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ENVIRONMENTAL ASSESSMENT REPORT
NUCLEAR TEST TECHNOLOGY COMPLEX

MASTER

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Lawrence
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Environmental Assessment Report:
Nuclear Test Technology Complex

ABSTRACT

The U. S. Department of Energy (USDUE) is planning to construct and operate a structure, designated the Nuclear Test Technology Complex (NTTC), on a site located west of and adjacent to the Lawrence Livermore National Laboratory. The NTTC is designed to house 350 nuclear test program personnel, and will accommodate the needs of the entire staff of the continuing Nuclear Test Program (NTP). The project has three phases: land acquisition, facility construction and facility operation.

The purpose of this environmental assessment report is to describe the activities associated with the three phases of the NTTC project and to evaluate potential environmental disruptions. The project site is located in a rural area of southeastern Alameda County, California, where the primary land use is agriculture; however, the County has zoned the area for industrial development. The environmental impacts of the project include surface disturbance, high noise levels, possible increases in site erosion, and decreased air quality. These impacts will occur primarily during the construction phase of the NTTC project and can be mitigated in part by measures proposed in this report.

1. SUMMARY

The U. S. Department of Energy has proposed to construct a Nuclear Test Technology Complex (NTTC) to house approximately 350 members of the Lawrence Livermore National Laboratory (LLNL) staff who are assigned to work on the Nuclear Test Program (NTP).

The NTTC project will include three phases: (1) acquisition of a 35-acre plot of land lying to the west of and adjacent to the present LLNL property, (2) construction of Building 124, a three-story structure having approximately 173,000 sq ft of floor space, and (3) operation of the facility so as to fulfill normal programmatic needs. The construction phase of the project should be completed 23 months after ground breaking takes place.

The area selected as the site for the NTTC project is in the grasslands of southeastern Livermore Valley. The area is characterized by a Mediterranean climate with warm summers. The land is currently used primarily for grazing and for hay production, although Alameda County has zoned the site and its environs for industrial development. The proposed site is located near an intermittent watercourse (the Arroyo Seco), and is some 5 km east of the City of Livermore.

The environmental effects of the project are expected to be minor, with routine surface disturbance and emissions being the principal impacts during the construction phase. Noise levels during some periods of the construction phase are expected to be relatively high, but not inordinately intrusive with recommended mitigation measures in effect. Some erosion of the construction site may take place during periods of precipitation. Locally elevated levels of suspended particulates, hydrocarbons, SO_x and NO_x are expected periodically during project construction. Some increases in local traffic will also take place.

Some of these impacts will be mitigated using standard procedures for good construction practice. The construction site, as well as access roads, will be sprinkled with water during the dry season to keep down dust levels. When heavy equipment is in use on site, it will be operated only during daylight hours so as to minimize any disturbance to near-by residents. Traffic will be routed so as to minimize congestion in the vicinity of the construction site, especially during normal commuting hours.

An archaeological survey performed on the proposed site did not result in the discovery of any historic or cultural artifacts.

Full utilization of the completed NTTC structure is expected to increase the efficiency of the Nuclear Test Program operations at LLNL by consolidating Program activities in one location and facilitating intergroup communications.

2. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 The Proposed Action

2.1.1 Purpose and Need for the Action

The Department of Energy (DOE) has the ongoing responsibility for the design and testing of nuclear weapons to equip the U. S. armed forces for the maintenance and upgrading of national security. The Lawrence Livermore National Laboratory (LLNL) is one of the two U. S. installations involved in nuclear weapons research and development.

Currently, LLNL personnel working on the Nuclear Test Program are housed in a number of buildings located in the southwest corner of the existing Laboratory site; both office and laboratory space is limited, and effective coordination of the program is difficult because of the physical isolation of many of the program groups and sections. In order to provide for more efficient Program operations, as well as for orderly expansion of the Program as may be needed for current national security requirements, a single facility of adequate size and capability is planned.

The Nuclear Test Technology Complex (NTTC), a multistory building (see Figure 1) with approximately 173,000 gross sq ft ($16,000 \text{ m}^2$) of floor space (approximately 100,000 gross sq ft (9300 m^2) of shielded, light laboratory, shop, and assembly space), is designed to house 350 Nuclear Test Program personnel. Laboratories and related offices will be located on the first floor and basement levels; the majority of the offices will be on the second floor. The facility is designed to accommodate all the current needs of the Nuclear Test Program (NTP).

Figure 1. Architect's Conception of the NTIC Building.

2.1.2 Site Location

The NTTC site is located about 65 km east of San Francisco at the southeast end of the Livermore Valley in Southern Alameda County (see Figure 2). The City of Livermore is about 5 km to the west. The building site is located in a 35-acre (14.2 hectare) plot in the SE 1/4 of (projected) Section 11, T3S, R2E of the USGS Altamont Quadrangle California, and is to the west and adjacent to the southwest corner of the existing LLNL site (See Figure 3). The land parcel on which the facility is to be constructed is designated 99A-1475-3-2 and is bounded on the north by Mesquite Way, on the west by Vasco Road, on the south by the Arroyo Seco, and on the east by LLNL.

2.1.3 Project Description ^{3,4}

The planned NTTC will be located on land to be acquired directly west of the Laboratory. The location is adjacent to the present weapons complex which is already situated in the southwest quadrant of the Laboratory. The proposed land acquisition of a minimum of 14 hectares (35 acres) is necessary to serve as a site for the complex and to provide parking for the projected growth in the number of weapons test program personnel. There is no room for a facility to be co-located within the present weapons complex without leveling existing permanent structures or placing the facility in the existing, fully-used parking lots. The weapons complex will be fenced and maintained as a secure area.

The new facility will have approximately 16,000 m² (173,000 sq ft) of floor space. About sixty percent of the space will be dedicated to various light laboratory functions with the remainder designed for office and related uses to accommodate 350 Nuclear Test personnel. The facility will be a multi-story structure with laboratories and related offices located on the

Figure 2. Area Map Showing Proposed NTTC Site (and Location of LLNL).

Figure 3. Detailed NTTC Site Location Map.

first floor and basement levels. The majority of the office facilities will be located on the second floor level.

The building will be designed to relate well to the existing nearby major facilities in the complex and will be constructed of fire-resistive materials. Fire sprinkler systems, as well as other safety devices, will be installed. Normal laboratory building utilities, heating, ventilation, power, lighting, and communication systems will be provided. The building will be cooled by mechanical refrigeration. In addition, a few rooms require close temperature and humidity control. Energy conserving design will be utilized throughout the facility.

Special ventilation and floor covering will be installed in areas where toxic or hazardous materials are used. Approved access control equipment and shielding will be provided for these areas where radioactive sources or radiation generating equipment are to be installed.

No solid or liquid radioactive wastes will be generated by activities carried out in the NTTC (Building 124). A small amount (less than 1 m³ per year) of toxic liquid waste (including industrial solvents, machine oils, laser dyes and some photographic solutions) will be handled in accordance with Resource Conservation and Recovery Act (RCRA) guidelines; these liquids will be collected in containers designed for the safe storage and transport of such wastes. These liquids will be transferred to a central LLNL facility for treatment or disposal (see Reference 5). In addition, some silver-containing photographic solutions will be collected separately and processed to recover the silver.

About 200 kg per operating day of miscellaneous solid waste (paper, cardboard, yard waste, wood, metal, etc.) will also be generated; this waste will be combined with similar waste from other LLNL facilities and disposed of off-site in an approved sanitary landfill (see Reference 5). Small amounts

of solid chemical waste will be generated occasionally in the course of operations carried out in Building 124; these will be segregated from other solid waste and disposed of in accordance with established LLNL procedures (see Reference 5).

Normal site utilities will be extended from mains between Buildings 121 and 131. Connections to storm and sanitary sewers will be made on 3rd Street. Electrical power will be extended from the high voltage switch gear north of Building 131 to a new substation serving this building. Area lighting will be installed for safety and security. Site development will comply with the Master Site Plan and will include grading, paving, off-street parking, curbs, gutters, sidewalks, fencing, security screens, landscaping, and irrigation systems with automatic controls.

The project schedule (Figure 4) indicates that about three years will be needed to complete the NTTC after funds are appropriated and authorized.

2.1.3.1 Land Acquisition

Following the approval of the NTTC project, it will be necessary to acquire the 35-acre (14.2-hectare) parcel identified as 99A-1475-3-2 (see Section 2.1.1 above). Currently, this land is used intermittently as pasture, but is zoned by Alameda County for industrial development (see Figure 5). This property, together with surrounding areas, is in the process of being annexed to the City of Livermore.

2.1.3.2 Building Construction

The NTTC building (Building 124) is to be located in the east-central portion of the newly acquired land (see Figure 6). An architect's conception of the finished building is shown in Figure 1, and the floor plans of the basement, first, and second floors are presented in Figure 7. The total area

Item	FY 1					FY 2					FY 3					FY 4					FY 5															
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
<u>Acquisition of land</u>																																				
<u>Building 124</u>																																				
Design																																				
Bid and award																																				
Construction																																				
Procure equipment																																				
Activation																																				

Figure 4. NTTC Project Schedule.

Figure 5. Land Use Zoning of the Proposed NTTC Site and Its Environs.

Figure 6. Location of Building 124 on the Proposed NTTC Site.

Figure 7a. Floor Plans of Building 124: Basement.

Figure 7b. Floor Plans of Building 124: First Floor.

Figure 7c. Floor Plans of Building 124: Second Floor.

to be disturbed during the building construction phase will be about five acres (2 hectares). Access to the construction site will be from Mesquite Way. A total of approximately 54,000 m³ (70,000 cu yd) of earth will be excavated in the course of the construction, of which 35,000 m³ (45,000 cu yd) will have to be removed from the building site and its immediate environs. Some 6,000 m³ (8,000 cu yd) of concrete will be used during the building construction, and about 1100 tonnes (1300 short tons) of structural steel will also be needed. As can be seen from Figure 4, building construction is estimated to require 23 months.

2.1.3.4 Land Improvement

Of the 14.2 hectares (35 acres) in the parcel of land to be acquired for NTTC construction, about 6.9 hectares (17 acres) will be improved during the course of this project, and will be either paved or landscaped. The improved area can be broken down as follows:

Bldg. 124 (NTTC structure),	0.5 hectares (1.2 acres)
Sidewalks,	0.3 hectares (0.8 acres)
Paving (Streets),	3.8 hectares (9.3 acres)
Landscaping,	2.1 hectares (5.3 acres)

The landscaped area will include 150 trees and will be irrigated. Because the area to be improved has only minimal relief, little grading will be needed.

