DOE/EA-1053

FINAL
ENVIRONMENTAL ASSESSMENT FOR DECONTAMINATING AND DECOMMISSIONING THE GENERAL ATOMICS HOT CELL FACILITY

U.S. DEPARTMENT OF ENERGY

AUGUST 1995

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LIST OF ACRONYMS

ADT	Average Daily Trips
AEC	Atomic Energy Commission
AIChE	American Institute of Chemical Engineers
ALARA	As Low As Reasonably Achievable
APCD	San Diego Air Pollution Control District
ARB	Air Resources Board
CAA	Clean Air Act
CAL-DHS	California Department of Health Services
CEDE	Committed Effective Dose Equivalent
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response and Liability Act
CFR	Code of Federal Regulations
D&D	Decontamination and Decommissioning
DOE	Department of Energy
DOT	Department of Transportation
EPA	Environmental Protection Agency
FFCA	Federal Facility Compliance Act
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
GA	General Atomics
HCF	Hot Cell Facility
HEPA	High Efficiency Particle Air Filter
HMTA	Hazardous Materials Transportation Act
HWA	Hazardous Work Authorization
keV	kiloelectron volts
mrem	millirem
NEPA	National Environmental Protection Act
NESHAPS	National Emissions Standards for Hazardous Air Pollutants
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
PCBs	Polychlorinated Biphenyls
PPE	Personal Protective Equipment
R&D	Research and Development
RCRA	Resource Conservation and Recovery Act
RQ	Reportable Quantity
RWP	Radiation Work Permits
SDAB	San Diego Air Basin
SR	Scientific Research
TEDE	Total Effective Dose Equivalent
TRIGA	Training, Research, Isotope-Production, General Atomics
TSCA	Toxic Substances Control Act
UBC	Uniform Building Code
UCSD	University of California at San Diego
WA	Work Authorization
WHC	Westinghouse Hanford Company

1. INTRODUCTION

In support of DOE-funded as well as commercial nuclear research and development (R&D), General Atomics (GA) has maintained a fully operational Hot Cell Facility (HCF) at its Headquarters in San Diego, California for over 30 years. The HCF is located within the GA "Main Site." GA occupies approximately 120 acres (48 hectares) on two contiguous areas approximately 13 miles (21 km) north of downtown San Diego, California, just southwest of the convergence of Interstates 5 and 805 and approximately one mile east of the Pacific Ocean. The two locations are referred to as the "Main Site" and the "Sorrento Valley Site," or collectively as the GA site. The location of GA in relation to San Diego County is shown in Fig. 1-1 and Fig. 1-2.

Under the U. S. Department of Energy (DOE) Environmental Restoration Program, DOE has agreed to share with GA the cost of decontaminating and decommissioning (D&D) the HCF. These activities would potentially include site and facility characterization, facility decontamination, dismantlement, waste disposition, and site remediation. Project activities would be performed by qualified and trained personnel in accordance with documented plans and procedures, as required by a project-specific plan approved by the DOE, the Nuclear Regulatory Commission (NRC), and the California Department of Health Services (CAL-DHS). Under the proposed action, low-level radioactive and mixed wastes generated by D&D activities would be transported to either a DOE owned facility, such as the Hanford site in Washington, or to a commercial facility, such as Envirocare in Utah, for treatment and/or storage and disposal.

This environmental assessment was prepared to evaluate potential impacts from D&D activities at the HCF in compliance with the National Environmental Policy Act of 1969, as amended; the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR 1500-1508); and according to the DOE National Environmental Policy Act Implementing Procedures (10 CFR 1021).

This document presents a description of the proposed action and alternatives to the proposed action, and evaluates impacts of the proposed action and alternatives on the environment as well as potential health and safety risks. The proposed action and the alternatives are as follows:

- Proposed Action—D&D of the GA HCF in a Timely Manner, Followed by Release of the Site to Unrestricted Use.
- Alternative 1—Facility Dismantlement with Minimal Decontamination;
- Alternative 2—Low-Level of Effort Implementation of D&D Activities, and
- Alternative 3—No Action, Maintain Safe Shutdown.

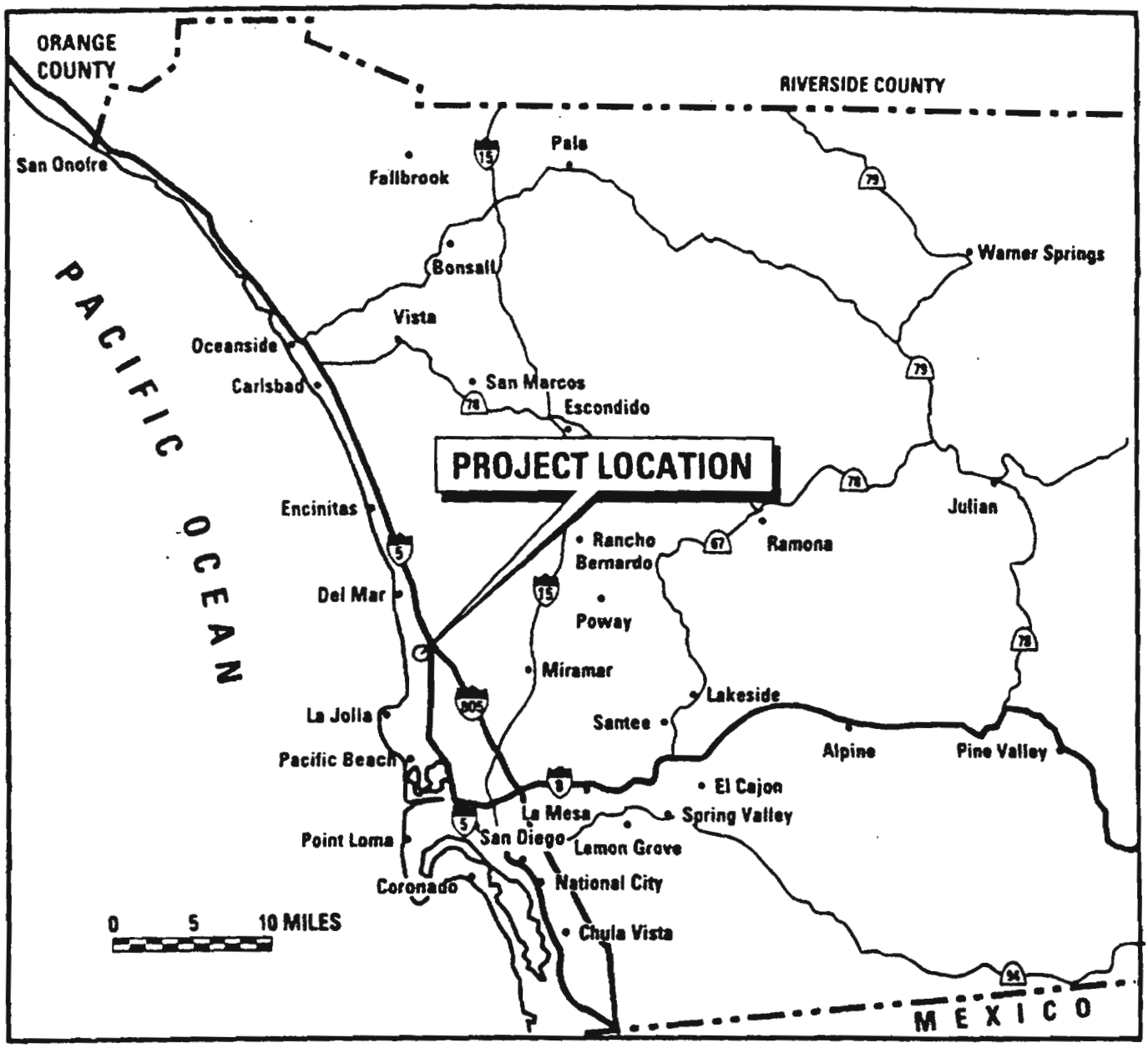

Fig. 1-1 Regional Location

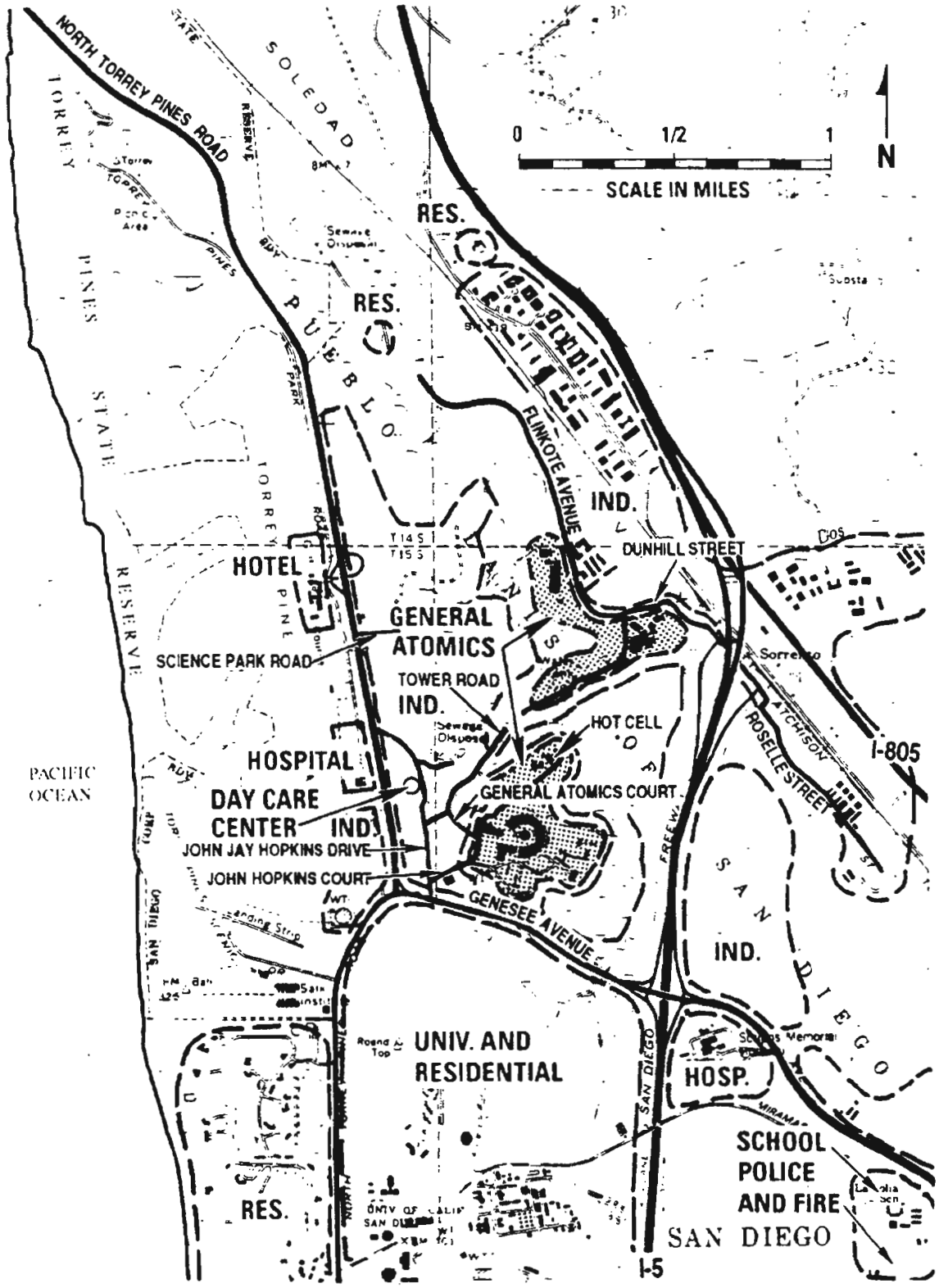

Fig. 1-2 GA Site and Surrounding Uses

2. PURPOSE AND NEED FOR ACTION

The purpose of the proposed work is to D&D the HCF at GA. The HCF has been used by FA to perform work under contract with DOE. Its decontamination is needed to reduce ongoing surveillance and maintenance costs, remove DOE's liability for this privately-owned facility, and eliminate the potential for a future inadvertent release of radioactive contaminants

3. DESCRIPTION OF THE FACILITY, PROPOSED ACTION AND ALTERNATIVES

3.1 Facility Description

As shown in Fig. 3-1, the HCF occupies GA's Building 23 and an outdoor service yard. The interior of Building 23 has approximately 7,400 ft.^{2} (690 m^2) of floor space consisting of offices, three hot cells, an operating gallery and auxiliary areas. The operating gallery is shown on Fig. 3-2.

