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Lawrence Livermore Laboratory

Environmental Impact Assessment for the Nova Projects
(Building 391 Complex)

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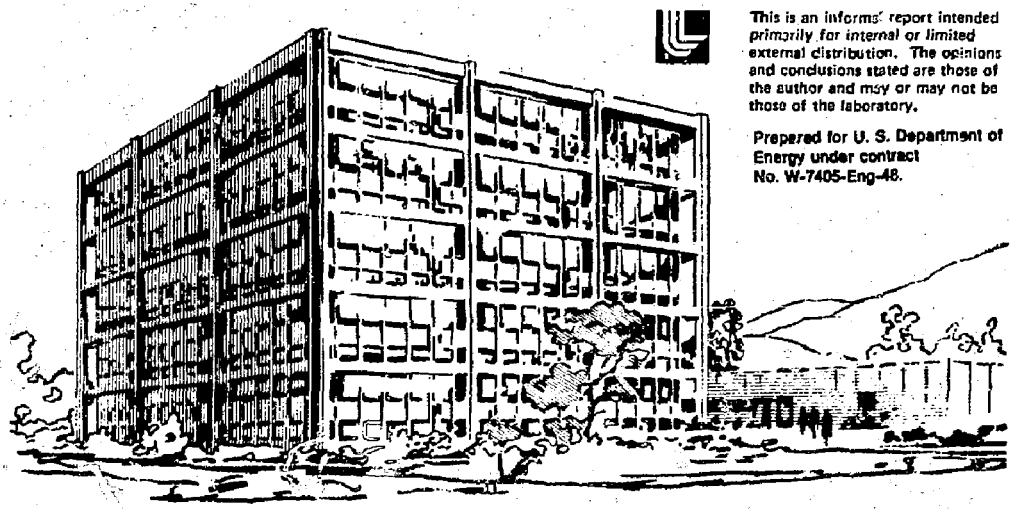
June 4, 1979



EIA-391

ENVIRONMENTAL IMPACT ASSESSMENT

FOR THE

NOVA PROJECTS

(BUILDING 391 COMPLEX)

University of California
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Livermore, California

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Abstract

The environmental impact assessment of the Nova projects (Building 391 Complex) describes 1) the proposed actions, 2) the existing environment in and around the Livermore Valley, and 3) the potential environmental impacts from the construction and operation of these facilities. It shows that the proposed action does not conflict with any Federal, State, Regional, or Local Plans and Programs. Possible alternatives to the proposed action are discussed. However, it is concluded that the proposed actions were the most reasonable of the alternatives and would involve relatively minor adverse environmental impacts.

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1. Description of the Proposed Action

The proposed projects involve the construction of an addition to and modification of existing Building 391, and construction of a new office building at the Lawrence Livermore Laboratory (LLL), Livermore, California (Fig. 1). The new addition to Bldg. 391 of 8175 m^2 (88 000 ft^2) will be similar to the present building except somewhat larger. Modification of the existing Bldg. 391 will occur after completion of the new addition. The new 5100 m^2 (55 000 ft^2) office building will be adjacent to Bldg. 391 and will provide offices for about 200 people. The proposed facilities are described in Refs. 1. through 4.

Building 391 (Fig. 2) was designed and constructed to perform laser fusion experiments. The enlarged complex will be used for studies to demonstrate the scientific feasibility of laser fusion.

This assessment describes the existing environmental setting; identifies the project's environmental effects and mitigating features; notes whether the projects conflict with the policies and plans of other governmental agencies; and discusses alternatives to the proposed projects. On the basis of this assessment, no detailed Environmental Impact Statement is required.

2. Description of the Existing Environment[5]

2.1 Environmental Setting

The Lawrence Livermore Laboratory (LLL) is located about 64 km east of San Francisco in the Livermore Valley in southern Alameda County, approximately 4.8 km east of the city of Livermore, California (Fig. 1).