2.1.3.5 Facility Operation

Subsequent to its completion and occupation it is estimated that annual Laboratory use of water will be increased by about 40,000 m³. Annual natural gas usage by the facility will be about 900,000 m³, and about 35 TJ of electrical energy will be consumed per year.

2.1.3.6 Equipment and Personnel

Estimated equipment use during the course of NTTC construction is given in Table 1. In addition to the equipment use presented in the table, a large number of truck deliveries of materials to the building site will be necessary. If it is assumed that ready-mix concrete is used for the building, some 3000 deliveries would be needed. Even if concrete is mixed on site, a large number of trips (about 2000) would be needed to supply cement, sand and aggregate. Over and above the concrete-related traffic, it is estimated that an average of ten truck deliveries per day (mostly building materials) will be needed during the 23-month construction period (about 5000 trips).

The maximum number of construction personnel expected to be on the NTTC site at any one time is sixty; the average number over the construction period would probably be about forty. Thus, about 20,000 man-days will be required for the NTTC project.

During the NTTC operational phase, the complex will be occupied by 350 LLNL personnel; however, no more than 90 of these will be new employees hired for the ongoing NTP. In addition to Test Program personnel, five or six additional employees will be needed for NTTC cleaning, maintenance, and repair work (both in and around Building 124).

2.2 Alternatives.

2.2.1 No Action

As is the case with all proposed projects, one of the possible alternatives is "no action." The open space west of LLNL would be preserved and there would be a considerable saving of building materials and fuel. However, the Test Program would still be faced with the problem of how best to

Table 1. Estimated Equipment Use During NTTC Const ruction

Description	Total use, equipment-days	Horsepower	H.P.-hours ^a	Remarks
Bulldozer	30	150	36,000	Diesel
Excavator	30	100	24,000	Diesel
Front loader- backhoe	100	50	40,000	Gasoline or diesel
Dump truck	120	75	72,000	Gasoline or diesel
Air compressors	600	30	144,000	Gasoline or diesel
Truck-mounted crane	250	100	200,000	Gasoline or diesel
Miscellaneous ^b	50	100	40,000	Gasoline or diesel
Office trailers	2000	---	----	----

^a Assuming 8 hrs per equipment-day

^b Including grading and asphalt paving equipment

maintain or accelerate the rate of nuclear testing with the present facilities. In addition, Test Program personnel would remain in scattered enclaves as they are at present. The "no action" option would not ease the difficulty of carrying out the present and future NTP.

2.2.2 Enlarge Existing Permanent Facilities on Present LLNL Site

Enlarging existing facilities would prevent or reduce personnel overcrowding, and could help to consolidate some Test Program groups. More adequate laboratory facilities would also be provided. Space is available to construct additions to a number of existing LLNL structures.

This option has been investigated, but the cost of constructing a number of relatively small additions onto several buildings on the present site would be significantly higher than the cost of an integrated facility such as the NTTC. Also, Test Program personnel would still remain in scattered groups housed in several different buildings, thus hindering effective intercommunication of ideas and programmatic information.

2.2.3 Provide Additional Temporary Facilities on Present LLNL Site

While this alternative would relieve office overcrowding, it would not significantly improve the communications problems resulting from the widely scattered locations of Test program groups. Also, the approach would not alleviate the problem of inadequate laboratory space.

2.2.4 Relocate Personnel in Existing LLNL Facilities

Of necessity, this technique is currently used at LLNL as a stopgap method for housing expanding programs. However, if the Test Program were to be expanded, the resulting dislocations of personnel could have a significant adverse effect on Program schedules. Without new facilities, it is inevitable

that crowding would occur; also, this approach does not satisfy the need for larger laboratory facilities.

2.2.5 Alternate Site and/or Alternative Building Locations

Relocation of the NTTC building to some other portion of the 14.2 hectare (35-acre) parcel west of the present LLNL site would not appreciably change the impact of construction activities or of the operation of the facility. The building could be constructed on the present LLNL site, but this would involve a change in the Livermore Site Development Plan. This change could, in fact, be accommodated; however, the only open building locations are at relatively large distances from the weapons design, engineering and computation facilities. Thus, the Test Program personnel would be somewhat isolated from other people with whom they should be working closely. This solution is considered to be sufficiently undesirable that this alternative has been rejected.

3. DESCRIPTION OF AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Physiography

The projected NTTC Site is located in (projected) Sec. 11, T3S, R2E, Mt. Diablo Base and Meridian, and adjacent to the Lawrence Livermore National Laboratory. It is located in the southern portion of the Livermore Valley, about 40 miles (65 km) east of San Francisco.

The Livermore Valley is flanked on the west by an extension of the Diablo Range, which runs north-south and includes Mt. Diablo (3849 ft/1174 m) to the north and Mt. Hamilton (4209 ft/1284 m) to the south.⁶ East of the Valley, a series of north-south trending hills (the Altamont Hills) reach an elevation of 1900 ft (580 m). Altamont Pass leads through these hills east into the Central Valley of California. A number of creeks and arroyos rise in the hills east and south of the Valley and flow north and west. These water courses are dry during most of the year.

Lawrence Livermore National Laboratory is located in a region of the valley that is rather flat, with a slight slope downward toward the northwest. Elevations within LLNL range from a low of 570 ft (174 m) at the northwest corner to 675 ft (206 m) at the southeastern corner.⁷ The elevation of the proposed NTTC site is approximately 610 ft (185 m) (see Figure 3). Generally, the land slope does not exceed 3%, with the exception of Arroyo Seco, which runs along the southern edge of the project site. The banks of the intermittent creek have an average slope of 50%.

Much of the area bordering the Laboratory comprises agricultural fields, rangelands and vineyards, with gently rolling topography; residential and commercial areas are found predominantly west of the site. The Laboratory itself has been constructed on ancient alluvial deposits which slope gently to the northwest.

The proposed NTTC site is located adjacent to the southwest corner of LLNL on Section 11 (see Figure 3). This 35-acre plot is bounded on the north by Mesquite Way, on the east by a LLNL parking lot, on the south by Arroyo Seco and a single residence, and on the west by Vasco Road (see map, Figure 6). This property is flat grassland, with a single dead tree dominating the center of the plot. An abandoned foundation and some dilapidated wooden structures are located on the southwestern corner. Most of the vegetation on the site are annual grasses, few of which are native. Yearly plowing and frequent grazing on this plot contribute to its disturbed condition. Some shrub vegetation is found along the banks of the arroyo.

In addition to Lawrence Livermore National Laboratory and Sandia National Laboratories facilities, the only structures in proximity to the site are four residences located on Vasco Road. Most of the surrounding acreage is currently used as rangeland or haylands.

Since the proposed project site is relatively flat, soil loss due to water- and wind-mediated erosion should not present a problem during the construction phase. Stabilization of the soil with shrubs, grass and trees will take place following construction. Care will be taken during on-site activity to prevent erosion near Arroyo Seco. The actual building site is located nearer the northern boundary of the land to be acquired for the project. Access roads to the construction should also bypass the creek bed and enter on the east from the LLNL parking lot or on the north from Mesquite Way.

Storm and irrigation drainage from the completed building complex area will be channelled into the existing LLNL storm drainage system. This will minimize the impact of the project on the surrounding farm lands and grazing lands.

3.2 Climate

The Livermore Valley is characterized by a Mediterranean climate with warm summers.⁸ Temperatures are moderate in winter and often high in summer. The average annual temperature is 17°C (62°F) with extremes as high as 46°C (115°F) reported in the summer.⁹

This climate is characterized by mild, rainy winters (about 380 mm (15 in) of rain) from October to April. Snow is rare during the stormy season. Winter storms are a result of migratory low pressure systems that originate in the Gulf of Alaska. These storms are occasionally characterized by strong, gusty winds, up to 30 m/s. Severe weather events are rare during the winter. Thunderstorms occur less than 5 days per year and these are not intense. A regular occurrence during these winter months is the formation of a dense ground fog in the morning hours which may restrict visibility.¹⁰

The summers are consistently warm and dry. A sea breeze may develop in the afternoon when ocean air moves through the passes to the west. These breezes help to moderate night-time temperatures in the Valley. During this season the arid conditions and high temperatures may exacerbate the impact of airborne pollutants, particularly particulates and sulfates (see Sec. 3.9, Air Quality).

Because of the equitability of the climate in the Livermore Valley, weather conditions should rarely interfere with construction activity at the NITC site. The impact of winter rains on erosion processes at the site may be mitigated by installing drainage systems. Airborne particulate loads may be minimized during the arid season by regular sprinkling of the access roads and the construction site. Following construction, landscaping and revegetation of the area will help in controlling both water-mediated erosion and wind blown dust.

3.3 Geology

The Livermore Valley is located in the geographic province known as the Coast Ranges, slightly west of the Great Valley Province⁶ (see Figure 2). The Coast Ranges shown display northwest-southeast trends, induced by folds and fractures associated with the San Andreas and other major fault systems. This region is characterized by sedimentary rocks underlain by basement rocks of middle Mesozoic age.

Extensive work on classifying the geology of the Livermore Valley and the LLNL site in particular has been carried out by both Laboratory geologists⁷ and state¹¹ and private¹² consultants. These studies are principally concerned with mapping the fault systems which characterize the Valley (see Sec. 3.5, Seismicity).

An overall view of the surface geology of the Livermore Valley is presented in Figure 8. The NTIC Site geology is similar to that of the LLNL site. It is underlain by a thick sequence of late Tertiary and Quaternary alluvial deposits and by poorly lithified rocks of continental origin. It is reported that these materials extend down approximately 2420 ft (738 m) to the basement rocks of the Franciscan assemblage.¹³

The southwestern corner of the Laboratory, including the project area, is mapped as Younger Alluvial Fan Deposits (Qyf) (see Figure 8). These are unconsolidated, moderately sorted, permeable fine sand and silt with some gravel.

