Extensive use of video taping is planned to help familiarize workers with high dose rate tasks and to critique tasks for further exposure reduction improvements.

3.2.4 Respiratory Protection and TEDE ALARA Evaluations

The use of engineering controls to mitigate the radiological hazard at the source is always the first choice with respect to controlling the concentrations of airborne radioactive material in the HCF. There will be, however, circumstances where engineering controls are not practical, or may not be sufficient to prevent airborne concentrations in excess of those that constitute an airborne radioactivity area. In such circumstances where worker access is required to conduct an activity, careful analysis of the alternatives will be made before a decision is made to place workers in respiratory protective equipment to limit internal exposures. Regardless of whether the analysis of alternatives results in a decision to utilize respiratory protective equipment, any situation whereby workers are allowed access to an airborne radioactivity area, or allowed to perform work that has a high degree of likelihood to generate airborne radioactivity in excess of 0.1 DAC, the decision to allow access will be accompanied by the performance of representative measurements of airborne radioactivity to assess worker intake.

When the assessments discussed above result in the determination that an Airborne Radioactivity ALARA Evaluation must be conducted, that evaluation will be documented. The results of DAC-hour tracking and air sample results for any intake will be documented.

When a situation has been evaluated, and the use of respiratory protective devices is prescribed to maintain worker radiological exposures ALARA, devices are selected in accordance with written GA HP instructions. A similar approach is taken when other hazards are possible. All workers who are issued respiratory protective devices will be verified to have been medically qualified for respiratory protection within the past 12 months, have received training on respiratory protection equipment usage within the last 15 months, and have been qualified and properly fit for the respiratory protection device to be used within the past 12 months. Respiratory protective devices will be inspected prior to each use. HCF HP personnel will maintain records of all issuance of respiratory protective equipment. Pre-job briefings are given to workers prior to use of respiratory protective equipment. Workers will provide nasal smears for HP evaluation following the use of respiratory protective equipment for radiological purposes.

3.2.5 Control and Storage of Radioactive Materials

The GA and Hot Cell D&D Project HP Programs establish radioactive material controls that ensure:

- Deterrence of inadvertent release of licensed radioactive materials to unrestricted areas.
- Confidence that personnel are not inadvertently exposed to licensed radioactive materials.
- Minimization of the volume of radioactive wastes generated during the decommissioning.

All material leaving the HCF Restricted Area will be surveyed to ensure that radioactive material is not inadvertently released from the Facility. The following methods will be utilized as appropriate to the material being evaluated to survey for licensed materials:

- Direct scans with a portable detector.
- Indirect survey by collection of representative smears for removable contamination with analysis.
- Collection of representative samples of bulk liquids or solids for analysis.

Details of equipment and materials unrestricted release criteria are provided in Sections 4.3.1 and 4.3.2.

3.3 Health Physics Program

3.3.1 Project Health Physics Program–General

GA intends to draw upon the principal elements of the HP Program that were successfully implemented during the more than thirty years of operation. GA HP procedures will continue to be implemented during the Decommissioning Project, with new procedures specific in application to the HCF decommissioning being developed and approved as necessary.

GA senior management is readily accessible to HCF HP Management to ensure timely resolution of difficulties that may be encountered. The HCF HP Manager, while organizationally independent of the Project staff, has direct access to the Project Manager on a daily basis, and has full authority to act in all aspects of protection of workers and the public from the effects of radiation. Quality aspects of the Hot Cell D&D Project HP program will be evaluated by both Project Quality Assurance oversight, and GA site HP audit activities.

3.3.2 Audits, Inspections, and Management Review

Throughout the decommissioning period, aspects of the Project will be assessed by the GA Quality Assurance Department, through audits, assessments, and inspections of various aspects of decommissioning performance, including HP, as described in Section 3.7.

3.3.3 Health Physics Equipment and Instrumentation

GA has selected HP equipment and instrumentation suitable to permit ready detection and quantification of radiological hazards to workers and the public, and to ensure the validity of measurements taken during remediation and final release surveys. The selection of equipment and instrumentation to be utilized was based upon detailed knowledge of the radiological contaminants, concentrations, chemical forms, and chemical behaviors that are expected to exist at the HCF as demonstrated during radiological characterization, and as known from process knowledge of the working history of the Facility. Equipment and instrumentation selection also takes into account the working conditions, dose rates, and source terms that are reasonably expected to be encountered during the performance of decommissioning work as presented in this Plan.

The following sections present details of the equipment and instrumentation presently selected for use during the decommissioning of the HCF. It is anticipated that through retirement of worn or damaged equipment/instrumentation or increases in quantities of available components or instruments that new technology will permit upgrades or, at a minimum, like-for-like replacements. GA is committed to maintaining conformance to minimum performance capabilities stated in this Plan whenever new components or instruments are selected.

3.3.3.1 Criteria for Selecting Equipment and Instrumentation for Conduct of Radiation and Contamination Surveys and Personnel Monitoring

A sufficient inventory and variety of instrumentation will be maintained on-site to facilitate effective measurement of radiological conditions and control of worker exposure consistent with ALARA, and to evaluate suitability of materials for release to unrestricted use. Instrumentation and equipment will be capable of measuring the range of dose rates and radioactivity concentrations expected to be encountered during conduct of remediation and dismantlement of the Facility, as well as for final survey measurements, and to less than the minimum values required for release or ALARA decision-making.

HP staff will select instrumentation that is sensitive to the minimum detection limits for the particular task being performed, but also with sufficient range to ensure that the full spectrum of anticipated conditions for a task or survey can be met by the instrumentation in use. Consumable supplies will conform to manufacturer and/or regulatory recommendation to ensure that measurements meet desired sensitivity and are valid for the intended purpose. GA will continue review of regulatory information notices and bulletins for applicability to Project HP instrumentation.

3.3.3.2 Storage, Calibration, Testing, and Maintenance of Health Physics Equipment and Instrumentation

Survey instruments are stored in a common location under the control of Project HP personnel. A program to clearly identify and remove from service any inoperable or out-of-calibration instruments or equipment as described in HP procedures will be adhered to throughout this Hot Cell D&D Project. Survey instruments, counting equipment, air samplers, air monitors, personnel contamination monitors, and electronic dosimetry for the Hot Cell D&D Project will be calibrated at license-required intervals, manufacturer-prescribed intervals (if shorter frequency) or prior to use against standards that are NIST traceable in accordance with Calibration Laboratory procedures, HP procedures, or vendor technical manuals. Survey instruments will be operationally tested daily when in use. Counting equipment operability will be verified daily when in use. The personnel contamination monitors are operationally tested on a daily basis, or prior to use. Electronic dosimetry (not utilized for dose of record) is functionally tested for response to radiation prior to issuance. The installed effluent monitor will be operationally tested on approximately a weekly basis.

3.3.3.3 Specific Health Physics Equipment and Instrumentation Use and Capabilities

Table 3-2 provides details of the HP equipment and instrumentation that has been selected for use in the Hot Cell D&D Project. As discussed earlier, the selection of instrumentation is subject to change as older equipment and instruments are retired. GA will maintain conformance to minimum performance capabilities or better, whenever new components or instruments are selected.

3.3.3.4 Policy, Method, Frequency, and Procedures

The HCF decommissioning will utilize the existing GA HP Program as specified for the Project. This Program prescribes policy, method, and frequency for effluent monitoring, conduct of radiological surveys, personnel monitoring, contamination control methods, and protective clothing usage.

Effluent Monitoring—The airborne effluent from the Facility has a single filtered exhaust point from the Facility ventilation exhaust stack. That exhaust point will be continuously monitored downstream of the last HEPA filtration system by an isokinetic real-time monitor system with alarm capability and at least a single back-up isokinetic sample collection point (at a minimum, a grab-type sample) which is also in continuous operation. The real-time alarming monitor will alarm in the Facility Operating Gallery or other nearby location where HP personnel are present. The particulate sample change-out frequency is approximately weekly; sample media are analyzed for particulates using laboratory counting systems in a timely manner after filter media change-out. Due to the age of Facility contaminants, there is no credible source term for radioiodine or noble gas; hence, sample media are only analyzed for particulate emissions. The GA HP Department also operates several continuous environmental air sample stations on the main GA site to further assess the potential for environmental airborne radiological effluents.

All radioactive liquids generated in the Facility are collected in the hot drain system and routed to liquid waste collection tanks. The contents of liquid waste collection tanks are then transferred to containers for removal and processing as radioactive waste (e.g., absorption, solidification, etc.) or filtered and disposed of into the sanitary sewage system if the levels meet all regulatory limits (NRC's 10 CFR 20 and the State of California Title 17, CCRs) and GA's Industrial Waste Discharge Permit issued by the City of San Diego. Some processes conducted in support of the Hot Cell Decommissioning, such as respirator washing, wet mopping, etc., create liquid wastes that are potentially contaminated. Any potentially contaminated liquids are sampled and analyzed for radioactivity prior to disposal. If these liquids are found to contain radioactivity, they will be evaluated for disposal options as discussed above for liquids generated in the facility.

Radiation Surveys—Radiation, airborne radioactivity, and contamination surveys during the Hot Cell D&D Project will be conducted in accordance with approved HP procedure(s). The purposes of these surveys will be to (1) protect the health and safety of workers, (2) protect the health and safety of the general public, and (3) demonstrate compliance with applicable license, federal, and state requirements, as well as Decommissioning Plan commitments. HP personnel will verify the validity of posted radiological warning signs during the conduct of these surveys. Surveys will be conducted in accordance with procedures utilizing survey instrumentation and equipment suitable for the nature and range of hazards anticipated. Equipment and instrumentation will be calibrated and, where applicable, operationally tested prior to use in accordance with procedural requirements. Routine surveys are conducted at a specified frequency to ensure that contamination and radiation levels in unrestricted areas do not exceed license, federal, state, or site limits. HP staff will also perform surveys during decommissioning whenever work activities create a potential to impact radiological conditions.

Table 3-2—Specific Health Physics Equipment and Instrumentation Use and Capabilities

Instrument Model	Detector Type	Instrument Range	Minimum Detection	Application
Eberline-RO-2 & 2A Eberline RO-20	Ionization chamber	RO-2 0-5,000 mR/hr RO-2A 0-50 R/hr RO-20 0-50 R/hr	RO-2 0.2 mR/hr RO-2A 20 mR/hr RO-20 0.2 mR/hr	Beta/gamma exposure rate measurements
Eberline Teletector-6112D/B	GM tube	0-1,000 R/hr	0.1 mR/hr	Telescoping detector with GM probe for high range
Ludlum-M239F Floor Monitor with 2221 ratemeter/43-37 probe	Gas proportional	0-500,000 cpm	20 cpm	Alpha and beta/gamma floor monitor 434 cm^2 ^{137}Cs efficiency approximately 30% 4π
Eberline-RM-14,14SA/HP-260 probe or HP100-BGS probe	GM tube pancake probe	RM-14 0-50,000 cpm RM-14SA 0 -5,000,000 cpm	RM-14 20 cpm RM-14SA 10 cpm	Beta/gamma surface contamination measurements Can be used with several types of probes–Information for HP-260 probe. ^{90}Sr efficiency ~ 32% 4π 15.5 cm^2 HP100-BGS probeC^{90}Sr efficiency 36% 4π, 100 cm^2
Ludlum Model 12 with 43-68 probe	Gas Proportional	0-500,000 cpm	<600 dpm/100 cm^2	Beta-Gamma surface contamination measurements
Canberra Low-Level Alpha/Beta Counting System	GM	CPU operated	Varies according to count time	Low-level α/β smear samples
Ludlum-177	ZnS(Ag) scintillation	0-500,000 cpm	20 cpm	Hand-held alpha frisker (50 cm^2 area) ^{239}Pu efficiency 15% 4π ^{230}Th efficiency 23% 4π
Ludlum Model 19 µR	NaI (Tl) Scintillator	0-5,000 µR/hr (i.e., 5 mR/hr)	1 µR/hr	Low gamma exposure rates
Eberline SAC-4	ZnS(Ag) Scintillator	6 Decade scalar	Background is generally less than 0.3 cpm, making MDCR ~ 0.4 cpm	Alpha laboratory measurement of air samples and smears 47 mm diameter ^{239}Pu efficiency ~ 40%–4π
Eberline BC-4	Shielded GM pancake tube	6 Decade scalar	MDCR ~ 20 cpm	Beta laboratory measurement of air samples and smears 47 mm diameter ^{90}Sr efficiency ~ 40%–4π
REGE Canberra S-100	Gamma-ray spectroscopy system	N/A	Varies by photon energy and sample media	Gamma laboratory measurement of water, air, smear/media samples
Eberline Personnel Contamination Monitor PCM-2	Gas Proportional	N/A	<5,000 dpm/100 cm^2	Personnel contamination monitor/walk-in monitor with microprocessor control and radon reject capability.
Eberline PING-1A	Multiple Detector types	N/A	N/A	This monitor is installed with an isokinetic sampling rake to provide real-time effluent monitoring for the facility effluent. Detection capability for particulates is less than 0.1 ECs (Effluent Concentrations).
SAIC RADeCO H809V "HiVol"	N/A	1-30 cfm	N/A	High Volume air sampling for minimum detection capability
SAIC RADeCO HD-29A "Goose Neck"	N/A	0.5-3.5 cfm	N/A	Low volume air sampling for long term air sampling
SAIC PD-3 Electronic Alarming Dosimeter	GM	2 µR- 999 R	2 µR	Personnel monitoring as back-up to record TLDs, ALARA tool, job control, and exposure tracking for facility. Dosimeter has dose, dose rate, and low battery alarm capability.
EG&G LB 1210 B/LB6255 Tritium surface monitor	Gas Proportional	0-3000 cps	< 1,000 dpm/100 cm^2	Hand held surface tritium monitor.
Technical Assoc. FM-5ABN-2CH modular air monitors	GM	10-10^5 cpm	N/A	Local airborne monitor with alarm capability
Ametek MG-4 Air Sampler	N/A	5 - 4,000 cc/min.	N/A	Lapel air sampler for use in chronic exposure situations

Personnel Monitoring–Internal and External—Personnel performing work at the HCF who are designated on the Facility WA as workers or frequent visitors will be provided with a TLD when working in the HCF restricted area or in accordance with periodic external prospective dose evaluations conducted by HP. Prospective external exposure evaluations will be performed, at a minimum, on an annual basis, or whenever changes in worker exposures warrant. Visitors to the Facility will be provided with external monitoring equipment in accordance with requirements specified in GA HP procedures, and according to the radiological hazards of areas to be entered. TLDs are processed on a quarterly basis during routine decommissioning work. In addition, the HCF is provided with an external monitoring electronic dosimetry system (not for record purposes) to monitor and warn workers at the Facility as well as track exposures for ALARA purposes and against limits on an ongoing basis. These electronic dosimeters are designed to alarm at specified doses or dose rates for worker protection and ALARA purposes. When dose gradients suggest that the highest dose rates may exist at locations other than the upper trunk of the whole body, HP personnel will direct the relocation of record TLDs or assign additional TLD badges to sufficiently monitor worker exposure. If dose rate to an extremity requires monitoring due to dose gradients, additional TLDs will also be provided for these purposes. HP personnel will carefully monitor the progress of work whenever high dose rates or significant dose gradients exist to ensure adequate protection of workers.

Internal monitoring will be conducted in accordance with the prospective internal exposure evaluation for the Facility. This prospective internal exposure evaluation will be evaluated on an annual basis, at a minimum, or whenever significant changes in planned work evolutions warrant it. A comprehensive air sampling program is conducted at the Facility to evaluate worker exposures regardless of whether internal monitoring is specified. The results of this air sampling program will be utilized to ensure validity of specified internal monitoring requirements for Facility personnel. Facility workers and frequent visitors may also be required to participate in a periodic Whole Body Counting program at Project HP Management direction to further ensure that internal exposure is carefully observed. If at any time during the decommissioning, hazards that may not be readily detected by the preceding measures are encountered, special measures or bioassay as appropriate will be instituted to ensure the adequate surveillance of worker internal exposure.

Respiratory Protection—The GA respiratory protection program provides direction for use of National Institute for Occupational Safety and Health/Mine Safety and Health Administration (NIOSH/MSHA) certified equipment. This program is administered by GA HP in consultation with GA Industrial Hygiene.

NIOSH/MSHA approved equipment are air purifying respirators which includes full face piece assemblies with air purifying elements to provide respiratory protection against hazardous vapors, gasses, and/or particulate matter to individuals in airborne radioactive materials areas. Individuals may be required to use continuous or constant flow full-face airline respirators for work in areas with actual or potential airborne radioactivity. The Manager, HP, or designee will also ensure that the respiratory protection program meets the requirements of 10 CFR Part 20, subpart H.

