CHAPTER 4

Affected Environment

4.1 INTRODUCTION

Understanding the affected environment is necessary for understanding potential impacts from operations at Sandia National Laboratories, California (SNL/CA). This chapter describes the existing conditions that comprise the physical and natural environment within SNL/CA, the Region of Influence (ROI), and the relationship of people with that environment. Descriptions of the affected environment provide a framework for understanding the direct, indirect, and cumulative effects of each of the three alternatives. The discussion is categorized by resource area to ensure that all relevant issues are included. This chapter is divided into the following thirteen resource areas that support the impact assessment discussed in Chapter 5:

- Land Use and Visual Resources
- Geology and Soils
- Water Resources and Hydrology
- Biological Resources
- Cultural Resources
- Air Quality
- Infrastructure
- Transportation
- Waste Generation
- Noise
- Human Health and Worker Safety
- Socioeconomics
- Environmental Justice

The information in this chapter comes primarily from the SNL/CA *Environmental Information Document* (EID) (SNL/CA 2002a) and from the comprehensive environmental monitoring and surveillance programs that the United States (U.S.) Department of Energy (DOE) maintains at SNL/CA. Data for 2000 are presented where available; data for 1996, 1997, 1998, and 1999 are also included where necessary to present trends. Other relevant information is summarized and incorporated by reference.

Each resource and topic area includes a discussion of the ROI—the area that may be affected by SNL/CA operations. The ROI establishes the scope of analysis and focuses the discussion on relevant information. Because resources and topic areas are often interrelated, one section may refer to another.

Regions of Influence

Each ROI—the area that SNL/CA operations may reasonably affect—is delineated by its resource. ROIs are determined based on characteristics of SNL/CA and the surrounding area. The ROI limits may be natural features or political boundaries. Other ROIs are delineated using industry-accepted norms for the resources.

Materials released from SNL/CA can reach the environment and people in a number of ways. The routes that materials follow from SNL/CA to reach the environment and subsequently people are called transport and exposure pathways. SNL/CA conducts environmental monitoring to determine whether radioactive and nonradioactive materials were potentially released into the environment. Environmental monitoring also assesses the potential for people to encounter these materials by any route of exposure. Sampled media include ground-water, storm water runoff, and wastewater discharge. SNL/CA publishes an annual site environmental report that contains details on these sampling programs (SNL 1996a, 1997a, 1998a, 1999a, 2000a).

4.2 GENERAL LOCATION

SNL/CA is located about 40 miles (mi) east of San Francisco at the southeast end of the Livermore Valley in eastern Alameda County. The City of Livermore's central business district is located about 3 mi to the west. SNL/CA occupies a 410-acre site adjacent to and south of Lawrence Livermore National Laboratory (LLNL).

4.3 LAND USE AND VISUAL RESOURCES

4.3.1 Land Use

4.3.1.1 Definition of Resource

Land use describes the condition of a particular area and the activities that take place in that area. It is a critical element in site operations decision-making, especially when determining the feasibility of siting new programs and facilities at SNL/CA, and identifying conflicts between existing or projected operations and the potential for new operations. DOE Policy 430.1, *DOE Land Use and Facility Policy* (DOE P 430.1), governs DOE's management of its land and facilities, based on the principles of ecosystem management and sustainable development.

4.3.1.2 Region of Influence

The ROI includes the entire SNL/CA site and the nearby surrounding areas. This includes the main campus of the site, all open spaces, the buffer zone located between the inner and outer boundary fences, the area between the boundary fence and the four surrounding main streets (Vasco, Tesla, Greenville, and East), and the areas adjacent to these roads.

4.3.1.3 Affected Environment

Sandia National Laboratories, California Location and Setting

SNL/CA is located approximately 40 mi (65 kilometers [km]) east of San Francisco, adjacent to Livermore, California. The site comprises 410 acres owned by DOE, and is bounded by the City of Livermore to the west, LLNL to the north, and privately-owned rural and agricultural land to the south and east. The far western edge of SNL/CA is bounded by Vasco Road (formerly known as Las Positas Avenue), the far eastern edge by Greenville Road and the South Bay Aqueduct, and the northern edge by East Avenue, which separates SNL/CA from LLNL on the north side of the road. South of the southern end of the site is Tesla Road.