3.4 Soils

The Livermore Valley is characterized by an alluvial soil, composed of eroded material from local hills and mountains. This region is considered to be in the Rincon-San Ysidro association, characterized by nearly level,

DESCRIPTION OF UNITS

- Qyl** YOUNGER ALLUVIAL FAN DEPOSITS — Includes colluvial fill in narrow canyons. Unconsolidated, moderately sorted, permeable fine sand and silt, with gravel becoming more abundant toward fan heads and within canyons. Forms well-drained levees which grade headward to stream deposits on terraces cut in Qof. Thickness varies from as much as 50 feet at fan heads and in canyons to about 20 feet where Qyl interfingers with Qyfo and Qb at the outer margins of fans. Locally contains aboriginal artifacts and skeletal remains.
- Qyfo** YOUNGER FLUVIAL DEPOSITS — Unconsolidated deposits of fine, but variable grain size — mainly fine sand, silt, and silty clay; intermediate in character and lateral extent between Qb and Qyl. Forms levees and overbank deposits along the San Francisco Bay margin and in Livermore Valley, as well as valley fill in some open canyons. May be in part windblown in the southwestern part of the county. Generally less than 15 feet thick. Overbank deposits locally contain minor amounts of organic matter including fresh-water gastropods and pelecypods.
- Qb** INTERFLUVIAL BASIN DEPOSITS — Plastic, poorly sorted, organic-rich clay and silty clay in poorly drained areas marginal to the bay and in Livermore Valley. Interfingers with Qyl, Qyfo, and recent mud of San Francisco Bay. Generally less than 10 feet thick. Locally contains fresh-water gastropods and pelecypods.
- Qof** OLDER ALLUVIAL FAN DEPOSITS — Includes stream terrace deposits in some narrow canyons and on the margins of Livermore Valley. Weathered, weakly consolidated, poorly sorted silt sand and gravel (generally fine grained in northeastern Livermore Valley owing to derivation from friable sandstone bedrock). Less permeable and more poorly drained than younger alluvial fan deposits. Maximum thickness unknown but at least several hundred feet thick near bay margin. Headward portions overlapped by younger deposits on southern bay margin and incised by channels that are partially filled with younger deposits on northern bay margin and in Livermore Valley. Locally contains concentrations of continental vertebrate and invertebrate fossils. Includes the San Antonio Formation of Lawson (1914).
- QTs** DEFORMED OLDER SEDIMENTARY DEPOSITS — Poorly consolidated to semiconsolidated alluvial deposits of gravel, sand, silt and clay with subordinate fine-grained lacustrine deposits; locally tuffaceous; locally contains abundant remains of continental vertebrate and invertebrate fossils. Maximum thickness unknown but over 5,000 feet in the hills south of Livermore Valley. Includes the Irvington Gravels of Savage (1951) in the Warm Springs and Mission San Jose districts of Fremont, the Livermore Gravels of Clark (1930) south of Livermore Valley, and the Tassajara Formation of Oestreich (1958) north of Livermore Valley.

Figure 8. Surface Geology of the Proposed NTTC Site and Site Environs.

shallow to very deep soils.

At the Lawrence Livermore National Laboratory the soils vary in texture from clay loam to sandy loam or mixed gravels.⁷ Water percolation is slow in most areas that are high in fine clay, but these clays tend to hold the moisture longer. Soils in this area tend to be high in such elements as sodium, chlorine, iron, calcium, sulfur and magnesium and low in organic material, nitrates, phosphates, and potassium.

Three general soil series may be found at the LLNL site¹⁴ including the Rincon Series (Rc), the San Ysidro Series (Sa) and the Zamora Series (Za) (see Figure 9).

The Rincon Series (Rc) or Rincon loam is found to predominate in the central part of the LLNL site. It contains a brown surface and dark brown subsurface soil, and is found on slopes of 0-3%. These soils have a high water-holding capacity and moderate fertility. They are suited to intensive cultivation when irrigated.

The San Ysidro Series (Sa), found generally in the northeastern corner of the LLNL site, is a pale brown loam, which is hard when dry and slightly sticky when wet. This type of soil has low permeability and is characterized by poor root permeability and low fertility. Dry farming (grain or pasture) is possible on this type of soil.

The NITC project site is characterized by soils of the Zamora Series (Za). These are well-drained, deep-loamy soils on nearly level flood plains. These soils are well-drained with relatively low permeability and moderate fertility. Vegetation on uncultivated areas consists of annual grasses. These soils are used mainly for row crops, grain or hay.

The soils in the project area currently support a nonirrigated crop of annual grasses which is cut in early summer for hay. Grazing of sheep on this plot has been the primary use of the land in recent times.

Soil types

Rc: Rincon series

Sa: San Ysidro series

Za: Zamora series

Figure 9. Project Region Soils.

These soils should provide a stable base for development on the site. With the application of fertilizer and irrigation water, bushes, trees and shrubs should do well as part of the landscaping effort at the NTIC complex. Disturbance of the drainage patterns in these soils by construction activities will be compensated for by channeling of runoff into the LLNL drainage system. At the construction site it may be necessary to use sedimentation basins during the rainy season to prevent excessive soil erosion.

Accelerated aeolian erosion of these soils during the hot, dry season will result following site clearing and preparation. The adverse effects of such wind-driven erosion during construction may be mitigated by minimizing the disturbed area during construction and by sprinkling the access roads and the construction site.

3.5 Seismicity

Lawrence Livermore National Laboratory lies in the southeastern part of the Livermore Valley, an east-west trending topographic and structural depression cutting cross the Diablo Range.

This area is included in the tectonically active Western Central California region which includes the San Andreas fault system and two of its major branches, the Hayward Fault Zone and the Calaveras Fault Zone⁷ (see Figure 10). The Livermore Valley is bounded on the west by the Calaveras Fault and on the east by the Greenville Fault Zone. Other minor faults in the Valley have been located or postulated. The most extensive geologic investigations to date have been carried out on the Calaveras Fault under the mandates of the Alquist-Priolo Act.¹⁵

A detailed evaluation of seismic potential in the LLNL area may be found in the final EIS for the Lawrence Livermore National Laboratory/Sandia National Laboratories Site.⁵ The most recent significant seismic activity

Figure 10. Major Fault Zones in the San Francisco Bay Area.

occurred in January and February 1980 along the Greenville Fault.¹⁶ Studies of seismic potential in this region are on-going. A local seismic net maintained by the Laboratory has been set up to complement a USGS effort.

Building design specifications for all new construction at LLNL have been formulated based on known seismic hazards. The NTTC construction will incorporate state-of-the-art techniques for earthquake resistant structures. To further mitigate against damage or injuries due to seismic activity, the Laboratory has instituted a program of facility inspections and evacuation drills. These considerations will be incorporated into the construction and operation of the new facility. Note that the NTTC site is not within a Fault Rupture Hazard Zone as defined by the (State of California) Alquist-Priolo Act (see Figure 11).

3.6 Hydrology

3.6.1 Ground Water*

The Livermore Valley is a major groundwater source area.^{17, 18} Sandy-gravelly aquifer horizons alternate with fine-grained, relatively impermeable beds, and groundwater occurs both under confined and unconfined conditions. Both the Quaternary alluvial sequence and the Livermore Formation are sources of water supplies sufficient for urban, industrial and agricultural use.

Quality of Livermore Valley groundwater varies, but is generally suitable for most uses. Groundwater in the northern and eastern Livermore Valley contains substantially higher mineral concentrations than that found in other portions of the Valley.

* This section is slightly revised from a discussion appearing in Ref. 5.

MAP EXPLANATION

POTENTIALLY ACTIVE FAULTS

1906 C

Faults considered to have been active during Holocene time and to have a relatively high potential for surface rupture; solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed; query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by creep or possible creep.

SPECIAL STUDIES ZONE BOUNDARIES

These are delineated as straight-line segments that connect encircled turning points so as to define special studies zone segments.

Seaward projection of zone boundary.

Altamont Quadrangle
California — Alameda Co.
7.5 minute series (topographic)

Figure 11. Fault Rupture Hazard Zones in the Project Region.

The California Department of Water Resources (CDWR) subdivided the Livermore Valley groundwater basin into 12 sub-basins based on variations in groundwater occurrence, movement, and quality. The sub-basins appear to be separated by partial groundwater barriers, most of which are believed to be faults. Difficulties in assessing characteristics of the basin were described together with the uncertainties that exist.¹⁷

The eastern Livermore Valley is underlain by water-bearing strata, mostly of alluvial origin.¹⁹ Faults and stratigraphic variations affect the movement of groundwater and divide the basin into sub-basins (see above). Groundwater recharge occurs in uplands east and southeast of the LLNL site. The flow of this groundwater is inferred to be to the northwest, in two fault-defined sub-basins, one of which is beneath LLNL. Some of this groundwater is ultimately discharged by seepage at the surface 3.5 km northwest of the LLNL site. The remaining groundwater moves an undetermined distance west of the discharge area. It is not known whether this water is ultimately contained in the eastern Livermore Valley or whether it flows west into other groundwater sub-basins of the Livermore Valley. (See Figure 12 for the thickness of the unsaturated zone in the vicinity of LLNL and of the NTTC site.)

It is not expected that the construction of the NTTC will affect either groundwater quality or flow patterns. No toxic or hazardous effluents generated during the routine operation of the facility will be disposed of in a sanitary or storm sewer; during the building construction phase, any such wastes will be disposed of in accord with applicable statutes and regulations (see also Sec. 3.11). For a discussion of sanitary waste disposal, see Sec. 3.11.

Figure 12. Depth to the Water Table in the Project Region.

3.6.2 Surface Water

Figure 13 shows the location of "natural" drainage channels in the vicinity of the LLNL site. Note that the alignment of the Arroyo Las Positas has been significantly modified so that it skirts the LLNL northern site boundary and subsequently runs west along the south side of the Western Pacific right-of-way. Both the Arroyo Las Positas and the Arroyo Seco are intermittent streams, with flowing water present during and after rainstorms (normally, from October through April). Periodic discharges of water into one or both of these channels may also be carried out by Zone 7, Alameda County Flood Control and Water Conservation District. Flooding of the NTTC area could occur only if the Arroyo Seco overflowed during a severe storm. In case flooding took place, the water would flow around the building, probably using access roads and parking lots as channels, and would eventually reach the Arroyo Las Positas. The construction of the NTTC would have relatively little effect on flow patterns resulting from such flooding conditions.

3.7 Land Use

The Livermore-Amador Valley area has a rural-agrarian history. Much of the land area is presently supporting vineyards, small farms, irrigated pasture, orchards and extensive haylands. The hilly terrain surrounding the Valley is used primarily for grazing sheep, cattle, and horses.