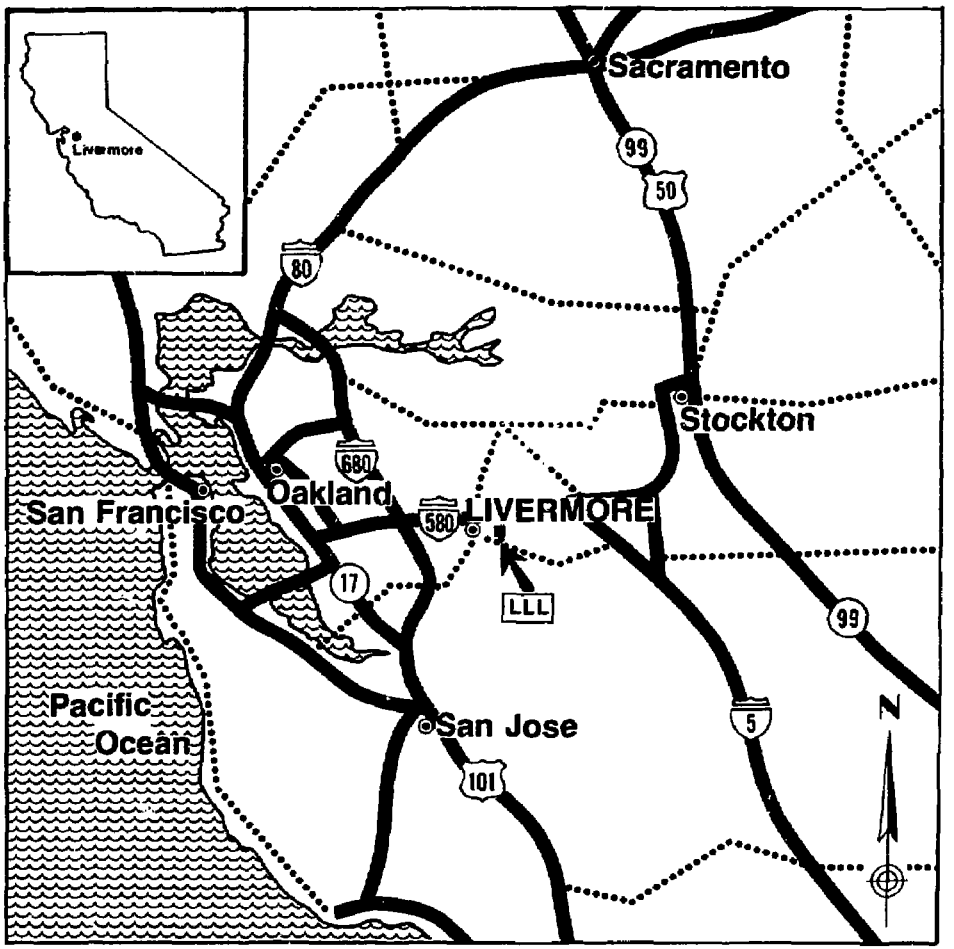

Fig. 1. Location of LLL with respect to Livermore and surrounding communities.