- Maintenance

  When respiratory protection equipment requires cleaning, the cartridges will be removed. The respirator will be cleaned and sanitized after every use with a cleaner/sanitizer and then rinsed thoroughly in plain warm water in accordance with HP procedures.

- Storage

  Respiratory protective equipment will be kept in proper working order. When any respirator shows evidence of excessive wear or has failed inspection, it will be repaired or replaced. Respiratory protective equipment that is not in use will be stored in a clean dry location.

Contamination Control—Contamination control measures that will be employed include the following:

- Worker training will incorporate methods and techniques for the control of radioactive materials, and proper use and donning/doffing of protective clothing.
- Facility procedures incorporate HP controls to minimize spread of contamination during work.
- Radiological surveys will be scheduled and conducted by HP.
- Containment devices such as designed containers and plastic bags will be used to prevent the spread of radioactive material.
- Physical decontamination of Facility, areas or items.
- Physical barriers such as Herculite sheeting, strippable paint, and tacky mat step-off pads to limit contamination spread.
- Posting, physical areas boundaries and barricades.
- Clean step off pads at the entrance point to contaminated areas.

Personnel entries into radiologically contaminated areas will require the use of protective clothing. This clothing will consist of a combination of the following, dependent upon the conditions outlined in the RWP:

- Heavyweight lab coat
- Heavyweight canvas, cotton, or cotton/polyester coveralls
- Heavyweight hoods
- Plastic calf-high booties
- Rubber shoe covers
- Plastic or rubber gloves which may require cloth liners.
- Tyvek paper coveralls or plastic rain suit disposable outer clothing
- Face shield or other protective device

Access Control—The Restricted Area (RA) will be controlled so as to prevent unauthorized access by the following means:

- Worker training will address proper methods and techniques for access to the Restricted Area.

- Existing procedures describing the control of access to the RA will be implemented.
- The HCF Restricted Area will be clearly posted to advise/warn workers.
- Heath Physics surveillance.
- Facility security will provide physical access control to the Facility, limiting building access to authorized or escorted personnel only.

Engineered Controls—Personnel exposure to airborne radioactive materials will be minimized by utilizing the following engineering controls:

- Ventilation devices—fume hoods, in-place or portable HEPA filters or Facility ventilation systems, local exhaust by use of vacuums.
- Containment devices—designed containers, plastic bags, tents, and glove-bags.
- Source term reduction—application of fixatives prior to handling, misting of surfaces to minimize dust and resuspension.

Airborne Radioactivity Monitoring—Monitoring for the intake of radioactive material is required by 10 CFR 20.1502(b) if the intake is likely to exceed 0.1 ALI (annual limit on intake) during the year for an adult worker or the committed effective dose equivalent is likely to exceed 0.05 rem (0.5 mSv) for the occupationally exposed minor or declared pregnant woman.

Prospective estimates of worker intakes and air concentrations used to establish monitoring requirements at the HCF will be based on consideration of the following:

- The quantity of material(s) handled
- The ALI for the material(s) being handled
- The release fraction for the radioactive material(s) based upon its physical form and use
- The type of confinement being used for the material(s) being handled
- Other factors that may be applicable

HP personnel will use technical judgment in determining the situations that necessitate air sampling regardless of generalized, prospective evaluations done for the Facility.

Prior to identifying the location for an air sampler, the purpose of the radiological air sample will be identified. Various reasons exist for collecting air samples. The following are a few examples:

- Estimation of worker intakes
- Verification of confinement of radioactive materials
- Early warning of abnormal airborne concentrations of radioactive materials
- Determining the existence of criteria for posting an ARA.

Smoke tubes and buoyant markers may then be used to determine air flow patterns in the area. Air flow patterns may be reevaluated if there are changes at the Facility that may impact the validity of the sampling locations. Such factors might include the following:

- Changes in the work process
- Changes in the ventilation system
- Use of portable ventilation that might alter earlier assessments

After identifying the purpose for the air sample and flow patterns are established, air sample locations are established as follows:

- For verification of confinement of radioactive materials:
  - Locate samplers in the air flow near the potential or actual release point.
  - More than one sampling point may be appropriate when there are more than one potential or actual release points.
- For estimation of a worker intake:
  - Sampler intakes will be located as close to the workers breathing zones as practical without interfering with the work or worker
- For fume hoods, glove boxes and similar confinement systems:

  Air sampler intakes may be located slightly above head height and in front of the worker or on the front face of the enclosure

General workplace air sampler intakes will not be placed in or near ventilation exhaust ducts unless their purpose is to detect system leakage during normal operation, **and** if quantitative measurements of workplace concentrations are not required. Locations or number of air samplers will be changed when dictated by modifications to Facility structure, changes in work processes, or elimination of potential sources.

A sufficient inventory and variety of operable and calibrated portable, semiportable, and fixed air sampling equipment will be maintained at the HCF to allow for effective collection, evaluation, and control of airborne radioactive material and to provide backup capability for inoperable equipment. Air sampling equipment will be calibrated at prescribed intervals or prior to use against certified equipment having known valid relationships to nationally recognized standards. Table 3-2 lists anticipated air sampling equipment.

When the work being performed is a continuous process, a continuous sample with a weekly exchange frequency is appropriate, except for situations where short-lived radionuclides are expected to represent a significant exposure. For situations where short-lived radionuclides are important considerations, the exchange frequency will be adjusted accordingly. Longer sample exchange frequencies may be approved by HCF HP management for situations where airborne radioactive material and nuisance dust are expected to be relatively low. Grab sampling for continuous processes may also be approved by GA (or HCF) HP management based upon consideration of variability of the expected source term for the given Facility and process. Grab sampling is the appropriate means of airborne sampling for processes conducted intermittently, and for short duration radiological work that involves a potential for airborne release.

3.3.3.5 Potential Sources of Radiation or Contamination Exposure to Workers and Public as a Result of Decommissioning Activities

Sources of radiation or contamination exposure at the HCF may be assessed by process knowledge, radiological survey data, surveys performed during characterization, previous and current job coverage surveys, ALARA/RWP Job History files, or daily, weekly and monthly routine surveys.

Classification of potential sources may also be identified by, radionuclide, physical properties, volatility, and radioactivity.

Worker exposure to external radiation may occur during handling, removal, packaging, and/or transport of radioactive materials, or when performing routine and nonroutine work/ activities in the Restricted Area of the HCF or in close proximity to radioactive materials. Worker exposure to airborne radioactivity may occur during decontamination operations/ work evolutions which may involve abrasives or methods that volatilize loose and/or fixed contamination, or during performance of routine and nonroutine work/activities in the contaminated areas of the HCF or while working on contaminated equipment.

Exposure of the public to external radiation could occur as the result of residual radiation from HCF operations, proximity to radioactive materials, or transport of radioactive materials from the Facility. Exposure of the public to internal radioactivity could occur due to airborne effluents from the Facility, or wind blown/resuspended dusts from residual radioactivity at the site.

The type(s) of controls used at the HCF takes into account the current state of technology and the economics of improvements in relation to the benefits.

Control of potential sources of radiation exposure to workers and public as a result of decommissioning activities will be achieved through, but not limited to, the use of administrative, engineering, and physical controls.

Administrative controls consist of but are not limited to:

- Administrative dose limits that are lower than regulatory limits
- RWPs, which set forth requirements such as exposure limits, engineering control requirements, shielding and special handling requirements, dosimetry requirements, mock-up training, stay-times, and HP instructions to the workers
- Alarming dosimeters, which alarm at pre-set limits that may be lower than administrative limits, as practical
- Training
- Radiological surveys

Physical barriers such as radiological warning rope/ribbon, in combination with radiological warning tape, lockable doors/gates as well as information signs and flashing lights or other applicable barriers may also be used.

Engineering controls may consist of but are not limited to:

- HEPA ventilation/enclosures

- Protective clothing/equipment
- Access restrictions/barriers
- Confinement
- Extension devices/tools
- Shielding
- Remote handling equipment
- Shielded, certified shipping casks

3.4 Health Physics Policies for Subcontractor Personnel

Subcontractor personnel may be used for certain required work during the Hot Cell D&D Project. Subcontractors who will work with licensed radioactive materials will be required to:

- Attend and complete applicable Radiological Worker Training
- Provide required exposure history information
- Read and sign an applicable RWP and comply with instructions
- Be issued proper dosimetry by cognizant HP personnel
- Follow all special instructions given by HP
- Be escorted by a cognizant authorized person listed on the HCF WA, unless specifically listed themselves on the HCF WA

3.5 Radioactive Waste Management

The processes of decontamination, remediation, and dismantlement of the Facility will result in solid and liquid radioactive waste, mixed waste, and hazardous waste. Soil remediation will also result in solid radioactive waste, mixed waste, and hazardous waste. The radioactive waste will be primarily contact-handled low-level waste with a small portion remote-handled low-level waste. This waste will be handled (processed and packaged), stored, and disposed of in accordance with applicable sections of the Code of Federal Regulations, Code of California Regulations, San Diego County and City Regulations, disposal site Waste Acceptance Criteria, respective State Administrative Codes, GA Licenses and Permits, and the Hot Cell D&D Project's implementing plans and procedures.

The DOE is committed to removal of all project generated waste from the designated GA site to an approved federal and/or commercial disposal site(s).

3.5.1 Processes and Systems for Handling, Storing, and Disposing of Radioactive Waste

Radioactive waste management incorporates disciplines that assure all processes and systems for handling, storing, and disposing of radioactive waste comply with regulatory requirements. This includes waste minimization or volume reduction, radioactive and hazardous waste segregation, waste characterization, disposal site waste acceptance criteria certification, and packaging and shipping compliance with applicable Code of Federal Regulations (10 CFR, 40 CFR, 49 CFR).

3.5.1.1 Conformance to Requirements of 10 CFR 61, 10 CFR 71, and 10 CFR 20.2006

10 CFR 61, *Licensing Requirements for Land Disposal of Radioactive Waste, Subpart D–Technical Requirements for Land Disposal Facilities*, establishes minimum radioactive waste classification, characterization, and labeling requirements. These requirements will be met through the implementation of Project Packaging and Characterization Procedures, Disposal Site Certification Plan, Characterization Plan, Sampling and Analysis Plan, and Quality Assurance Program Document. Training will be provided for Project Waste Certification Officials, Waste Packaging personnel, and Waste Characterization personnel to assure conformance to applicable 10 CFR 61 requirements as stated in the specific implementing procedures and plans. Quality Assurance conducts audits and surveillances per the Quality Assurance Program Document based on ASME NQA-1-1989, which confirms conformance with Disposal Site Acceptance Criteria and applicable 10 CFR 61 requirements.

10 CFR 71, *Packaging and Transportation of Radioactive Material*, establishes requirements for packaging, shipment preparation, and transportation of licensed material. A majority of the radioactive waste that will be packaged and shipped will be LSA material. A small portion of the radioactive waste will be Class C. GA is an NRC and State of California Licensee to receive, possess, use, and transfer licensed by-product and source materials. 10 CFR 71 requirements will be met through the implementation of Project and Nuclear Waste Processing Facility (NWPF) Packaging and Shipping Procedures. Training will be provided for Waste Packaging Personnel and Waste Shipping Personnel to assure conformance to applicable 10 CFR 71 requirements. LS&NC's Nuclear Material Accountability Department provides compliance oversight and off-site shipment notices. Quality Assurance will confirm conformance to Subpart H (Quality Assurance) requirements through the implementation of the GA Quality Assurance Manual and Quality Assurance Program Document. 10 CFR 71 applicable Quality Assurance requirements apply to design, purchase, fabrication, handling, shipping, storing, cleaning, assembly, inspection, testing, operation, maintenance, repair, and modification of components of packaging which are important to safety.

10 CFR 20.2006, *Transfer for Disposal and Manifests,* establishes requirements for controlling transfers of low-level radioactive waste intended for disposal at a land disposal facility; establishes a manifest tracking system; supplements requirements concerning transfers and record keeping; and requires generator certification that transported materials are properly classified, described, packaged, marked, and labeled, and are in proper condition for transport. These requirements will be met through the implementation of Project and NWPF Packaging and Shipping Procedures with the oversight of GA's LS&NC's Nuclear Material Accountability department.

3.5.1.2 Conformance to Disposal Site Requirements

The Proposed Site Treatment Plan (PSTP) for U.S. Department of Energy Oakland Operations Office (DOE/OAK) Mixed Wastes at General Atomics was written in response to the Federal Facilities Compliance Act (FFCAct). The FFCAct requires that the site treatment plans (STPs or plans) be developed for facilities at which DOE generates or stores mixed waste. Mixed Waste is defined by the FFCAct as any waste containing both a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) and source, special nuclear, or by-product material subject to the Atomic Energy Act of 1954

(42 U. S. C. 2011 et. seq.). Current inventories of characterized DOE/OAK mixed wastes to be treated on-site at GA consist of contaminated waste waters (approximately 22 cubic meters) resulting from Hot Cell D&D activities. Current inventories of DOE/OAK mixed wastes to be treated off-site at Hanford are relatively small, with total quantities not exceeding 6.5 cubic meters. Future generation of small quantities of DOE/OAK mixed wastes at GA is expected due to continued D&D and research activities. Future mixed wastes generated that do not meet RCRA Land Disposal Restriction (LDR) requirements will be characterized and addressed in updates to the plan as required.

Radiological and mixed wastes will be disposed of at designated disposal sites per the applicable Disposal Site's Acceptance Criteria. Certification Plans, Waste Minimization Plans, Characterization Plans, Sampling and Analysis Plans, Quality Assurance Plans, etc. and associated implementing procedures will reflect the characterization, processing, packaging and transportation requirements specified in the applicable Disposal Site Acceptance Criteria. Appropriate application to designated disposal sites will be conducted including, as required, certification plans, qualification statements, assessments, waste stream analysis, evaluations and profiles, transportation plans, and waste stream volume forecasts. Waste characterization, waste designation, waste traceability, waste segregation, waste packaging, waste minimization, and quality assurance and training requirements of the designated disposal sites will be incorporated in Project Plans and implementing procedures to assure conformance to disposal site requirements.

3.5.1.3 Conformance to State Requirements

Generator State (California) and Treatment/Storage/Disposal Facility States (Washington, Utah, etc.) requirements for radioactive and mixed waste management will be incorporated into Project plans and procedures to assure conformance with applicable state regulations, licenses, and permits. Applicable state regulations include California Hazardous Waste Management Regulations (California Code of Regulations, Title 22), Washington Dangerous Waste Regulations (Washington Administrative Code 173-303), and Utah Department of Environmental Quality Rules (R313) for the control of ionizing radiation reflected in Envirocare's Utah Radioactive Material License, UT 2300249. The Project will conform to GA CAL-DHS, Radiological Health Branch (CAL-RHB) License (0145-80) to possess and use source materials as directed by California Code of Regulations, Title 17. GA will also conform to the California Environmental Protection Agency (CAL-EPA) requirements (EPA ID Number CAD 067 638 957) which permit/authorize GA to operate as a generator of hazardous waste, to treat hazardous waste on site under California's Tiered Permit program Conditional Authorization (CA) or Conditional Exemption (CE) tiers, and to manage radioactive mixed wastes under Interim Status granted by the State of California Department of Toxic Substances Control (CA-DTSC). The Project will also conform to the GA Health Permit to manage hazardous materials issued by the County of San Diego Department of Health Services Hazardous Materials Management Division (SD-DHS-HMMD). Project Plans and Procedures will also incorporate Metropolitan Industrial Waste Program (MIWP) requirements for the discharge of industrial waste waters into the sanitary sewer system managed by the City of San Diego (San Diego Metropolitan Water District).

3.5.2 Waste Characterization Projections

The Hot Cell Site and Facility has been characterized for radiological and hazardous contaminants. The radiological assessment demonstrated that approximately 21% of the building floor area had no contamination and is a candidate for release to unrestricted use. Approximately 50% of the wall areas and 79% of the floor areas are contaminated. The cell penetrations are contaminated and core drilling results indicate subsurface contamination in soils below the Facility. Structural materials on the roof are contaminated and limited areas of the exterior walls are also contaminated. Hazardous constituent sampling in accordance with EPA requirements indicated 23% of the floor and walls are contaminated with low levels of various hazardous constituents including PCBs, semivolatile organic compounds, and metals. Core sampling confirmed subsurface hazardous contaminants at low levels in areas where oils were used. A majority of the rooms contain removable lead, asbestos, and PCB contaminants. Asbestos sampling indicates significant concentrations in building materials, primarily roofing material and floor tile and mastic. The yard soil assessment indicates limited surface and subsurface areas of elevated activity primarily from ^{137}Cs, ^{134}Cs and ^{60}Co and hazardous constituent concentrations within background range.

3.5.2.1 *Projected Waste Volumes*

Table 3-3 reflects a projection of estimated waste volumes (disposal) based on the Hot Cell site and facility characterization results and the selected dismantlement alternative.