Building 23 is surrounded by a 46,740 ft.^{2} (4,340 m^2) fenced service yard. The service yard includes several concrete pads used for staging heavy equipment and making material transfer into and out of the HCF building. The remaining area is comprised of asphalt, soil, scattered small rocks and vegetation. There is a small 400 ft.^{2} (37 m^2) metal ancillary building and two above ground waste storage tanks. Other equipment includes the ventilation filtration system and 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.

The focal point of HCF activities has been the three hot cells. These cells and their associated equipment have been used for examining irradiated capsules and small fuel elements, mechanical testing, metallographic preparation and examination and photography. The walls of the three hot cells are constructed of high density magnetite concrete (225 lb./cubic foot or 3,600 kg/m^3) to provide shielding.

HCF operations have been performed subject to NRC Special Nuclear Material License No. SNM-696 and the CAL-DHS Radioactive Materials License No. 0145-80. The HCF has been routinely and periodically reviewed and inspected by these agencies.

The HCF is presently in a safe shut-down condition. All required utility services, such as electrical service, water supply and natural gas supply, building air ventilation and HEPA-filtered cell exhaust systems are active. The HCF presently houses a quantity of (non-radioactive) materials and equipment normally associated with the work scope requirements of an operational HCF that are radioactively contaminated and/or contain minimal amounts of hazardous materials.

3.2 **Proposed Action**

The proposed action is the D&D of the GA HCF, including site remediation. D&D activities and site remediation are to follow a project-specific plan approved by the DOE, the NRC and the CAL-DHS. These activities would generally consist of site and facility characterization, decontamination, dismantlement, waste disposition and remediation of any contaminated soil. All low-level radioactive and mixed wastes generated by D&D activities would be transported to either a DOE owned facility or to a commercial facility, such as Envirocare in Utah, for treatment and/or storage and disposal. The objective of the proposed action is to obtain from the NRC and the CAL-DHS a timely release of the site for "unrestricted use." The term "unrestricted use" means that there will be no restrictions on the use of the site, other than those imposed by the city of San Diego zoning ordinance.

D&D includes removing or decontaminating equipment, decontaminating building surfaces and structural members, surveying the facility for residual contamination, and characterizing, packing, and shipping the resulting waste. Removal of surface contamination would begin with the simplest and least aggressive method. Increasingly aggressive techniques would be taken up, as appropriate, to remove the remaining fixed contamination (e.g., contamination embedded in concrete). The less aggressive techniques include standard vacuuming and wiping with a damp cloth. In order of increasing aggressiveness, They can be supplemented, by hand washing or scrubbing, dry abrasive blasting and scabbling or scarification. New innovative technologies will be considered if they are sufficiently developed and cost effective.

If it is determined that the HCF building or the underlying soil cannot be decontaminated sufficiently or cost effectively to allow release of the building to unrestricted use, the building would be dismantled.

About 30,000 cubic feet (840 cubic meters) of contaminated equipment and debris are to be removed. This estimate assumes that the HCF can be decontaminated without extensive dismantlement. Any items or areas that cannot be decontaminated effectively or economically would increase this volume. Perhaps 50,000 cubic feet (1,500 cubic meters) of contaminated soil may also be removed. On-site soil treatment may be employed to reduce the volume of contaminated soil.

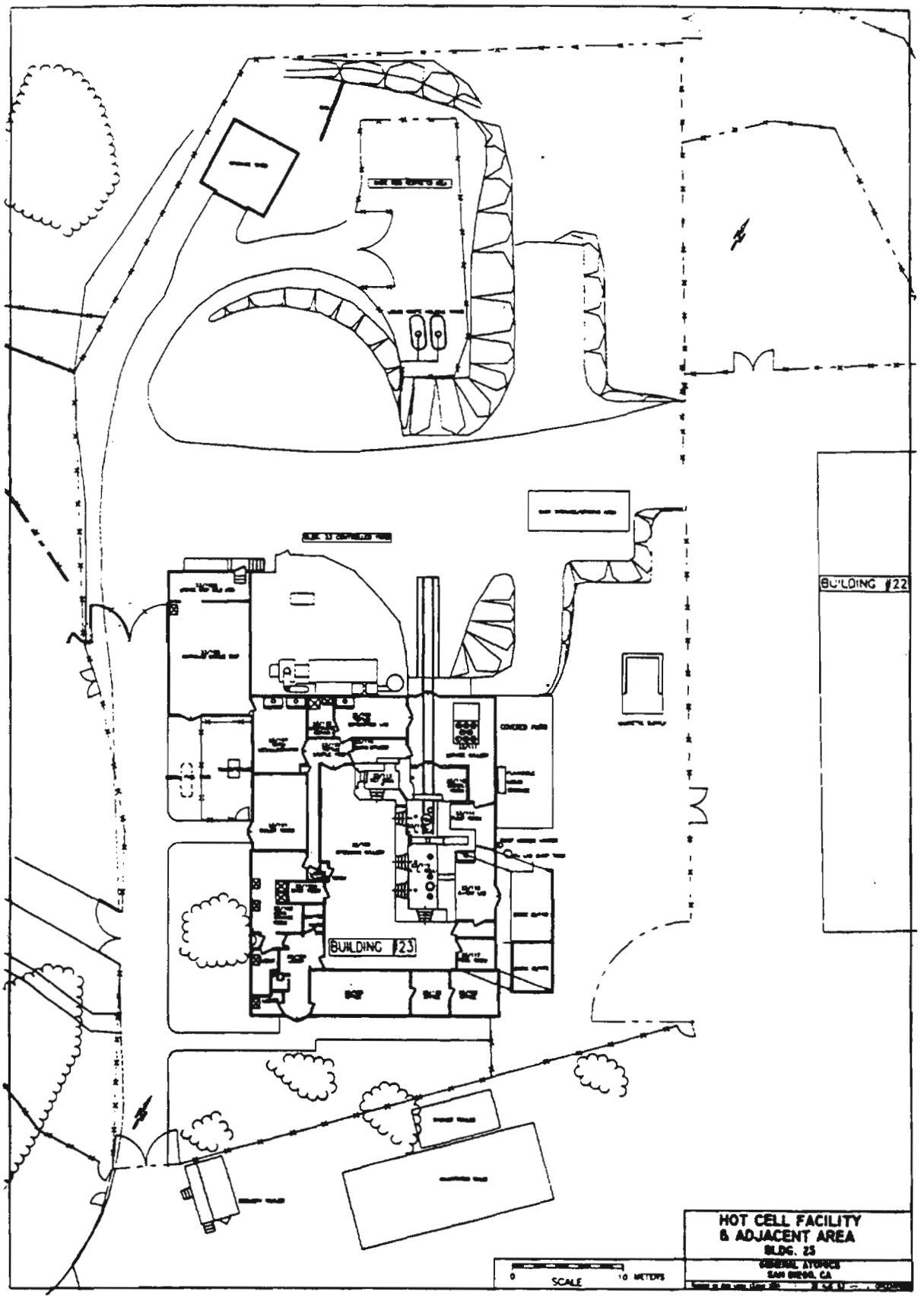

Fig. 3-1 Hot Cell Facility Layout

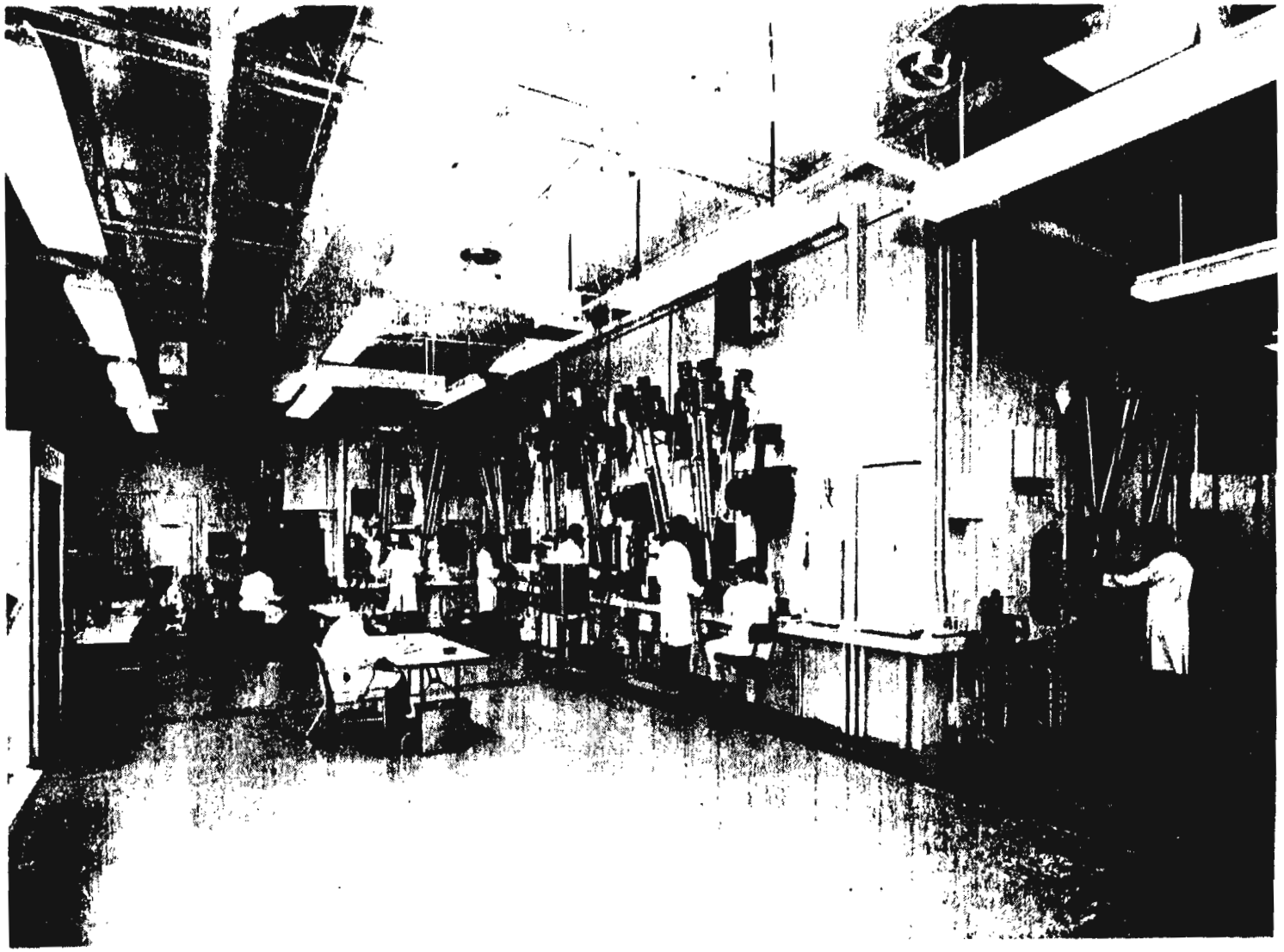

Fig. 3-2 Hot Cell Building Interior

3.3 Alternative Actions

3.3.1 Alternative 1 to Proposed Action—Facility Dismantlement with Minimal Decontamination

This alternative would involve minimal decontamination activities. Fixatives would be applied to all contaminated surfaces to prevent the dispersion of contaminants during dismantlement. An independent survey would be performed to assure that all contaminants are fixed in place. The entire facility would be dismantled and debris would be shipped to a disposal site as radioactive and mixed waste.

3.3.2 Alternative 2 to Proposed Action—Low-Level of Effort Implementation of D&D Activities

This alternative would involve maintaining the HCF in safe-shutdown status, including on-going surveillance and maintenance, while performing limited D&D activities as funding permits.