The general project area is situated at the southeast corner of the Livermore Valley in Alameda County, California. The valley, an east-west trending topographic and structural depression cuts the Diablo Range of central California. The majority of the 410-acre site is situated on relatively flat terrain, although the southern portion is hilly with gentle to steep slopes as it extends into the Altamont Hills, which are located to the south and east of the site. The elevation of the site ranges from 615 feet (ft) above mean seal level (MSL) in the northwest to approximately 850 ft MSL at the highest point in the south. One watercourse is present on the site. Arroyo Seco (formerly Muddy Creek) traverses the site from southeast to northwest. The area is characterized by perennial grasses and scattered oak woodland. Riparian vegetation is present along Arroyo Seco, a seasonal stream (Busby *et al*. 1990).

Historical Land Use at Sandia National Laboratories, California

SNL/CA is situated within the Chochenyo territory of the Ohlone/Costanoan Indians. Linguistic data suggest that these people moved to the Bay Area approximately A.D. 500. Historical accounts of the Ohlone/Costanoan from the 1770s to 1790s describe a people conducting seasonal rounds of hunting and gathering activities in the area. During the Hispanic Period, the Livermore area was part of Mission San Jose, established in 1797.

This area was likely used for livestock grazing, as raising cattle for tallow and hides was a major economic pursuit at that time. The far northwest corner of SNL/CA was included in the land grant Rancho Las Positas. This land grant was confirmed to Robert Livermore in the second half of the 19th century and was used for vineyards, orchards, and raising cattle. William Mendenhall established a city next to a railroad in 1869 and named it after Robert Livermore (Busby *et al*. 1990, SNL/CA 2002b).

The agrarian use of the site continued through World War II. LLNL was established on the site of the abandoned Livermore Naval Air Station in 1949. In March 1956, SNL/CA was established on 75 acres, formerly the Naval Air Station's barracks and gunnery range, and farmland, to support the nuclear weapons research being conducted at LLNL. An additional 86 acres of land were acquired in 1970, 24 acres in 1979, and 228 acres in 1986 to 1987, bringing the total to 413 acres. In 1998, the DOE exchanged land with a neighboring property owner to straighten out the west property boundary—the neighbor received approximately three more acres than did DOE, bringing the total to 410 acres (Busby *et al*. 1990, SNL/CA 2002b, SNL 2001d).

Current Land Use at Sandia National Laboratories, California

Primary land use at SNL/CA fits into the category of industrial/research park uses, although not all facilities are industrial in nature (for example, administrative offices). Land use at the site includes buildings and structures, infrastructure systems (water, sewer, gas, and electrical), a firing range, roadways, parking areas, and landscaping. Spaces between buildings are landscaped or used as paved service areas, roads, or sidewalks. Parking areas are positioned along the perimeter of the developed area and cluster along East Avenue. Open space within the developed area is set aside for future construction use, with the exception of Arroyo Seco. A security buffer surrounding the western, southern, and eastern edges of the developed area ranges in width from 600 to 1,200 ft and represents 175 acres. This zone is located between the security fence and the outer boundary fence. The buffer zone has a dual purpose, ensuring that an adequate safety zone exists for the physical protection of the public and providing facility security. East Avenue lies at the north end of SNL/CA, separating SNL/CA from the LLNL site. East Avenue is a paved two-way street, with four lanes at the west end and two lanes at the east end and walking/bike lanes the entire length. Three roads are located on the site but outside the developed area. These are Sandia Drive on the west, Thunderbird Lane on the east, and South Portal Drive to the south, which provides emergency access to and egress from the site (SNL/CA 2002b) (Figure 4-1).

SNL/CA has 72 buildings used for administrative offices, laboratories, shops, storage, or technical support. These buildings provide approximately 740,000 adjusted gross