Table 3-3—Projected Waste Volumes

Form	Volume (ft.^{3})	Boxes	Drums	Casks	Bulk (ft.^{3})
Structure					
Clean	22,000				22,000
Rad	19,500	188			
Mixed	600		80		
Hazardous	300		40		
Equipment					
Clean (scrap)	100				100
Rad	2,100	19		5	
Mixed	120		16		
Soil					
Rad	8,300				8,300
mixed	2,300	22			
Paving					
Clean	13,400				13,400
Rad	2,300				2,300
Asbestos					
Rad	7,400	71			
Decon–Misc.					
Rad	1,300	12		2	
Mixed	200		27		
TOTAL	79,920	312	163	7	46,100

3.5.2.2 *Radionuclide Concentrations*

Based on HCF radiological surveillance records, past process knowledge, and recent site and facility characterization studies, it is known that existing levels of radioactive contamination of equipment and structural materials within the HCF environment vary over a wide range, dependent upon the specific Facility location at issue. It follows that the radioactive waste materials to be removed from the site in the course of HCF decommissioning will reflect this inherent variability in radioactivity levels.

From recent, documented analytical measurements, it may be stated that the relative radionuclide concentrations present as radioactive contamination in the HCF environment are consistent with the activity inventory normally associated with reactor-irradiated, neutron-activated materials, which have been allowed to decay for greater than five years, i.e., mixed activation product and mixed fission product isotopes with half-lives greater than five years.

3.5.2.3 Waste Forms and Classifications

Table 3-4 reflects 10 CFR 61 radioactive waste classifications anticipated for the waste forms identified in Table 3-3. A majority of the radioactive waste that will be packaged and shipped will be LSA material. A small portion of the radioactive waste will be Class C.

Table 3-4—Radioactive Waste Classifications

Form	Classification
Structure	A, C
Equipment	A, C
Soil	A
Asbestos	A
Decon–Misc.	A

3.5.2.4 Special Wastes

Decommissioning activities will not only result in radioactive wastes, but a series of other materials containing hazardous constituents regulated by the RCRA, the Toxic Substances Control Act (TSCA) and the CCR will also be generated. In addition, some materials generated may contain both radioactive and hazardous components and therefore will be managed as radioactive mixed wastes. Activities will be managed to insure that wastes will be segregated into discrete categories depending on their waste classifications. Satellite Accumulation Areas (SAAs) for the storage of 55-gallon or less quantities of hazardous or mixed wastes will be established at various locations inside and outside the HCF for segregation purposes. In addition, the HCF will continue to maintain the 90-day Waste Accumulation Area (WAA) outside the HCF for the temporary storage of 55-gallon drums of hazardous and mixed waste generated during decommissioning. Once a shipment of drums is accumulated, the drums will be transferred to the NWPF or other EPA and State permitted Treatment, Storage and Disposal Facility (TSDF).

<u>Mixed Wastes</u>—Resultant mixed wastes will consist of various types of radioactive construction debris contaminated with hazardous constituents. General categories of mixed wastes will include wastes such as radioactive construction debris contaminated with lead, hydrocarbons, PCBs, or solvents. Soils that are both radioactive and contain hydrocarbons, solvents, metals, or PCBs will be classified as low-level mixed wastes depending on the levels of hazardous constituents regulated under 40 CFR and CCR. Lead and brass that cannot be decontaminated will be classified as a D008 mixed waste in accordance with RCRA.

Further sampling and analysis will be required during decommissioning for suspected mixed waste locations to determine if the materials removed from the floor and subsurface will be regulated as Land Disposal Restricted (LDR) wastes, or if the hazardous levels can be exempted under the hazardous debris rule. Under this rule, and in accordance with the debris treatment standards (40 CFR 268.45), treated hazardous debris is excluded from the definition of hazardous (or mixed) waste provided that the debris is treated to the performance or design and operation standards by an extraction or destruction technology and the treated debris does not exhibit a characteristic of a hazardous waste. The excluded debris can be disposed in an industrial landfill (Subtitle D) rather than a RCRA-permitted landfill (Subtitle C). These exemptions apply to disposal of certain low-level radioactive mixed wastes if they meet the disposal site's waste acceptance criteria for hazardous debris.

Rooms that are considered to be moderately contaminated with hazardous constituents will be evaluated to ensure that the decontamination methods recommended for radioactive contaminant removal will also be feasible for hazardous contaminant removal. It is likely that materials removed from the walls of these areas will be analyzed to determine if it is classified as mixed waste and will need to be segregated from other wastes, wherever possible. In addition, decontamination may require that contaminated surfaces (such as the walls in Room 122 Manipulator Repair) be wiped clean with detergent solutions to remove surface contamination such as lead dust and oils.

Hazardous Wastes—Decommissioning activities will result in the generation of certain hazardous wastes including lead, hydraulic fluids and oils, PCB containing equipment and ballasts, mercury light tubes, batteries, and asbestos-containing building materials (ACBM). Although asbestos is not considered hazardous under the definitions in 40 CFR 261 of RCRA, the State of California considers ACBM to be hazardous. In addition, ACBM materials must be managed in accordance with the Toxic Substance Control Act with regard to removal, packaging, labeling, and disposal. For this reason, it is anticipated that a state-licensed asbestos contractor will be utilized to remove ACBM from the Facility prior to dismantlement.

Hazardous wastes that are free-released as nonradioactive from the HCF will be handled in accordance with CCR, RCRA, and GA's internal procedures for transfer to an on-site Waste Accumulation Area from which they are shipped and manifested in accordance with state and federal requirements to an off-site EPA-approved TSDF. The Hot Cell D&D Project maintains records on all transfers of hazardous wastes dispositioned in addition to tracking the manifest numbers associated with each shipment.

3.5.3 Interim Storage of Radioactive and Mixed Wastes on the GA Site

Radioactive waste will be staged in designated controlled areas in accordance with NRC 10 CFR 19 and 20 requirements, CAL-DHS 17 CCR requirements, and the requirements of GA Nuclear Material License and State of California Material License. Mixed wastes will be staged in designated controlled areas per EPA 40 CFR requirements, CAL-DHS 22 CCR, 10 CFR 19 and 20, and per local and state permits. Measures will be implemented through plans and procedures to control the spread of contamination, limit radiation levels, prevent unauthorized access, prevent unauthorized material removal, prevent tampering, and prevent weather damage.

3.5.3.1 Expected Quantities to be Stored

Radioactive and mixed waste material will be packaged for shipment per 10 CFR, 40 CFR, 49 CFR, 17 CCR, 22 CCR, and the designated Disposal Site Criteria and placed in permitted interim storage (staged) until shipped. The quantity of waste packages staged for shipment will be a function of waste generation and packaging rate, shipment preparation rate, shipment rate, and disposal site acceptance rate. The objective is to minimize the quantity of waste in interim storage (staged).

3.5.3.2 Expected Duration of Storage On-site

The duration of radioactive and mixed waste storage on-site will be a function of the waste generation and packaging rate, shipment preparation rate, shipment rate, and disposal site acceptance rate. The objective is to minimize the duration waste materials are in interim storage (staged) on-site. To meet this objective, regular shipments will be scheduled throughout the life of the Project to designated treatment, storage, and disposal facilities.

3.5.3.3 Location of Interim Storage Area(s)

Radiological and mixed waste materials will be staged in designated controlled areas to control the spread of contamination, limit radiation levels, prevent unauthorized access, prevent unauthorized removal, prevent tampering, and prevent weather damage. The designated controlled areas will be approved by WAs, Radiological Work Permits, and Hazardous Work Permits. Designated controlled areas include the GA HCF Yard, the NWPF Yard, and the Mixed Waste Management Facility Yard.

3.5.3.4 Radiation Levels at Access Points

Radioactive material storage areas will be contained inside posted restricted areas according to existing procedures as follows:

- Radiation areas will be posted with yellow and magenta rope or ribbon and placarded so that all areas/items will be contained inside an area whose boundaries will be no greater than 2 mR/hour at 30 cm from any part of the item(s) within the boundary.
- High Radiation Areas will be posted with yellow and magenta rope or ribbon and placarded, locked, barricaded or guarded so that all areas/items will be contained inside an area whose boundaries will be no greater than 100 mR/hour at 30 cm from any part of the item(s) within the boundary.
- Dose rates outside of restricted areas will be below those specified in 10 CFR 20 unless a clear written basis is provided.

3.5.3.5 Access Controls for Interim Storage Area(s)

Areas may be used for the storage of radioactive materials (with the exception of placarded vehicles prepared for shipment) that are not normally indicated as storage areas, or posted as such. These areas will be contained inside the posted Restricted Area and posted appropriately as a Radiation Area(s) or High Radiation Area(s). These Restricted Area access controls cover the Interim Storage Areas.

3.5.4 Mixed Waste Impacts

3.5.4.1 Impact of Mixed Wastes on Work Procedures

For decommissioning planning purposes, areas that are considered to be moderately contaminated with mixed waste constituents have been evaluated to ensure that the decommissioning methods recommended for radioactive contaminant removal will also be feasible for identified hazardous contaminant removal. Materials removed from the walls of mixed contaminant areas will be sampled and analyzed in accordance with EPA and CCR requirements to determine if the hazardous constituents are detected at regulated levels. In addition, decontamination methods proposed for certain areas will require that contaminated surfaces (such as the walls in Room 122 Manipulator Repair) be wiped clean with detergent solutions prior to scabbling to remove surface contamination such as lead dust and oils.

Procedures require that all materials that are classified as mixed wastes be segregated from non-mixed and radioactive-only wastes. Satellite Accumulation Areas (55-gallon drums) will be established in each designated work area for the accumulation of each waste stream generated. Drums will be labeled in accordance with RCRA and CCR requirements. Full drums will be moved to the 90-day storage WAA which have procedures already in place for waste management and inspection. Because GA has several procedures for the management of mixed wastes already in place as a result of characterization and waste management activities, it is not likely that mixed wastes will have a significant impact on the procedures to be utilized for decommissioning.

3.5.4.2 Impact of Mixed Wastes on Decommissioning Schedule

GA's current procedures and programs address waste management activities involving mixed wastes. Mixed wastes will be shipped to Hanford in accordance with the Hanford Solid Waste Acceptance Criteria as required by the Hot Cell D&D Project Low-Level Waste Certification Program or other designated TSD Facility. No impact on the decommissioning schedule is anticipated.

3.6 Fire Safety

Some activities may present potential fire hazards. Flame cutting, welding, and grinding are examples of such activities which are likely to occur on the Project. To reduce this potential hazard, a Project fire safety program will be implemented.

The Project fire safety program will consist of employee awareness, fire prevention, and fire protection. The goal of the program is to reduce the likelihood of fire and to minimize the effect of a fire should one occur. Employees will receive training and instruction in fire prevention and fire protection. The GA General Emergency Plan provides for effective control of emergency situations throughout the GA complex, including the Hot Cell Facility. It describes the actions to be taken in the event of fire. Decommissioning Project personnel will respond to fire (and to other emergencies) as required in the emergency plan.

The Hot Cell Emergency Response and Recovery Director (ERRD) is responsible for control of emergency responses to fire at the Hot Cell Facility, operation and maintenance of fire alarm and major fire suppression systems, and coordination of outside support.

Fire prevention on the Project will include utilization of good housekeeping practices, proper control and storage of flammables, use of cutting and burning permits, the presence of fire watches for hot work, fire safety instruction as part of the initial training, and weekly meeting programs. Fire safety inspections will be conducted regularly.

When using an ignition source, e.g., cutting, welding or grinding, a cutting or burning permit is required. The permit will be issued and controlled by GA Industrial Hygiene, in accordance with the National Fire Protection Association (NFPA) Code NFPA-1, Appendix H. Any hot work will require the presence of a dedicated fire watch with ready access to a fire extinguisher. Fire watchers will be trained in fire causes and types, fire extinguisher selection and use, and specific fire watch duties and responsibilities.

Fire suppression equipment will be inspected monthly and general fire safety walkdowns of the Facility will also be conducted monthly. Areas requiring cutting or burning permits will be inspected daily before the start of work.

Project personnel will sound the fire alarm by (1) word of mouth to co-workers in the area, (2) activating the fire alarm pullbox located at the front door of the Facility, and/or (3) telephoning Ext. 2000, the GA Emergency Telephone Number. The Project Emergency Response Team will provide initial response to any local fire alarm. That response is limited to evacuating the area and an attempt to confine or control the fire until off-site fire departments arrive. Emergency Response Team members will be first aid/CPR trained and trained in the use of fire suppression equipment.

Fire suppression systems available for use on the Project include portable equipment, a fire main capable of supplying water to fire hoses, and heat activated sprinklers and water and CO_2 fire suppression systems for the hot cells. The sprinklers are automatic and were part of the Facility fire protection system during operation. The CO_2 and cell water systems are manually activated. The fire extinguishers and fire hoses will be used as appropriate in controlling fire emergency situations.

The Hot Cell ERRD will take control of the scene and will determine if outside support is needed. If outside support is required, GA Security will notify the appropriate outside organization and provide assistance to them as necessary.

Progress on the Project may necessitate reconfiguration and even removal of some of the fire suppression equipment. In that event, temporary fire suppression will be made available. These activities will be performed at the latest possible point in the Project. Proposed system reconfiguration and/or removal will be reviewed by GA Facilities Engineering and appropriate outside organizations will be advised as necessary prior to performing the work. Whenever a portion of a fixed fire suppression system must be deactivated, replacement capability will comply with the requirements of the OSHA General Industry Standard for Portable Fire Extinguishers (29 CFR 1910.158), the OSHA Construction Industry Standard, Subpart E on Fire Protection (1926.150) and NFPA Standard No. 10, Standard for Portable Fire Extinguishers.

3.7 Project Quality Assurance

3.7.1 Quality Assurance Program

The GA QA program for this Project is described in a Quality Assurance Program Plan, and in the GA Corporate Quality Assurance Manual.

The GA Corporate QA program has been reviewed and accepted by the NRC Performance and Quality Evaluation Branch, Division of Reactor Inspection and Licensee Performance, Office of Nuclear Reactor Regulation, as well as by the NRC Transportation Branch, Division of Industrial and Medical Nuclear Safety, Office of Nuclear Material Safety and Safeguards.

The Quality Assurance Program Plan meets the applicable requirements of the following quality assurance regulations and standards:

- ASME NQA-1-1989, "Quality Assurance Program Requirements for Nuclear Facilities."
- Code of Federal Regulations Title 10, Part 71, "Packaging and Transportation of Radioactive Material," Subpart H, "Quality Assurance."

3.7.2 Audits, Inspections, and Management Review

Formal Quality Assurance audits will be performed annually in accordance with ASME NQA-1, *Quality Assurance Program Requirements for Nuclear Facilities,* to verify compliance with the Hot Cell quality assurance program and to determine its effectiveness. These audits will be performed in accordance with written checklists by personnel who do not have direct responsibility for performing the activities being audited. Audit reports will be distributed to responsible management, up to the Senior Vice President level. Follow-up action will be taken, where indicated.

Project technical assessments and QA surveillance will be performed frequently to assess compliance with procedures, including HP procedures. These assessments will be coordinated by the Hot Cell D&D Project QA Manager. The assessment team will consist of quality assurance and technical personnel. Assessments will be performed in accordance with a written plan. Assessment reports will be approved by the Project QA Manager and distributed to the Project Manager and other project personnel. Follow-up action will be taken, where indicated.

Inspections will be performed on procured and fabricated items to verify compliance with the controlling documents. Inspections will be conducted by qualified inspectors in accordance with inspection plans approved by a Quality Engineer. Discrepancies will be documented on a Nonconformance Report, which will be dispositioned by a Quality Engineer or a Material Review Board, as appropriate.

Additional assessments or management reviews will be performed when deemed appropriate by the Project Manager. Such assessments may include Readiness Reviews prior to start of a new task, or Management Assessments.

Methods to be employed for reviewing, analyzing, and auditing data are discussed in Section 4.5.

4. PLANNED FINAL RADIATION SURVEY

The final release of the HCF construction materials, equipment, and site will be performed in accordance with specific release criteria for surface contamination, soil, and other bulk materials specified in this Plan. The criteria presented in this Plan were developed using established criteria from GA's licenses that affect the HCF. The intended course of action for HCF decommissioning, based upon consideration of site and facility radiological characterization results, is to strive to decontaminate structural materials to the extent practicable in balance with radioactive waste minimization considerations, and dismantle the HCF while releasing materials that are below release criteria, and packaging for burial those materials that cannot reasonably be decontaminated. As such, the Final Release Survey Plan (and subsequent Final Survey Report that is submitted to the State and NRC) discussed in this section deals exclusively with release of the HCFA property to unrestricted use following dismantlement of the structures and concrete and asphalt surfaces. This section will, however, also discuss the survey methods and release criteria that will apply to release decisions for structural materials and Facility equipment.