3.3.3 Alternative 3 to Proposed Action—No Action, Maintain Safe Shutdown

This alternative is a continuation of the safe shutdown institutional controls currently in place at the HCF. The "no action" alternative requires commitment to contractually obligated long-term surveillance and maintenance of the Facility following DOE operational program activities which have already ceased. The surveillance and maintenance activities would include a continued environmental monitoring program to maintain assurance that radioactive contamination has not escaped to the environment. Regularly scheduled inspection and maintenance of health, safety, and radiation protection equipment and instrumentation calibration would be performed and documented.

4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1 Man-Made Environment

4.1.1 Human Health

4.1.1.1 Radioactive Materials

Contamination within the HCF building is monitored under an extensive surveillance and maintenance program. The radionuclides shown on Table 4-1 potentially exist in the HCF. Table 4-1 also shows the half-life of the radionuclides. The half-life (Ref. 4-2) is the time required for half the initial number of nuclei to radioactively decay.

Representative specimens of contaminated debris from the HCF have been analyzed to identify the radionuclides present. This information indicates that the predominant radionuclide species are primary (high yield and high activity) fission products such as Strontium 90/Yttrium 90 ($^{90}Sr/^{90}Y$) and Cesiums 134 and 137 (^{134}Cs and ^{137}Cs). Other fission products found include ruthenium 106 (^{106}Ru), cerium 144 (^{144}Ce) and antimony 125 (^{125}Sb). Second in importance are activation products, namely cobalt 60 (^{60}Co), iron 55 (^{55}Fe) and nickel 63 (^{63}Ni). Least important from the standpoint of external dose rate exposure are the actinides and transuranics, including thorium as well as uranium and plutonium isotopes.

Radioactive atoms undergo spontaneous nuclear transformations and release excess energy in the form of ionizing radiation. Such transformations are referred to as radioactive decay. As a result of the radioactive decay process, one element is transformed into another; the newly formed element, called a decay product, will possess physical and chemical properties different from those of its parent, and may also be radioactive. A radioactive species of a particular element is referred to as a radionuclide or radioisotope. Radiation emitted by radioactive substances can transfer sufficient localized energy to atoms to remove electrons from the electric field of their nucleus (ionization). In living tissue this energy transfer can destroy cellular constituents and produce electrically charged molecules (i.e., free radicals). Extensive biological damage can lead to adverse health effect (Ref. 4-3). The adverse biological reactions associated with ionizing radiation, and hence with radioactive materials, are skin injury, cancer, genetic mutation and birth defects (Ref. 4-4).

Major types of ionizing radiation include alpha particles, beta, and gamma or X-ray radiation. Alpha particles expend their energy in short distances and will not usually penetrate the outer layer of skin. Alpha particles represent a significant hazard only when taken into the body, where their energy is completely absorbed by small volumes of tissues. Beta particles constitute external hazards if their source is within a few centimeters of an exposed skin surface and the beta energy is greater than 70 keV. Internally, beta particles deposit much less energy to small volumes of tissue and, consequently, inflict much less damage than alpha particles. Gamma radiation is of the most concern as an external hazard because its greater ability to penetrate makes it more difficult to shield against.

Table 4-1 List of Potential HCF Radionuclides

Chemical Element	Isotope	Half-Life (years)*
Hydrogen (Tritium)	^{3}H	12.3
Iron	^{55}Fe	2.73
Cobalt	^{60}Co	5.27
Nickel	^{63}Ni	100.0
Strontium/Yttrium	$^{90}Sr/^{90}Y$	29.1/0.0073
Ruthenium/Rhodium	$^{106}Ru/^{106}Rh$	1.02/9.51E-07
Antimony	^{125}Sb	2.76
Cesium	^{134}Cs	2.70
Cesium/Barium	$^{137}Cs/^{137m}Ba$	0.3./4.85E-06
Cerium/Praseodymium	$^{144}Ce/^{144}Pr$	0.779/3.23E-05
Europium	^{154}Eu	8.59
Europium	^{155}Eu	4.71
Thorium	^{228}Th	1.91
Uranium	^{232}U	70.0
Uranium	^{233}U	1.59E+05
Uranium	^{234}U	2.46E+05
Uranium	^{235}U	7.04E+08
Uranium	^{236}U	2.34E+07
Uranium	^{238}U	4.47E+06
Plutonium	^{238}Pu	87.7
Plutonium	^{239}Pu	2.41E+04
Plutonium	^{241}Pu	14.4

* where aaE+b = aa x 10^{+b}

4.1.1.2 Hazardous Materials

Hazardous materials of concern in terms of potential exposure to D&D workers, on-site GA employees and off-site neighbors are elemental lead, beryllium compounds, mineral oil, hydraulic oil and asbestos (Ref. 4-5). A complete list of potential hazardous materials at the HCF is shown in Table 4-2.

Table 4-2 List of Potential Hazardous Materials at the HCF

Hazardous Materials[1]	Physical Form	RQ[2] (lb)	Amount Present >RQ?
Acetone	liquid	5000	no
Asbestos	solid	1	yes
Benzene	liquid	10	no
Beryllium	solid	10	no
Beryllium Oxide	solid	10	no
Bromoform	liquid	100	no
Cadmium	solid	10	no
Chromium	solid	5000	no
Copper	solid	5000	no
Diesel oil	liquid	none	NA[3]
Ethanol	liquid	none	NA
Hydraulic oil	liquid	none	NA
Isopropanol	liquid	none	NA
Kerosene	liquid	none	NA
Lead	solid	10	yes
Lubricating oil	liquid	none	NA
Mercury	solid	1	yes
Methanol	liquid	5000	no
Mineral oil	liquid	none	NA
PCBs	solid/liquid	1	yes
Sodium	solid	10	no
Toluene	liquid	1000	no
Xylene	liquid	1000	no
Zinc	solid	1000	no

[1] Under either federal or California definitions
[2] Reportable Quantity under 40 CFR Part 302.4, List of Hazardous Substances and Reportable Quantities
[3] NA = Not Applicable

4.1.1.3 Safety Program

The HCF safety procedures are dictated by the GA's Company Policy Manual and the GA Company Accident Prevention Manual. HCF tasks are performed in accordance with specific procedures which incorporate the Engineering and Administrative safety controls. All work at the HCF is performed under the control of Work Authorizations (WA). Radiation Safety is controlled by the WA and/or Radiation Work Permits (RWP), which define limits, controls, personal protective equipment (PPE), instrumentation, conditions expected, and instructions. Any hazardous work is performed under the control of a Hazardous Work Authorization (HWA) or permits. Examples of activities that require permits are "confined space entry" and "cutting and welding."

Safety walkdowns are performed to examine the general facility, waste storage, personnel equipment, emergency equipment and emergency postings. Logged records of the inspections of the fire suppression equipment and the testing of the alarms are kept. The breathing air is checked every quarter to meet the breathing air requirements. The GA Medical Surveillance program is being implemented for those workers identified as needing to be respirator trained, and for those workers designated to handle hazardous substances. Those workers currently identified as needing to be respirator trained have been trained. All the procedures supporting a specific work task, as identified in the procedure master list are reviewed for safety aspects and must be issued prior to the start of that task. The inventory list is reviewed periodically for hazardous substances and the locations of these substances are inspected during the walkdowns. The training for the industrial health and safety is maintained current for all Hot Cell personnel.

The HCF building is maintained at negative air pressure by the ventilation system in order to contain any potential contamination. The direction of the air flow in the HCF building is always from clean to contaminated areas and from ceiling to floor. Ventilation air is supplied by a single fan located in the boiler room at a design rate of 10,950 cubic feet (310 cubic meters) per minute. This air is prefiltered and may be heated to control building temperature. Building air is released to the atmosphere through a special high-grade filtering system.

4.1.2 Transportation

The main roadways in the vicinity of the GA site are shown on Fig. 1-2. They include Genesee Avenue beyond the southern boundary, John Jay Hopkins Drive beyond a portion of the western boundary, North Torrey Pines Road further to the west, and Interstate 5 to the east. Genesee Avenue is a four-lane primary arterial which currently carries approximately 31,000 Average Daily Trips (ADT). Since the design capacity of a four-lane primary arterial is 30,000 ADT, this roadway presently exceeds the City standard. North Torrey Pines Road north of Genesee Avenue is a six-lane primary arterial with an existing ADT of 34,000. There are four northbound lanes to accommodate turning movements at the Genesee Avenue/North Torrey Pines intersection. North of Science Park Road, North Torrey Pines Road becomes a four-lane primary arterial. South of Genesee Avenue, North Torrey Pines Road becomes a four-lane major street with approximately 20,000 ADT. John Jay Hopkins Drive is currently a four-lane collector street which connects Genesee Avenue with North Torrey Pines Road. This street currently has an existing ADT volume of 5,000 and its intersection with Genesee Avenue is signalized (Ref. 4-6).

The GA site is generally accessed from the Interstate 5 freeway, exiting on Genesee Avenue and traveling west, turning north on John Jay Hopkins Drive and east on General Atomics Court. The site can be entered through two entrances shown on the map (Fig. 1-2) from General Atomics Court and from John Hopkins Drive. Traffic onto the site is controlled by a guard posted at a guard station and by personnel at an office reception area. Off-hour access is through a keyboard gate at the south entrance. The nearest entrance to the GA compound is 1500 ft. (457 m) from the HCF.

4.1.3 Cultural and Historical

No significant archeological or cultural resources have been found in surveys of the GA site. The National Register of Historic Places mentions no historical structures or sites within the boundary of the plant. There is a state park, called Torrey Pines State Park, located one mile to the northwest of the site, which contains a unique species of pine tree. Contact with the local Historical Society indicates no historical, archaeological or cultural properties under consideration on or near the HCF. For this reason, the State Liaison Officer for Historic Preservation has not been contacted (Ref. 4-6).

4.1.4 Population and Land Use

The site is located within the Torrey Pines Mesa area and is currently zoned SR (Scientific Research). The University Community Plan designates open space and scientific research land uses for the site. Land uses surrounding the GA site include scientific research and development parks to the north and to the east across Interstate 5, undeveloped land associated with Torrey Pines State Park, research and development parks and a hospital to the west and the University of California at San Diego (UCSD) to the south. Surrounding land uses are shown graphically on Fig. 1-2.

The present population within the University Census Tract Subregion, in which the main site lies, is primarily of an industrial and university campus makeup, with an estimated daytime total of up to 52,000 people including about 1,400 GA employees (Ref. 4-7). The University Subregion contains six Census Tracts. The immediate vicinity of the Flintkote Avenue facilities is zoned for industrial activity.

Estimates of future growth indicate that the University Subregion could have a daytime total of 57,000 people by year 2000, based upon future industrial growth in the Sorrento Valley area and an increased number of students on the university campus. Because of terrain, zoning, and current land use, most future residential development will occur beyond a two mile radius from the site.

Nearby sensitive human populations include:

- GA non-radiological workers located 720 ft. (219 m) from the HCF;
- Agouron Pharmaceuticals, located 0.25 miles (0.4 km) to the west;
- Children at a day care center, located on John Jay Hopkins Drive, approximately 0.45 miles (0.7 km) to the west;
- Scripps Green Hospital, located 0.5 miles (0.8 km) to the west;
- UCSD dormitories located about 0.9 miles (1.5 km) to the south; and
- A residence along Torrey Pines Road across from the UCSD campus (about 1.2 miles or 2 km from to the southwest).

4.1.5 Noise

Within GA site boundaries, the ambient noise environment is generated by vehicular traffic, jet aircraft, general aviation aircraft and building, heating, ventilating and air conditioning equipment.

4.1.6 Aesthetics

The GA site lies atop the eastern edge of a high coastal plateau incised by steeply sloping canyons. The HCF itself is located in the interior of the GA site and is not visible to adjacent neighbors. However, the HCF is visible at a 0.5 mile (0.8 km) distance from Interstate 5 to the east and Scripps Green Hospital to the west. The HCF will be visible from future science-related development to the northeast.