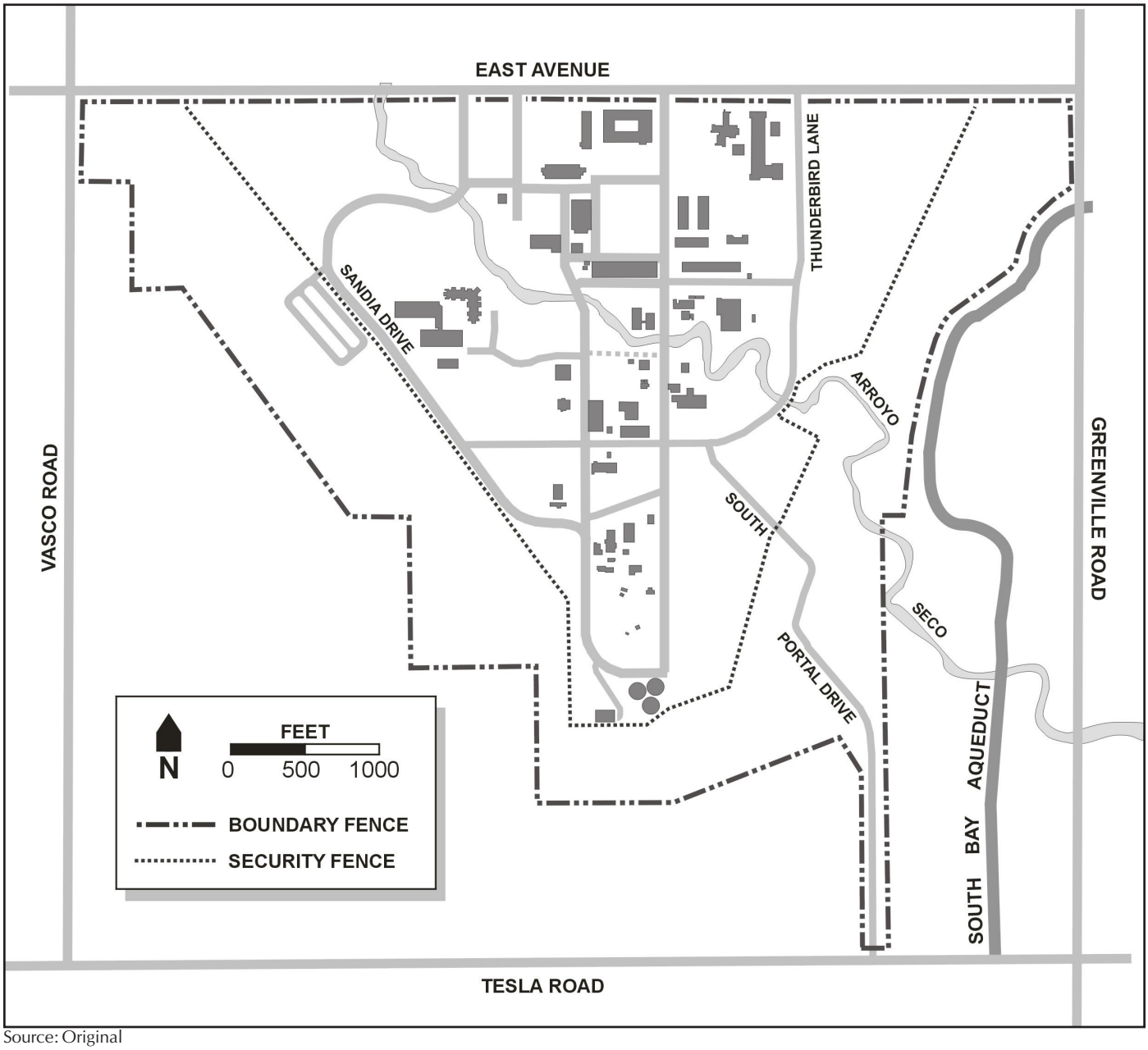

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Figure 4-1. The Sandia National Laboratories, California Site, Occupying 410 Acres, is owned by the U.S. Department of Energy

Lawrence Livermore National Laboratory is located adjacent and north of East Avenue.

square feet (gsf) (SNL/CA 2002b). Section 4.9 provides discussion of site infrastructure.

There are three private utility easements on SNL/CA, all of which cross the site at the southern end. Chevron-Texaco Corporation has an easement for an underground oil pipeline. Pacific Gas and Electric Company (PG&E) has easements for an overhead high-voltage electric power transmission line and an underground high-pressure gas pipeline (SNL/CA 2002b).

Land Use Surrounding Sandia National Laboratories, California

Land use in the region surrounding SNL/CA is a result of city and county planning and zoning regulations. The City of Livermore and the County of Alameda do not have planning jurisdiction over SNL/CA. SNL/CA is situated within the sphere of influence of the City of Livermore, but not within the incorporated area of the city. The area to the west of the site, including Vasco Road, is within the City of Livermore (SNL/CA 2002b).