4.1 Description of Final Radiation Survey Plan

The purpose of the Final Radiation Survey is to demonstrate that the radiological condition of the HCFA are at or below established release criteria in anticipation of State and NRC approval of license amendments removing the Facility as a location to handle licensed materials and remove restrictions from use of the Facility or property and permit its unrestricted use. The proposed decommissioning approach to the HCF described in this Plan involves the dismantlement of the Facility in a piecemeal manner until the Facility has been torn down and only the site property remains. The Final Release Survey (and report) will deal with release of the HCFA to unrestricted use.

During dismantlement of the HCF, GA, with the support of the DOE, will be systematically decontaminating and removing equipment wherever reasonable for free release to disposal at landfills or use elsewhere, to the greatest extent practicable. While the Final Release Survey deals solely with release of the GA HCFA, a discussion of the criteria that will be applied to release determinations for structural materials and Facility equipment during Facility dismantlement is also included. GA has developed its Final Release Survey Plan using the guidance provided in NUREG/CR-5849 (draft) (Ref. 4-1).

4.1.1 Means for Ensuring that all Equipment, Systems, Structures, and Site are Included in the Survey Plan

As discussed above, the Final Release Survey will deal principally with the HCFA property itself. The need to ensure that all materials removed from the Facility conform to specific release criteria is not diminished by this approach, however. In the Engineering Plan presented in Section 2.1.1 to this Plan, the systematic approach to dismantlement of Facility equipment is presented. Systems will only be removed from service when it can be demonstrated that they no longer are needed to provide important safety or effluent/ exposure control functions, or when their removal has been adequately compensated for by other means. Every item that is to be removed from the HCF will be evaluated for ability to decontaminate and demonstrate satisfaction of release criteria. When it is impractical or not possible to satisfy release criteria (or conclusively demonstrate that they have been met), the item will be treated as radioactive waste. The systematic approach to Facility dismantlement will inherently ensure that each and every component or structure in the HCF is specifically evaluated for release before beginning the Final Release Survey. The Final Release Survey will treat the balance of the HCFA as "affected" and ensure 100% scans and systematic soil sampling prior to requesting release of the property for unrestricted use.

4.1.2 Means for Ensuring that Sufficient Data is Included to Achieve Statistical Goals

GA has developed the HCF Final Release Survey Plan in conformance with the guidance presented in NUREG/CR-5849. By adhering to this guidance, the Hot Cell D&D Project will satisfy the NRC recommended statistical goals.

4.2 Background Survey Results

The Final Release Survey Guideline values for residual activity are generally taken to be levels above the naturally occurring background radiation. The final release measurements will consist of a combination of general area radiation values and samples of media (principally soils). In addition, a detailed micro-R survey of the site will be performed and compared to background measurements.

Background radiation as encountered at any location includes contributions due to both natural radiation sources and manmade sources. Natural radiation sources include terrestrial radioactivity due to naturally occurring radioisotopes in soils and construction media, airborne radioactivity (principally radon and radon progeny) from the radioactive decay of certain of these naturally occurring radioisotopes, and cosmic radiation from high speed particle interactions in the earth's atmosphere. Manmade background radiation as it would impact the Final Release Survey would primarily consist of atmospheric fall-out of fission products due to weapons testing and reactor accidents and any contribution that might exist as a result of other licensees' activities.

The general area background radiation as would be measured with the micro-R meter is influenced by a number of factors, principally the naturally occurring radioactivity in soils and other nearby materials, radon and radon progeny concentrations in the air, and extent of cosmic radiation (which varies with elevation). Due to the number of influences, the natural background varies appreciably from location to location, day-to-day (even time of day) and season-to-season as related to changing weather conditions and materials in the surroundings. Under ideal conditions, it would be desirable to have available pre-construction and pre-operational general area background radiation measurements to use as a reference during Final Release Survey; for the case of the HCF, pre-operational micro-R measurements are not available due to the age of the Facility. The Final Release Survey will include the establishment of background area radiation levels according to the recommendations of NUREG/CR-5849 in the general time frame immediately preceding Final Release Survey.

The site and facility characterization study included measurements to establish background radioactivity in soils, concrete, and asphalt that were considered representative of those that would be encountered in the Final Release Survey. The principal constituents of global fallout, ^{137}Cs and ^{90}Sr, which are found principally as a result of atmospheric weapons testing and reactor accidents are also the principal contaminants at the HCF, as well as the principal contaminant in construction media and soils. The concentration of these isotopes in the upper atmosphere has been declining over the past two decades, and is also resulting in a gradual decline of the concentration of these isotopes in soils and new building materials. ^{137}Cs and ^{90}Sr have been seen to be persistent in the upper 15 cm (6 in.) of soil with concentrations decreasing exponentially with depth beyond this depth (Ref. 4-2).

Release criteria that have been established for this Hot Cell D&D Project were established as an increment in excess of background values. Hence, it was critical to carefully establish the natural background values of various isotopes that could be of concern in gamma spectrometry evaluations of soils and construction media as well as those which affect the background external radiation values. In order to study these concentrations in soils, a careful review of the surrounding region was done to identify locations that held a good potential to (1) possess similar soil characteristics so that radionuclide retention behavior could be considered similar, and (2) be undisturbed by recent construction activity that would disrupt the upper 15 cm (6 in.) of soil. The HCF benefited from proximity to state and county parks and preserves that had limited development and hence, limited attendant soil disturbance. The sites that were selected are shown in Figure 4-1. Similarly, the background media study attempted to identify locations where concrete or asphalt was believed to be older construction material that may be other than contemporary. Asphalt and concrete background media were collected on unaffected portions of the GA property. NUREG/CR-5849 recommends that background media measurements consist of at least ten samples; this recommendation was followed during the background media study.

The background media study was composed of seventeen (17) surface soil samples, ten (10) asphalt samples, and ten (10) concrete samples. The results of background measurements are summarized in Table 4-1. Other radionuclides (not listed) in the Hot Cell waste stream were not detected in background samples. These data may be supplemented by additional data or measurements prior to conducting the Final Release Survey.

Table 4-1—Typical Background Media Results

Media Type	^{137}Cs (pCi/g)	^{238}U (pCi/g)	^{232}Th (pCi/g)
Soil	0.21 ± .20	1.54 ± 0.76	1.97 ± 0.82
Asphalt	Not Detected	5.68 ± 2.96	5.96 ± 1.36
Concrete	Not Detected		4.13 ± 1.44

4.3 Release Criteria—Residual Radiation and Contamination Levels

This section provides bases and specific criteria for release of materials and equipment, Facility structures, and the hot cell property. The structure will be dismantled piecemeal and either disposed of as radioactive waste or released to unrestricted use according to the extent of contamination and cost-effectiveness of decontamination. The Final Release Survey will principally be for the property (i.e., soils) itself. The approach to survey is in accordance with the guidance provided in NUREG/CR-5849.

4.3.1 Equipment Release Criteria

All materials leaving the HCF Restricted Area will be surveyed to ensure that licensed materials are not inadvertently released from the Facility. HCF and GA HP procedures will be adhered to in performing these evaluations. These evaluations will include the following types of evaluations.

<u>Materials and Equipment</u>—Direct frisk (β–γ) with a portable detector and indirect survey for smearable activity evaluated with portable or fixed detector. In any situations where process knowledge would suggest a potential for alpha activity, survey with alpha detection instruments or counters will also be employed. The HCF routinely checks a portion (designated by HP Management) of all smears that are in excess of 10,000 dpm/100 cm^2 β–γ for alpha as an additional conservative measure despite the remote possibility of positive result. Materials will be released in accordance with GA and Project HP procedures in accordance with criteria specified in GA's NRC (SNM-696) and State of California (0145-80) licenses. Those criteria are summarized in Table 4-2. Release criteria for fixed and smearable residual radioactivity would be based upon the relative concentrations of isotopes on the material for beta-gamma emitters if more than one category of nuclides for beta-gamma emitters from Table 4-2 would apply.

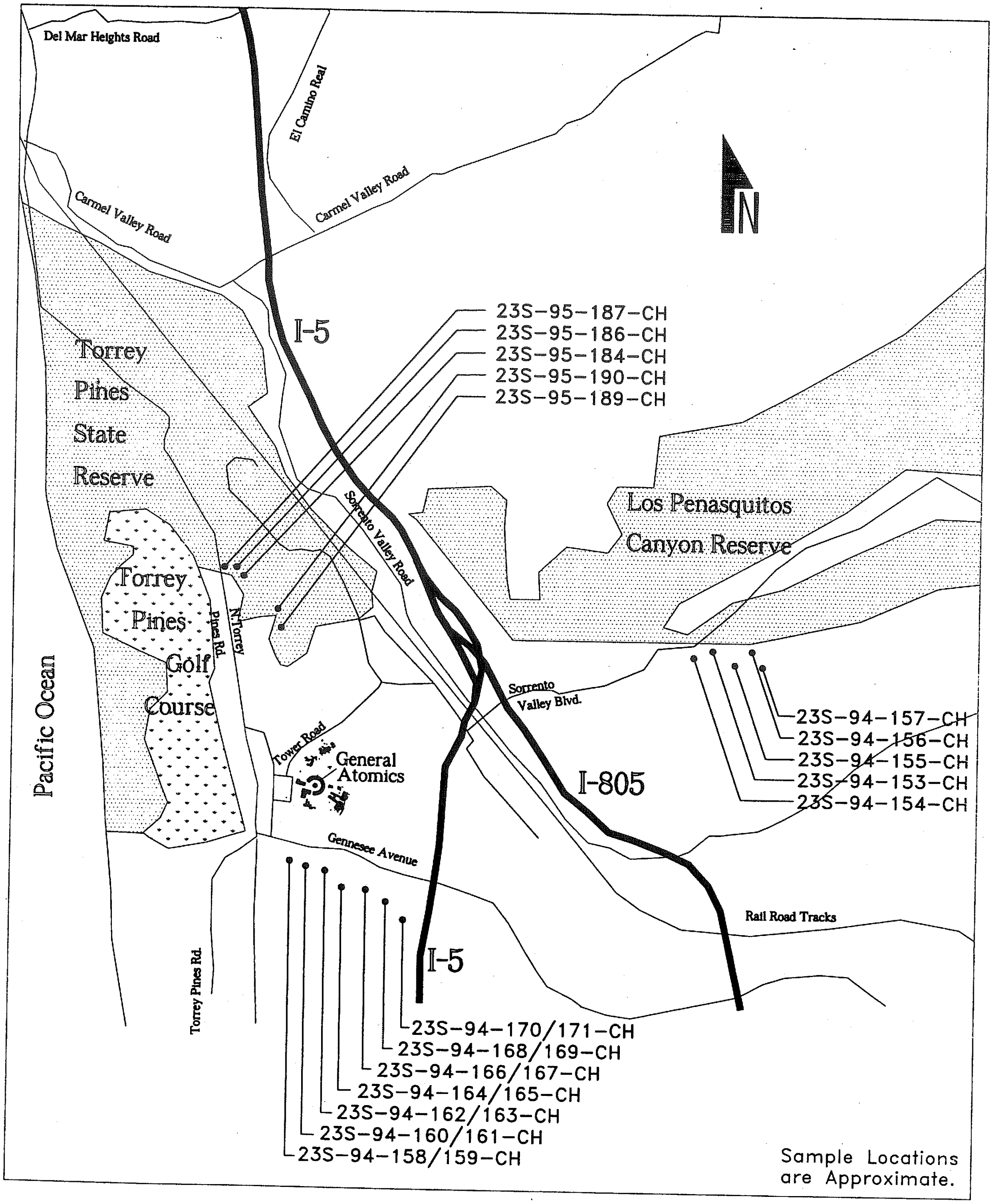


Figure 4-1—Background Soil Sample Locations

Table 4-2—Acceptable Surface Contamination Levels

Nuclides[a]	(dpm/100 cm²)[b,f]		
	Average[c]	Maximum[d,g]	Removable[e]
U-nat, ^{235}U, ^{238}U, & associated decay products	5,000	15,000	1,000
Transuranics, ^{226}Ra, ^{228}Ra, ^{230}Th, ^{228}Th, ^{231}Pa, ^{227}Ac, ^{125}I, ^{129}I	100	300	20
Th nat, ^{232}Th, ^{90}Sr, ^{223}Ra, ^{224}Ra, ^{232}U, ^{126}I, ^{133}I, ^{131}I	1,000	3,000	200
Beta/gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except ^{90}Sr and other noted above.	5,000	15,000	1,000

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 material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, an geometric factors associated with the instrumentation.

c Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of 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 100 cm².

e The amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with dry filter (e.g., smear) or soft absorbent paper (e.g., masslin), 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 area is determined, then pertinent levels should be reduced proportionally and the entire surface should be wiped.

f The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

g HCF HP Manager's approval is required before material may be released from the HCF if fixed contamination levels are in excess of the value stated in the "average" column, even if below the "maximum" column.

In evaluation of equipment and materials for fixed or smearable licensed materials, items painted with other than original manufacturer's paint will not be released unless clear process knowledge demonstrates that the paint was applied to a clean, nonradioactive surface prior to use in the Restricted Area or approval from the Manager, HCF HP, has been obtained and an acceptable survey course for this situation has been approved. If the potential exists for contamination on inaccessible surfaces, the equipment will be assumed to be internally contaminated unless (1) the equipment is dismantled allowing access for surveys, (2) appropriate tool or pipe monitors with acceptable detection capabilities are utilized that would provide sufficient confidence that no licensed materials were present, or (3) it may readily be concluded that surveys from accessible areas are representative of the inaccessible surfaces (i.e., surveying the internal surface from both ends of a straight pipe from a nonradioactive process system with cotton swabs would be representative of the inaccessible areas).

Bulk Materials or Bulk Liquids—Analysis of representative sample(s) with high resolution gamma spectrometry system. Bulk materials (not to include concrete or asphalt rubble which is addressed separately below) or bulk liquids will be released if no discernible facility-related activity is detected. Minimum Detectable Activities for bulk materials of less than or equal to 10% of the established soil target concentrations (see Table 4-3) will be met for principal HCF isotopes in release evaluations.

4.3.2 *Facility Release Criteria*

The proposed decommissioning alternative that has been presented in this Decommissioning Plan involves the piecemeal dismantlement of the Facility. The results of the Site and Facility Radiological Characterization have indicated areas that show promise for being directly releasable without need for decontamination, and other areas where it may be cost effective to perform decontamination of construction materials in order to achieve unrestricted release of significant portions of the construction materials to reduce radioactive waste volumes. Building service systems will only be removed from operation when it can be demonstrated that they are no longer needed to provide important safety or effluent/exposure control functions, or when their removal has been adequately compensated for by other means. Some areas of the Facility could not be directly evaluated during radiological characterization due to inaccessibility, hence every item or piece of the Facility that is to be dismantled will be evaluated for ability to decontaminate and ability to demonstrate satisfaction of release criteria in the same manner discussed in Section 4.3.1. When it is impractical or not possible to satisfy release criteria (or conclusively demonstrate that they have been met), the item will be treated as radioactive waste.

As was discussed in the previous section (Section 4.3.1), GA will utilize previously established release criteria as provided in Table 4-2 as surface contamination release criteria for this Hot Cell D&D Project. Removable surface contamination will be eliminated where possible by wiping or other method, but will not exceed the limits specified in Table 4-2. Release criteria for fixed and smearable residual radioactivity for beta-gamma emitters would be based upon the relative concentrations of isotopes on the material and their respective release criteria if more than one category of nuclide for beta-gamma emitters applies from Table 4-2.

GA may apply the release criteria in Table 4-3 to evaluations of representative samples of asphalt, concrete, or other similar construction media that have been reduced to rubble. Concrete slabs may be released based upon demonstration of conformance to Table 4-2 or evaluation of representative samples by gamma spectrometry showing results below the criteria in Table 4-3.

4.3.3 Soil Release Criteria

Previous decommissioning projects have employed NRC guidance for residual soil contamination limits of 8 pCi/g ^{60}Co, 15 pCi/g ^{137}Cs, 1,800 pCi/g ^{90}Sr, and 30 pCi/g enriched uranium. These release criteria were based upon external exposure rates for ^{60}Co and ^{137}Cs, or internal dose for ^{90}Sr and enriched uranium. Radiological characterization results (see Section **Error! Reference source not found.** for details) have demonstrated that the isotopes that are expected to be encountered are not entirely addressed by those for which previous guidance already exists. In an effort to establish release criteria that would apply to the subject Decommissioning Project, GA utilized the DOE computer code RESRAD, version 5.18, for external exposure limits, employing the same assumptions that had been utilized by NRC staff in development of the aforementioned criteria. For internal exposure criteria, GA utilized data from Volume II of NUREG/CR-0150, an alpha quality factor of 20, and endpoints of 20 mrem lung dose or 60 mrem bone dose, whichever was most restrictive. A summary of the proposed soil release criteria is provided in Table 4-3.