4.2 **Natural Environment**

4.2.1 Topography, Geology and Seismicity

Topography

Site topography is typical of coastal San Diego County, with mesas bounded by bluffs and ravines. The mesa runs in a northerly direction paralleling the coast and rising to a height of 400 ft. (122 m) above sea level between the site and the ocean. The topography of the site is characterized by steeply sloping canyons and relatively level mesa areas. The main GA site is on Torrey Pines Mesa about one mile east of the ocean at an elevation of 340 ft. (105 m) above sea level.

Geology

The HCF has been built on artificial fill (Ref. 4-8). This fill overlies the Ardath Shale, a member of the La Jolla Group of Eocene Deposits, which is predominantly weakly fissile, olive-gray shale. A cross section on the Del Mar quadrangle shows subsurface formations roughly 750 ft. (228 m) northeast of the HCF. Based on this cross section, the Ardath shale in the HCF area is approximately 300 ft. (91 m) thick. It is underlain in turn by 500 ft. (150 m) of Torrey Sandstone and 250 ft. (76 m) of Del Mar Formation.

Soils

Soils present at the HCF have been mapped as Huerhuero loam, 5 to 9 percent slopes and eroded (Ref. 4-9). The Huerhuero series soils have developed in sandy marine sediments and consist of moderately well drained loams that have a clay subsoil. A representative Huerhuero profile has a surface layer that is brown and pale-brown, strongly acid and medium acid loam about 12 inches (0.3 m) thick; an upper subsurface layer that extends to a depth of about 41 inches (1.0 m) and is a brown, moderately alkaline clay; and an underlying brown, mildly alkaline clay loam and sandy loam layer that extends to a depth of more than 60 inches (1.5 m).

Soils immediately downslope of the HCF have been mapped as Altamont Clay, 15 to 30 percent slopes (AtF) Huerhuero loam, 5 to 9 percent slopes and eroded. The Altamont series consists of well-drained clays that formed in material weathered from calcareous shale. A representative Altamont profile has a surface layer that is dark-brown and light olive-brown, moderately alkaline heavy clay loam about 8 inches (0.2 m) thick that lies over soft calcareous shale. Small areas of Linne clay loam and areas where the soil is only 10 inches (0.2 m) over shale are included in the survey area (Ref. 4-9).

There may be localized areas of soil contamination. The extent of contamination will be defined through the site characterization process.

Seismicity

San Diego County has been considered one of the more moderate seismic risk regions in Southern California. The historical pattern of seismic activity has generally been characterized by a broad scattering of small magnitude earthquakes whereas neighboring regions have had a higher rate of seismicity with many moderate-to-large-magnitude earthquakes.

A recent study (Ref. 4-10) estimated the probabilities of large earthquakes occurring on the major strands of the San Andreas fault system, including the Imperial and San Jacinto Faults. The estimated probability of a magnitude 7 or greater earthquake occurring in the next 30 years along these faults in Southern California is 0.5 or greater. However, a quake of magnitude close to 7 on these fault lines should not seriously impact the GA site because of intervening distance.

Current information (Ref. 4-11) however, indicates the Rose Canyon, Coronado Bank, San Diego Trough, La Nacion, and Elsinore fault zones are capable of generating strong ground motion in the San Diego area. Possible Richter magnitudes for earthquakes on these faults can be as high as 7.0, 7.5, 7.5, 6.3 and 7.5, respectively. Passing approximately 3 miles (5 km) west of the GA site, the Rose Canyon fault is the nearest active fault. Recent excavations (Ref. 4-12) showed definite evidence of Halocene (within the last 10,000 years) activity. It is clear that San Diego has experienced major earthquakes in the recent geologic past.

The presence of three small, local faults was confirmed by the Woodward-Clyde Consultants field reconnaissance of the GA site (Ref. 4-13). An unnamed fault in the northern portion of the site trends east to west. The Salk fault trends east to west across the southern portion of the site. A northerly trending fault crosses the Genesee Avenue canyon southeast of the site. All of these faults are overlain by early Pleistocene formations which have not been displaced. For this reason, these faults are not considered active.

The one-story HCF building structure was built in 1958 and predates the current Uniform Building Code (UBC) seismic requirements. The foundation is made of reinforced concrete. All exterior walls are made of concrete masonry blocks reinforced with steel rods.

4.2.2 Climate and Air Quality

Climatology

The Torrey Pines Mesa and Sorrento Valley, as with most of San Diego County's coastal areas, has a semi-arid Mediterranean climate characterized by hot, dry summers and mild, wet winters. The mean annual temperature in the project vicinity is 61°F (33.8°C), with summer high temperatures in the low-90s (50°C) and winter lows in the mid-30s (16°C) (Ref.4-14).

The dominating meteorologic feature affecting the region is a semipermanent high pressure cell located over the eastern Pacific Ocean. This high pressure cell maintains clear skies for much of the year and drives the prevailing westerly to northwesterly winds. In the summer, this high pressure system deflects or blocks eastward-traveling storm systems resulting in little rain from frontal activity. The migration or breakdown of this high pressure system during the winter allows transient storms to pass through the area, bringing the winter rains to southern California.

Two types of temperature inversions (reversals of the normal decrease of temperature with height) help to degrade local air quality. In summer a marine/subsidence inversion is formed when warm, continental air is undercut by a shallow layer of cool marine air flowing onshore. This inversion forms over the entire coastal plain and allows for mixing below the inversion base at 1,100 - 1,500 ft. (457 m), but not any higher. During winter cold air pools in low areas and air in contact with the cold ground cools while the air aloft remains warm. A nightly shallow inversion layer [at about 800 ft. (244 m)] between them can trap pollutants in the colder air below.

The predominant pattern is sometimes interrupted by so-called Santa Ana conditions, when high pressure over the Nevada-Utah area overcomes the prevailing westerlies, sending strong, steady, hot, dry winds west over the mountains and out to sea. Strong Santa Anas tend to blow pollutants out over the ocean, producing clear days. However, at the onset or breakdown of these conditions or if the Santa Ana is weak, air quality may be adversely affected. In these cases, emissions from the South Coast Air Basin to the north are blown out over the ocean, and low pressure over Baja California draws this pollutant laden air mass southward. As the high pressure weakens, prevailing northwesterlies reassert themselves and send this cloud of contamination ashore in the San Diego Air Basin. There is a potential for such an occurrence about 45 days of the year, but the region is adversely impacted on only about five of them. When this impact does occur, the combination of transported and locally produced contaminants produces the worst air quality measurements recorded in the San Diego basin.

Local Winds and Dispersion Data

The prevailing day time wind direction is westerly, although easterly winds are almost as common during the winter months. During the day, the westerly winds developing from the Pacific high-pressure system are reinforced by the sea-land breeze caused by the Pacific Ocean resulting in stronger average wind velocities [6 to 9 mph (10 to 15 km/h)] than from the easterly land breeze [1 to 7 mph (1.6 to 11.6 km/h)]. The land breezes are most common during stable conditions and dominate the flow toward the ocean during the night and early morning hours. The airflow in either direction is channeled effectively by topographical features of the area. Strong winds are infrequent; the strongest recorded was 51 mph (82 km/h) from the southeast in 1944.

Data from an on-site meteorological system were used to provide atmospheric stability and wind frequency results. The on-site annual wind data are consistent with the wind rose data from the Miramar Naval Air Station.

Precipitation

The average annual rainfall for the city of San Diego is 10.4 in. (26.4 cm), but relatively large variations in monthly and seasonal totals occur. The average monthly precipitation from 1940-1970 ranges from 2.15 in. (5.5 cm) in February to 0.01 in. (0.03 cm) in July. Approximately 75% of the annual precipitation occurs from November-March. The maximum annual precipitation during the last 60 years was 24.9 in. (63.3 cm) occurring in 1941.

Air Quality

State regulations place the GA site within the San Diego Air Basin (SDAB). The concentration of pollutants within the SDAB is measured at eight stations maintained by the County of San Diego Air Pollution Control District (APCD) and the California Air Resources Board (ARB). Air quality at a particular location is a function of the type and amount of pollutants being emitted into the air locally and throughout the basin and the dispersal rates of pollutants within the region. The air quality monitoring station nearest the project area is located in a school ground at Ninth and Stratford Court in the City of Del Mar. This is four miles (6.4 km) north of the site. Air quality measurements are expressed as the number of days on which air pollutant levels exceed state and federal clean air standards.

Federal regulations place the GA site in the southwestern portion of the San Diego Interstate Air Quality Control Region. The Environmental Protection Agency (EPA) has designated this region as an "attainment area" for sulfur dioxide and nitric oxides, indicating that the concentrations of these pollutants are below the federal air quality standards. The region was classified as a "non attainment area" with respect to carbon monoxide, ozone, and small suspended particulates (PM_{10}) some years ago, but in recent years only the federal standards for ozone have been exceeded.

In 1993 at the APCD monitoring station in Del Mar, ozone exceeded the state standard on 19 days and the federal standard on three days. This is characteristic of the entire SDAB.

In 1992 and 1993, the maximum 24-hour measured level of particulates less than 10 microns in size in the SDAB was found to exceed the state standard on several days. Annual average measured PM_{10} levels were marginal with state standards. However, neither the 24-hour nor the annual federal standard for PM_{10} was exceeded.

4.2.3 Hydrology

Ground Water

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 (Ref. 4-15) and has not been developed for water supply purposes. No ground water wells are present at or immediately adjacent to the HCF. Ground water beneath the HCF is approximately 300 feet below ground surface. Test borings on the GA site ranging from approximately 6 to 30 ft. (1.8 - 9.1 m) did not encounter ground water (Ref. 4-16). There is currently no reason to suspect that any ground water contamination exists under the HCF. Further studies may be conducted, if warranted, during D&D activities.

Surface Water

Based on ground surface elevations and surface drainage patterns, surface run-off from the HCF Controlled Yard Area currently flows primarily northwestward across paved and unpaved surfaces in the service yard. Run-off that accumulates in the service yard is retained at the HCF by a dam and tested prior to discharge into an existing drainage feature that directs surface run-off eastward, into the Soledad Valley. Surface run-off from the eastern corner of the HCF currently flows eastward, across paved surfaces, into the storm water drainage system.

The HCF is located within the Los Penasquitos Creek drainage basin. Drainage runs through the Soledad Valley into Los Penasquitos Creek, which flows to the northwest and empties into the Pacific Ocean. Detention basins and silt collection structures have been constructed for the

development of the Torrey Pines Science Park that surrounds and includes the GA site to ensure that adverse downstream impacts will not occur from storm water run-off.

Surface water downstream from the site cannot be used domestically because of its intermittent flow and dirty condition during periods following rainstorms or heavy run-offs. No freshwater recreation areas exist within the local vicinity. Agriculture is not prevalent because soils are not well suited for agriculture, precipitation is limited, and ground water quality (primarily in Penasquitos Valley) is considered marginal or inferior for irrigation. Water use in the vicinity of the site is limited by the ephemeral nature of many streams and the high suspended solids content of winter flows.

Floods do not represent a danger to the site as it is situated approximately 340 ft. (103 m) above the valley floor on a mesa. Also, drainage downstream from the site to the Pacific Ocean is unrestricted. The HCF is not located within a 100-Year Flood Zone.

Waste water collection services are supplied to the GA site by the San Diego Department of Public Utilities. Waste water from the site is discharged through the City's sewer system to the Point Loma treatment plant. Any waste water released to the city treatment system must meet the requirements of GA'a San Diego Industrial Waste Discharge Permit.

4.2.4 Biology

Vegetation

The GA site is professionally landscaped. The open space surrounding the HCF and the GA site is a combination of disturbed/developed lands, several eucalyptus groves and three distinct types of native or naturalized plant communities; coastal mixed chaparral, coastal sage scrub, and southern California grassland. No federally-listed endangered plant species are known to exist on or near the GA site (Ref. 4-6 and Appendix A).

The most significant natural areas in the vicinity of the site are Torrey Pines Park, Torrey Pines State Reserve, and Los Penasquitos Lagoon and associated marsh. These areas are located west and northwest of the site along the coast (Fig. 3-2). In addition to providing relatively undisturbed refuge-like habitats, the park and reserve contain a rare species of pine tree, the torrey pine (Pinus torreyana). This species is endemic to California, known to occur only in San Diego County and on Santa Rosa Island.