However, industrial and residential development has increased in the Valley, particularly in the western side, near the intersection of Interstate Routes 580 and 680. A series of new, light-industrial parks have been constructed in the Dublin-San Ramon area. Commercial development has accelerated with the construction of a large, mall-type shopping center at the Route 580-680 intersection.

Figure 13. Surface Water Channels in the Project Region.

A large complex of gravel quarries is located in the area between Pleasanton and Livermore. Mining operations in the surrounding hills are no longer carried on; however, there are still producing oil wells located about 0.8 km (0.5 miles) east of LLNL along Patterson Pass Road. Recently a cluster of windmills has been erected in the hills east of LLNL near the Altamont Pass.

A percentage of the land area near Livermore is preserved as watershed land surrounding the Del Valle and San Antonio Reservoirs. These reservoirs are linked to the South Bay Aqueduct system, part of the California Aqueduct, which transports water south and east of the Laboratory toward San Jose.

The City of Livermore has experienced increased growth in the residential and light-industrial/commercial sectors. The Research Drive area, near to LLNL and the Airport Park development are two locations of increased construction activity.

In recent years the City has been growing toward LLNL from the west and the north. The land parcels located on the northern and western perimeters of the Laboratory are for sale and may eventually be annexed by the City. The project area is one of these western perimeter plots. It has been zoned by the City as light-industrial (see Figure 5).²⁰ Other nearby zones include residential and heavy-industrial areas.

Some of the open lands surrounding the Laboratory on the west, east, and south have been designated as agricultural open space, with the option of becoming industrial or remaining as agricultural land. These lands are subject to the Land Conservation Act of 1965, which creates agricultural preserves. A ten-year notice is required before Alameda County will permit dissolution of these agreements.

The project area, although zoned light-industrial, is currently being used for grazing or for hay production. With the increasing development in the area around LLNL it is unlikely that future use of this 35-acre plot will be agricultural.

3.8 Vegetation and Wildlife

3.8.1 Vegetation

The natural grassland vegetation native to the Livermore Valley covers much of the area surrounding LLNL. These grasslands are primarily made up of annual grasses and wildflower species. Many of these species of grasses have been introduced on land disturbed by livestock grazing and farming. For a discussion of the general vegetation types in the Livermore Valley, see the work by Barbour and Major.²¹ No rare, threatened, or endangered plant species have been identified at LLNL.⁸

Much of the vegetation present on the LLNL site has been planted as part of a landscaping effort. Some of the original oaks and eucalyptus trees have been maintained on the site. An estimated 7000 trees have been planted since 1952.²² Many are species which are adapted to areas with limited water supplies; some of these include monterey pine, ash, oak and sycamore. Some species of native wildflowers (California poppies) and grasses have been planted. For a comprehensive list of site vegetation, see Appendix A.

The project site flora are composed primarily of disturbed grassland species. Grazing and harvesting of hay on this site have lead to a chronically disturbed type of ecosystem. Annual grasses, many of them introduced species, are found here. A screen of eucalyptus trees is located on the eastern perimeter of the site, at the boundary with LLNL. Some trees are located in the southeast corner of the site, near the abandoned buildings

and adjacent to the nearest residence and livestock barn area. Brushy vegetation, including a number of willows, is characteristic of the area along the banks of Arroyo Seco, an intermittent creek running along the southern edge of the site.

Development on this site will necessarily result in disturbance of the vegetation. Preparation of the site and construction of the facilities will require clearing of most of the vegetation in proximity to the building site. This will result in increasing the potential for short-term erosion due to wind and water action. This erosion will be controlled during construction by watering the exposed areas during the arid summer months and by use of sedimentation basins and drainage ditches during the rainy season.

During the phase of land improvement extensive landscaping will be carried out. Shade trees, native wildflowers and drought-resistant shrubs will be planted to enhance the attractiveness of the facility and to provide for some environmental modification. Irrigation and drainage systems will be installed. Erosion will be controlled by the planting of ground cover. Thus the short-term impact of the construction phase will be mitigated once the facility is in operation. Regular maintenance of the Complex grounds will prevent any adverse environmental impacts in the NTTC vicinity.

3.8.2 Wildlife

The LLNL site is the home of a number of species of wildlife and domestic fauna (some now feral). Compilation of species lists has been carried out at LLNL on a number of occasions.^{5, 8} For a comprehensive list of faunal species to be found at LLNL, see Appendix B. Among these are species of mammals (particularly jackrabbits, field mice and gophers), birds (including hawks, vultures, meadowlarks, quail, pheasant, blackbirds and some shorebirds), amphibia (toads, frogs, salamanders), reptiles (snakes and

lizards), insects and other invertebrates. No rare, threatened or endangered species, protected by the Endangered Species Act of 1973 (reauthorized 1982) and by state mandate,²² have been observed on the LLNL site.

The proposed NTTC site includes a number of wildlife habitats: open grassland, riparian thickets (along the arroyo), a cluster of trees and abandoned buildings. Clearing this area will necessarily result in the disturbance of the resident wildlife populations. There should be sufficient suitable habitat adjacent to the site to which these species can migrate. Noise and activity on the site will disturb wildlife in nearby habitats. This is a short-term impact which will be mitigated following the construction phase. Land improvement following building construction will allow for some of the species to become reestablished at this site. Much of the landscaping activity carried out at LLNL actually encourages the establishing of small populations of certain mammals, birds, insects and amphibia.

It might be expected that there will be short-term impacts during the construction phase on the domestic animals which graze in the fields near the NTTC site. There is currently a donkey barn and grazing area located adjacent to the southwestern corner of the site. Across Vasco Road from the site there are several fields in which sheep are grazed during part of the year. The noise, dust and increased truck traffic which will be experienced during the clearing and construction phases could have negative impacts on these domestic animals. These effects can be mitigated by providing access roads that are located away from grazing areas and by limiting the amount of dust and air pollutants that are released from the area.

Use of adjacent land for residences and for grazing must be taken into account when planning for construction activity. Access roads should be constructed so as to minimize nuisances to nearby residents. Construction

activity and material deliveries should be confined to daylight hours to minimize disturbance to residents.

3.9 Air Quality

Air quality in the Livermore Valley is considered to be good with state and federal ambient air standards being exceeded on occasion for the criteria pollutants ozone/oxidant and particulates.

The Bay Area Air Quality Maintenance District (BAAQ) maintains a monitoring station in Livermore, where regular measurements are taken. Trends in ambient concentrations of various pollutants are reported in a yearly publication of the California Air Resources Board.²³

For 1980, the Livermore Valley station reported the following air pollutant levels: ozone/oxidant: 0.011-0.034 ppm (averages); carbon monoxide (CO): high of 8.0 ppm in 8-hr period; nitrogen dioxide (NO₂): 0.025-0.042 ppm (averages); particulates: 24.0-137.0 $\mu\text{g}/\text{m}^3$ (averages); lead: 0.13-0.29 $\mu\text{g}/\text{m}^3$; suspended nitrates: 1.0-21.8 $\mu\text{g}/\text{m}^3$ and suspended sulfates: 0.8-9.1 $\mu\text{g}/\text{m}^3$. For comparison with State and Federal air quality standards see Appendix C.

Visibility in this region is dependent on both pollutant levels and meteorological factors. The morning fog characteristic of the inland valleys during fall and winter restrict visibility due to increases in humidity. Decreased visibility during other seasons and times of day is the result of high levels of sulfates, nitrates and total suspended particulates (TSP).¹⁰

Higher than permissible levels of particulates and ozone/oxidant are the results of a number of complex factors including topography, land use and levels of anthropogenic emissions (especially from automobiles). Because of the climate and the topography of the Valley (hot, stagnant air becoming

stalled within the Valley during the summer) photochemical smog has become a seasonal problem in Livermore. Most of the the chemical components of this type of air pollution originate in the Bay Area and are transported into the Valley. The increasing population of the Livermore-Amador Valley has contributed to the pollution load, primarily in the form of nitrogen oxides emitted from vehicles. High levels of suspended particulates are linked to the arid nature of the hills surrounding Livermore and the farming and grazing activity which are common in the Valley.

3.9.1 Building Construction Phase

The principal air quality impacts associated with this project will occur during building construction. These adverse impacts will be of limited duration and can be mitigated using several routine strategies.

The preparation of the site will require clearing of vegetation, some earth-moving and construction of access roads. This activity will result in short-term increases in levels of particulates and vehicular emissions. Dust levels can be controlled using water sprinkling at the site. Localized increases in emissions from vehicles and machinery are unavoidable.

3.9.2 Land Improvement Phase

Upon completion of the facility there will be activity associated with landscaping, completion of parking facilities and walkways. Again, it may be expected that there will be some local increases in particulates in the atmosphere, along with some hydrocarbon releases during road and walkway surfacing. These impacts are unavoidable and should have limited impact on the environment.

3.9.3 Facility Operation

Operation of the NTTC complex should have minimal impact on air quality. The largest source of air pollution from this facility will be the relatively constant venting of emissions from an oil- or gas-fired boiler used to produce heat. All facilities will be in compliance with applicable State and Federal air quality regulations and needed permits will be obtained from the Bay Area Air Quality Maintenance District (BAAQMD). Because the 350 workers who will occupy this facility would be working at LLNL even if the facility were not constructed, there should be no substantial increases in levels of air pollutants from automobiles.

3.10 Noise

There will be some unavoidable impacts due to noise during the construction of the NTTC complex. In order to gauge the magnitude of this impact, it is useful to compare noise levels with levels of human response. Table 2 presents the "A" weighted sound levels and the type of human response that they elicit.²⁴ In the case of the NTTC construction, the highest noise level that can be expected will be about 85-90 dBA at a distance of 15 m (50 ft) from the site.²⁵ The impact of this noise level on community response is presented in Figure 14.²⁶

An important consideration here is not so much the level of the noise that is experienced on site, but rather the proximity of the source of noise to residences. There are four residences in proximity to the proposed NTTC (see Figure 15). All of these residences, along with all LLNL buildings, are located greater than 150 m (500 ft) from the source of the noise. This distance should serve to attenuate the noise sufficiently to avoid community or laboratory complaints.

Table 2. Typical "A" Weighted Sound Levels and Human Response.