If a location is determined to exceed release criteria, remediation will only be required if the soil activity exceeds the release criteria by more than a factor of $(100/A)^{1/2}$ where A is the area of residual activity in m^2 and provided that the activity level at no location is greater than three times the release criteria. If any location within a grid requires remediation in order to support a decision in favor of release to unrestricted use, the entire affected grid will be scanned again with the hand-held detector and re-sampled in accordance with the above methodology after completion of remediation efforts.

Table 4-3—Soil and Concrete/Asphalt Rubble Release Criteria[1]

Isotope	Release Criteria Based upon External Exposure Limitations (pCi/g)	Release Criteria Based upon Internal Exposure Limitations (pCi/g)
^{60}Co	8[2]	
^{134}Cs	10	
^{137}Cs	15[2]	
^{152}Eu	11	
^{154}Eu	10	
^{155}Eu	635	
^{94}Nb	7.5	
^{125}Sb	37	
^{90}Sr		1800[2]
^{238}Pu		26[4]
^{239}Pu		27[4]
^{240}Pu		27[4]
^{241}Pu		4326[4]
^{242}Pu		28[4]
^{244}Pu		28[4]
^{241}Am		25[4]
Natural Uranium		35[3]
Enriched Uranium (^{234}U & ^{235}U)		30[3]
Thorium (^{232}Th & ^{228}Th)		10[3]

1 The release criteria shown in this table without annotation by footnotes 2, 3, or 4 were calculated by the licensee using RESRAD version 5.18 adhering to the same assumptions that were provided in the correspondence listed in note 2, below. This corresponds to conservative calculation of the homogenous concentration of an isotope in the soil that by itself would give approximately 10 µR/hr external exposure rate above background for the maximum year of exposure. It is the licensee's intent to apply criteria from this table to concrete, asphalt, or similar construction media materials that have been ground to a coarse rubble.

2 These release criteria are based upon past precedent through NRC and State of California approved release limits for the GA site. See Correspondence K. E. Asmussen to W. T. Crow, dated October 1, 1985, correspondence identification 696-8023, Subject: "Docket 70-734: Plan for Obtaining Release of Certain Areas to Unrestricted Use."

3 These release criteria are based upon past precedent established by NRC through NRC Policy Issue SECY-81-576, dated October 5, 1981, Subject: "Disposal or on-site storage of residual thorium or uranium (either as natural ores or without daughters present) from past operations."

4 Numbers were established using the most limiting of lung dose (20 mrem/yr) or bone dose (60 mrem/yr) using Dose Conversion Factors from NUREG/CR-0150, Volume 2, with an alpha quality factor of 20, where applicable, lung mass of 580 grams, and AMAD of 1.0.

In situations where more than one isotope is detected in the soil, determination of conformance to release criteria would be made according to the following method for the mixture:

$$\frac{C_1}{G_1}+\frac{C_2}{G_2}+\ldots+\frac{C_n}{G_n}\leq 1$$

where

C_1, C_2, ... n is the concentration of nuclide 1, 2, ... n in the soil above background values

G_1, G_2, ... n is the release criteria of nuclide 1, 2, ... n

Table 4-3 shows release criteria based upon the most limiting pathway for nuclides that have been detected in soils or in the Facility during the radiological characterization (or those that conceivably could be encountered). If additional nuclides are encountered during the remediation or Final Release Survey activities, their respective release criteria would be determined in the same manner as the values provided above.

The residual contamination in the Facility soils and asphalt were characterized in detail during site and facility radiological characterization using the methodology specified in NUREG/CR-5849 and a 10 m^2 grid. The results of this characterization are summarized in Table 4-4. Correlation of sample locations (e.g., A-5) to the site map may be determined from review of Figure 4-2, which has a horizontal (with respect to the page) alphabetic grid designator system (A-G) and a vertical numeric grid designator (1-10). A sample location of A-5 would represent a sample collected at the nodal intersection of grid lines A and 5. Other sample locations were selected based upon process knowledge of activities conducted or incidents that may have impacted the distribution of radiological contaminants. The highest activities at a specific sampling location were generally encountered in surface soils, with the exception of a single location that was denoted as "Drainage Path from Liquid Waste Tanks Area S06A," where the 3-9 in. sample was approximately five times greater concentration than the surface sample for the same location. This particular location is believed to have been biased against surface activity peaking due to deposition of silts and soil disturbance by runoff control measures that had been employed to prevent inadvertent release of activity from the Facility yard. The radiological characterization results showed a general area that was more significantly affected by residual radioactivity in the soil than most of the yard, and is the most likely area to review for soil remediation efforts. This area is depicted in Figure 2-4. Soil concentrations discovered underneath the Facility during core sampling were generally much lower than the more elevated samples taken in the general yard area, and are not expected to require extensive remediation efforts. In general, soil concentrations in the majority of the yard will require only a moderate amount of soil remediation involving surface soils only.

Table 4-4—Summary of Soils, Concrete and Asphalt Analytical Results, Radiological

Sample Location	Depth Interval cm (in)	^{137}Cs (pCi/g)	^{134}Cs (pCi/g)	^{60}Co (pCi/g)	Sample ID #	Sum C_n/G_n
A-4 (#)	0.0-5.0(0.0-2.0)	1.8	< LLD	< LLD	23BL-94-022-CH	0.120
	5.0-30.0(2.0-12.0)	< LLD	< LLD	< LLD	23S-94-087-CH	0.000
	60.0-87.5(24.0-35.0)	< LLD	< LLD	< LLD	23S-94-088-CH	0.000
A-5 (##)	0.0-7.5(0.0-3.0)	< LLD	< LLD	< LLD	23BL-94-013-CH	0.000
	7.5-27.5(3.0-11.0)	4.6	< LLD	0.56	23S-94-044-CH	0.377
A-6 (#)	0.0-7.5(0.0-3.0)	1.52	< LLD	< LLD	23BL-94-012-CH	0.101
	7.5-32.5 (3.0-13.0)	0.62	< LLD	< LLD	23S-94-040-CH	0.041
	32.5-40.0 (13.0-16.0)	< LLD	< LLD	< LLD	23S-94-039-CH	0.000
A-7 (#)	0.0-6.2 (0.0-2.5)	0.34	< LLD	< LLD	23BL-94-014-CH	0.023
	6.2-23.8(2.5-9.5)	0.37	< LLD	0.25	23S-94-043-CH	0.056
B-1 (#)	0.0-15.0(0.0-6.0)	< LLD	< LLD	< LLD	23C-94-063-CH	0.000
	15.0-42.5(6.0-17.0)	< LLD	< LLD	0.29	23S-94-077-CH	0.036
B-2 (##)	1.2-23.8(0.5-9.5)	0.68	< LLD	0.53	23S-94-085-CH	0.112
	23.8-35.0(9.5-14.0)	0.22	< LLD	< LLD	23S-94-086-CH	0.015
B-3	0.0-7.5(0.0-3.0)	< LLD	< LLD	< LLD	23BL-94-021-CH	0.000
	7.5-23.8(3.0-9.5)	< LLD	< LLD	< LLD	23S-94-078-CH	0.000
B-4 (##)	0.0-15.0(0.0-6.0)	0.22	< LLD	1.26	23S-94-079-CH	0.172
	15.0-30.0(6.0-12.0)	< LLD	< LLD	< LLD	23S-94-080-CH	0.000
B-6	0.0-5.0(0.0-2.0)	< LLD	< LLD	< LLD	23BL-94-011-CH	0.000
	5.0-22.5(2.0-9.0)	< LLD	< LLD	< LLD	23S-94-038-CH	0.000
B-7 (##)	0.0-3.8(0.0-1.5)	2.97	< LLD	1.44	23BL-94-015-CH	0.378
	5.0-25.0(2.0-10.0)	0.77	< LLD	0.57	23S-94-041-CH	0.123
B-8 (###)	0.0-12.5(0.0-5.0)	38.3	0.24	21	23S-94-075-CH	5.202
	12.5-30.0(5.0-12.0)	0.43	< LLD	< LLD	23S-94-076-CH	0.029
B-9	0.0-12.5(0.0-5.0)	< LLD	< LLD	< LLD	23BL-94-020-CH	0.000
	12.5-30.0(5.0-12.0)	< LLD	< LLD	< LLD	23S-94-074-CH	0.000
C-1 (##)	2.5-13.8(1.0-5.5)	0.81	< LLD	1.75	23S-94-081-CH	0.273
	13.8-30.0(5.5-12.0)	0.07	< LLD	< LLD	23S-94-082-CH	0.005
C-5 (##)	0.0-3.8(0.0-1.5)	2.92	< LLD	0.92	23BL-94-017-CH	0.310
	3.8-17.5(1.5-7.0)	3.47	< LLD	4.03	23S-94-042-CH	0.735
C-6	0.0-13.8(0.0-5.5)	0.62	< LLD	< LLD	23BL-94-016-CH	0.041
	13.8-28.2(5.5-11.5)	0.38	< LLD	< LLD	23S-94-037-CH	0.025
C-7	N/A - Not Sampled					
C-8 (#)	0.0-15.0(0.0-6.0)	0.46	< LLD	< LLD	23S-94-070-CH	0.031
	21.2-42.5(8.5-17.0)	< LLD	< LLD	< LLD	23S-94-071-CH	0.000
C-9	0.0-12.5(0.0-5.0)	0.28	< LLD	< LLD	23S-94-068-CH	0.019
	15.0-40.0(6.0-16.0)	< LLD	< LLD	< LLD	23S-94-069-CH	0.000
C-10	0.0-20.0(0.0-8.0)	0.17	< LLD	< LLD	23S-94-066-CH	0.011
	20.0-40.0(8.0-16.0)	< LLD	< LLD	< LLD	23S-94-067-CH	0.000
D-1 (#)	1.2-18.8(0.5-7.5)	0.67	< LLD	< LLD	23S-94-083-CH	0.045
	18.8-45.0(7.5-18.0)	0.26	< LLD	< LLD	23S-94-084-CH	0.017
D-5	N/A - Not Sampled					
D-6 (##)	0.0-7.5(0.0-3.0)	8.4	< LLD	< LLD	23BL-94-009-CH	0.560
	7.5-20.0(3.0-8.0)	2.22	< LLD	< LLD	23S-94-036-CH	0.148
D-7 (###)	0.0-13.8(0.0-5.5)	4.53	< LLD	0.44	23S-94-072-CH	0.357
	15.0-35.0(6.0-14.0)	0.12	< LLD	< LLD	23S-94-073-CH	0.008

Table 4-4—Summary of Soils, Concrete and Asphalt Analytical Results, Radiological

Sample Location	Depth Interval cm (in)	^{137}Cs (pCi/g)	^{134}Cs (pCi/g)	^{60}Co (pCi/g)	Sample ID #	Sum C_i/G_i
D-8 (#)	0.0-5.0(0.0-2.0)	2.71	< LLD	0.52	23BL-94-019-CH	0.246
	5.0-21.2(2.0-8.5)	0.11	< LLD	0.27	23S-94-062-CH	0.041
D-9	0.0-5.0(0.0-2.0)	7.11	0.65	< LLD	23BL-94-018-CH	0.539
	5.0-17.5(2.0-7.0)	0.23	< LLD	< LLD	23S-94-061-CH	0.015
D-10	0.0-5.0(0.0-2.0)	< LLD	< LLD	< LLD	23S-94-027-CH	0.000
	10.0-30.0(4.0-12.0)	< LLD	< LLD	< LLD	23S-94-028-CH	0.000
E-1 (##)	0.0-16.2(0.0-6.5)	< LLD	< LLD	< LLD	23BL-94-003-CH	0.000
	16.2-32.5(6.5-13.0)	1.89	< LLD	1.47	23S-94-029-CH	0.310
E-2 (#)	0.0-13.8(0.0-5.5)	< LLD	< LLD	< LLD	23BL-94-001-CH	0.000
	13.8-30.0(5.5-12.0)	0.79	< LLD	0.22	23S-94-006-CH	0.080
	52.5-65.0(21.0-26.0)	< LLD	< LLD	< LLD	23S-94-007-CH	0.000
	65.0-72.5(26.0-29.0)	< LLD	< LLD	< LLD	23S-94-008-CH	0.000
	75.0-82.5(30.0-33.0)	< LLD	< LLD	< LLD	23S-94-009-CH	0.000
	90.0-100.0(36.0-40.0)	< LLD	< LLD	< LLD	23S-94-010-CH	0.000
E-3	0.0-13.8(0.0-5.5)	< LLD	< LLD	< LLD	23BL-94-006-CH	0.000
	13.8-25.0(5.5-10.0)	0.2	< LLD	< LLD	23S-94-034-CH	0.013
E-4	0.0-11.2(0.0-4.5)	< LLD	< LLD	0.76	23C-94-055-CH	0.095
	13.8-35.0(5.5-14.0)	< LLD	< LLD	< LLD	23S-94-032-CH	0.000
E-5	0.0-7.5(0.0-3.0)	2.28	0.28	< LLD	23BL-94-008-CH	0.180
	11.2-37.5(4.5-15.0)	< LLD	< LLD	< LLD	23S-94-033-CH	0.000
E-6	0.0-15.0(0.0-6.0)	0.54	< LLD	< LLD	23C-94-056-CH	0.036
	0.0-30.0(0.0-12.0)	< LLD	< LLD	< LLD	23C-94-091-CH	0.000
	30.0-55.0(12.0-22.0)	< LLD	< LLD	< LLD	23C-94-092-CH	0.000
	55.0-87.5(22.0-35.0)	< LLD	< LLD	< LLD	23S-94-099-CH	0.000
E-7	0.0-7.5(0.0-3.0)	1.58	< LLD	< LLD	23BL-94-007-CH	0.105
	7.5-27.5(3.0-11.0)	0.21	< LLD	< LLD	23S-94-035-CH	0.014
E-8	N/A - Not Sampled					
E-9	0.0-5.0(0.0-2.0)	0.19	< LLD	< LLD	23S-94-023-CH	0.013
	22.5-37.5(9.0-15.0)	< LLD	< LLD	< LLD	23S-94-024-CH	0.000
E-10 (#)	0.0-5.0(0.0-2.0)	0.64	< LLD	< LLD	23S-94-025-CH	0.043
	10.0-30.0(4.0-12.0)	< LLD	< LLD	< LLD	23S-94-026-CH	0.000
F-2	0.0-11.2(0.0-4.5)	0.65	< LLD	< LLD	23BL-94-004-CH	0.043
	11.2-30.0(4.5-12.0)	< LLD	< LLD	< LLD	23S-94-030-CH	0.000
F-3	0.0-8.8(0.0-3.5)	< LLD	< LLD	< LLD	23BL-94-005-CH	0.000
	8.8-37.5(3.5-15.0)	< LLD	< LLD	< LLD	23S-94-031-CH	0.000
F-4 (#)	0.0-5.0(0.0-2.0)	0.6	< LLD	0.19	23S-94-011-CH	0.064
	5.0-15.0(2.0-6.0)	< LLD	< LLD	< LLD	23S-94-012-CH	0.000
F-5 (##)	0.0-5.0(0.0-2.0)	2.1	< LLD	1.5	23S-94-013-CH	0.327
	15.0-22.5(6.0-9.0)	< LLD	< LLD	< LLD	23S-94-014-CH	0.000
F-6 (##)	0.0-5.0(0.0-2.0)	2.9	< LLD	2.4	23S-94-015-CH	0.493
	10.0-22.5(4.0-9.0)	< LLD	< LLD	< LLD	23S-94-016-CH	0.000
F-7 (##)	0.0-5.0(0.0-2.0)	1.1	< LLD	0.35	23S-94-017-CH	0.117
	5.0-17.5(2.0-7.0)	0.6	< LLD	0.12	23S-94-018-CH	0.055
F-8 (#)	0.0-5.0(0.0-2.0)	0.7	< LLD	0.25	23S-94-019-CH	0.078
	7.5-27.5(3.0-11.0)	0.08	< LLD	< LLD	23S-94-020-CH	0.005
F-9 (#)	0.0-5.0(0.0-2.0)	0.45	< LLD	< LLD	23S-94-021-CH	0.030
	22.5-30.0(9.0-12.0)	< LLD	< LLD	< LLD	23S-94-022-CH	0.000

Table 4-4—Summary of Soils, Concrete and Asphalt Analytical Results, Radiological