A biological study was prepared for this project by Natural Resource Consultants, dated May 10, 1994 and attached as Appendix A. Non-native ruderal (weedy) plant species occur in the service yard and surrounding the HCF fence line. These weed patches are isolated clumps of vegetation with no habitat value for native wildlife. There are no plant species recognized as rare, threatened, or endangered by any resource protection agencies within the HCF. Plants observed on the site include tree tobacco (Nicotana glauca), wild oats (Avena barbeta), short-podded mustard (Brassica geniculata), curly doc (Rumex crispus), and telegraph weed (Heterotheca grandiflora).

Regional Wetlands

Storm water run-off from the HCF and the GA site flows into the Los Penasquitos Lagoon. The Los Penasquitos Lagoon and associated marsh are designated by the California Department of Fish and Game as a wetland area. The saltwater marsh and lagoon support a diverse fish fauna and a mussel fauna of about 20 species. The Pacific little-neck cochral and common little-neck clam are the most common mussel species. A total of approximately 30 species of salt-marsh plants occurs in the Los Penasquitos Lagoon. The predominant vegetation in the marsh and

lagoon is pickleweed (Solicormia). Solicormia subterminalis occurs in the drier areas; Solicormia virginica, in the lower-lying areas. Pickleweed filters out most of the suspended material brought in by upstream drainage.

Wildlife

Surveys of the areas surrounding the HCF and the GA site, (Ref. 4-17), identified several mammal, birds and reptile species, with the majority of these occurring in the brushland habitats (coastal sage scrub and coastal mixed chaparral). Raptors utilize the grassland and to a lesser extent the brushland habitats on the site for foraging. Raptors are protected in California and are considered sensitive due to the general trend of declining populations in many species and their importance in the ecological structure of biological communities. Two species observed in the brushland habitats around the site, black-tailed gnatcatcher *(Polioptila melanuria californica)* and the orange-throated whip tail *(Cnemidophorus hyperythrus beldingi)* appear to be experiencing declines in their populations in coastal San Diego County. The black-tailed gnatcatcher is a species of special concern and is listed by the California Department of Fish and Wildlife Service as endangered.

The Torrey Pines Park, Torrey Pines State Reserve, and Los Penasquitos Lagoon and associated marsh area provides habitat for several species of shorebirds and waterfowl, as well as two federally listed endangered species of birds, the light-footed clapper rail *(Rallus longirostris levipes)* and the California least tern *(Sterma albifrons browni)*. These species have been declining because of human disturbance and water pollution that destroyed nesting and feeding habitats. The Belding's Savannah sparrow *(Passerculus sandwichensis beldingi)*, listed by the state as endangered, is also associated with the pickleweed habitat of the lagoon. It, too, has been declining because of human developments affecting its habitat. None of these unique wildlife species have ever been observed on the GA site.

During the biological survey conducted for this project (Natural Resource Consultants, May 10, 1994), a total of three bird species were observed on the site. These include the house finch (*Carpodacus mexicanus*), common raven (*Corvus corax*), and mourning dove (*Zenaida macroura*). A single fence lizard (*Sceloporus occidentalis*) was also observed. There are no wildlife species recognized as rare or endangered by any resource protection agencies within the HCF boundary (Ref. 4-17).

4.2.5 Socioeconomics and Environmental Justice

The socioeconomic environment of the GA facility consists of a well-established, diverse, middle-income community consisting of research institutions, a medium-sized university, light industry, tourism, and residences. The setting is attractive physically with the nearby California coastline, the Torrey Pines Park, and picturesque La Jolla. The road system is adequate with both interstate highways and secondary roads. GA operations do not constitute a large percentage of the area's economy.

As defined by the census data center, GA is situated in the center of the University Subregion in the North City Region of San Diego County. According to the 1990 census, the total population of this Region was 570,000 people, comprised of 78% White, 10% Asian, 8.7% Hispanic, 2.6% Black, 0.5% American Indian, and 0.2% unclassified races (Ref. 4-7). Other than the students residing at UC San Diego, there are no pockets of poverty within 2 miles of the GA site.

5. POTENTIAL ENVIRONMENTAL CONSEQUENCES OF PROPOSED ACTION AND ALTERNATIVES

This section discusses the potential direct and cumulative effects of the proposed action on human health and the environment.

5.1 Human Health Effects

Types of exposures that could lead to human health effects considered in this report are worker and off-site exposures to hazardous chemicals or radioactive materials from routine D&D activities or potential accidents on site or from a transportation accident off-site that involves hazardous or radioactive waste.

5.1.1 Hazard Identification

This section identifies and discusses potential hazards that may affect workers on-site or people off-site during normal or routine Hot Cell D&D activities. Impacts of the hazards relative to human health and safety are summarized in Section 5.1.2.

During the initial site characterization and the final site survey, site workers would be taking readings and measurements of any contamination using direct reading instruments and sampling techniques. Hazards during this work are mostly those involving external radiation, inhalation of hazardous or radioactive materials, or dermal contact with these materials.

The key hazards would involve external radiation, inhalation of hazardous or radioactive materials, or dermal contact with those materials during characterization of contamination and the decontamination, dismantling, packaging and disposal of equipment, the HCF structure, and contaminated soil (as necessary).

5.1.2 Occupational Health Impacts

5.1.2.1 Basis andd

In 1978 and 1979 the GA HCF was refurbished. These activities included decontamination of the high-level and low-level hot cells at the facility, repainting of the walls, and movement of the irradiated fuel under contaminated conditions believed to be more severe than today. Therefore, the work performed during the refurbishment is considered to be a conservative representation of the type of work expected to take place during the D&D of the HCF. Exposure histories for personnel working at the HCF during that time period have, therefore, been used to estimate the exposure that D&D workers may receive. Similar historical data was obtained for stack releases and was used to estimate the exposure to people off-site during D&D operations. Details of these calculations are provided in Appendix B and are summarized below.

The calculations focus mainly on radiological exposure because the potential for chemical exposure is low. A significant factor in the low-level of chemical exposure is the solid form of the major toxic chemicals, such as lead and beryllium, leading to efficient removal of airborne particles by the HEPA filter in the HCF ventilation system and by the respirators worn by workers.

5.1.2.2 Impacts to D&D Workers

For decommissioning workers, the total dose during the D&D activities has been estimated and compared to current NRC occupational limits. Estimated radiation doses to decommissioning workers are shown in Table 5-1. Supporting calculations are summarized in Appendix B. Main contributors to these doses are $^{90}Sr/^{90}Y$ and $^{137}Cs/^{134}Cs$ radionuclides that cause radiation exposure during direct contact in decontamination work (wipe downs, waste movement, etc.)

The highest exposure is less than 50 percent of the occupational limits (effective January 1, 1994), and the mean exposure is less than 20 percent of the guideline. These estimates are consistent with separate NRC conclusions that the dose impact of the decommissioning of nuclear facilities is small, particularly in comparison with operation of the facility over its lifetime. The NRC conclusions were drawn in an environmental Impact Appraisal for operations at the HCF prepared by the NRC Office of Nuclear Material Safety and Safeguards (Ref. 5-1).

The maximum worker exposure is 2.04 rem/yr (2,040 mrem/yr). Using a latent cancer risk factor (Refs. 5-2 and B-4) of 0.4 chances in a thousand of contracting cancer for each rem that a single worker receives over a 5 year exposure duration, the maximum exposed worker cancer risk would be about four chances in a thousand.

As shown in Appendix B, Section B.2, the maximum cumulative Committed Effective Dose Equivalent (CEDE) exposure for all Hot Cell Facility D&D workers is projected to be less than 63 person-rem over the life of the project. Based on worker risk factors from Refs. 5-2 and B-4, at least 2,500 person-rem would be needed before even a single, latent cancer fatality would be predicted. Thus, considerably less than one fatality (0.025) is expected over the project lifetime. In other words, the probability of any excess cancer fatality among exposed workers is very small.

During previous refurbishment operations, there were no worker exposures to hazardous chemicals above the permissible exposure limits. Medical monitoring results for beryllium or lead health effects or evidence of exposure in workers were negative.

Actual doses attributed to the current proposed action would be lower than those experienced during the refurbishment because of technological advances in decontamination techniques, use of remote equipment wherever practicable, better awareness of ALARA techniques, and more advanced personal monitoring equipment.

Table 5-1 Estimated Worker Radiation Doses and Occupational Exposure Limits

	Committed Effective Dose Equivalent	
	Estimated	**Allowable***
Average external exposure	840 mrem/yr	
Maximum external exposure	2,020 mrem/yr	
Average internal exposure	6.9 mrem/yr	
Maximum internal exposure	33 mrem/yr	
Total average annual exposure	850 mrem/yr	5,000 mrem/yr
Total maximum annual exposure	2,040 mrem/yr	5,000 mrem/yr
* Effective January 1, 1994		

The proposed action could involve the exposure of HCF employees and contractors to soil contaminated with hazardous and radioactive materials. Measures will be implemented to protect workers such as HWA procedures, PPE, confined space entry procedures (consistent with 29 CFR 1910.146), air monitoring, work zone controls, personal dosimetry, medical surveillance and bio-assay program, personnel training and emergency response program. Other measures will be implemented to prevent dust or soil particles from becoming airborne, such as watering down, tenting, etc. Soil and vegetation samples for environmental monitoring purposes will be collected on a frequency commensurate with activities being conducted in the HCF, as stated in the Environmental Monitoring Plan for the proposed action.

5.1.2.3 Off-site Exposure and Impacts

Approximately 1,400 GA employees and 450 contract and tenant personnel are employed at the GA site. The exposure to non-HCF industrial workers on and off of the GA site and residents surrounding the GA site was estimated from stack effluent data from the 1978-1979 refurbishment of the HCF. Potential exposures outside of the Hot Cell Facility were calculated using the CAP88PC computer code (Ref. 5-3), which provides the individual effective dose equivalent rate from all pathways. Exposure was estimated at the HCF property line closest to the building ventilation stack. This estimate is conservative because the area at the GA property line is zoned for scientific research, and the closest actual resident lives over 1 mile from the stack. The nearest sensitive receptor location is the day care center on John Jay Hopkins Drive (see Section 4).

The Committed Effective Dose Equivalent (CEDE) for an exposed individual, hypothetically located at the GA property line, is 0.046 mrem/yr. If the Hot Cell D&D lasts five years, the cumulative individual hypothetical lifetime exposure would be 0.23 mrem. The dose at the nearest residence (1 mile from the GA site) would be several times less than at the property boundary. The corresponding resident exposure is less than that for a worker at the site boundary, even though the resident is assumed to be home 24 hours per day, 365 days per year. Exposures at the day care center are also below 0.23 mrem for the 5 year duration of HCF D&D activities. Thus, all off-site exposures are well below the 100 mrem/yr limit for unrestricted areas.

The maximum individual exposure to non-HCF workers on the GA site was estimated to be 0.04 mrem/yr, compared to the allowable exposure limit for people in unrestricted areas of 100 mrem/yr per 10 CFR 20.105. Annual doses to other GA employees, contractors, and tenants on GA property (outside the vicinity of the HCF) range from 0.018 mrem to 0.0061 mrem, depending upon their distance from the HCF. These levels are also well below allowable dose levels for unrestricted areas.

For the maximum site boundary dose rate of 0.046 mrem/yr and five years of exposure, the corresponding individual lifetime cancer risk would be about 1 chance in 10 million. This estimate is based on a cancer risk factor of 0.5 chances in a thousand for each rem that an individual receives (Refs. 5-2 and B-4).

In Appendix B, Table B-3, the calculated dose rates at various locations outside of the HCF are listed. Exposure for most of the 1,400 GA employees would be between the 0.04 mrem/yr at TRIGA Fuel Fabrication and the 0.0061 mrem/yr at Genesee Avenue. Beyond the GA property and adjacent open space, the exposure would be below 0.0061 mrem/yr. The population exposure beyond GA can be bounded by multiplying the total estimated daytime population within the University Census Tract Subregion at year 2000, namely 57,000 (Section 4.1.4), by a dose rate of 0.0061 mrem/yr and considering a five year exposure period. This sum is about 1.7 person-rem. The GA population exposure is below 0.04 mrem/yr times 1,000 people times 5

years or about 0.3 person-rem. The total two person-rem corresponds to 0.001 excess cancer fatality among the entire population exposed (Refs. 5-2 and B-4).