Sound source	dBA ^a	Response criteria	Intensity $\mu\text{W}/\text{m}^2$
Carrier deck jet operation	150		10^9
	140	Painfully loud, limited amplified speech	10^8
	130		10^7
Jet takeoff [60 m (200 ft)]		Maximum vocal effort	
Unmuffled geothermal well venting [15 m (50 ft)]	120		10^6
Discotheque	110		10^5
Jet takeoff [610 m (2000 ft)]			
Shout [0.2 m (0.5 ft)]	100		10^4
Heavy truck [15 m (50 ft)]		Very annoying, hearing damage (8 h)	
Muffled geothermal well venting [30 m (100 ft)]	90		10^3
Pneumatic drill [15 m (50 ft)]	80	Annoying	10^2
Freight train [15 m (50 ft)]			
Freeway traffic [15 m (50 ft)]	70	Telephone use difficult Intrusive	10^1
Air conditioning unit [6 m (20 ft)]	60		1
Light auto traffic [15 m (50ft)]		Quiet	

Table 2 (continued).

Sound source	dBA ^a	Response criteria	Intensity $\mu\text{W}/\text{m}^2$
Living room	50		10^{-1}
Bedroom			
Library	40		10^{-2}
Soft whisper [5 m (15 ft)]		Very quiet	
	30		10^{-3}
	20		10^{-4}
Broadcasting studio		Just audible	
	10		10^{-5}
		Threshold of hearing	
	0		10^{-6}

^aTypical A-weighted sound levels taken with a sound-level meter and expressed as decibels on the scale. The "A" scale approximates the frequency response of the human ear.

Source: Council on Environmental Quality, *Environmental Quality - The First Annual Report of the Council on Environmental Quality*, transmitted to Congress, August 1970.

Community Reaction

Vigorous community action

Several threats of legal action, or strong appeals to local officials to stop noise

Widespread complaints or single threat of legal action

No reaction, although noise is generally noticeable

U.S. Environmental Protection Agency: Noise from Industrial Plants, Report NTID 300.2. Washington, D.C.
Relationship of Normalized Community Noise Levels and Other Human Response Scales and the Expected Community Response. (From Community Noise, U. S. Environmental Protection Agency Report NTID 300.2).

Figure 14. Expected Complaint Response for a Sound Pressure Level of 60 dBA in an Urban Residential Environment.

Figure 15. Structures Near the Project Site.

3.10.1 Building Construction Phase

This phase of the project will produce the largest noise-related impacts. Ground clearing and excavation activities will have the most impact. These two activities have reported noise levels of 84 dBA for clearing and 79-89 dBA for excavation (see Table 3).²⁷ In addition to on-site noise sources, there will be increased noise levels due to the movement of trucks and heavy machinery to and from the site. Peak noise levels for these types of vehicles range from 92-108 dBA, with the attenuation levels being 54-81 dBA at 120 m (400 ft).²⁷

The impacts associated with elevated noise levels can be mitigated during construction. The construction site can be cordoned off to prevent individuals from being exposed to the noise. Should the noise levels become an irritation to residents or laboratory workers, then sound absorbing screens can be constructed around the site. By confining most activity to the daylight hours, irritation to nearby residents should be minimized.

On-site noise levels may reach or exceed standards set by the Occupational Safety and Health Administration (OSHA). In this event workers will be required to wear ear protection while working.

3.10.2 Land Improvement Phase

Completing the exterior work on the building complex will result in moderate noise levels. Graders and large trucks will still be operated on site. This phase should be shorter and noise levels considerably reduced from those experienced during the construction phase. The same mitigation measures would apply here.

Table 3. Typical Noise Levels During Construction²⁷

Type	Phase	Housing		Office Building, Hotel		Road, Highways		Commercial, Industrial	
		I	II	I	II	I	II	I	II
Ground Clearing		83	83	84	84	84	84	84	83
Excavation		86	75	89	79	88	78	89	71
Foundation		81	81	78	78	88	88	77	77
Erection		81	65	87	75	79	76	84	72
Finishing		88	72	89	75	84	84	89	74

3.10.3 Facility Operation

Operation of the NTTC should add little in the way of additional noise pollution. During the morning and evening rush hours additional traffic-generated noise might be experienced.

3.11 Utility Systems

3.11.1 Water

During NTTC construction, water will be supplied to the contractor from the LLNL water system, probably by a tap from existing underground mains. Incremental usage is expected to be small: less than 1% of the current LLNL/SNL use rate (less than 1% of 1,000,000 m³ per year). Water for the operation of the NTTC will be provided by the westward extension of existing mains located between Buildings 121 and 131. Total annual water use by the facility is expected to be about 40,000 m³. Source of this water (as with the rest of LLNL's water supply) will be the City of San Francisco's Hetch Hetchy water system.

3.11.2 Power

Electric power requirements during the NTTC construction phase will be relatively insignificant (less than 1% of the total LLNL/SNL annual use rate of 866 TJ, or less than 8 TJ per year). Electric power for NTTC operation will be supplied by buried lines extended from the high voltage switch gear north of Building 131 to a new substation serving Building 124. Total annual usage is estimated at about 35 TJ. The ultimate supplier of the electricity used will be the same as for the entire LLNL site (i.e., Pacific Gas and Electric).

3.11.3 Solid and Liquid Wastes

During the NTTC construction phase, miscellaneous debris including wood, metal, concrete, paper, cardboard, glass, rags, etc., will be disposed of in an off-site sanitary landfill. Total construction debris is estimated at about 600 m^3 (800 cu yd). Chemical and sanitary wastes, primarily from chemical toilets, are classified as Group 1 wastes (toxic substances) and will be transported by an outside contractor to a Class I disposal site for terminal storage.

During NTTC facility operation, it is expected that about 200 kg (500 lb) of miscellaneous waste will be generated per operating day (waste will include paper, cardboard, liquids, metal, wood, yard waste, food waste, glass and plastic). Small amounts of solid chemical waste will be generated occasionally in the course of operations carried out in Building 124; these will be segregated from other solid waste and disposed of in accordance with established LLNL procedures (see Reference 5).

Sanitary sewage will flow eastward through a new line that will connect with the north-south main LLNL sewer (just inside the present LLNL west boundary line). Sewage will then flow north to the northwest corner of LLNL, into the connection with the City of Livermore sanitary sewer. Discharge from the NTTC facility is expected to be about 13 m^3 (3500 gal) of wastewater per working day.

A small amount (less than 1 m^3 per year) of toxic liquid waste (including industrial solvents, machine oils, laser dyes and some photographic solutions) will be handled in accordance with RCRA guidelines; these liquids will be collected in containers designed for the safe storage and transport of such wastes. These liquids will be transferred to a central LLNL facility for treatment (see Reference 5). In addition, some silver-containing photographic

solutions will be collected separately and processed to recover the silver. No toxic or hazardous effluents generated during routine operation of the facility will be disposed of in a sanitary or storm sewer.

No solid or liquid radioactive waste will be generated by activities carried out in the NTTC.

3.11.4 Miscellaneous

Gas to be used for normal space and water heating for the NTTC facility will be provided by the westward extension of the existing 8-psi main located between Buildings 121 and 131. Total annual gas use by Building 124 is expected to be about $900,000 \text{ m}^3$ (186,000 Btu/sq ft). In case of gas service interruption, a propane-air mixture can be used for heating. Under normal conditions, the ultimate gas supplier for Building 124 will be (as for the entire LLNL site) Pacific Gas and Electric.

A low-conductivity water (LW) supply and return piping distribution system will be provided for mechanical equipment cooling. Both the supply and return piping will be connected to the LLNL on-site LW supply and return mains.

The compressed air system will consist of an extension to the on-site air system.

3.11.5 Energy Conservation

The NTTC facility will be equipped with automatic cut-off devices to shut down unnecessary systems during nights, weekends, and holidays. Other methods to reduce energy consumption will be the maintenance of thermostatic controls on building temperature (between 18 and 26°C), use of either sensor or manual (administrative) controls on area lighting, and the possible installation of solar heating/cooling facilities.

3.12 Socioeconomic Conditions

Currently, approximately 7,000 persons are employed at LLNL, of which almost half reside in the City of Livermore. Other near-by communities having significant numbers of Laboratory employees as residents include Pleasanton, Dublin, San Ramon, Danville and Tracy. Of the nearly 50,000 population of Livermore, it is estimated that 14,000 reside in this area due to the presence of LLNL. Total LLNL payroll to Livermore residents (1981) is estimated at \$110 million.

With regard to the current level of construction activities at the LLNL site, there may be up to 200 contractor personnel present on any given day of the work week. Most of these personnel reside in the Bay Area, with about 20% coming directly from the Livermore Valley.

3.12.1 Impacts on Socioeconomic Conditions

While the NTTC will house about 350 engineers, scientists, and support personnel, at least 260 of these will have been moved from other work locations at LLNL. Thus, a maximum of only about 90 new employees will be housed in Building 124. Based on current residential patterns, the population of the City of Livermore would be increased by less than 100, which would represent an insignificant local impact.

During the construction of the NTTC facility, a maximum of 60 contractor personnel are expected to be on site working on the project at any one time. This would represent about a 30% increase in current levels of contractor personnel at LLNL. While this 30% increment would be appreciable, it is not expected to impact the local community to any measurable extent.

3.13 Archaeological and Historic Resources

Archaeological and cultural resource surveys have been carried out at both the LNL site and the 35-acre plot which is the proposed site of the NTTC complex. These surveys were carried out in accordance with the requirements of the CEQ, the NEPA and Sec. 106 of the National Historic Preservation Act (NHPA).

The first, and more comprehensive survey, was performed by Archaeological Consulting and Research Services. A report of their findings is included in the final Environmental Impact Statement (EIS) for the Livermore site.⁵ No significant finds were recorded at that time.

Basin Research Associates, Inc. of Hayward, California, conducted a field survey of the 35-acre land parcel on March 8, 1982. A careful examination of the land surface revealed no significant cultural artifacts. It was noted that two wooden structures and a concrete foundation located in the southwest corner of the parcel were recent cultural resources which are considered to be nonsignificant.

The survey findings and the results of a review of archival resources are presented in Appendix D.

It is recommended that, should an artifact be uncovered during excavation or construction, on-site activity will cease within a 50-m radius of the find until it can be examined by a licensed archaeologist.

4. IRREVERSIBLE COMMITMENT OF RESOURCES

In the event of site acquisition and building construction, both land and material resources will be committed for the useful lifetime of the complex.

The 35 acres of grazing land will be converted to industrial use, thus preempting agricultural activity. The building materials and other resources (water, energy) used during construction will be irrevocably committed to the project. Quantities of construction materials to be used are described in 2.1.3.2. Heavy construction equipment operating on-site during this phase will be portable and reuseable.