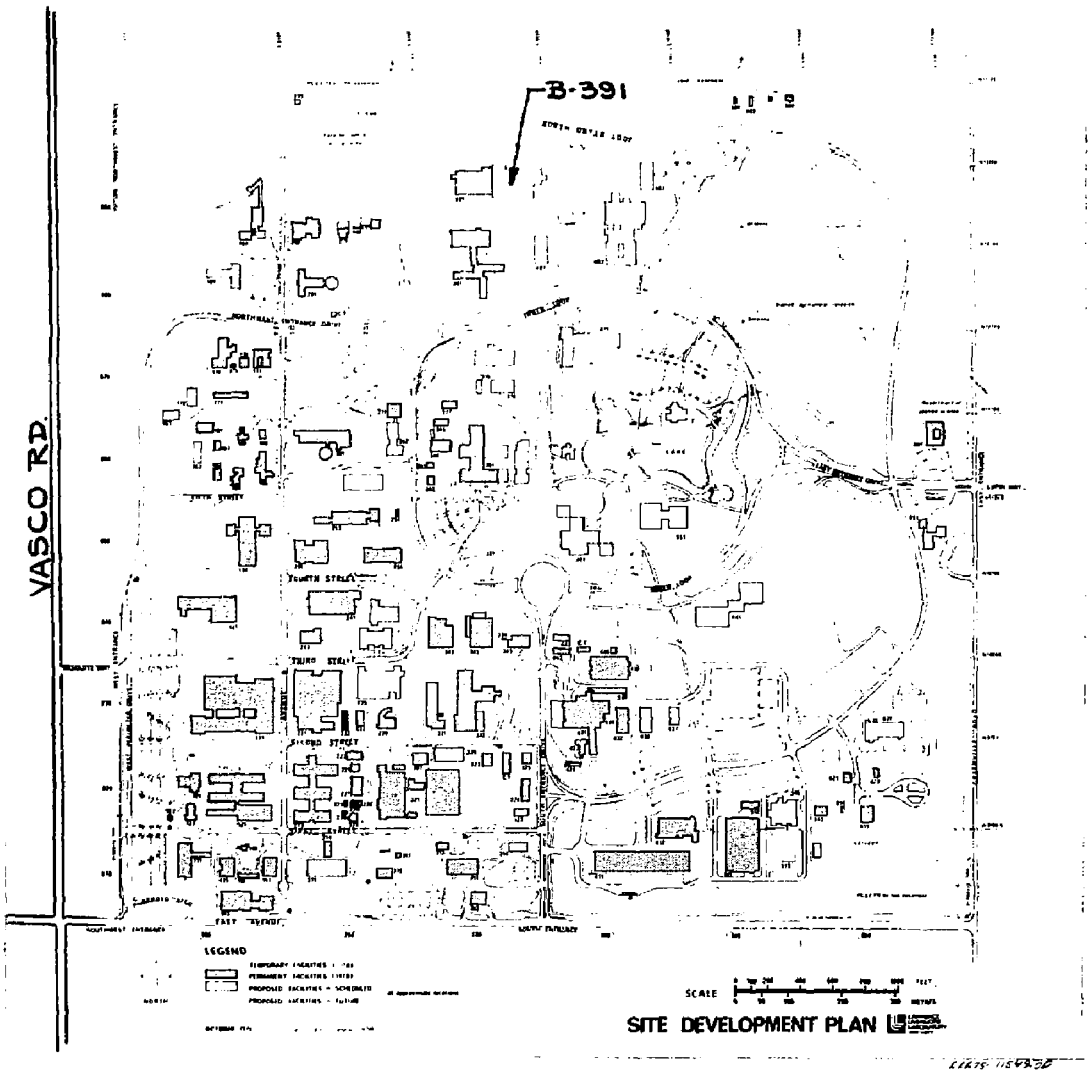

Fig. 2. Location of Nova Facilities within the LLL Site.

The Site occupies an area of approximately 2.6 km.^{2} Open agricultural areas surround the Laboratory on the north, east, west, and part of the south side. Sandia Laboratories - Livermore (SLL) occupies a portion of the adjoining property on the south.

2.2 History

Prior to World War II, the land now occupied by LLL was used for light agriculture and cattle grazing. In 1942, the U. S. Navy purchased the property as a site for the Livermore Naval Air Station, a primary training base.

This site was selected in 1952 as a nuclear weapons laboratory and is now called the Lawrence Livermore Laboratory. LLL is operated for the Department of Energy by the University of California under contract number W-7405-Eng-48 and currently employs approximately 7000 people. Although nuclear weapons research and development has always been the prime mission of LLL, additional programs include controlled thermo-nuclear research, biomedical and environmental studies, and laser fusion research. Most recently, major programs aimed at developing non-nuclear energy technologies have been established at Livermore.

2.3 Seismology

A number of faults either pass through or are adjacent to the Site. The Laboratory is beginning a study to discover the exact location of these faults and to determine, more accurately, the seismic potential of these faults. Because there is no evidence of recent faulting or displacement, the probability of future local seismic activity is low. Of the faults

that either pass through or adjacent to the Site, the Tesla fault is thought, at present, to have the most potential for damage to LLL. An earthquake with 6.5 magnitude at a 4 km epicentral distance from the Laboratory site is the maximum to be expected on the Tesla fault.