Sample Location	Depth Interval cm (in)	^{137}Cs (pCi/g)	^{134}Cs (pCi/g)	^{60}Co (pCi/g)	Sample ID #	Sum C_n/G_n
F-10 (##)	0.0-15.0(0.0-6.0)	2.1	< LLD	0.58	23S-94-001-CH	0.212
	15.0-30.0(6.0-12.0)	0.07	< LLD	< LLD	23S-94-002-CH	0.005
	30.0-45.0(12.0-18.0)	0.47	< LLD	< LLD	23S-94-003-CH	0.031
	75.0-90.0(30.0-36.0)	< LLD	< LLD	< LLD	23S-94-004-CH	0.000
Judgement Locations						
General Trestle Area	0.0-10.0(0.0-4.0)	217	158	9.38	23BL-94-023-CH	31.439
R-11A (###)	10.0-22.5(4.0-9.0)	28.4	6.71	4.62	23S-94-089-CH	3.142
	45.0-60.0(18.0-24.0)	0.69	0.26	< LLD	23S-94-090-CH	0.072
	65.0-90.0(26.0-36.0)	< LLD	< LLD	< LLD	23S-94-091-CH	0.000
	90.0-105.0(36.0-42.0)	< LLD	< LLD	< LLD	23S-94-092-CH	0.000
General Trestle Area	0.0-6.2(0.0-2.5)	41.2	< LLD	5.38	23BL-94-024-CH	3.419
R-11B (###)	6.2-18.8(2.5-7.5)	25.8	0.66	9.9	23S-94-093-CH	3.023
	41.2-50.0(16.5-20.0)	0.84	< LLD	0.19	23S-94-094-CH	0.080
	67.5-80.0(27.0-32.0)	0.79	< LLD	0.2	23S-94-095-CH	0.078
General Trestle Area	0.0-5.0(0.0-2.0)	163	6.56	23.2	23BL-94-025-CH	14.423
R-11C (##)	6.2-22.5(2.5-9.0)	5.88	0.39	1.18	23S-94-096-CH	0.578
	60.0-67.5(24.0-27.0)	0.23	< LLD	< LLD	23S-94-097-CH	0.015
	75.0-82.5(30.0-33.0)	0.18	< LLD	< LLD	23S-94-098-CH	0.012
Liquid Waste Tanks	0.0-17.5(0.0-7.0)	84	2.49	18.4	23S-94-055-CH	8.149
Area R13 (###)	35.0-50.0(14.0-20.0)	7.81	0.88	2.58	23S-94-056-CH	0.931
	55.0-97.5(22.0-39.0)	0.58	< LLD	0.16	23S-94-057-CH	0.059
Liquid Waste Tanks	0.0-20.0(0.0-8.0)	126.8	< LLD	107.3	23S-94-058-CH	21.866
Area R16 (###)	45.0-57.5(18.0-23.0)	0.78	< LLD	1.16	23S-94-059-CH	0.197
	65.0-100.0(26.0-40.0)	0.7	< LLD	0.92	23S-94-060-CH	0.162
Liquid Waste Tanks	0.0-17.5(0.0-7.0)	110.4	1.32	10.9	23S-94-063-CH	8.854
Area R35 (###)	35.0-60.0(14.0-24.0)	2.36	< LLD	0.6	23S-94-064-CH	0.232
	62.5-100.0(25.0-40.0)	0.31	< LLD	< LLD	23S-94-065-CH	0.021
Drainage Path from	0.0-7.5(0.0-3.0)	17.1	0.15	4.3	23S-94-045-CH	1.692
Liquid Waste Tanks	7.5-22.5(3.0-9.0)	107.2	< LLD	14	23S-94-046-CH	8.897
Area S06A (###)	35.0-60.0(14.0-24.0)	4.07	< LLD	0.92	23S-94-047-CH	0.386
	82.5-100.0(33.0-40.0)	1.47	< LLD	0.45	23S-94-048-CH	0.154
Drainage Path from	0.0-18.8(0.0-7.5)	73.5	< LLD	13.3	23S-94-049-CH	6.562
Liquid Waste Tanks	30.0-50.0(12.0-20.0)	5.6	< LLD	1.53	23S-94-050-CH	0.565
Area S06B (###)	50.0-90.0(20.0-36.0)	1.59	< LLD	0.58	23S-94-051-CH	0.178
Drainage Path from	0.0-25.0(0.0-10.0)	34.5	6.29	4.77	23S-94-052-CH	3.525
Liquid Waste Tanks	25.0-50.0(10.0-20.0)	5.59	0.69	1.6	23S-94-053-CH	0.642
Area S06C (###)	57.5-97.5(23.0-39.0)	0.6	< LLD	< LLD	23S-94-054-CH	0.040

NOTE: Sample numbers contain information regarding the type of sample media. For example, samples with an "S" following the number 23 are soil media, and samples with a "BL" following the number 23 are blacktop or asphalt, and samples with a "C" following the number 23 are concrete media.

NOTE: Soil sample numbers are blocked and shaded if their result exceeds proposed release criteria, and blocked if their result was greater than or equal to 10% of proposed release criteria. Asphalt concrete results are not applicable to the final release survey.

Legend:

(#) The location soil was positive for licensed material in excess of background values.

(##) The location soil was positive for licensed material and exceeded 10% of proposed release criteria.

(###) The location soil was positive for licensed material and exceeded proposed release criteria.

<LLD means that measured concentration was less than the lower limits of detection for the isotope.

Sum C_n/G_n is the sum of the ratios of isotope concentrations to respective guideline limits for indicated nuclides. The Sum C_n/G_n must be less than unity (i.e., 1) to comply with proposed release criteria.

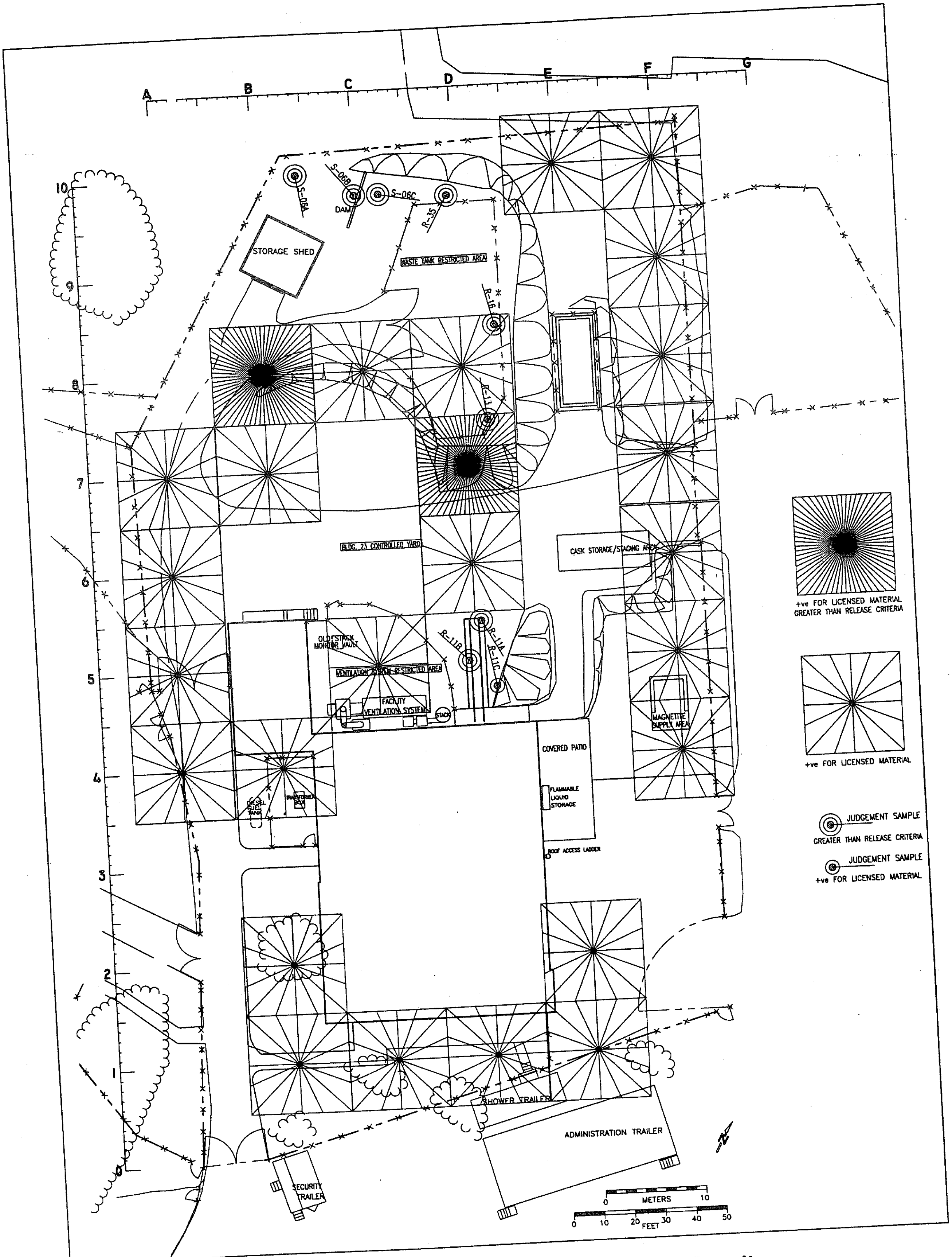


Figure 4-2—Summary of Radiological Soil Results

4.4 Measurements for Demonstrating Compliance with Release Criteria

4.4.1 Instrumentation—Type, Specifications, and Operating Conditions

Instrumentation utilized during the Final Release Survey (and equipment and materials survey) will be selected based upon the need to ensure that site residual radiation will not exceed the release criteria. In order to achieve this goal, instrumentation that is sensitive to the isotopes of concern and capable of measuring levels below 75% (preferably below 10%) of the guideline values for those isotopes will be selected. Instrumentation selected will be based upon the recommendations of NUREG/CR-5849. Instrumentation that is available for the Final Release Survey, and their respective minimum detection capability was presented in Table 3-2 of this plan. Instrumentation that is used in the surveys will be calibrated against sources and standards that are NIST traceable and representative of the representative isotopes encountered at the HCF. Instruments will be operationally tested daily, or prior to each use, whichever is less. Instruments will not be used in conditions that are not in conformance with manufacturer recommendations.

4.4.2 Measurement Methodology for Conduct of Surveys

The entire HCFA will be treated as an "affected" area in accordance with the definition provided in NUREG/CR-5849. The yard area was characterized during Facility radiological characterization, and several subsurface cores were also taken underneath the Facility in the same characterization study. This Decommissioning Plan presumes that the Facility has been decontaminated to the extent practicable and dismantled prior to the Final Release Survey, and that all asphalt and concrete in the Hot Cell yard area has also been removed prior to the Final Release Survey. The HCFA and any impacted areas under the "footprint" of the dismantled HCF will be methodically remediated as necessary prior to conduct of the Final Release Survey. The characterization results and the continuous feedback from remediation surveys will be the basis for soil remediation efforts.

The principal isotopes that were discovered in the HCF Yard during radiological characterization efforts were ^{137}Cs, ^{134}Cs, ^{60}Co, and ^{90}Sr/^{90}Y. Similarly, the principal isotopes encountered in subsurface sampling performed under the HCF during the core study were ^{137}Cs, ^{134}Cs, and ^{60}Co. All of these isotopes are readily detectable using β–γ sensitive instrumentation. Furthermore, all of these isotopes are readily detectable with gamma spectrometry techniques as well, with the exception of ^{90}Sr/^{90}Y. The ^{90}Sr/^{90}Y ratio to ^{137}Cs was studied during the characterization study and will be applied to ^{137}Cs activity concentrations to presume the ^{90}Sr/^{90}Y activity concentration (i.e., the ^{90}Sr/^{90}Y activity concentration will be taken to be the product of the ^{90}Sr/^{90}Y: ^{137}Cs ratio and the ^{137}Cs activity concentration).

Each grid will be surveyed initially with a hand-held instrument system to ascertain locations of any elevated concentrations. Areas where the portable measurement exceeds pre-set values (these values will be established based upon correlation to background) over the grid by a factor of two or more will be designated as judgment sample locations. The precise location of these judgment sample locations will be determined by scanning the surface of the soil with either a large-area hand-held probe or a floor monitor. Judgment locations will be marked with clearly visible stakes and annotated on grid maps of the area.

In addition, systematic sampling will be performed within each grid at locations equidistant between the center and each of the four grid block corners (see Figure 4-3). If for any reason the desired sensitivity of less than or equal to 25% of the release guidelines cannot be reliably detected with the hand-held instrument system (e.g., excessive background due to proximity to nearby licensed activities or materials), the systematic sampling for affected grids will be modified according to the recommendations of NUREG/CR-5849. In such a case, the 10 meter grid will be further subdivided as shown in Figure 4-4. Systematic sample locations will also be physically identified with stakes and annotated on survey grid maps.

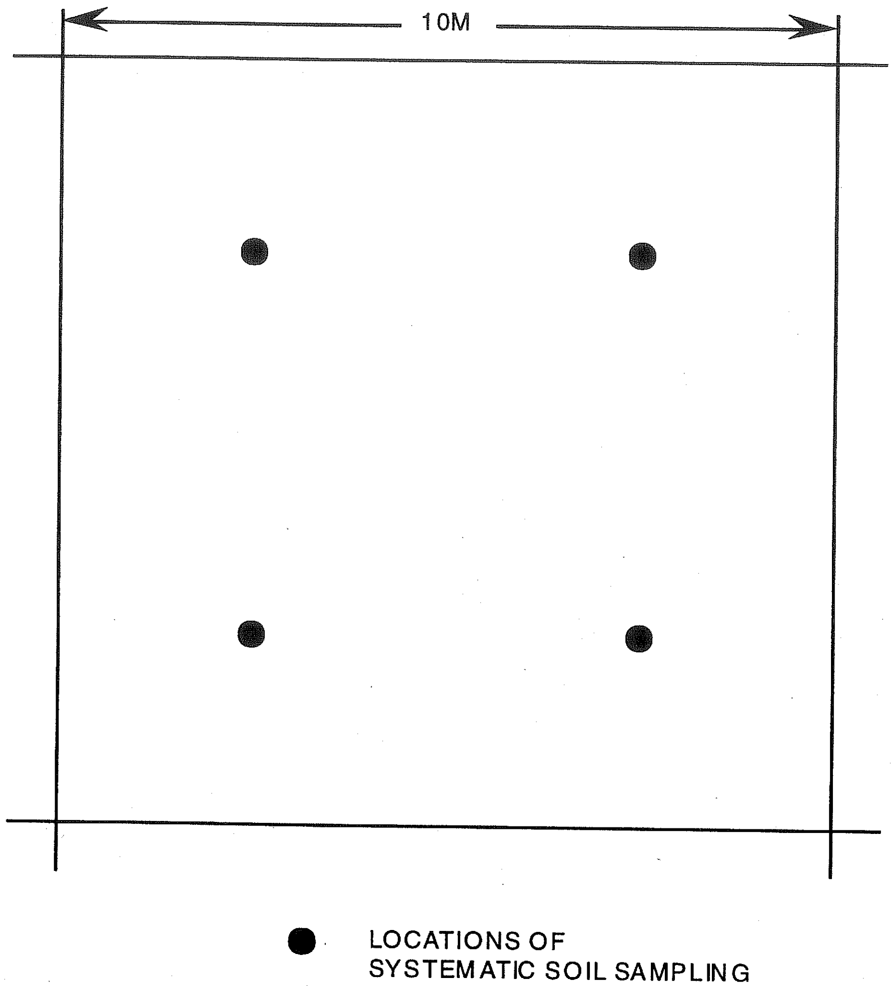
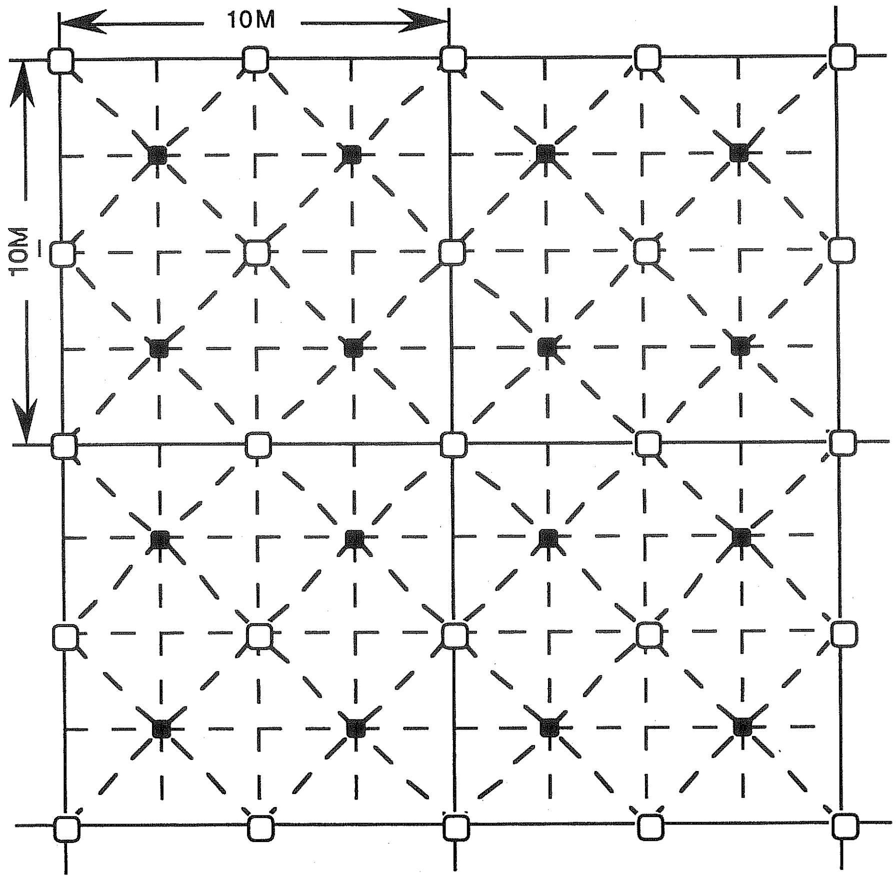