During the operation of the NTTC complex quantities of water, natural gas and electricity will be expended for normal building operation and maintenance (see Section 3). These resources might well be expended in a less efficient way if the added Test Program personnel are located in scattered temporary quarters on site.

5. RELATION OF SHORT-TERM TO LONG-TERM USES OF THE ENVIRONMENT

The acquisition of this 35-acre parcel and the construction of the NTTC on that site will preempt use of the land for other purposes (agricultural, grazing, other light industrial). In the recent past little use had been made of the land except for sheep grazing. The fact that the land has been zoned light-industrial and is currently on the market points to the possibility that it will be sold and taken out of pasturage.

This site is in proximity to many Laboratory buildings and has good access, making it an ideal location for expansion of Laboratory facilities. Disturbance due to construction can be minimized at this location. The costs of taking this small area of grazing land out of cultivation are more than outweighed by the benefits of using this land as a site for the NTTC. Alternative sites and plans (see "Alternatives") would be far more costly as regards efficiency of operation of Laboratory programs and goals.

6. PROCEDURAL REQUIREMENTS

To be completed in consultation with U.S. DOE.

7. REFERENCES

1. The National Environmental Policy Act of 1969, Section 102(c).
2. U. S. Department of Energy Environmental Compliance Guide, document DOE/EV-0132, February 1981.
3. Holmes and Narver, Inc., Nuclear Test Technology Complex: Conceptual Design Report, Holmes and Narver, Inc. (report prepared for Lawrence Livermore National Laboratory, 1981).
4. Schedule 44, Nuclear Test Technology Complex, Project No. 83-07, August 19, 1981.
5. U.S. Department of Energy, Final Environmental Impact Statement, Lawrence Livermore National Laboratory and Sandia National Laboratories - Livermore Sites, U.S. Department of Energy document DOE/EIS-0028, 1982.
6. R. M. Norris and R. W. Webb, Geology of California (John Wiley and Sons Inc., NY, 1976).
7. D. W. Carpenter, K. P. Puchlik, A. L. Ramirez, J. L. Wagoner, K. G. Knauss, and P. W. Kasameyer, Status Report on the Geology of the Lawrence Livermore National Laboratory Site and Adjacent Areas, Lawrence Livermore National Laboratory, UCRL-53065 Vol. 1, 1980.
8. D. R. McIntyre, Ecology of Lawrence Livermore Laboratory, Lawrence Livermore National Laboratory, UCRL-51987, 1977.
9. R. W. Durrenberger and R. B. Johnson, Patterns in the Land (Mayfield Pub. Co., Palo Alto, CA, Fifth Edition, 1965).
10. J. Trijonis, Visibility in California, Final report to the California Air Resources Board, Sacramento, CA, #A7-181-30, 1980.
11. California Department of Water Resources, Livermore and Sunol Valleys: Evaluation of Ground Water Resources, Appendix A, Bulletin 118-2, Geology, State of California, Department of Water Resources, Sacramento, CA, 1966.

12. John A. Blume and Associates, Investigation of Faulting at Lawrence Livermore Laboratory, report to the University of California, Lawrence Livermore National Laboratory, 1972.
13. A. S. Huey, Geology of the Tesla Quadrangle, California, bulletin 140, California Division of Mines and Geology, San Francisco, CA, 1948.
14. U.S. Department of Agriculture and California Experimental Station, Soil Survey of Alameda Area, California, U.S. Government Printing Office, Washington, DC 1966.
15. E. W. Hart, Fault Rupture Hazard Zones in California, California Division of Mines and Geology, Sacramento, CA, Special Publication 42, Revised March, 1980.
16. M. G. Bonilla, J. J. Lienkaemper and J. C. Tinsley, Surface Faulting Near Livermore, California, Associated with the January 1980 Earthquakes, USGS Open File report 80-523, Menlo Park, CA, 1980.
17. California Department of Water Resources, Livermore and Sunol Valleys: Evaluation of Ground Water Resources, Bulletin 118-2, Geology, State of California, Department of Water Resources, Sacramento, CA, 1974.
18. Alameda County Planning Department, Draft-Environmental Impact Report, Livermore- Amador Valley Quarry Reclamation Plan, Alameda County Planning Department, Hayward, CA, 1979.
19. L. L. Rogers, Water Table Configuration below the Lawrence Livermore National Laboratory Site and Its Surrounding Sections, Lawrence Livermore National Laboratory, UCID-19340 (1980).
20. Alameda County Board of Supervisors, Livermore-Amador Planning Unit General Plan, Alameda County Board of Supervisors, Oakland, CA, November 3, 1977.
21. M G. Barbour and J. Major, Terrestrial Vegetation of California (John Wiley and Sons, Inc., NY, 1977).

22. State of California, Endangered, Rare and Threatened Animals and Plants of California, Department of Fish and Game Report, Sacramento, CA, 1980.
23. California Air Resources Board, California Air Quality Data: Summary of 1980 Air Quality Data, Vol. VII, California Air Resources Board, Sacramento, CA, 1980.
24. Council on Environmental Quality, Environmental Quality - The First Annual Report to the Council on Environmental Quality, transmitted to Congress, August 1970.
25. L. Canter, Environmental Impact Assessment (McGraw-Hill Inc., NY, 1977).
26. U.S. Environmental Protection Agency, Community Noise, USEPA report NTID-300.2, Washington, DC, 1973.
27. J. Golden, R. P. Ouellette, S. Saari, and P. N. Cheremisinoff, Environmental Impact Data Book (Ann Arbor Science Publishers, Inc., Ann Arbor, MI, 1979).

APPENDIX A
FLORA OF THE LLNL SITE

Plants of the LLNL and SNL sites.

Cupressaceae (Cypress Family)

Juniper	<u>Juniperus sp.</u>
Golden cypress	<u>Chamaecyparis obtusa</u>

Salicaceae (Willow Family)

Golden weeping willow	<u>Salix babalonica</u>
Sandbar willow*	<u>Salix exigua</u>

Moraceae (Mulberry Family)

Fruitless Mulberry	<u>Morus alba</u>
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Ulmaceae (Elm Family)

Chinese elms	<u>Ulmus pumila</u>
Zelkova	<u>Zelkova sp.</u>

Polygonaceae (Buckwheat Family)

Curly dock*	<u>Rumex crispus</u>
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Chenopodiaceae (Goosefoot Family)

Nettleleaf goosefoot	<u>Chenopodium murale</u>
Lambsquarters	<u>Chenopodium album</u>
Russian thistle (tumbleweed)	<u>Salsola kali</u>

Portulacaceae (Purslane Family)

Miner's-lettuce*	<u>Montia perfoliate</u>
Common purslane	<u>Portulaca oleraceae</u>

Rhamnaceae (Buckthorn Family)

Ceanothus	<u>Ceanothus sp.</u>
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* Plants native to the LLNL/SNL site.

Cruciferaceae (Mustard Family)

Shepherd's purse*

Black mustard

Wild radish

Wild turnip

Capsella bursa-pastoris

Brassica nigra

Raphanus sativus

Brassica campestris

Juglandaceae (Walnut Family)

English walnut

Juglans sp.

Leguminosaceae (Pea Family)

Vetch

Lupine*

Alfalfa

California burclover

Locust (black)

Vicia americana

Lupinus sp.

Medicago sativa

Medicago polymorpha

Robinia sp.

Geraniaceae (Geranium Family)

Filaree (Heronbill)*

Erodium cicutarium

Zygophyllaceae (Caltrop Family)

Puncture-vine

Tribulus terrestris

Malvaceae (Mallow Family)

Cheeseweed

Rose of Sharon

Malva parviflora

Althaea sp.

Hypericaceae (St. Johnswort Family)

St. Johnswort

Hypericum perforatum

Hydrophyllaceae (Waterleaf Family)

Great valley phacelia*

Phacelia ciliata

Labiataceae (Mint Family)

White Horehound

Purple sage*

Rosemary

Marrubium vulgare

Salvia dirrrii

Rosemarinus officinalis

Compositaceae (Thistle Family)

Prickly lettuce

Common groundsel*

Annual sowthistle

Milk thistle

Smooth cats-ear

Pineapple weed

Yellow starthistle

Mayweed

Dandelion

Coyote bush*

Spiny clotbur

Lactuca serriola

Senecio vulgaris

Sonchus oleraceus

Silybum marianum

Hypochoeris glabra

Matricaria matricarioides

Centaurea solstitialis

Anthemis cotula

Taraxacum officinale

Baccharis pilularis

Xanthium spinosum

Boraginaceae (Borage Family)

Common fiddleneck*

Amsinckia intermedia

Polygonaceae (Buckwheat Family)

Common knotweed

Polygonum aviculare

Onagraceae (Evening-Primrose Family)

Panicked willow-herb

Evening primrose*

Epilobium paniculatum

Oenothera sp.

Proteacea (Protea Family)

Silk oak

Grevillea robusta

Liliaceae (Lily Family)

Grass nut*

Brodiaea laxa

Amoryllidaceae (Amaryllis Family)

Lily of the Nile

Agapanthus africanus

Urticaceae (Nettle Family)

Burning nettle

Urtica urens

Typhaceae (Cattail Family)

Cattail*

Typha latifolia

Graminaceae (Grass Family)

Large crabgrass	<u>Digitaria sanguinalis</u>
Rye	<u>Secale cereale</u>
Barnyard grass	<u>Echinochloa crusgalli</u>
Wild barley	<u>Hordeum californicum</u>
Squirrel tail grass (Foxtail barley)	<u>Hordeum jubatum</u>
Wild oats	<u>Avena barbata</u>
Rabbitfoot grass	<u>Polypogon monspeliensis</u>
Annual bluegrass	<u>Poa annua</u>
Italian ryegrass	<u>Lolium multiflorum</u>
Ripgut brome	<u>Bromus rigidus</u>
Bermuda grass	<u>Cynodon dactylon</u>
Bluegrass	<u>Poa sp.</u>
Perla grass (Timothy)	<u>Phleum pratense</u>
Wheat grass	<u>Agropyron sp.</u>
Field oats	<u>Avena sp.</u>
Barley	<u>Hordeum sp.</u>

Primulaceae (Primrose Family)

Scarlet Pimpernel	<u>Anagallis arvensis</u>
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Amaranthaceae (Amaranth Family)

Kedroot pigweed (Green amaranth)	<u>Amaranthus retroflexus</u>
Tumble pigweed	<u>Amaranthus albus</u>