2.4 Hydrology

The eastern Livermore Valley including the LLL site, is underlain by water-bearing strata, mostly of alluvial origin. Groundwater recharge occurs in uplands east and southeast of the Laboratory site. The flow of this groundwater is inferred to be to the northwest, beneath the Lawrence Livermore Laboratory. Some of the groundwater flowing beneath the Laboratory ultimately is discharged by seepage at the surface some 3.5 km northwest of the Site. The remaining groundwater moves an undetermined distance west of the discharge site.

Laboratory surface drainage is collected in storm sewers in developed areas of the Site and in ditches in undeveloped areas of the Site. The drainage then empties into the Arroyo Las Positas, which runs along the north perimeter of LLL. The Arroyo Seco crosses near the southwest corner of the Laboratory and meets Arroyo Las Positas northwest of the Laboratory site. The surface drainage continues to flow to the west, and ultimately joins Alameda Creek near Sunol.

2.5 Meteorology

The Livermore Valley is characterized by mild, rainly winters and warm, dry summers. Annual rainfall averages 36 cm with the greatest recorded daily rainfall being 8.9 cm. Rains occur predominantly between November

and April, usually in connection with Pacific storms. [redacted] winds prevail from April through September. During the remainder of the year, winds from the east and northeast occur as frequently as those from the west and southwest.

2.6 Population

The total present population within 80 km of the Laboratory is approximately 4.3 million people, distributed as indicated in Fig. 3. The population of the city of Livermore is approximately 50 000, and the nearest residential area is 0.8 km from the Laboratory's west perimeter.

Approximately 110 000 people live in the Livermore-Amador Valley, which includes the cities of Livermore, Pleasanton, and Dublin.

At the present time, the on-site population of LLL is approximately 7300 persons, and consists of employees, contractors and outside agency personnel, and visitors.

2.7 Environmental Background

In past years, LLL's extensive environmental surveillance program[6] has shown that:

- The median annual gamma radiation dose rate at the Laboratory perimeter is about 60 mrem, identical to the median background dose rate observed in the off-site vicinity.
- Air samples collected within the Livermore Valley exhibit alpha and beta activity consistent with worldwide weapons testing fallout levels.