5.2 Transportation

The primary project impacts to the environment due to transportation could occur when trucks with deliveries or waste travel to or from the site. Transportation would be conducted in accordance with applicable DOT, EPA, and NRC regulations. During such transport, hazardous and radioactive materials are packaged to limit external radiation. Thus, the primary impacts are accident risk and emissions/noise from the trucks themselves.

From the GA site, one can access the Interstate 5 freeway via 2.2 km (1.4 mi.) of surface streets, namely General Atomics Court, John Jay Hopkins Drive, and (for most of the 2.2 km) Genessee Avenue.

Truck shipments of concern consist of: (1) hazardous waste and radioactive waste leaving the site; and (2) delivery of small amounts of hazardous materials such as compressed gases to be used during D&D activities. Short-term transportation effects would include employee trips, which occur under existing conditions, a small number of contractor trips, and fewer than 200 round-trip truck trips for waste transfer over a 5 year period. Traffic, circulation and parking effects are expected to be minor due to the small increase in trips and the short duration of this action and would not significantly impact the surrounding roadways.

5.3 Waste Disposal

5.3.1 Hazardous Waste

Small amounts of solid and liquid hazardous waste from D&D activities would be accumulated in satellite accumulation areas. After accumulation for up to 90 days, the waste would be transferred by a licensed contractor to authorized off-site commercial treatment and disposal facilities or recyclers.

5.3.2 Low-Level Radioactive and Mixed Waste

Low-level radioactive waste, including contaminated soil, would be temporarily stored at the GA Nuclear Waste Processing Facility. Liquid waste would be solidified and solid waste would be compacted, whenever possible, in accordance with the appropriate regulations. The waste would then be shipped to a DOE owned disposal facility, such as Hanford or a commercial disposal facility, such as Envirocare.

The estimated 30,000 cubic feet of waste generated by D&D of the HCF equals 12% of the approximately 250,000 cubic feet annually received at the Hanford site. Envirocare accepts more than 3 million cubic feet of Low Level Radioactive waste annually; its permitted capacity (for all types of waste) is 500,000,000 cubic feet. Both Hanford and Envirocare anticipate no capacity problems and expect to receive radioactive and mixed waste well into the next century.

This mixed waste is not GA's. It is generated at GA by DOE funded projects - that is why it is going to DOE's Hanford site. GA currently ships mixed waste to Hanford. Mixed waste sent to Hanford is stored there until its hazardous components can be treated, as treatment is prerequisite to land disposal at mixed waste facilities.

5.3.3 Non-Hazardous Solid Waste

D&D activities would generate some uncontaminated construction debris which would be sent to a local sanitary landfill. Despite the implementation of aggressive solid waste recycling and reduction programs by many facilities (including GA) and municipalities, there is a shortage in solid waste capacity in many regions of California. California has enacted recent legislation aimed at reducing solid waste by 50 percent over the next several years, coupled with a planning process designed to ensure adequate new solid waste disposal capacity. It is difficult to predict how these trends might impact the availability of disposal options for uncontaminated HCF waste.

5.4 Noise

During D&D activities, noise will be generated by equipment such as jackhammers, scabblers and concrete saws. Backhoes could also be used for partial dismantling activities.

On-site workers will be outfitted with ear protection devices. The closest non-HCF GA employees are 100 feet (30 m) away (within a building) and 500 (152 m) feet away (frequently out of doors). The closest off-site business is Agouron Pharmaceuticals, Inc. which is 0.25 miles (0.40 km) away. These distances will substantially diminish the noise from D&D activities perceived by non-HCF employees or off-site businesses.

5.5 Geology and Seismicity

5.5.1 Soils

The proposed action could involve the partial dismantlement of the HCF building and potential excavation of up to 50,000 cubic feet (1,500 cubic meters) of contaminated soil. D&D activities would occur inside the HCF building, protected by the HEPA filter system or in tented areas within the service yard. Contaminated soils would be boxed at the HCF. Excavation of contaminated soil could lead to very minor wind or water erosion.

5.5.2 Seismicity

D&D activities would involve the removal of surface contamination and some dismantlement activities. Dismantlement plans and specifications would be reviewed by a structural engineer to assure that these alterations would not render the building seismically unsafe.

5.6 Air Quality

Several D&D related activities could minimally impact air quality due to both mobile and stationary source emissions. A small amount of mobile source emissions such as carbon monoxide and nitrogen oxides could be released from contractors' trucks and cars and approximately 200 waste transport truck trips. However, the San Diego Air Pollution District does not set thresholds for determination of significant emissions from mobile source emissions. Due to the temporary nature of the truck trips and the small number, mobile source emissions would be low.

Stationary source emissions could be released during decontamination, building dismantlement and solid remediation but are expected to be negligible. Any releases from decontamination would occur within Building 23. All hazardous materials are located inside the building and only asbestos, solid lead, beryllium, mercury and PCBs are expected to be removed in any significant quantities. Standard asbestos abatement procedures, under the oversight of the San Diego County Air Pollution Control District, will be used to remove the asbestos. Lead is found

in solid form in the shielding and bricks and is only expected to produce negligible quantities of dust during removal. Beryllium dust could be stirred up, but will be controlled. Mercury is found in very small quantities in electrical switches but would not produce any emission. PCBs are only found in cutting fluids and lubricants inside machine shop equipment and would not produce any emissions during removal from equipment. Radionuclides would be bound on dust particles but the HCF's negative-pressure, HEPA filters, and monitoring system would prevent the escape of contaminated particles.

Contaminated dust from building demolition would be controlled by tarping, periodic watering and possibly tenting.

As fugitive dust could be released during the excavation and packaging of contaminated soil, dust control measures would be implemented as needed. If a transportable soil cleanup processing unit were used on-site, all air emissions would be controlled, in compliance with applicable NRC and San Diego Air Pollution Control District rules and regulations.

Site workers would be protected during decontamination, demolition and soil excavation activities through air monitoring and the use of personal protective equipment and respirators when required.

The proposed action is only a temporary potential source of air emissions. Negligible amounts of mobile source and stationary source, demolition and soil remediation emissions would be produced. They would not affect regional attainment standards.

5.7 Hydrology

5.7.1 Surface Water

The proposed action would result in the decontamination of surface areas outside the building and possibly some building dismantlement. Decontamination activities could release very small amounts of radionuclides to the surface waters. Erosion of newly-exposed soil could aggravate storm water turbidity.

Currently, surface water samples are collected for environmental monitoring purposes on a frequency commensurate with activities being conducted in the facility and at least annually. Results are evaluated and proper corrective action is taken as needed.

Above ground waste storage tanks have a secondary containment system to prevent any releases from contaminating surface water run-off. Perimeter berms control run-on.

5.7.2 Ground Water.c.5.7.2

The probability of ground water contamination is very low since ground water depth is estimated to be 300 ft. (91 m) below ground surface. D&D activities could include the drilling of exploratory borings to confirm ground water depth if characterization results reveal significant subsurface contamination.

5.8 Biology

Based on the biological study prepared for this project by Natural Resource Consultants, dated May 10, 1994, there are minimal biological resources on the HCF site and none of them are sensitive or endangered.

No releases would occur from D&D activities through the soil, Ground Water or surface water. The soil and surface water would be monitored regularly via the Environmental Monitoring Plan for the proposed action.

5.9 Regulatory Issues

Table 5-2 discusses the applicability of various state and federal regulations for the proposed action.

5.10 Potential Accidents

5.10.1 Transportation

Fewer than 200 round-trip truck trips are anticipated in the course of the 5-year long project. Truck accident rates, based on national statistics for surface streets, are 2 accidents per million miles (Ref. 5-5). For 200 movements at 1/2-mile each, this corresponds to an annual accident probability of one in 5,000. This probability is so low that an accident can be classified as "very unlikely."

Waste would be shipped along Interstate highways and their urban bypasses. The 1,321 miles to the Hanford disposal site near Richland, Washington follows Interstate 5 (and 405), 205, 184, 82 and finally 182. About 78% of the route is through rural areas, 18% through suburban areas and only 3.2% through urban areas. Accidents and death rates were calculated using the Interstate Data Base (Ref. 5-6). The estimated truck accident rate is one per 3,650 trips, which is equivalent to a 5.5% chance of an accident occurring in the course of this project. The estimated death rate is one fatality per 38,200 trips which is equivalent to a 0.5% chance of a traffic fatality arising from this project. The 821 mile route to Envirocare near Clive, Utah follows Interstates 5, 805, 15, and 80 and segments of state routes 163 in California and 201 in Utah. This route is 80.7% rural, 15.7% suburban, and 3.6% urban. The probability of a traffic accident or traffic fatality arising from this project s estimated (Ref. 5-6) to be 3.4% or 0.4%, respectively, which is only 62% of the corresponding risk from shipping to Hanford.

These probabilities are based on decontamination. Completely dismantling the HCF would roughly double waste load and, therefore, double the probability of traffic accidents and fatalities. Removal of contaminated soil would require additional truck trips and add proportionately to the risks estimated in the paragraphs above.

5.10.2 Other Potential Accidents and Their Impacts

For the Hot Cell D&D, an accident identification analysis was conducted using a hazard analysis method recommended by the AIChE Center for Chemical Process Safety (Ref. 5-4). Five potential accident scenarios were identified by studying previous documents and analysis dealing with the decontamination and decommissioning of the HCF and are described below:

A. Failure of the HEPA System—The most likely accident is a failure of the HEPA filter system caused by a failure of the filter or a power outage (during an earthquake, storm or other event). A radionuclide release due to failure of the HEPA system during a power outage is not expected. All air flow would stop and workers would be evacuated. No particulates on HCF building surfaces would be stirred up. Within 24 hours, a diesel generator would be brought in to restore the operation of the HEPA filter.

A HEPA filter failure could also occur if the filter became overloaded and either tore or was bypassed by contaminated air. In either case, radiation instruments on the exhaust that continuously monitor radiation levels downstream of the HEPA filter would sound an alarm for high radioactivity readings. The exhaust fan would be shut down immediately and D&D operations stopped. Workers would be evacuated. There would be a negligible release of contaminated particles and little exposure risk.

B. Small Fire Occurring within the HCF—The structure of the HCF is primarily concrete and steel. Almost all flammable materials have been removed from the HCF, except for very small amounts of flammable chemicals such as small cans of residual cleaning solvents or petroleum oils. Petroleum oils have a very high flash point and are not very flammable. These materials are stored in locked cabinets designated and labeled as "flammable." No smoking is allowed within the HCF. A fire is not expected due to the lack of flammable materials and absence of ignition sources. If a small fire did occur, the concrete building and HEPA filtration system would contain the airborne particles entrained by the blaze. If the fire were caused by an electrical short that caused, a power outage, the HEPA system could fail, as discussed under Scenario A.

C. Earthquake During D&D Activities—The probability of an earthquake during D&D activities is the same as the probability of an earthquake at any other time. The probability of building failure is very low because it is a one story steel and reinforced concrete building.

D. Small spill during packaging of liquids—A small spill of hazardous liquids could occur during packaging for transfer to a disposal site. The workers would cleanup the spill using a spill kit, and wearing appropriate personal protective clothing. There would be minimal exposure to HCF workers.

5.11 Areas Not Affected

The proposed action would not affect the following areas:

Population and Land Use—The proposed action would increase the compatibility of Building 23 with other science research activities on-going within the GA site. Future use of the Building 23 site could result in the addition of employees or tenants at GA.

Cultural Resources—There are no cultural resources on the GA site.

Aesthetics—The proposed action would only be visible from Interstate 5, located approximately 0.5 mile (0.8 km) to the east and Scripps Green Hospital, located 0.5 mile (0.8 km) to the west. The HCF is not visible to GA's immediate neighbors. Temporary D&D activities will be compatible with continuing industrial use and development of the surrounding areas.