Euphorbiaeae (Spurge Family)

Turkey mullein	<u>Eremocarpus setigerus</u>
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Convolvulaceae (Morning-Glory Family)

Field bindweed	<u>Convolvulus arvensis</u>
Hopseed bush	<u>Dodonea sp.</u>

Rosaceae (Rose Family)

Tea rose	<u>Rosa sp.</u>
Firethorn	<u>Pyracantha sp.</u>
India hawthorn	<u>Phaphiulepsis indica</u>
Toyon*	<u>Heteromeles arbutifolia</u>

Stone fruits	
Apricot	<u>Prunus</u> sp.
Green-gage plum	<u>Prunus</u> sp.
Pear	<u>Pyrus</u> sp.
Quince	<u>Chaenomeles</u> sp.
Apple	<u>Malus</u> sp.
Hawthorn	<u>Crataegus</u> sp.
 Punicaceae (Pomegranate Family)	
Pomegranate	<u>Punica</u> sp.
 Anacardiaceae (Cashew Family)	
Pistachio	<u>Pistacia</u> sp.
 Pinaceae (Pine Family)	
Aleppo pine	<u>Pinus halepensis</u>
Monterey pine	<u>Pinus radiata</u>
Mugno pine	<u>Pinus</u> sp.
 Fagaceae (Beech Family)	
Black oak	<u>Quercus</u> sp.
Cork oak	<u>Quercus</u> sp.
 Uleaceae (Olive Family)	
Asn	<u>Fraxinus</u> sp.
 Taxodiaceae (Taxodium Family)	
Coast redwood	<u>Sequoia sempervirens</u>
Giant redwood	<u>Sequoia gigantea</u>
 Casuarinaceae (Casuarina Family)	
Beefwood or she-oak	<u>Casuarina stricta</u>
 Myrtaceae (Myrtle Family)	
Gum-tree	<u>Eucalyptus</u> sp.
Bottle brush	<u>Calistemon</u> sp.

Apocynaceae (Dogbane Family)	
Oleander	<u>Nerium oleander</u>
Gorylaceae (Hazelnut Family)	
Alder*	<u>Alnus</u> sp.
Hamamelidaceae (Witch-Hazel Family)	
Liquidambar sweet-gum	<u>Liquidambar</u> sp.
Platanaceae (Plane-Tree Family)	
Sycamore*	<u>Platanus</u> sp.
Iridiaceae (Iris Family)	
Blue eyed grass*	<u>Sisyrinchium bellum</u>
Araliaceae (Ginseng Family)	
Ground ivy	<u>Hedera</u> sp.
Acanthaceae (Acanthus Family)	
Bears-breech	<u>Acanthus latifolius</u>
Leguminosaceae (Pea Family)	
Mimos	<u>Albizzia</u> sp.
Red Bud*	<u>Cercis occidentalis</u>
Elaeagnaceae (Oleaster Family)	
Russian Olive	<u>Elaeagnus angustifolia</u>
Cyperaceae (Sedge Family)	
Yellow Nutgrass	<u>Cyperus esculentus</u>
Scrophulariaceae (Figwort Family)	
Wool Clover*	<u>Orthocarpus purpurascens</u>
Ericaceae (Heath Family)	
Strawberry tree	<u>Arbutus unedo</u>

Papaveraceae (Poppy Family)

California poppy*

Eschscholzia californica

Solanaceae (Nightshade Family)

False tobacco

Nicotiana glauca

APPENDIX B
FAUNA OF THE LLNL SITE

Table 1. Mammals of the LLNL and SNL sites.

Marsupialia (pouched)	
Opossum	<u>Didelphis marsupialis</u>
Chiroptera (Bats)	
Little brown bat	<u>Myotis lucifugus</u>
Carnivora (Meat-eaters)	
Spotted skunk	<u>Spilogale putorius</u>
Rodentia (Gnawing)	
Muskrat	<u>Undatra zibethica</u>
Pocket gopher	<u>Thomomys bottae</u>
Deer mouse	<u>Peromyscus maniculatus</u>
House mouse	<u>Mus musculus</u>
Meadow vole	<u>Microtus californicus</u>
Norway rat	<u>Rattus norvegicus</u>
Lagomorpha	
Black-tailed jackrabbit	<u>Lepus californicus</u>
Brush rabbit	<u>Sylvilagus auduboni</u>
Domestic Animals	
Cows	<u>Bos sp.</u>
Goats	<u>Capra sp.</u>
Sheep	<u>Ovis sp.</u>
Cats	<u>Felis domestica</u>
Dogs	<u>Canis familiaris</u>
Horses	<u>Equus caballus</u>

Table 2. Birds of the LLNL and SNL sites.

Turkey vulture	<u>Cathartes aura</u>
White-tail kite	<u>Elanus leucurus</u>
Red-tailed hawk	<u>Buteo jamaicensis</u>
Sparrow hawk (American kestrel)	<u>Falco sparverius</u>
Golden eagle	<u>Aquila chrysaetos</u>
Bald eagle	<u>Haliaeetus leucocephalus</u>
California quail	<u>Lophortyx californicus</u>
Ring-necked pheasant	<u>Phasianus colchicus</u>
Chukar	<u>Alectoris graeca</u>
Killdeer	<u>Charadrius vociferus</u>
Ring-billed gull	<u>Larus delawarensis</u>
California gull	<u>Larus californicus</u>
Rock dove (Domestic pigeon)	<u>Columba livia</u>
Mourning dove	<u>Zenaidura macroura</u>
Barn owl	<u>Tyto alba</u>
White-throated swift	<u>Aeronautes saxatalis</u>
Anna's hummingbird	<u>Calypte anna</u>
Red-shafted flicker	<u>Colaptes cafer</u>
Western kingbird	<u>Tyrannus verticalis</u>
Cliff swallow	<u>Petrochelidon pyrrhonota</u>
Scrub jay	<u>Apelocoma coerulescens</u>
Yellow-billed magpie	<u>Pica nuttalli</u>

Raven	<u>Corvus corax</u>
Crow	<u>Corvus brachyrhynchos</u>
Red-breasted nuthatch	<u>Sitta canadensis</u>
Mockingbird	<u>Mimus polyglottos</u>
Robin	<u>Turdus migratorius</u>
Cedar waxwing	<u>Bombycilla cedrorum</u>
Loggerhead shrike	<u>Lanius ludovicianus</u>
Starling	<u>Sturnus vulgaris</u>
Yellow warbler	<u>Dendroica petechia</u>
House sparrow (English sparrow)	<u>Passer domesticus</u>
Western meadowlark	<u>Sturnella neglecta</u>
Redwinged blackbird	<u>Agelaius phoeniceus</u>
Bullock's oriole	<u>Icterus bullockii</u>
Brewer's blackbird	<u>Euphagus cyanocephalus</u>
House finch (Linnet)	<u>Carpodacus mexicanus</u>
Pine siskin	<u>Spinus pinus</u>
American goldfinch (Common goldfinch)	<u>Spinus tristis</u>
Lesser goldfinch	<u>Spinus psaltria</u>
Savannah sparrow	<u>Passerculus sandwichensis</u>
White-crowned sparrow	<u>Zonotrichia leucophrys</u>
Golden-crowned sparrow	<u>Zonotrichia atricapilla</u>

Table 3. Amphibians and Reptiles of the LLNL and SNL sites.

Toad and Frog

Pacific treefrog

Hyla regilla

Western toad

Bufo boreas

Lizard

Western fence lizard

Sceloporus occidentalis

Salamanders

Eschscholtz's salamander

Ensatina eschscholtzii

California slender salamander

Batrachoseps attenuatus

Pacific giant salamander

Dicamptodon ensatus

Snake

Gopher snake

Pituophis catenifer

Table 4. Insects of the LLNL and SNL sites.

Diptera

House fly	<u>Musca domestica</u>
Syrphid fly	<u>Syrphus ribesii</u>
Mosquito	<u>Culex</u>
Crane fly	<u>Tipula</u>
Horse fly	<u>Tabanus</u>
Horse bot fly	<u>Gasterophilus intestinalis</u>
Vinegar flies	<u>Drosophila melanogaster</u>
Sun fly	<u>Pseudoleria</u>
Green bottle fly	<u>Lucilia</u>

Thysanura

Machilids	<u>Machilis</u>
Silverfish	<u>Thermobia</u>

Ephemeroptera

May fly	<u>Caenis</u>
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Odonata

Dragon fly	<u>Anax</u>
Dragon fly	<u>Libellula</u>
Damselfly	<u>Argia</u>

Orthoptera

Catantopids	<u>Microcentrum</u>
Field crickets	<u>Gryllus</u>
Grasshoppers	<u>Melanoplus</u>

Dermaptera

Earwig	<u>Forficula auricularia</u>
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Coleoptera

Whirligig beetles	<u>Dineutes</u>
Grain beetles	<u>Tenebroides</u>
Click beetles	<u>Monocrepidius</u>
Lady beetle	<u>Hippodamia convergens</u>

Hemiptera

Stink bug
Water strider
Squash bug
Back swimmers

Chlorochroa
Gerris
Anasa
Notonecta

Homoptera

Cicadas
Leaf-hoppers
San Jose scale
Whiteflies
Plant lice
Ants

Magicicada
Platymetopius
Aspidiotus perniciosus
Trialeurodes
Aphis
Formica

Neuroptera

Snakeflies
Aphid lions

Mantispa
Chrysopa oculata

Lepidoptera

Swallowtail butterfly
Cabbageworm
Monarch butterfly
Fritillary
Tobacco hornworm (Spinx)
Measuring worms

Pieris rapae
Danaus plexippus
Euptoieta
Protoparce sexta
Cleora

Hymenoptera

Wasps
Mud-dauber wasp
Bumble bee
Honey bee

Polistes
Sceliphron
Bombus
Apis mellifera

Table 5. Arachnids and crustaceans of the LLNL and SNL sites.