To the north across East Avenue is LLNL, which encompasses approximately 821 acres and has land uses similar to those at SNL/CA (Figure 4-2). To the east and south is agricultural. East of SNL/CA are Greenville Road and a hilly area used for cattle grazing. The South Bay Aqueduct is located between the SNL/CA boundary and Greenville Road. A private residence is located near the southeastern corner of the site, between the aqueduct and the site boundary fence. The area south of the site is primarily vineyards with residences or buildings that are used for activities such as wine tastings, parties, and dining. West of SNL/CA is the City of Livermore and Vasco Road. Various private landowners own the property on this side of the site. In the area between Vasco Road and the west boundary of SNL/CA is a mix of rural residential and agricultural use, including an elementary school, Steivers Academy. This area is currently zoned as single-family residential with construction to start in 2002. With this new residential development, the area will no longer be rural residential. The National Nuclear Security Administration (NNSA) is currently negotiating with the property owner a "Grant of Easement and Agreement" to establish conditions, limitations, and provide disclosures. To the west of Vasco Road, the present and proposed uses are residential and light industrial (SNL/CA 2002b).

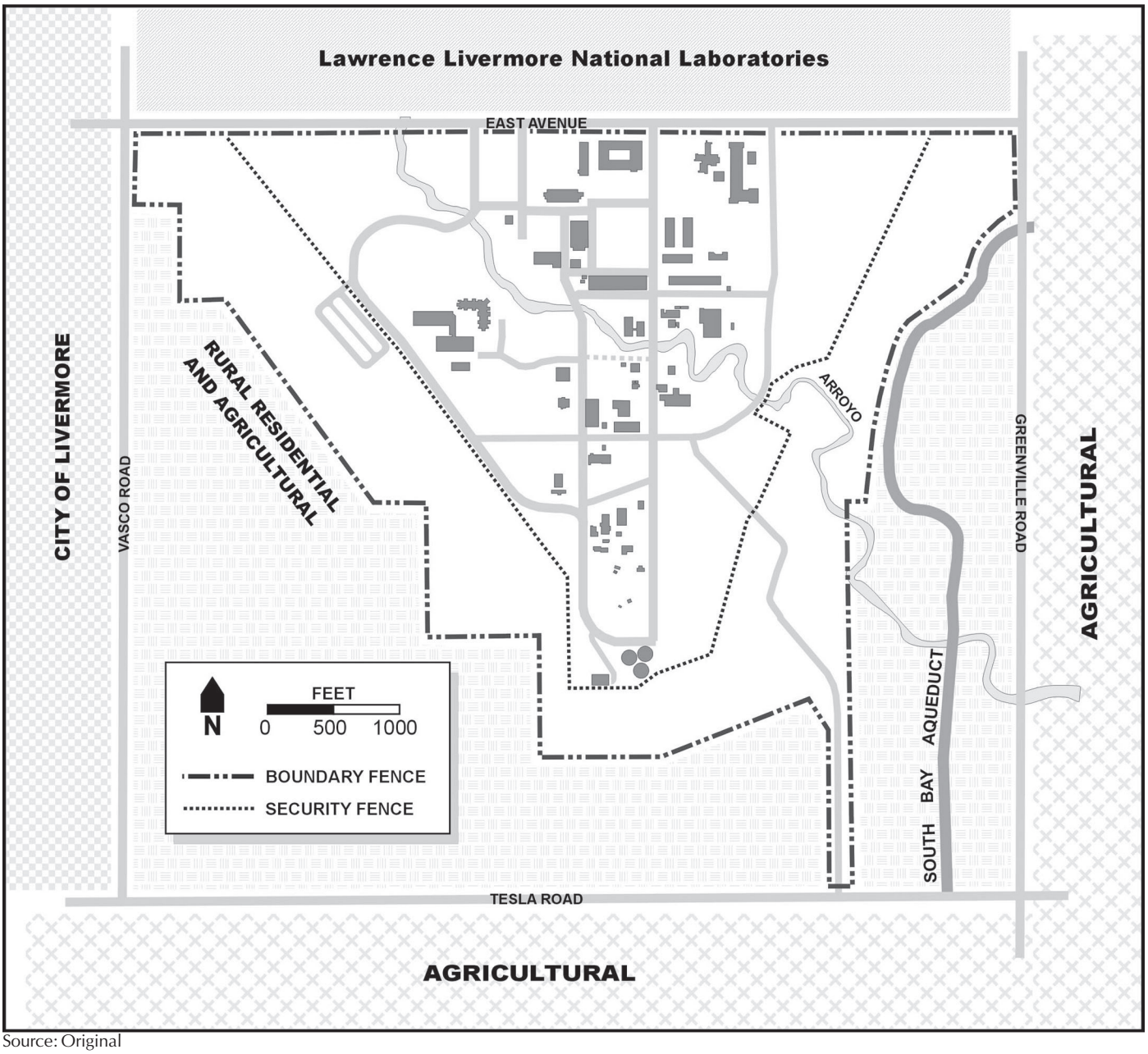

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Figure 4-2. Land Use in the Areas Adjacent to Sandia National Laboratories, California

Sandia National Laboratories, California occupies 410 acres and is adjacent to East Avenue.