Biology—There are no sensitive or endangered species on the HCF site.

Hydrology—The site elevation is 340 feet above mean sea level. It is not in a wetland, nor is it in a 100-year flood plain.

5.12 Cumulative Effects

No cumulative effects are expected from the proposed action, as discussed below:

Human Health—The radiological exposures of the public due to expected D&D activities at the HCF are calculated to be below 0.04 mrem/year. This amount of incremental exposure would be an insignificant addition to the normal background exposure level.

Traffic—The temporary contractor and 200 waste transport trips over a 4-year period would add little to existing traffic on Genesee Avenue and John Jay Hopkins Drive.

Waste Generation—The proposed action could generate approximately 30,000 cubic feet of waste from D&D activities and up to 50,000 cubic feet of contaminated soil from site remediation. All radioactive, mixed and hazardous wastes would be transported to either a DOE owned disposal facility, such as the one at Hanford, or a commercial facility such as Envirocare. Both facilities have sufficient capacity to receive this waste and continue operations well into the next century.

Cultural Resources—No cultural resources would be impacted.

Table 5-2 Applicability of Environmental Statutes and Regulations

Statute/Regulation	Evaluation	Applicability
National Environmental Policy Act (NEPA)	DOE must evaluate the proposed action for potential environmental impacts. The evaluation is contained in this document.	Yes
Endangered Species Act	No critical habitats exist in the affected area, and no adverse impacts to threatened or endangered species are expected to result from the proposed action.	No
Floodplain/Wetlands Regulations	The proposed action is not located within a wetland or in a floodplain.	No
Fish and Wildlife Coordination Act	The proposed action does not modify or impact fish and wildlife in any way or modify any bodies of water more than 10 acres in surface area.	No
Farmland Protection Policy Act	The proposed action does not affect prime or unique farmlands.	No
National Historic Preservation Act	There are no historical sites or areas in the location of the proposed action.	No
American Indian Religious Freedom Act	The proposed action does not interfere with the right of Native Americans to exercise their traditional freedom.	No
Wild and Scenic Rivers Act	The proposed action does not involve waterways designated as wild and scenic rivers.	No
Resource and Conservation Recovery Act (RCRA)	The proposed action may include the generation, packaging and transportation of mixed waste.	Yes
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)	Any required release reporting would be performed in compliance with CERCLA requirements.	Yes
Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)	The proposed action is not involved in the distribution, use or disposal of any insecticides, fungicides or rodenticides.	No
Toxic Substances Control Act (TSCA)	The proposed action would include the generation of polychlorinated biphenyls (PCBs) which would be disposed of at an authorized facility. Asbestos would also be encountered during D&D operations which would be properly packaged and disposed of in accordance with TSCA.	Yes
Clean Air Act (CAA)	Asbestos would be encountered during the project which will be contained in enclosed spaces, properly packaged and disposed of.	No
Clean Water and Safe Drinking Water Act	The proposed action is not expected to affect surface water bodies or water supplies. Air emissions would be below warning levels.	No
Noise Control Act	Noise levels that could adversely affect workers and staff will be mitigated by providing ear protection for workers and relocation of staff to areas away from the activities. The public is not expected to be impacted from the noise.	No
Hazardous Materials Transportation Act (HMTA)	The proposed action will require shipment of radioactive materials, PCBs, mixed wastes and asbestos. All waste will be packaged and shipped in appropriate containers and disposed of at licensed facilities	Yes
National Emissions Standards for Hazardous Air Pollutants (NESHAPS)	The EPA has stated that NESHAPS are applicable to NRC licensed facilities. Compliance with emission standard would be demonstrated.	Yes
Atomic Energy Act	License required. Compliance with environmental and worker protection standard.	Yes
California Environmental Quality Act (CEQA)	Proposed action does not trigger discretionary review by a state agency.	No
California Health and Safety Code, Div. 20, Chapter 7.6, Articles 13, 14	Proposed action must comply with worker safety regulations.	Yes
California Integrated Waste Management Act	Transportation of low-level radioactive waste would require notification/consultation and manifest.	Yes
Oregon Hazardous Waste and Hazardous Materials II	A manifest is required for the transportation of low-level radioactive waste.	Yes
Washington Dangerous Waste Regulations	Packaging, transport and waste disposal at Hanford requires a manifest. Waste acceptance at Hanford is also required.	Yes
California Code of Regulations Title 17, Div. 1, Chapter 5, Subchapter 4, Radiation	License required. Compliance with environmental, worker, and public protection standard.	Yes

Population and Land Use—Only temporary employment for a few contractors would be provided by the proposed action. No increase in population would occur. D&D of the HCF or its site would make them available for another use.

Noise—D&D activities would occur in an industrial area and would largely occur within Building 23. They would not contribute significantly to off-site background noise levels due to the relative isolation of the site.

Aesthetics—D&D activities would not be visible to adjacent neighbors. D&D activities would only be visible from Interstate 5 and Scripps Green Hospital, both located approximately 0.5 miles (0.8 km) away. After being released to unrestricted use, the HCF site would be used in a manner consistent with the existing GA site.

Geology, Soils, Seismicity and Hydrology—All D&D activities would be localized and storm water runoff would be contained and tested.

Regional Air Quality—The San Diego Air Basin is a non-attainment area for carbon monoxide, ozone, and small suspended particulates (PM_{10}). The proposed action is temporary. A small number of vehicle trips would be generated and would contribute only negligible amounts of these pollutants to the basin.

Hydrology—No changes to any land forms would occur and no radionuclides or hazardous materials would be released to storm water run-off.

Biological Resources—No resources have been identified on the HCF site, nor would D&D activities effect off-site resources.

5.12 Alternatives to Proposed Action

5.12.1 Alternative 1 to Proposed Action—Facility Dismantlement with Minimal Decontamination

This alternative poses essentially the same potential risks and environmental impacts as the proposed project, but would also generate significantly greater volumes of radioactive waste for shipment and disposal and would increase transportation risks proportionately. This alternative is not consistent with the DOE's waste minimization goals and is not environmentally preferable.

5.12.2 Alternative 2 to Proposed Action—Low-Level of Effort Implementation of D&D Activities

This alternative would necessitate continued interim surveillance and maintenance of the HCF over the substantial period until job progress permitted elimination. During this period, the HCF would be deteriorating with age and the risk of environmental contamination would continue to exist. Moreover, development of the land around the GA site over the next few years may significantly increase the local employee population density and increase the potential for public exposure. Ultimately, however, the Facility decommissioning would be completed.

Because operations in the Hot Cell ceased several years ago, the short-lived nuclides have already decayed to levels that would not seriously impact public or worker health and safety.

The remaining primary dose contributors, Cesium-137 and Cobalt-60, have half-lives of 30 years and 5.3 years, respectively. A few years delay would not appreciably reduce worker radiation exposures.

Further, a drawn out D&D would increase total costs due to the fixed costs of continued surveillance, maintenance, and the additional project activities over the added years required.

This alternative is more costly than the proposed action and not environmentally superior.

5.12.3 Alternative 3 to Proposed Action—No Action, Maintain Safe Shutdown

This alternative would necessitate continued surveillance and maintenance of the HCF. During this period, the HCF would be deteriorating with age and the risk of environmental contamination would continue to exist. Exposure to workers would continue and development of the land around the GA site over the next few years may significantly increase the local population density and the potential for public exposure.

These considerations, the high cost of continued maintenance and surveillance under shutdown status, and its incompatibility with NRC requirements for timely D&D of a shutdown facility make this alternative unreasonable.

Martin J. Donegan

James M. Turner, Ph.D.
Manager
Oakland Operations Office

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4-16 General Atomics. "Safety Study for the General Atomics Hot Cell Facility." January 24, 1961.

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7. PEOPLE AND AGENCIES CONSULTED

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California Department of Fish and Game

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San Diego Association of Governments (SANDAG)

Local Businesses and Hospitals

APPENDIX A **NATURAL RESOURCE CONSULTANTS BIOLOGICAL REPORT**

May 10, 1994

Ms. Lisa Clements
Energy & Environmental Solutions
3550 General Atomics Court
San Diego, California 92121-1194

Subject: Letter Report Describing Existing Biological Resources Within the Hot Cell Facility and Adjacent Area (Building 23) Within General Atomics, City of San Diego, County of San Diego, California

Dear Ms. Clements:

The following report describes the existing biological resources within the Hot Cell Facility (Building 23) at General Atomics, City of San Diego, County of San Diego, California. The Hot Cell Facility is a laboratory and research building with an associated outdoor yard. The yard is covered with asphalt and there are no natural communities or sensitive biological resources within the project area. General Atomics proposes to decommission this site. There are no anticipated impacts to biological resources associated with decommissioning and decontaminating this site, nor are mitigation measures recommended to reduce anticipated impacts.

Project Location

The approximately one-acre Hot Cell Facility is located at the north east portion of the General Atomics facility. General Atomics is located within the City of San Diego and is bound on the south by Genesee Avenue and is between I-5 and North Torrey Pines Road. Adjacent land uses include research buildings to the south and west, and natural open space to the west and north.

Project Description

The Hot Cell Facility includes a cement building, an asphalt lot, and small landscaped areas surrounding the building. The asphalt lot includes a small area of exposed gravel and is surrounded by chain-linked and barbed wire fence. There is a small asphalt-lined depression in the lot designed as a water retention basin. There are several pieces of machinery and empty tanks scattered near the building.

Vegetation

Non-native ruderal (weedy) plant species occur within cracks in the asphalt and surrounding the fence line of the site. These weed patches are isolated clumps of vegetation with no habitat value for native wildlife. There are no plant species recognized as rare, threatened, or endangered by resource protection agencies within the Hot Cell Facility. Plants observed on the site include tree tobacco (*Nicotana glauca*), wild oats (*Avena barbeta*), short-podded mustard (*Brassica geniculata*), curly doc (*Rumex crispus*), and telegraph weed (*Heterotheca grandifolia*).

Wildlife

A total of three bird species were observed the site. These include the house finch (*Carpodacus mexicanus*), common raven (*Corvus corax*), and mourning dove (*Zenaida macroura*). A single fence lizard (*Sceloporus occidentalis*) was also observed. There are no wildlife species recognized as rare or endangered by resource protection agencies within the Hot Cell Facility.

Surrounding Habitats

The Hot Cell Facility is adjacent to a canyons that supports coastal sage scrub resources. Surveys conducted in 1988 by RECON indicate that these canyons support sensitive biological resources including the coastal California gnatcatcher (*Polioptila californica californica*); a federally threatened bird species. The fence surrounding the site and parking areas sufficiently separates the native vegetation and sensitive wildlife species from the Hot Cell Facility.

Anticipated Impacts Associated With Project Construction

General Atomics proposes to decommission and decontaminate the Hot Cell Facility. These actions include moving of equipment and empty tanks. These actions will be completed using a truck and manual labor. There is no anticipated impact to biological resources associated with these actions.

Recommended Mitigation Measures

The decontamination and decommissioning of the site will proceed according to strict rules and laws established by the Nuclear Regulatory Commission. No additional mitigation measures are recommended to protect biological resources.

The information included above is sufficient to meet the needs of the biological resources section of a federal Environmental Assessment as specified by the National Environmental Policy Act. If you have questions or comments pertaining to this letter report please contact me at 714.497.0931.

Sincerely,

NATURAL RESOURCE CONSULTANTS

Dave Levine

C:\wp51\GENERAL.ATM – May 10, 1994 – Job Number:0494-02014

APPENDIX B RADIOLOGICAL EXPOSURE AND RISK ESTIMATES

RADIOLOGICAL EXPOSURE AND RISK ESTIMATES

B.1 Introduction

In 1978 and 1979 General Atomics' Hot Cell was refurbished. These activities included decontamination of the high-level and low-level cells. Exposure histories for personnel working at the hot cell during that time period are used to estimate the exposure that decommissioning workers will receive. Similar historical data was obtained for stack releases and was used to estimate the exposure to the general public. The work performed during the refurbishment period is representative of the type of work expected to take place during the decommissioning of the Hot Cell and, therefore, was used to estimate the exposure to workers during the decommissioning of the Hot Cell. Exposure to non-involved GA staff in the immediate vicinity was estimated for activities which may result in their exposure to radiation from the Hot Cell D&D. GA staff which are not in the immediate vicinity are expected to receive exposures in the range that workers at neighboring firms might receive.