Figure 4-3—Systematic Soil Sampling Method



■ SYSTEMATIC SAMPLING LOCATIONS

□ ADDITIONAL SAMPLING LOCATIONS TO PROVIDE CLOSELY-SPACED TRIANGULAR GRID PATTERNS

Figure 4-4—Modified Systematic Sampling System

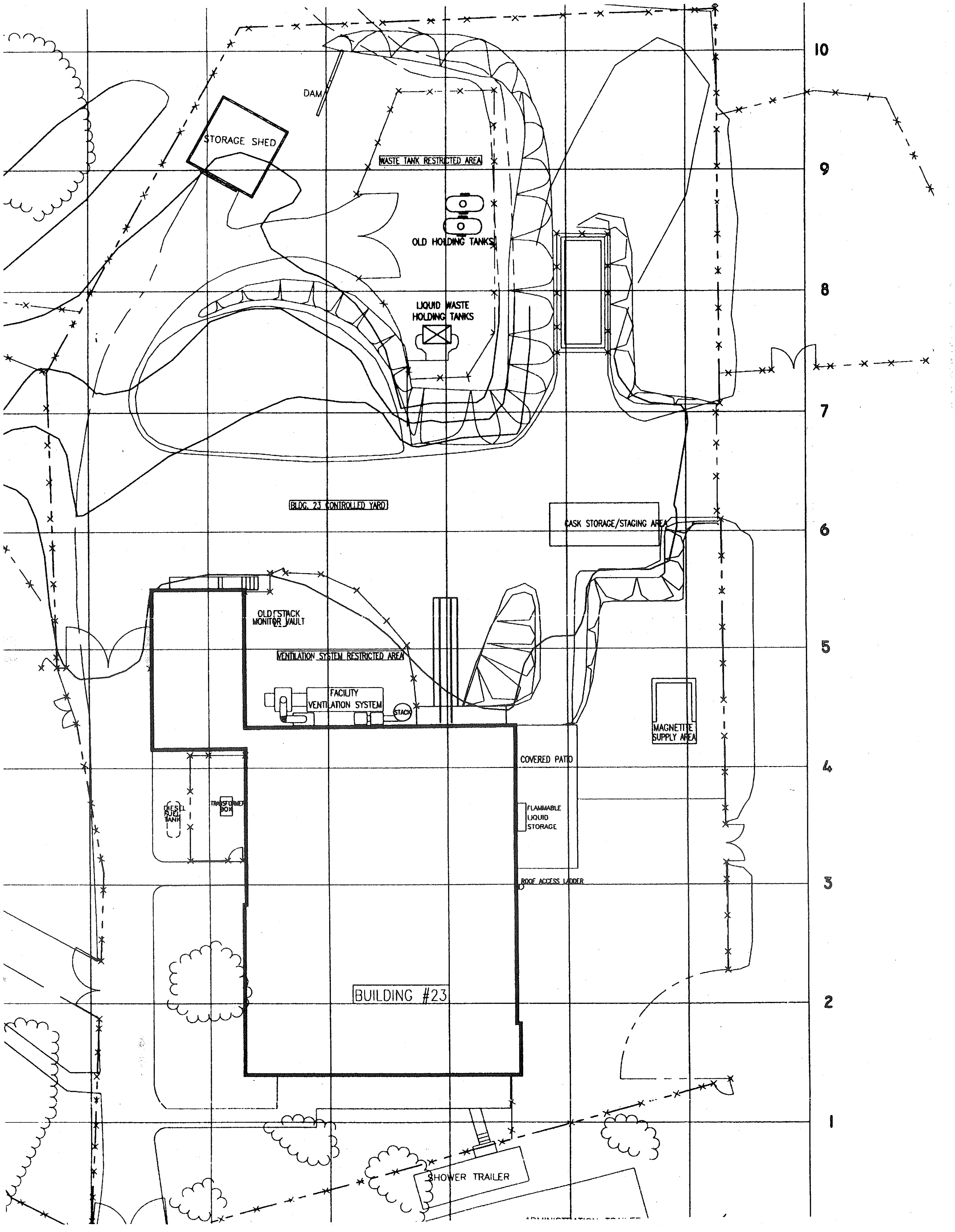
All soil samples collected during the Final Release Survey will be analyzed by gamma spectrometry and compared to release limits. If the soil (or construction media) sample result for any location demonstrates presence of ^{241}Am or ^{235}U, further evaluations may be required to demonstrate compliance with release criteria for plutonium isotopes. The targeted sensitivity of the gamma spectrometry measurement will be at 10% of release limit concentration for isotopes specified in Table 4-3. In no event, would the sensitivity exceed 25% of the established release criteria for contaminants identified in yard soils. If a location is determined to exceed release criteria, remediation will only be required if the soil activity exceeds the release criteria by more than a factor of $(100/A)^{1/2}$ where A is the area of residual activity in m^2 and provided that the activity level at no location is greater than three times the release criteria. If any location within a grid requires remediation in order to support a decision in favor of release to unrestricted use, the entire affected grid will be scanned again with the hand-held detector and re-sampled in accordance with the above methodology after completion of remediation efforts.

4.4.3 Site Survey Grid

As was discussed in the previous section, this Decommissioning Plan presumes that the Facility has been decontaminated to the extent practicable and dismantled prior to the Final Release Survey, and that all asphalt and concrete in the Hot Cell yard area has also been removed prior to the Final Release Survey. Hence, the Final Release Survey will deal solely with residual radioactivity in the HCFA soils. In developing the Final Release Survey approach, it was determined that the HCFA would be treated as "affected" and essentially be surveyed for 100% coverage. In order to support this survey, the HCFA would be gridded and staked into areas that are 10 meters by 10 meters (i.e., 100 m^2 size grid sections). This approach matches the approach that was taken during the soils radiological characterization survey. Figure 4-5 shows the intended survey grid for the HCF Final Release Survey.

4.4.4 Fixed Contamination Survey Protocol

The surfaces of equipment and materials will be surveyed in their entirety to the extent practical in accordance with Project and GA HP procedures for release of equipment and materials to unrestricted use. Direct frisk will be performed with either a portable Geiger-Mueller, or a gas flow proportional detector, as dictated by the minimum detectable activities of the instrument/probe, or beta-scintillator for the contaminants of concern and the associated release criteria. In any situations where process knowledge would suggest a potential for alpha activity, survey with alpha detection instruments or counters will also be employed. In evaluation of equipment and materials for fixed or smearable licensed materials, items painted with other than original manufacturer's paint will not be released unless clear process knowledge demonstrates that the paint was applied to a clean, nonradioactive surface prior to use in the Restricted Area or approval from the Manager, HCF HP, has been obtained and an acceptable survey course for this situation has been approved, or the paint removed in its entirety. If the potential exists for contamination on inaccessible surfaces, the equipment will be assumed to be internally contaminated unless (1) the equipment is dismantled allowing access for surveys, (2) appropriate tool or pipe monitors with acceptable detection capabilities are utilized that would provide sufficient confidence that no licensed materials were present, or (3) it may readily be concluded that surveys from accessible areas are representative of the inaccessible surfaces (i.e., surveying the internal surface from both ends of a straight pipe from a nonradioactive process system with cotton swabs would be representative of the inaccessible areas). The results of contamination surveys will be recorded either on survey maps or special release logs. Results of all surveys will be compared to average and maximum criteria prior to any material being released.


10
DAM
STORAGE SHED
9
WASTE TANK RESTRICTED AREA
OLD HOLDING TANKS
8
LIQUID WASTE HOLDING TANKS
7
BLDG. 23 CONTROLLED YARD
CASK STORAGE/STAGING AREA
6
OLD STACK MONITOR VAULT
5
VENTILATION SYSTEM RESTRICTED AREA
FACILITY VENTILATION SYSTEM
STACK
MAGNETITE SUPPLY AREA
COVERED PATIO
4
DIESEL FUEL TANK
TRANSFORMER BOX
FLAMMABLE LIQUID STORAGE
ROOF ACCESS LADDER
3
BUILDING #23
2
1
SHOWER TRAILER

4.4.5 Removable Contamination Survey Protocol

Removable contamination will be assayed by collection of 100 cm^2 smears from surfaces, or the entire surface if it is 100 cm^2 or less. The smear samples will be evaluated using suitable hand-held instruments or low level beta counting systems. As discussed in Section 4.4.4, smears will be evaluated for alpha contaminants if process or survey information recommends this, though the HCF routinely evaluates a portion of its positive smears for alpha contamination. Survey evaluations are recorded in the same manner described in Section 4.4.4.

4.5 Methods to be Employed for Reviewing, Analyzing, and Auditing Data

4.5.1 Laboratory/Radiological Measurements Quality Assurance

During decommissioning survey activities, many direct and indirect measurements and sample media samples will be collected, measured, and analyzed for radiological contaminants. The results of these surveys will be utilized to evaluate the suitability of the material or item for release to unrestricted use, or whether decontamination of structures, components, and the surrounding site have achieved the desired result. Sample collection, analysis, and the associated documentation will adhere to written procedures and meet the guidance of the NRC, as well as comply with recognized industry recommendations and good practices. GA HP (or Radiochemistry) laboratory practices will be periodically reviewed by the Project Quality Assurance staff. Outside (i.e., non-GA) laboratories selected to analyze HCF decommissioning samples shall be approved by the GA Quality Assurance organization and listed on the Non Safety-Related QA Suppliers List or other similar document maintained by the GA Quality Assurance Department.

Organizations that perform radiological monitoring measurements recognize the need to establish quality assurance programs to assure that radiological monitoring measurements are valid. These programs are established for the following reasons: (1) to readily identify deficiencies in the sampling and measurement processes to those individuals responsible for these activities so that prompt corrective action can be taken, and (2) to routinely monitor the survey and laboratory measurement results in order to assure that results and conclusions are valid.

Written procedures will be used for sample collection in order to ensure that samples are representative. Written procedures will also be utilized for sample preparation to ensure that media are prepared in accordance with laboratory specifications. A chain of custody will be maintained on all radiological samples to ensure integrity of the sample. Quality control records for laboratory counting systems will include the results of measurements of radioactive check sources, calibration sources, backgrounds, and blanks. Records relating to overall laboratory performance will include the results of the analysis of quality control samples such as analytical blanks, replicates, inter-laboratory cross-check samples, and other quality control analyses.

4.5.2 Cross-check of Results

Final radiation survey results that are based upon laboratory measurements via gamma spectroscopy are subject to a laboratory quality assurance program. An important complement to this quality assurance program is cross-check of results (Ref. 4-3). GA will cross-check gamma spectroscopy results utilizing an approach that addresses three separate aspects of the measurement. This cross-check is intended to complement sound laboratory quality assurance measures. Approximately 5% of the samples processed will be replicas taken from the same sample source, but not identified as such to the laboratory. Results will be compared for the same common source. In addition, periodic blank samples (samples with no licensed materials) will be sent to the laboratory, again without identification, to check for laboratory contamination. Finally, periodic cross-check blind spiked samples of known isotopic constituents will be sent to the laboratory without identification, to allow Project HP management to compare results to stated assay. Wherever significant questions regarding data validity are identified, affected results will be recounted after system performance is restored to acceptable levels.

4.5.3 Technical Oversight and Audit

During the conduct of remediation survey activities and Final Release Survey activities, the Project Quality Assurance organization will perform periodic audits to verify that Project survey activities comply with established procedures and the commitments made in this Plan. The audits will be conducted in accordance with written checklists developed in advance of the audit, and will be led by individuals not directly participating in the activities being reviewed. It will, however, be necessary to involve Project or GA HP personnel in some of these audits to ensure that audits accurately and comprehensively review technical aspects of the activity being reviewed. Audit results will be reported in writing to Project Management and corrective actions to resolve any identified deficiencies will be documented, tracked, and verified by the Project Quality Assurance organization. Follow-up action by Project Quality Assurance personnel may involve verification of adequate resolution of deficiencies at a later date.

The Hot Cell D&D Project may periodically utilize the technical expertise of outside consultants to review critical technical aspects of the remediation and Final Release Survey activities. These consultants may be used to provide additional technical insight and assist in the analytical consideration of potential solutions when difficult technical problems arise during remediation and remediation survey activities.

4.5.4 Supervisory and Management Review of Results

Radiological surveys are conducted by HP technician staff members who are trained and qualified in accordance with applicable requirements of ANSI/ANS 3.1-1993 (Ref. 4-4), or individuals that are under the direct supervision of HP personnel who are qualified and trained in accordance with ANSI/ANS 3.1-1993. In addition, radiological surveys and sample results are reviewed by a senior level member of the Project HP staff other than the individual that performed the survey. Final Radiation Survey data is also reviewed by the Project HP Manager and the Hot Cell D&D Project Manager.

4.6 References

4-1 NUREG/CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination, Draft for Comment, June 1992.

4-2 National Council on Radiation Protection and Measurements (NCRP), NCRP Report No. 50, Environmental Radiation Measurements, December 27, 1976.

4-3 US Nuclear Regulatory Commission Regulatory Guide 4.15, Quality Assurance for Radiological Monitoring Programs (Normal Operations)—Effluent Streams and the Environment, Revision 1, February 1979.

4-4 ANSI/ANS 3.1-1993, American National Standard for Selection, Qualification, and Training of Personnel for Nuclear Power Plants, April 23, 1993.

5. FUNDING

5.1 Cost Estimate for Decommissioning Project

A cost estimate has been developed to accomplish the decommissioning tasks to the schedule shown in Section 2.1.4. The total cost estimate of $17.9 million is detailed in Table 5-1. The cost data shown has been extracted from a contractual proposal which was prepared for the DOE and subsequently audited by a government agency with no adverse findings. Table 5-1 shows the estimated cost of labor, and other costs by task. Other costs include: materials, supplies, purchased services, waste shipping and disposal costs, and indirect costs associated with Licensing, Safety and Nuclear Compliance.

The cost estimate was developed from defined tasks based upon the site and facility characterization data. The characterization data is contained in a characterization report which was the culmination of an exhaustive study known as Phase 1 of the Hot Cell D&D Project. Because of the high level of confidence in the characterization data, the decommissioning cost estimate is expected to be accurate and achievable in the time span allotted.

Table 5-1—Hot Cell D&D Cost Detail

Title	Labor Costs ($000)	Other Costs ($000)	Total Cost ($000)
Facility Maintenance/Security/Surveillance	3,047.8	741.9	4,531.6
Licensing, Safety and Nuclear Compliance	0.0	1,628.0	3,256.0
Training	289.3	0.0	289.3
Plans and Procedures	334.2	9.7	353.6
QA Support	1,342.0	0.0	1,342.0
Materials and Services	0.0	405.6	811.2
Site Supervision	475.8	0.0	475.8
Engineering Support	295.2	0.0	295.2
Hot Cell Equipment Disposition	124.8	0.0	124.8
Structural Decontamination	864.2	0.0	864.2
Dismantlement	1,095.2	122.3	1,339.8
Yard Structures	192.8	97.6	388
Clean Waste Disposal	16.1	72.2	160.5
Hazardous Waste Disposal	30.9	33.1	97.1.0
Mixed Waste Disposal	49.0	766.7	1582.4
Structural Rad Waste Disposal	386.1	1,289.8	2,965.7
Soil and Paving Rad Waste Disposal	195.1	313.0	821.1
Machines & Equipment Rad Waste Disposal	61.1	147.3	355.7
Project Management	2,933.2	9.7	2,952.6
Final Site Report	26.7	0.3	27.3.0
Confirmatory Survey	0.0	200.0	400.0
Site Survey/NRC/State Coordination	87.9	213.7	515.3
Total	11,847.4	6,050.9	23,949.2

The cost estimates for shipping and disposal of waste are based upon all radioactive and mixed waste going to WHC with the exception of soil which is designated for Envirocare of Utah. If acceptable and cost effective, Envirocare may also be used for other waste streams. These waste disposal plans are as directed by the DOE. The DOE has committed to the removal of project generated waste to approved federal and/or commercial disposal site(s). The estimated disposal costs are based on 1995 rates for DOE waste disposal at WHC and Envirocare respectively, and were escalated appropriately based on the project waste disposal schedule. Shipping estimates are based on a rate of $1.62 per mile and include an allowance for permits and fees. Rates for various waste types and sites are given below and the total disposal costs are summarized in Table 5-1.