Sandia National Laboratories, California Land-Use Trends

SNL/CA land use will not change significantly in the near future. In accordance with the *Sandia National Laboratories Sites Comprehensive Plan* (SNL 2001c), land use at SNL/CA will remain consistent with industrial/research park uses (SNL/CA 2002b).

Surrounding Land-Use Trends

The area surrounding SNL/CA is transitioning from agricultural/open space to residential/light industrial/commercial uses. Residences are encroaching on SNL/CA's western border, promoted by the city's and county's designation of this area for such uses. The areas south and east of SNL/CA are zoned agricultural and it is expected that these areas will remain agricultural. LLNL, located north of SNL/CA, is in stable, long-term use as a DOE facility.

4.3.2 VISUAL RESOURCES

4.3.2.1 Definition of Resource

Visual resources are those aspects of an area that pertain to its appearance and to the manner in which people view it. This resource area provides a means to review the aesthetic qualities of landscapes and their modifications, associated perceptions and concerns of people, and the physical or visual relationships that influence the visibility of any proposed landscape modifications.

Scenic values are identified as views (typically from publicly accessible areas) where there are natural landforms, man-made structures or elements (such as landscaping), and/or a panorama or distinctive composition of the location or area (SNL/CA 2002b). Individuals may hold these views as distinctive because of the visual character present. Expansive bodies of natural objects and colors, such as hills, grassland, and open space, tend to have a peaceful and calming effect on the viewer. Repetitive patterns also tend to have a calming effect. Buildings, urban elements, and other man-made structures often appear as abrupt and thus can provide an unwelcome visual diversity in the view field. However, buildings and structures that exhibit high artistic value, such as historic buildings, can also provide an aesthetically pleasing view.

4.3.2.2 Region of Influence

The ROI is similar to that for land use. It consists of the area in and adjacent to SNL/CA, where SNL/CA operations may influence the landscape and associated visual characteristics.

4.3.2.3 Affected Environment

One of the goals for SNL/CA is to create a campus-like atmosphere at the site. To achieve this goal, SNL/CA developed the *Sandia National Laboratories California Site Visual Quality Guidelines & Landscape Master Plan* (Royston *et al*. 1993). Important aspects of the plan that pertain to development of the site are to maintain view corridors, to cluster buildings to create sheltered spaces, to close connections between buildings, and to situate service access in unobtrusive areas.

Views from Within Sandia National Laboratories, California

The views from within SNL/CA tend to fall into two categories: views of buildings and associated landscaping and paved surfaces (parking and service areas, sidewalks, and roads), and views of open spaces that are either landscaped or natural. The latter views include spaces within the built-up area of the campus, open areas along the arroyo or in the buffer zones of the site, and more distant open spaces such as the hills that are visible to the south and east (near distant) and to the north and west (far distant). Visibility of these open spaces is facilitated by the low building density of the site and the moderate height of the buildings. The site has 72 buildings used for offices, laboratories, facilities, and storage. Views of SNL/CA from within these buildings consist primarily of landscaping, other buildings, and paved surfaces, though some distant views of open spaces are visible from taller buildings. Views seen while walking, biking, or driving on SNL/CA are the same. From some areas of the site, views are of the built areas located adjacent to SNL/CA, namely LLNL to the north and the City of Livermore at Vasco Road to the west. While many parts of SNL/CA could provide an aesthetic value of relaxation and attractiveness due to the campus-like atmosphere and the presence of mature landscaping, the site as a whole would not likely be considered of high scenic value due to the buildings and paved surfaces (SNL/CA 2002b).

Views of Sandia National Laboratories, California from Surrounding Areas

SNL/CA is situated on mostly flat terrain that provides little or no public views of the site from locations a mile or more away. Views of the site are limited to immediately adjacent areas.

The view of SNL/CA from East Avenue consists of the built portion of SNL/CA in the middle and the buffer zones at the west and east ends. The view of the built portion of the site is screened in many places by mature trees and other landscaping. At the west end of the road, views of distant open spaces to the south are available, though views to the distance in the east, north, and west are blocked by SNL/CA, LLNL, and the City of Livermore respectively. At the east end of the road, distant views to the east, south, and north are present, though views to the west are blocked by SNL/CA, LLNL, and the City of Livermore. From all portions of the road, LLNL's built area is

in view and the City of Livermore is adjacent to the west end of the road.