Arachnida

Spiders and mites

Red Spider mite	<u>Paratetranychus pilosus</u>
Garden spider	<u>Argiope</u>
Black widow	<u>Latrodectus mactans</u>
Scorpion	<u>Centruroides</u>
Harvestman spider	

Chilopoda

Centipede	<u>Solopendra marsitans</u>
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Crustacea

Sow-bug	<u>Cylisticus convexus</u>
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Diplopoda

Millipede	<u>Spirobolus</u>
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APPENDIX C

AMBIENT AIR QUALITY STANDARDS*

Pollutant	Averaging Time	California Standards ¹		National Standards ²		
		Concentration ³	Method ⁴	Primary ⁵	Secondary ⁶	Method ⁷
Oxidant ¹⁰	1 hour	0.10 ppm (200 ug/m ³)	Ultraviolet Photometry	—	—	—
Ozone	1 hour	—	—	240 ug/m ³ (0.12 ppm)	Same as Primary Standard	Chemiluminescent Method
Carbon Monoxide	12 hour	10 ppm (11 mg/m ³)	Non-Dispersive Infrared Spectroscopy	—	Same as Primary Standards	Non-Dispersive Infrared Spectroscopy
	8 hour	—		10 mg/m ³ (9 ppm)		
	1 hour	40 ppm (46 mg/m ³)		40 mg/m ³ (35 ppm)		
Nitrogen Dioxide	Annual Average	—	Saltzman Method	100 ug/m ³ (0.05 ppm)	Same as Primary Standards	Gas Phase Chemiluminescence
	1 hour	0.25 ppm (470 ug/m ³)		—		
Sulfur Dioxide	Annual Average	—	Conductimetric Method	80 ug/m ³ (0.03 ppm)	—	Paraseleniline Method
	24 hour	0.05 ppm (131 ug/m ³)		365 ug/m ³ (0.14 ppm)	—	
	3 hour	—		—	1300 ug/m ³ (0.5 ppm)	
	1 hour	0.5 ppm (1310 ug/m ³)		—	—	
Suspended Particulate Matter	Annual Geometric Mean	50 ug/m ³	High Volume Sampling	75 ug/m ³	50 ug/m ³	High Volume Sampling
	24 hour	100 ug/m ³		260 ug/m ³	150 ug/m ³	
Sulfates	24 hour	25 ug/m ³	AIHL Method No. 61	—	—	—
Lead	30 day Average	1.5 ug/m ³	AIHL Method No. 54	—	—	—
	Calendar Quarter	—	—	1.5 ug/m ³	1.5 ug/m ³	Atomic Absorption
Hydrogen Sulfide	1 hour	0.05 ppm (42 ug/m ³)	Cadmium Hydroxide Sulfate Method	—	—	—
Hydrocarbons (Corrected for Methane)	3 hour (5-9 a.m.)	—	—	160 ug/m ³ (0.24 ppm)	Same as Primary Standards	Flame Ionization Detection Using Gas Chromatography
Vinyl Chloride (Chloroethene)	24 hour	0.010 ppm (26 ug/m ³)	Gas Chromatog- raphy (ARB staff report 78-4-3)	—	—	—
Ethylene	8 hour	0.1 ppm	—	—	—	—
	1 hour	0.5 ppm	—	—	—	—
Visibility Reducing Particles	1 observation	In sufficient amount to (8) reduce the prevailing visibility to less than 10 miles when the relative humidity is less than 70%		—	—	—
APPLICABLE ONLY IN THE LAKE TAHOE AIR BASIN:						
Carbon Monoxide	8 hour	6 ppm (7 mg/m ³)	NDIR	—	—	—
Visibility Reducing Particles	1 observation	In sufficient amount to (8) reduce the prevailing visibility to less than 30 miles when the relative humidity is less than 70%		—	—	—

(Footnotes on following page)

* Taken from California Air Quality Data, California Air Resources Board, Sacramento, CA, 1981.

NOTE:

1. California standards are values that are not to be equaled or exceeded.
2. National standards, other than those based on annual averages or annual geometric means, are not to be exceeded more than once per year.
3. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 mm of mercury. All measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 mm of Hg (1,013.2 millibar); ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.
4. Any equivalent procedure which can be shown to the satisfaction of the Air Resources Board to give equivalent results at or near the level of the air quality standard may be used.
5. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health. Each state must attain the primary standards no later than three years after that state's implementation plan is approved by the Environmental Protection Agency. (EPA).
6. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Each state must attain the secondary standards within a "reasonable time" after implementation plan is approved by the EPA.
7. Reference method as described by the EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the EPA.
8. Prevailing visibility is defined as the greatest visibility which is attained or surpassed around at least half of the horizon circle, but not necessarily in continuous sectors.
9. At locations where the state standards for oxidant and/or suspended particulate matter are violated. National standards apply elsewhere.
10. Measured as ozone.

APPENDIX D

A CULTURAL RESOURCE ASSESSMENT OF A LAND PARCEL ADJACENT
TO LAWRENCE LIVERMORE NATIONAL LABORATORY,
LIVERMORE, CALIFORNIA

Colin I. Busby
PRINCIPAL INVESTIGATOR

FOR

Mr. Howard Tewes
Lawrence Livermore National Laboratory
Livermore, California

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BY

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March, 1982

~~NOTICE AND STIPULATION~~

~~Because this document discusses exact cultural resource locations, it must be kept ADMINISTRATIVELY CONFIDENTIAL and should only be released to qualified personnel who are directly connected with the proposed project or interested members of the professional anthropological community, on a need-to-know basis; and;~~

~~This report must either be presented in the final draft Environmental Impact statement or other documents exactly as received, or if the language, meaning, or intent are changed in any way, it must be submitted to the authors for final approval or revision.~~

INTRODUCTION

Basin Research Associates, Inc. was retained by Mr. Howard Tewes, Lawrence Livermore National Laboratory, to conduct an archaeological assessment/evaluation of a land parcel adjacent to the western boundary of the Lawrence Livermore National Laboratory's property in Alameda County. The land parcel comprises approximately 35 acres. Basin Research Associates' assessment consisted of an archive/literature search and a pedestrian field reconnaissance of the project area. The assessment was conducted in accordance with mandates in the California Environmental Quality Act (CEQA), the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act (NHPA).

PROJECT LOCATION AND DESCRIPTION (Figures D-1 and D-2)

The 35 acre land parcel is bordered on the north by Mesquite Way, on the west by Vasco Road, on the south by Arroyo Seco, and on the east by the Lawrence Livermore National Laboratory. The parcel is located in T 3S, R 2E, USGS Altamont, CA, 7.5' Quadrangle (1953 edition, photorevised 1981).

RESEARCH SOURCES CONSULTED

Prior to the pedestrian field survey the following sources were consulted by Basin Research Associates:

- (1) A site record and literature search was performed by personnel of the California Archaeological Site Survey Records Office at California State University, Sonoma, Rohnert Park.
- (2) National Register of Historic Places (1979, 1980, 1981, 1982).
- (3) Basin Research Associates' archives on Alameda County archaeology.

RESEARCH RESULTS - LITERATURE SEARCH

The archival research conducted at the Archaeological Site Survey Records Office revealed that no known prehistoric or historic sites are present within a one mile radius of the land parcel. One archaeological field reconnaissance has been conducted by CALTRANS (Watts 1979) in the vicinity of Highway 580 and Taylor Avenue which resulted in no cultural resources being located.

FIELD METHODOLOGY

An intensive field reconnaissance was conducted on the land parcel. Specifically, a general surface reconnaissance was carried out as defined below:

"Inspection of all land surfaces that can reasonably be expected to contain visible archaeological resources. Every portion of the project area whose surface can be seen without major modification of the the vegetation or structural cover and where it is reasonably possible that human activities that would leave traces might be carried out, is inspected in a general surface reconnaissance. Every foot of ground is not necessarily covered. A general surface reconnaissance is the functional equivalent of a complete reconnaissance (investigation of every visible portion of the project area) in some areas where soil, vegetaton, or other conditions make it unlikely tht some kinds of archaeological phenomena would be preserved, or where surface conditions obscure such phenomena to a point at which they could not be observed without undertaking large-scale brush clearing, grading, etc.." (King et al. 1973; King 1978; Edwards 1978).

RESEARCH RESULTS - FIELD RECONNAISSANCE

A pedestrian field survey was conducted on March 8, 1982 by

Mr. David J. Fee of Basin Research Associates' Technical Staff. The entire surface of the land parcel was covered utilizing north-south oriented transects spaced at 20 meter intervals. The survey began at the western boundary and worked toward the east. Special attention was given to the areas adjacent to the Arroyo Seco. A large dead tree of undetermined species is present on the parcel. The area surrounding this conspicuous "landmark" was carefully examined. No prehistoric cultural resources were observed during the survey. Two wooden structures and a concrete foundation exist in the extreme southwest portion of the parcel (Fig. 2). The structure and surrounding area were carefully examined and were determined to be non-significant recent cultural resources.

MANAGEMENT RECOMMENDATIONS

The archival research and field reconnaissance conducted for the land parcel revealed no known archaeological resources present within the parcel boundaries. Basin Research Associates, Inc. therefore recommends the following:

(1) The proposed development of the land parcel can proceed as planned;

(2) Although the consulting archaeologist conscientiously surveyed and researched the area to be affected by any development, much of the area was obscured by surface vegetation. To avoid the possible destruction of undetected archaeological sites, it is recommended that the personnel involved in construction activities (both line and supervisory personnel) be advised of the possibility of encountering unreported sites and be briefed on what evidence of prehistoric archaeological remains (varieties of artifacts, shell, fire-cracked rock, bone, etc.) and historic archaeological remains (19th century glass bottles, ceramics, butchered bone, bricks, etc.) which might be looked out for in the course of construction. Both the prime contractor and

sub-contractors should be cautioned on the legal implications of knowingly destroying cultural resources.

(3) It is further recommended that should evidence of cultural materials be discovered during the course of construction operations performed on the project, work should be halted within a 50 meter radius of the find and a qualified archaeologist consulted for further recommendations.

REFERENCES CITED

- Edwards, R.
1979 Recommendations for Archaeological Impact
 Evaluations: Procedures and Guidelines for
 Archaeological Consultant Qualifications -
 Prepared for Santa Clara County. MS on file,
 California Archaeological Site Survey Records
 Office, Cabrillo College, Aptos.
- King, T.F.
1978 The Archaeological Survey: Method and Uses.
 Heritage Conservation and Recreation Service,
 Washington, D.C.
- King, T.F. et al.
1973 Recommended Procedures for Archaeological Impact
 Evaluation. Society for California Archaeology
 Publication.
- Watts, D.C.
1979 Archaeological Survey Report, 04-Ala-580, P.M.
 13.1. Proposed Maintenance Station in the City
 of Livermore, Alameda County. MS on file,
 California Archaeological Site Inventory, Sonoma
 State University, Rohnert Park.

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