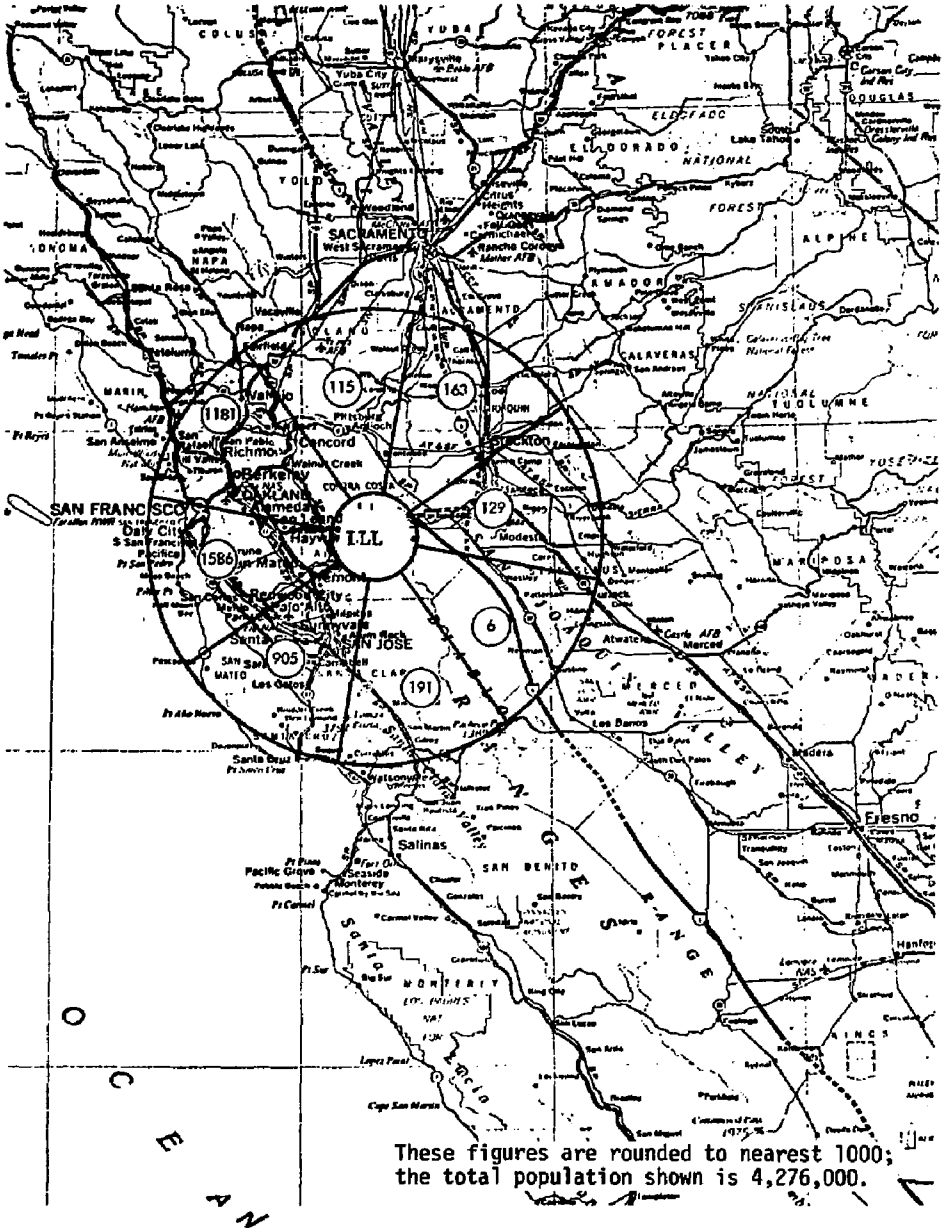

Fig. 3. Estimated population distribution within 80 km of LLL. Figures are rounded to nearest 1000; the total population shown is 4 276 000.

- Surface water samples collected within the Livermore Valley exhibit normal background alpha and beta activity. Some minor elevations of tritium levels have been noted, but these are limited to the Las Positas Creek, which receives discharge from the Livermore Water Reclamation Plant.
- Liquid wastes discharged to the Livermore sanitary sewer system have not exceeded DOE (DOE Manual Chapter 0524) or City of Livermore (City Code, Sec. 18.66) discharge limits for radioactive materials.
- The person living nearest the Laboratory receives less than 1 mrem per year from the radioactive effluent of all the Laboratory's operations.

2.8 Sociological and Economic Factors

Employment and Population

LLL was responsible for the major growth of the city of Livermore and nearby communities in the 1960s and still remains one of the factors in their growth. However, the trend to suburban living by San Francisco Bay Area people is now the major input to populating these communities.

Economic Aspects

The economic impact of the Laboratory may be seen in the annual payroll. The dollar value of this payroll spent in Livermore has been estimated assuming (1) a direct relation between payroll and the percentage of Laboratory employees living in Livermore, and (2) that 30% of the employees' income is available to be spent on retail taxable sales. With these assumptions, the Laboratory accounts for approximately 21 percent of the total taxable sales. The economic impact of the Laboratory is still very important to the Public School System in Livermore since the city is

granted impact aid for students whose parents work on Federal installations. The percentage of Laboratory related students enrolled in the school district is approximately 19%.

In the mid-seventies, 7.5×10^5 in federal impact aid was granted. This amounted to about 4.7% of the funds required for school expenditures. In addition, LLL provides, in lieu of property taxes, approximately $30 000 annually for the support of Livermore Public Schools.

2.9 Traffic

Interstate 580 is the major freeway through the Livermore-Amador Valley which feeds traffic from the Bay Area to the Central Valley (Fig. 1). Vasco Road and Greenville Road (Fig. 2), located approximately 1.6 km north of the Laboratory, serve as the major routes from most points outside of Livermore to LLL. Traffic to LLL from within Livermore follows East Avenue or Tesla Road to South Vasco Road.

According to a 1976 survey conducted by LLL, Laboratory employees contribute an average weekday both-way, peak-hour count at Vasco Road and East Avenue of 4700 vehicles. A typical peak-hour both-way count on Mesquite Way, which is the LLL entrance off Vasco Road, is about 1550 vehicles. The both-way traffic count on Greenville Road at the Laboratory's east entrance indicates that about 580 vehicles travel that road daily.