The view of SNL/CA from Vasco Road includes the northwest portion of the buffer zone and at one point, a view of the Micro and Nano Technologies Laboratory's (MANTL's) building shape, roof, and exhaust stacks. Along most of the road, the view east includes rural residential areas and the distant open spaces beyond. To the west and adjacent to the road is the City of Livermore, which encompasses the entire view. To the north is LLNL, which dominates the view, though at the south end of the road distant hills to the north can be seen beyond LLNL. The view to the south is of distant hills.

The view of SNL/CA from Tesla Road includes South Portal Road and the gated entrance, and the water towers on the hills at the south end of the site. These hills effectively block any other view of the site from this road. On either side of the gated entrance are pastureland and vineyards, which encompass the view from the road to the north. Because Tesla Road is somewhat higher in elevation, the distant open spaces to the north can still be seen. To the south and east are views of agricultural areas and distant hills. At the west end of the road, the area is still agricultural, but the view west includes the City of Livermore and distant open spaces.

Greenville Road is on terrain higher than SNL/CA, but there are hills between the road and the site. Thus, views of the site are available from the road only between these hills. The view of the site from the northern end of the road includes the buffer zone and the eastern edge of the built area of the site, and the buffer zone and water tanks at the southern end. Also included in the western view are LLNL, the City of Livermore, and distant open spaces to the west, south, and north. Views south and east from the road are of agricultural open space and distant hills. The view north includes LLNL and agricultural open space, with hills in the distance.

The City of Livermore and the County of Alameda have identified certain scenic routes where an effort is being made to maintain the scenic view corridors (SNL/CA 2002b). While the city and county have no jurisdiction to enforce any requirements on SNL/CA, it is useful to note that of the eight roads identified as scenic routes, Greenville, Tesla, and Vasco are the only ones from which SNL/CA is visible. As explained above, the views of SNL/CA from these three roads are very limited.

4.4 GEOLOGY AND SOILS

4.4.1 Definition of Resource

The discussion of geology and soils includes general geology, geological resources, geological hazards (seismology), and soils. General geology refers to topography, structural geology, and stratigraphy. Geological resources include aggregate deposits, fossil occurrences, and oil production. Geological hazards include seismology (which refers to the geology below the soil layer that is relevant to the occurrence, frequency, and magnitude of earthquakes) and slope stability. The discussion of soils briefly describes soils present at the site and contaminated soils.

4.4.2 Region of Influence

The main concern of seismic activity is the effect on onsite facilities, specifically, whether damage from earthquakes could result in a contaminant release. Therefore, the ROI would be the extent of environmental or human health effects from such a release. Soil contamination could potentially result at or near the point of release. Thus, the ROI is limited to SNL/CA. Potential migration of soil contaminants into groundwater or surface water is addressed in Sections 4.5.1.3 and 4.5.2.3.

4.4.3 Affected Environment

4.4.3.1 General Geology

Topography and Geomorphology

SNL/CA is located in the California Coast Ranges geologic province (DOE 1992a, SNL/CA 2002b) characterized by low rugged mountains and relatively narrow intervening valleys. Figure 1-1 shows the location of SNL/CA relative to the surrounding area. Specifically, SNL/CA is located in the southeastern portion of the Livermore Valley. The valley forms an irregularly shaped lowland area about 16 miles-long east-to-west and 7 miles- to 10 miles-wide north-to-south. The floor of the valley slopes to the west at about 20 ft per mile.

In general, the site consists of relatively flat foothills that have low relief and slope gently northwest and north. Slopes at SNL/CA vary from 1 to 3 degrees. The southern area of SNL/CA is situated on the north side of a ridge (the Altamont Hills) approximately 150 ft above the surrounding land. The SNL/CA property ranges in elevation from 849 ft above MSL at the south end of the SNL/CA ridge top to 615 ft MSL at the northwest corner of the site.

San Francisco Bay Area Structural Geology

A generalized map of the regional structural geology and physiography of the San Francisco Bay Area is presented in Figure 4-3. The Diablo Range, which includes the Altamont Hills, is part of the northwest-trending Coast Ranges, and parallels three major faults in the area (DOE 1992a, SNL/CA 2002b). These include the San Andreas Fault system, the Sur-Nacimiento fault, and the Coast Range thrust fault system (the Sur-Nacimiento fault and the Coast Range thrust are not exposed in the area shown in Figure 4-3). These faults can generally be considered to define three different lithologic blocks. The