Waste Type	Disposal Site	Disposal Cost per cu. ft.
Low-Level Waste	Hanford	$42.13
Mixed Waste	Hanford	$140.68
Low-Level Waste	Envirocare	$16.77
Mixed Waste	Envirocare	$29.71

GA uses Data Resources, Inc., Cost Forecasting Service Projections in preparing its escalation projections. DCAA has found these escalation factors to be acceptable in pricing proposals and were used in developing the D&D cost estimate.

The direct labor escalation projection for exempt and nonexempt personnel is 3.6% for CY96 and beyond. The projection is based on an estimate made by GA's Human Resources Department of actual GA labor cost increases expected after CY95.

The overhead escalation projection made for each burden cost center is based on estimated cost increase for CY95. Projections indicate the overhead will increase by 3.5% in CY96 and beyond.

The travel escalation projection is 6.4% for CY96, 5.1% for CY97, 5.0% for CY98, 4.1% for CY99, and 5.0% for CY00 for air fare and 3.2% for CY96, 3.3% for CY97, 3.6% for CY98 and CY99, and 3.7% for CY00 for car rental. Meals and lodging are not escalated.

The material escalation projection is 3.2% for CY96, 3.3% for CY97, 3.6% for CY98 and CY99, and 3.7% for CY00.

The project employee staffing levels supporting the effort are shown in Table 5-2.

Table 5-2—Employee Levels

Employee Level	Typical Title	Typical Qualifications
M	Project Manager	M.S., Ph.D., or equivalent plus 20 years of pertinent experience. Recognized senior expert in field. Responsible for directing, planning, and managing major programs.
6	Senior Staff Engineer Principal Engineer Task Manager	M.S., Ph.D., or equivalent plus 15 to 20 years of pertinent experience. Recognized expert in field. Responsible for planning and management.
7	Staff Engineer	B.S., M.S., Ph.D., or equivalent plus 10 to 15 years of pertinent experience. Recognized specialist in field. Mature professional.
9	Engineer	B.S., M.S., or equivalent plus 2 years of pertinent experience. Emerging professional.
Senior non-exempt (SN)	Senior Technician	Specialized schooling and training plus 10 years of pertinent experience. Works under minimal supervision of senior exempt technical/management personnel.
Non-exempt (NE)	Technician	Specialized schooling and training plus 5 years of pertinent experience. Works under general guidance and supervision of more senior technical personnel.

5.2 Comparison of Cost Estimate to Planned Funding for Decommissioning of Hot Cell Facility

Estimated DOE Cost	$13.6 million
Estimated GA Cost	4.3 million
Total Estimate	$17.9 million

DOE's planned funding for the Project is $15.7 million which provides an additional factor of 15%. GA's total would increase correspondingly to $4.9 million with a 15% addition. Total planned funding is $20.6 million.

5.3 Plan for Assuring the Availability of Adequate Funds for Completion of Decommissioning

GA and the DOE have entered into an agreement to share the cost of decommissioning the HCF based upon prior usage of the HCF. The planned cost share projections noted above are based upon the DOE providing 76% of the required decommissioning funds and GA providing the remaining 24%.

Both DOE and GA are committed to carry this Project to completion. The DOE has provided a prepared statement of commitment to the Project which is reproduced below.

DOE Statement of Commitment

General Atomics (GA), owner and operator of the Hot Cell Facility (HCF) has performed work in the HCF in support of various Department of Energy (DOE) nuclear research programs and its own commercial ventures in past years. As a result of that work, the HCF and surrounding yard became contaminated with various radioactive and hazardous materials. All nuclear research related work in the HCF ceased in 1993. Although GA is responsible for any required HCF decontamination, decommissioning (D&D), and surrounding site remediation, pursuant to its federal and state licenses, the DOE, as an agency of the United States of America, has agreed to assume responsibility for a percentage of that D&D, in proportion to the amount of DOE work performed in the HCF over the years. The DOE has agreed to be responsible for tasks equating to 76% of the work delineated in the project's Decommissioning Plan. GA is responsible for the other 24% of the project's total share.

As a committed partner in the GA HCF Decommissioning and Demolition Project, the DOE's Office of Environmental Management (EM) will supply the necessary resources to complete its share of the GA HCF project by September 30, 2000. That commitment also includes removal of all project generated waste from the designated GA site to an approved federal and/or commercial disposal site(s).

The DOE has planned for and requested through the yearly Congressional budget cycle process, the necessary funds for project completion by 2000. Those funding requests, are however, always at risk of being reduced by Congress. If our budgets are reduced, originally planned HCF project completion dates may slip beyond 2000. The DOE commitment to complete the project however, will remain strong and intact even during those restrained budgetary periods.

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

The HCF is physically secured within outer and inner fenced areas at the Torrey Pines Site. Admittance into the outer fenced area is through either of two Entry/Exit Control Points located along the south side of the fence. Access is controlled by electronic badge scanners. One of the gates is for personnel access, and the other is for vehicle access. Vehicle access is limited to official business vehicles only. The outer fenced area allows personnel access to the HCF Administrative Trailer and to the entrance to the TRIGA Nuclear Fuel Fabrication Facility.

Access into the outer area is controlled by GA Security and is limited to those persons who are listed on the GA Authorized Access List (AAL) for this area. This list names personnel who are authorized to enter the area without escort. Any person not on the AAL will not be admitted through the Entry/Exit Control Point without escort by an authorized individual.

Personnel entering the inner fenced area must surrender his/her GA-issued badge for a "Controlled Access" badge. Personnel listed by name on the WA for the HCF have their picture on the "Controlled Access" badge and may enter the inner fenced area unescorted. Personnel not listed on the WA will be issued a "Visitor" badge and will require an escort. Authorization for escorted access to the Hot Cell Building may be granted by the Engineering Manager or designee on site at the HCF.

During non-working hours, the Facility is secured with the main gate and entrances to the building locked. To assure that the Facility is properly shutdown, a Shutdown/Startup procedure and checklist is followed.

6.1 Physical Security Plan Changes Required During Decommissioning

There are no anticipated changes required during decommissioning. As the Project progresses, appropriate changes will be made to assure proper security of the HCF.

6.2 Special Nuclear Material Control and Accounting Changes Required During Decommissioning.

The control and accountability of SNM at GA is administered by the Nuclear Material Accountability Organization, which in turn reports to the GA LS&NC Division. The methodology employed for SNM control and accountability is set forth in Ref. 6-1. No changes to this existing program are expected to be required as a result of HCF decommissioning activities.

6.3 References

6-1 Nuclear Material Custody and Control Manual, Nuclear Materials Accountability Organization, General Atomics, San Diego, CA; latest issue.

7. WASTE MINIMIZATION DURING DECOMMISSIONING

The management of hazardous, radiological, and mixed wastes shall be accomplished in a manner that minimizes the generation of such wastes. The management program (1) includes the identification of waste minimization requirements and techniques in project plans and procedures, (2) maintains awareness through training project personnel to these plans and procedures, and (3) evaluates and improves program performance through periodic assessments to these plans and procedures. Waste minimization will be accomplished through a hierarchical approach to waste reduction by first eliminating or minimizing the generation of waste through application of source reduction methods, including input material changes, operational improvements, process changes, and administrative steps. Those potential waste materials that cannot be eliminated or minimized through source reduction will be minimized by recycling through reuse or reclamation activities, or treating through neutralization, compaction, filtration, evaporation, and stabilization processes, or packaging through segmenting, nesting, and void space management techniques. Commercial waste processing facilities will be utilized if appropriate to minimize waste volume on a cost justification basis.

8. ENVIRONMENTAL MONITORING DURING DECOMMISSIONING

Environmental monitoring standards are defined primarily by EPA, NRC, OSHA, and associated state agencies. These standards are detailed in applicable sections of 40 CFR and 29 CFR pursuant to regulations promulgated under the Clean Water Act (CWA), Clean Air Act (CAA), Safe Drinking Water Act (SDWA), Comprehensive Environmental Response and Liability Act (CERCLA), RCRA, and OSHA.

During decommissioning, areas within the HCF being decontaminated will normally be isolated and maintained as closed systems under negative pressure relative to atmospheric pressure to prevent the release of unfiltered radioactive contamination outside the work areas. Air releases will be minimized by several techniques such as: (1) a system of air locks at entrances, (2) a negative pressure work area, (3) HEPA filtration systems on equipment exhaust pick-ups and the room exhaust, (4) use of water sprays where feasible to reduce dust, and (5) closure of ducts, vents, and passages. Water releases will be prevented by sealing all effluent outlets from the enclosed work areas. Liquid wastes will be accumulated in DOT-approved holding tanks.

Solid waste will be collected and packaged in approved containers and the containers will be decontaminated to acceptable levels in accordance with the HCF license and destination waste acceptance criteria prior to removal to clean areas. A separate air purification system with appropriate filters will generally be maintained for areas being decontaminated. The environmental monitoring program will continue throughout the decontamination operations to assure early detection of possible release of contamination.

For the Decommissioning Environmental Monitoring Program, the number and location of effluent monitoring stations and environmental surveillance stations, the frequency of sampling, and the type and frequency of analyses are based on technical assessments which consider the following factors:

- The inventory of radioactive isotopes in the HCF to be decommissioned
- The potential for release of radiation and radioactive materials from the HCF into the environment
- The standard radiation protection measures undertaken both prior to and during Decommissioning operations
- Modeling results
- Applicable laws, regulations, criteria, and standards
- The capabilities and reliability of available monitoring instruments

Estimated maximum dose rates from GA HCF site boundaries were calculated using the AIRDOS™ air transport model. The building's maximum estimated off-site dose rates are below the DOE standard for continuous monitoring of point sources with room exhaust filtration functioning. However, to demonstrate compliance with the requirements of 10 CFR 20, continuous effluent monitoring will be provided during all phases of the Hot Cell D&D Project.

In addition to specific effluent monitoring at point sources, general environmental surveillance of the GA HCF site will be employed to detect the effects of airborne and liquid radiological concentrations above background in the environment and to ensure compliance with applicable regulatory standards. The environmental surveillance system includes both continuous sampling of radionuclide concentrations in air, and periodic sampling of water, vegetation, and soil from numerous locations on-site, at site boundaries, and off-site. The environmental surveillance system in place exceeds the DOE criteria (DOE/H-0173T) for environmental surveillance.

9. SAFETY ANALYSIS OF DECOMMISSIONING PROJECT

A Hazards Analysis has been conducted for the HCF. Although the HCF is a private Facility and not a DOE site, the Hazards Analysis followed the methods and formats recommended in DOE Orders, Standards, Safety Guides, and Management Directives. The purpose of this Hazards Analysis was to establish a hazard classification for the HCF and to identify approximate levels of risks to workers and the public due to future HCF D&D activities. The HCF did not contain any extremely hazardous substances as defined in 40 CFR 355, or highly hazardous materials as defined by OSHA in 29 CFR 1910.119. The key hazardous materials at the HCF as defined in 40 CFR 302.4 are asbestos and lead. Small quantities of PCBs exist as components of electrical equipment (i.e., ballasts) and residual oil contamination in specified areas at low concentrations (<1 lb. RQ, reportable quantity). The key potential accident scenarios identified in the Hazards Analysis are a release of external radiation, and release of radioactivity or hazardous waste. Based on the low risk levels calculated for the key potential accidents and a review of the existing engineering controls and administrative procedures at the HCF, the document concluded there is no need for operational restrictions or technical safety requirements in order to protect the health and safety of the public.

While the exact methods to be used for the decontamination of the building have not been selected, decontamination can expose the workers to many hazards, e.g., electric and pneumatic power tools, industrial vehicles, and heavy lifting. All work at the HCF is performed under the control of a WA. Radiation Safety is controlled by RWP, which define limits, controls, personal protective equipment, instrumentation, conditions expected, and instructions. Before any work is performed, all the tasks are evaluated for hazards, if significant hazard sources are identified, a GA HWA will be written and approved. This HWA will address the necessary precautions and define the safeguards required to minimize the effects of the hazard. Before work on that task commences the workers are trained to the specific HWA.

10. ENVIRONMENTAL COMPLIANCE

The GA Hot Cell D&D Project utilizes the support of GA's LS&NC organization and, as needed, an Environmental Compliance Specialist to assist in addressing permitting and compliance issues related to the areas listed. Below is a brief description of GA's compliance status with regard to the specific items listed above:

National Environmental Policy Act (NEPA)—This act requires that Federal Projects, such as the Hot Cell D&D Project, be reviewed for potential impacts to the environment. In accordance with this law, GA and DOE have prepared the document entitled "Environmental Assessment for the General Atomics Hot Cell Decontamination and Decommissioning" (PC-000414). The result of this process is expected to be a "Finding of No Significant Impact" (FONSI) for the Hot Cell D&D Project. The Hot Cell D&D Project is in compliance with the requirements of this act.

Resource Conservation and Recovery Act (RCRA)—This act and its implementing regulations establishes a comprehensive hazardous waste management system which provides "cradle-to-grave" regulation of hazardous wastes as defined by 40 CFR 261. The GA Hot Cell D&D Project has implemented a hazardous and mixed waste management program which insures compliance with RCRA requirements. The Hot Cell D&D Project is in compliance with the requirements of this act.

Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendment and Re-authorization Act of 1986 (SARA)—This Act was passed to address the problem of investigating and cleaning up hazardous substance contamination at inactive or abandoned facilities. Radionuclides and mixed wastes are regulated under CERCLA, which also specifies how clean-ups must be conducted at Federal Facilities. The GA site is not considered to be a Federal Facility and is therefore not included in the ranking system used for designation of Federal Facilities listed on the National Priorities List (NPL). In addition, the GA site is under an NRC license; the NRC is the lead agency for conducting clean-ups at NRC-licensed sites. The GA site is in compliance with the provisions of applicable sections of this act.

Permits Required for Decommissioning Activities—Environmental permitting requirements for the HCF Decommissioning program are assessed on a case-by-case basis by the San Diego Regional Permit Assistance Center. The following list contains permits that are known to be required, based on discussions with local regulators.

- Building Demolition—Local agencies will be notified in advance of demolition and permits obtained if required.
- Asbestos Removal—Requires a permit from the Air Pollution Control Department (APCD) and 10 days' notification prior to any removal actions.
- Rock Drilling Equipment—Drilling equipment used for the purpose of rock removal will require a permit from the APCD if diesel powered.
- Grading Permit—The City of San Diego requires a Grading Permit for the grading of soils within city properties.
- Diesel Tank Removal and Soil Excavation—Requires a tank removal permit from the Regional Permit Assistance Center and 48 hour advance notice.
- Engines for Power Demolition—Engines used (if over 200 HP) for power supply for demolition must be permitted by the APCD.

- Abrasive Blasting—Sand blasting and other types of abrasive blasting equipment will require a permit from the APCD if the operation is performed such that the open air is affected.
- Treatment, Storage, and Disposal Permit—The GA site has a NWPF which is permitted by the State of California for treatment and storage of hazardous and mixed wastes. Wastes proposed to be generated by the Hot Cell D&D Project have been included in the permit modifications. No additional permits will be required for this Facility.

11. PROJECTIONS OF OCCUPATIONAL EXPOSURE

The total exposure to complete the decommission of the HCF and yard from all sources is estimated to be 35 person-rem. This estimate is based on completing all activities in October of the year 2000. This estimate is for planning purposes only. Detailed exposure estimates and exposure controls will be developed in accordance with the requirements of the GA ALARA program during detailed planning of the decommissioning activities. Area dose rates based on process knowledge and current survey maps (when available) were used to determine the dose rate estimates. A summary of the major contributors to estimated exposures for the decommissioning activities is presented below:

- The bulk of the exposure will be received while decontaminating and dismantling the three cells. The estimated exposure for cell decontamination and dismantlement is 20 person-rem.
- The estimated exposure to remove the ventilation system and package for disposal is 10 person-rem.
- The estimated exposure to ship all waste to burial/storage is 2 person-rem.
- The estimated exposure to remove the liquid waste system and drain lines is 1 person-rem.
- The estimated exposure to remove the rest of the HCF is 2 person-rem. This estimate includes decontaminating and dismantling the Manipulator Repair Room, Service Gallery and pit, and the Warm Metallography Rooms which account for almost all of the 2 person-rem.