3. Potential Environmental Impact

3.1 Construction Aspects

There will not be a significant impact on the environment as a result of this construction. There are no native trees in the construction area and no soil erosion is expected because of the level terrain and the limited area involved. An archaeological survey, conducted in 1975 by Archaeological Consulting and Research Services, indicated no evidence of archaeological resources within the LLL site boundaries. Traffic increase as a result of construction crews on roads leading to the Site will be negligible. Some dust and noise typical of construction projects will be generated, but will be temporary; and will be controlled to the maximum extent possible.

3.2 Operational Aspects

Electrical Energy

The total electrical usage for the addition to Building 391 including the charging of the capacitor banks will be approximately 35 million kWh. (The total DOE Livermore Laboratories electrical usage in 1976 was about 210 million kWh.) The existing Shiva facility uses less than 50 percent of that expected by the Nova addition. Since the office buildings will replace existing trailers, it should not increase the overall electrical consumption.

Radiation

The Nova experiment in some cases will use laser fusion targets, some of which will contain U-235. The maximum yield expected from such targets is 10^{19} D-T neutrons per burn pulse.[7] These neutrons will induce nuclear

reactions in not only the target materials, but also in adjacent structural and shielding materials. In the case of targets containing U-235, the neutrons will lead to the production of fission products and actinides. To protect personnel from radiation, a 2-ft-thick water shield will envelope the target chamber as well as several feet of concrete. This shielding was designed to limit the dose rate to $\leq$250 mrem/yr for facility personnel and <1 mrem/yr at the LLL Site boundary, based on maximum predicted dose rates and 500 test per year.

Gaseous Waste

Waste gases result from target fabrication, unburned target tritium, neutron activated air, and fission products. All waste gases will be released, following a decay period, through an exhaust system equipped with continuous monitoring capability. If releases approach 1 Ci/day, the tritium in the exhaust will be removed by molecular sieves. It is estimated that .02 Ci of ^{85}Kr will be released in one year's continuous operaton. The expected off-site radiation dose from ^{3}H and ^{85}Kr is .025 mrem/yr, .005% of that allowed by DOEM 0524.

Since each target contains only 2 Ci of tritium, the maximum amount of tritium available for release from ruptured targets would be 1000 Ci/yr. If this tritium was released in an oxidized form, the site boundary dose would be less then 0.1 mrem/yr.

When targets are used that yield fission product gases, a special exhaust system will be employed to minimize any releases. This system will remove iodine on charcoal filters and hold other gases for decay.

Activated air, primarily ^{13}N and ^{41}Ar, when released at the rate of 1% of the target room volume per minute, will yield a boundary dose of approximately 1 mrem/yr. This is low enough to not require special handling or delay.

Solid and Liquid Waste

Solid waste consists of target debris (mainly embedded in the target chamber liner), molecular sieves, and filters. This waste is expected to add less than 2% to the total Laboratory radioactive waste volume and will be processed, packaged, and shipped for disposal by the Hazards Control Department.

Liquid waste is generated primarily by washdown of the target chamber walls. This liquid will be captured in shielded waste-retention tanks and transferred to the Laboratory liquid waste treatment plant for decontamination.

The shielding, retention tanks, charcoal bed, and HEPA filters will limit personnel exposures to below the current standards or from having an adverse impact on the envionment.

Water Quality

All sanitary sewage and non-radioactive liquid waste from the 391 Complex will be discharged to the City of Livermore treatment facilities. The quantity of wastewater generated by the Nova facilities will be about twice that generated in the existing facility. However, most of this wastewater is being generated by the present personnel who are housed in

trailers. The City of Livermore sanitary sewage treatment plant will be able to adequately handle wastewater, and the treated effluent will have no adverse impact on the environment.

Very little radioactive liquid waste will be produced by the operation of Nova. This waste will be collected in tanks and then transferred to LLL Waste Disposal.