B.2 Exposure to Decommissioning Workers

The external exposure and bioassay data for 14 individuals were used to estimate external exposure to workers involved in the D&D of the Hot Cell facility. These 14 individuals worked at the Hot Cell during refurbishment in 1978 and 1979. The group included decontamination workers, Hot Cell technicians, health physics technicians, and management. Bioassay (in vivo total body counts for mixed fission products and mixed activation products) data for 13 of these individuals were also evaluated using the computer code CINDY to determine doses from internal exposure. Table B-1 and Table B-2 summarize the annual exposure data for Hot Cell personnel in 1978 and 1979.

External Exposure

The average annual exposure from external radiation for the 14 individuals was determined to be 0.84 rem (840 mrem). The maximum annual external exposure during the 2-year time period was 2.02 rem (2,020 mrem). These individuals were involved in refurbishment activities which included decontamination of the high and low-level cells, packaging of low-level waste for shipment, packaging and transfer of irradiated fuel, and routine maintenance and support for these activities, as well as for operational activities performed during this time period. The average exposure of 0.84 rem (840 mrem) per year is indicative of the external exposures expected for D&D workers during decommissioning work.

Internal Exposure

The average annual exposure to 13 individuals from internal radiation was determined to be 0.0069 rem (6.9 mrem) (Table B-2). The maximum annual internal exposure during the 2-year time period was 33 mrem. The CINDY program (Ref. B-3) was used to evaluate in vivo total body measurements for mixed fission products and mixed activation products with the assumption that worker intakes were chronic intakes due to inhalation. Although there is the possibility of internal exposures due to uptake through cuts or ingestion, Health Physics control measures make this an insignificant pathway, and the most likely route would be through inhalation of airborne radioactivity from aggressive decontamination of the facility.

Table B-1 External Exposure Data (Whole Body)

Individual	1978 (rem)	1979 (rem)
1	0.18 (180 mrem)	0.02 (20 mrem)
2	0.85 (850 mrem)	0.18 (180 mrem)
3	2.02 (2,020 mrem)	1.74 (1,740 mrem)
4	1.86 (1,860 mrem)	0.63 (630 mrem)
5	0.70 (700 mrem)	0.26 (260 mrem)
6	0.31 (310 mrem)	0.06 (60 mrem)
7	1.19 (1,190 mrem)	0.58 (580 mrem)
8	1.90 (1,900 mrem)	1.42 (1,420 mrem)
9	1.09 (1,090 mrem)	0.81 (810 mrem)
10	1.38 (1,380 mrem)	0.56 (560 mrem)
11	1.78 (1,780 mrem)	0.21 (210 mrem)
12	0.44 (440 mrem)	1.35 (1,350 mrem)
13	0.33 (330 mrem)	0.13 (130 mrem)
14	1.33 (1,330 mrem)	0.16 (160 mrem)
Total =	15.36 (15,360 mrem)	8.11 (8,110 mrem)
Yearly Average =	1.10 (1,100 mrem)	0.58 (580 mrem)
Two Year Average =	0.84 (840 mrem)	

Table B-2 Internal Exposure Data

Individual	1978 (rem)	1979 (rem)
1	0.0120 (12 mrem)	0.0220 (22 mrem)
2	0.0042 (4.2 mrem)	0.0075 (7.5 mrem)
3	0.0026 (2.6 mrem)	0.0041 (4.1 mrem)
4	0.0010 (1.0 mrem)	0.0016 (1.6 mrem)
5	0.0046 (4.6 mrem)	0.0085 (8.5 mrem)
6	0.0024 (2.4 mrem)	0.0045 (4.5 mrem)
7	0.0042 (4.2 mrem)	0.0079 (7.9 mrem)
8	0.0029 (2.9 mrem)	0.0054 (5.4 mrem)
9	0.0020 (2.0 mrem)	0.0037 (3.7 mrem)
10	0.0007 (0.7 mrem)	0.0011 (1.1 mrem)
11	0.0045 (4.5 mrem)	0.0083 (8.3 mrem)
12	0.0041 (4.1 mrem)	0.0078 (7.8 mrem)
13	0.0180 (18 mrem)	0.0330 (33 mrem)
Total =	0.0632 (63.2 mrem)	0.1154 (115.4 mrem)
Yearly Average =	0.0049 (4.9 mrem)	0.0089 (8.9 mrem)
Two Year Average =	0.0069 (6.9 mrem)	

Total Exposure

Assuming that the majority of the dose from internal exposures is delivered within the first year of exposure, the total effective dose equivalent is estimated to be 0.85 rem (850 mrem) and the maximum annual exposure to be 2.04 rem (2,040 mrem). Using a latent

cancer risk factor (Refs. 5-2 and B-4) of 0.4 chances in a thousand of contracting cancer for each rem that a single worker receives and a 5 year exposure duration, the maximum exposed worker cancer risk would be about four chances in a thousand.

The decommissioning is expected to take approximately 5 years to complete using an average of 15 decommissioning workers to complete the work. The cumulative exposure expected for the project is determined as follows:

0.85 rem/yr x 15 persons x 5 y = 63 person-rem

Based on the risk factor in Refs. 5-2 and B-4, the number of expected cancer fatalities in the worker force is 0.025 (one chance in 40 of one death).

B.3 Exposure to the General Public

Exposure to the general public at, and surrounding, the GA site was determined in a similar manner using stack effluent data from the refurbishment period. The weighted average release of mixed fission products (including radioiodines) during 1978 and 1979 were averaged. The exposure and risk associated with exposure to the general public was determined using the CAP88PC computer code (Ref. B-2) which provides the individual effective dose equivalent rate from all pathways (inhalation, ingestion and dermal contact).

Because information on specific radionuclide concentrations was unavailable, for conservatism the concentration for mixed fission products was entered as ^{137}Cs and the concentration for Iodine was entered as ^{131}I for the exposure and risk estimates. Exposure to the general public was estimated at the GA property line closest to the stack at 320 ft. (98 m) to 50 miles (80 km). The estimate at the fence line is considered to be a conservative estimate because the area outside the fence is zoned for scientific research and the closest residential area is approximately 1 mile (1.6 km) from the site.

The total effective dose equivalent for the maximally exposed individual due north of the facility at 320 ft. (98 m) is 0.046 mrem/yr. The Hot Cell D&D is expected to last at most 5 years, so that the summed dose is 0.23 mrem. As shown in Table B-3, exposure decreases with increasing distance from the site. The dose at 1 mile (1.6 km), the approximate distance to the nearest resident, ranged from 0.0014 mrem/yr to 0.0027 mrem/yr. The highest exposure rates for varying distances are summarized in Table B-3. These exposure rates are negligible compared to the 300 mrem/yr an average person receives from natural sources.

Table B-3 Dose Summary for Members of the General Public and Non-HCF Workers on the GA Site

Distance and Directions from Stack (meters/miles)	Individual Committed Effective Dose Equivalent (mrem/yr)
40 meters/0.02 miles East (TRIGA Fuel Fabrication)	0.04
98 meters/0.06 miles North (Open Area)	0.046
300 meters/0.20 miles North (Tower Road)	0.016
800 meters/0.50 miles South (Genesee Avenue)	0.0061
1600 meters/1.00 miles South (UCSD Dorms)	0.0027
8000 meters/5 miles N, WNW, W, S, SSE, SE, ESE, E, NNE	0.0012

The population exposure beyond GA can be bounded by multiplying the total estimated daytime population within the local census tract at year 2000, namely 57,000 (Section 4.1.4), by a dose rate of 0.0061 mrem/yr and considering a five year exposure period. This sum is about 1.7 person-rem. The GA population exposure is below 0.04 mrem/yr times 1,000 people times 5 years or about 0.3 person-rem. The total 2 person-rem corresponds to a small probability of any excess cancer among the exposed population (2,000 person-rem would be expected before even a single, latent cancer fatality is expected, using the risk factor of 500 cancers per million person-rem for the public from Refs. 5-2 and B-4). Specifically, only 0.001 cancer fatality is predicted among the exposed population.

B.4 Exposure to General Atomics Staff Not Involved in D&D Operations

During D&D of the Hot Cell, access to the area will be controlled so that the only non-D&D workers in the vicinity of the facility will be GA's radiation workers in nearby buildings; Building 21-TRIGA, Building 22-TRIGA Fuel Fabrication, Building 27-Experimental Area, and Building 27-1-Experimental Area One. Access into the Hot Cell boundary area will be further limited to D&D personnel. With access and engineering controls in place, the estimated exposure to non-involved staff outside these areas are expected to be on the order of those estimated for the off-site workers at adjoining industries.

Total Exposure From Stack Effluents

Total exposure to individuals within controlled and uncontrolled areas, due to stack effluents from the project, was estimated using the CAP88PC computer code. The exposure estimated with this program is a conservative estimate because individuals are not likely to occupy the site 24-hours-a-day.

The maximum individual exposure to GA's non-D&D workers will be to radiological workers located approximately 130 ft. (40 m) east of the Hot Cell in Building 22. This exposure is estimated to be 0.04 mrem/yr.

Annual dose to GA employees, contractors and tenants on site (outside the controlled area) ranges from 0.018 mrem at 750 ft. (230 m) in the east/southeast direction to 0.0061 mrem at 0.5 miles (0.8 km) south of the facility. These doses are far below allowable annual doses for unrestricted areas in 10 CFR 20.105.

B.5 Exposure During Transportation

The occupational exposure to drivers during the transportation of radioactive waste from the Hot Cell was determined from the number of shipments required to transport 30,000 $ft.^3$ (850 m^3) of waste and 50,000 ft^3 (1500m^3) of soil to the Hanford facility in Washington. It is estimated that transporting the waste generated from the Hot Cell will require about 200 shipments . However, if radioactive waste is generated due to complete dismantlement of the facility, the volume of waste could increase by a factor of two, thus, increasing the number of shipments to 400. The maximum exposure allowed by DOT to drivers in the cab of a truck during transport of radioactive materials is 2.0 mrem/hr However, GA's records show that the exposure to drivers during shipment of the types of wastes to be generated during the D&D are generally less than 0.2 mrem/hr. If the exposure in the cab is assumed to be 0.2 mrem/hr for each shipment and there are two drivers per shipment, the total exposure for transportation of Hot Cell waste would be:

200 x 1,500/45 mph x 0.0002 rem/hr x 2 people = 2.6 person-rem,

which corresponds to 0.1% chance of inducing one latent cancer fatality.

For 400 shipments the total cumulative exposure could reach 5.5 person-rem or a 0.2% chance of inducing a single latent cancer fatality.

B.6 Exposure Summary

The annual average and maximum total doses to D&D workers were estimated to be 0.85 rem (850 mrem) and 2.04 rem (2,040 mrem), respectively. The maximum annual dose to outside workers or the general public is estimated to be 0.046 mrem. The maximum annual exposure to non-D&D workers on-site was estimated to be 5 mrem for individuals in the controlled area surrounding the Hot Cell. The exposure estimates for the D&D workers, non-D&D workers and the general public are well below NRC's annual occupational radiation dose limit of 5 rem (5,000 mrem) total effective dose equivalent (TEDE) per year and/or the annual dose limit for members of the public of 100 mrem per year (dose limits effective January 1, 1994).

B.7 References

B-1 Standards for Protection Against Radiation; Final Rule, NRC 10 CFR Part 20 et al., May 21, 1991.

B-2 User's Guide For CAPP88-PC (DRAFT), Version 1.0, Prepared for the U. S. DOE, EPA 52016-91-022, December 1991.

B-3 User's Guide for the Code for Internal Dosimetry (CINDY) Version 1.2, Prepared for the US DOE, PNL-7493, 1992.

B-4 1990 Recommendations of the International Commission on Radiological Protection, ICRP Publication 60, Volume 21, No. 1-3, 1991.