Socioeconomics

Within five year, approximately 200 employees will be required to operate the Nova facilities. Most of these employees will be transfers of existing Laboratory personnel. Therefore, the socioeconomic impact from these facilities on the nearby communities will be minimal.

Traffic

Since most of the 200 Nova employees are expected to be existing Laboratory personnel, no increase in traffic is expected.

3.3 Site Restoration

In decommissioning the buildings, it would be necessary to remove the target chamber, ventilation ductwork, and the radioactive waste system from Building 391. Experience has shown that most contamination of smooth painted surfaces can be scrubbed off using detergents. These facilities could be restored to the public or future occupants of the site with no residual radiological hazard.

4. Identification of Known or Potential Conflicts with Federal, State, Regional, or Local Plans and Programs

The proposed actions will be located within the LLL site boundaries, and will not conflict with any known plans or programs sponsored by federal, state, regional, or local agencies.

5. Implications of Alternatives

Possible alternatives to the proposed projects and the operation of the Nova Experiments in these facilities include the following:

- Construct an entirely new facility on the LLL site.
- Relocate the experiment.
- Abandon the experiment

The environmental and other implications of these are as follows:

Construct entirely new facilities on the LLL site: Constructing and operating entirely new facilities on the LLL site would not cause any significant impact on the environment. The impact would be the same as that created by modifying Building 391 and conducting the experiment in it.

Although this alternative would not cause any significant adverse environmental impact, it would not be a feasible choice. Construction costs would be considerably higher, and the projects would be delayed.

Relocate the experiment: The environmental impact caused by constructing or modifying these facilities at a site other than LLL cannot be determined until the relocation site is selected. However, it is unlikely that the impact would be less severe than the impact caused by the proposed action. With respect to operation, any environmental impact would not be reduced, but merely

transferred to another geographical area. The relocation may require people to move out of the Livermore Valley causing societal and economic changes such as reduced local business and lowered school attendance. However, since only 200 employees and their families are involved, the impact will be relatively insignificant.

Considerations other than those related tc the environment must be examined. Relocating personnel and equipment would result in programmatic delay. Also, some project personnel may choose to remain in the Livermore area and seek LLL transfers or jobs elsewhere in the area. Since many of these people possess specialized knowledge and skills, hiring new people would cause further delays.

Another consideration is that close contact with the Laboratory's support and scientific personnel would be lost. This contact is essential for the advancement of the project. For these reasons, relocating the experiment to a site other than LLL would not be a reasonable alternative.

Abandon the experiment: For obvious reasons, this alternative would cause the least impact from the environmental standpoint. However, the Nova as proposed, would involve relatively minor adverse environmental impacts and should not be abandoned.

In prior laser fusion energy experiments, such as Janus, Cyclops, Argus, and Shiva, major advancements have been made in understanding the physics of plasma, developing the technology needed to create and confine plasma, and achieving required plasma conditions. Nova is designed to provide an important link between previous laser fusion energy experiment and the

feasibility of laser fusion. Success in the Nova experiment would mean being on the threshold of demonstrating the feasibility of laser fusion power reactors and moving toward energy self-sufficiency. This prospect leads to the conclusion that abandonment of the Nova experiment would be an unreasonable alternative.

References

1. CP&D Preliminary Report Shiva Upgrade/Nova Laser Fusion Program, September 1976.

2. CP&D Interim Report Shiva Nova Laser Fusion Program, October 1977.

3. CP&D Final Report Nova Laser Fusion Program, March 1978.

4. Preliminary Proposal Nova Laser Facility Building 391, Increment II., December 1978.

5. B. N. Odell, Supporting Documents for LLL Safety Analysis Reports Livermore Site, Lawrence Livermore Laboratory Report UCRL-51801 (April 30, 1975).

6. W. J. Silver, C. L. Lindeken, K. M. Wong, E. H. Wiles, and J. H. White, Environmental Monitoring at the Lawrence Livermore Laboratory 1977 Annual Report, Lawrence Livermore Laboratory Report UCRL-50027-77 (March 11, 1978).

7. M. S. Singh, Inventory of Actinides and Fission Products for Shiva Nova II Operations, Lawrence Livermore Laboratory Communication NOVA 78-24 (to Novans) February 8, 1978.