

CHAPTER 6

Cumulative Effects Analysis

The Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act (NEPA) define cumulative effects as “the impact on the environment which results from the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions” (40 CFR 1508.7). The regulations further explain “cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.” The cumulative effect analysis presented in this Site-Wide Environmental Assessment (SWEA) is based on the incremental actions at Sandia National Laboratories, California (SNL/CA) and in the region.

Based upon examination of the potential environmental effects of direct and indirect actions, coupled with other agencies and the United States (U.S.) Department of Energy (DOE) and the National Nuclear Security Administration (NNSA) actions in the region and private actions, NNSA has determined the following resource areas would be likely to experience cumulative effects and needed to be analyzed in detail: biological and ecological resources, air quality, and transportation. This chapter provides a description of the impacts of SNL/CA as they relate to impacts from other activities in the region of influence (ROI) including Lawrence Livermore National Laboratory (LLNL). The methods of analysis are identified in Section 6.1. Section 6.2 summarizes the impacts associated with potentially affected resources. Section 6.3 discusses resource areas with potential cumulative impacts.

6.1 METHODS OF ANALYSIS

Methodology for the analysis of cumulative effects for this SWEA was developed from the guidelines and methodology in the CEQ’s *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997b). The major components of the CEQ methodology include:

- Scoping, including identifying the significant potential cumulative effects issues associated with the proposed action, identifying the ROI and time frame for the analysis, and identifying other actions affecting the resources,
- Describing the affected environment (see Chapter 4), and
- Determining the environmental consequences, including the impacts from the proposed action and other activities in the ROI, and the magnitude and significance of the cumulative effects.

NNSA assessed the cumulative effects by combining the potential effects of the Maximum Operations Alternative with the effects of other past, present and reasonably foreseeable activities in the ROI. The ROIs vary by resource area, and are generally the same as those presented in Chapter 4. The Maximum Operations Alternative was selected to assess a bounding scenario of potential cumulative effects. This approach results in a conservative analysis of the maximum cumulative effects.

An internet search, literature review of environmental documents for the ROI, and personal contacts with local government planning departments were undertaken to obtain information on the potential cumulative effects for each resource area analyzed in Chapter 5. In most

resource areas, the analysis in Chapter 5 includes the cumulative regional impacts. For example, for air resources impacts, the analysis accounts for projected impacts to the region regulated by the Bay Area Air Quality Management District (BAAQMD).

6.2 POTENTIALLY AFFECTED RESOURCES

The well-defined ROIs presented in Chapter 4 associated with the continued operation of SNL/CA results in a baseline for assessing cumulative impacts. In some cases the ROI for cumulative impacts may be larger than that presented in Chapter 4. For example, although potential impacts from a proposed action may impact only local biological resources, if loss of habitat is a problem throughout the region, then the ROI for cumulative effects may extend to a larger area.

Potential impacts to land use and visual resources, geology and soils, water resources, cultural resources, infrastructure, human health, waste generation, noise, socioeconomics, and environmental justice pose no incremental or relatively minor roles in this assessment. As such, these areas are not discussed in the same level of detail as the other subject areas addressed in this Site-Wide Environmental Assessment (SWEA). This helps focus the assessment on factors most relevant to the nature of the proposed actions and avoids duplication of analyses. The following discussion summarizes the baseline condition (Maximum Operations Alternative) of each of the areas not discussed in detail. Potential accidents at SNL/CA are not cumulative with other impacts in the ROI, so they are not discussed here, but are included in Chapter 5. Cumulative impacts are summarized in Table 6-1.

Table 6-1. Comparison of Potential Cumulative Impact Data by Resource Area

Discipline Area	Summary of Cumulative Impacts
Land Use and Visual Resources	<p>ROI—Encroaching development and loss of agricultural land and open spaces is a major concern and cumulative impact from all activities in Alameda County. Agricultural land uses and undeveloped land are increasingly being converted into residential, commercial, and light industrial land uses. Growth of the surrounding community is placing suburban and industrial development closer to site boundaries.</p> <p>SNL/CA—Use of SNL/CA as a federal research and development facility is consistent with existing land use plans. No new land use impacts are expected.</p>
Geology and Soils	<p>ROI—At LLNL, existing soil contamination is being cleaned up under the remediation program, and routine analyses of surface soil, sediment, and vadose zone soil samples in 2000 indicate that the impact of LLNL has not changed from previous years and remains insignificant.</p> <p>SNL/CA—Soil contamination at SNL/CA occurred as the result of past operations. Analyses indicate no significant risk to the general public. No other geological or soil impacts were found to have a cumulative effect.</p>
Water Resources and Hydrology	<p>ROI—Flooding from Arroyo Seco has occurred downstream from SNL/CA. LLNL drains to Arroyo Las Positas, which is also subject to flooding. Radioactivities detected in storm water samples at LLNL were small percentages of the MCL for drinking water. Nitrates and chromium have been detected above their MCLs in wells on LLNL. LLNL is working to contain and cleanup groundwater contamination. In the Livermore Valley, no monitored radioactive or inorganic nonradioactive constituent was found to exceed primary drinking water MCLs in any well off LLNL.</p> <p>SNL/CA—The <i>Arroyo Seco Management Plan</i> would reduce current flood and erosion potential offsetting the 27 percent increase in impervious areas for the Maximum Operations Alternative. Groundwater monitoring would be part of a long-term monitoring program. No groundwater use is expected.</p>
Biological Resources	<p>ROI—Throughout the area, vegetation in developed areas has been altered by human activity. The wildlife present are species that have adapted to human presence. In 2000, Federally threatened California red-legged frogs were found in the area including LLNL.</p> <p>SNL/CA—The <i>Arroyo Seco Management Plan</i> identifies concepts for providing additional and improved habitat and migration conditions for protected species that may use Arroyo Seco on SNL/CA property. The initial impacts may disrupt critical habitats and sensitive species, however, the long-term impact of improved habitat would be beneficial both on a local and regional basis.</p>
Cultural Resources	<p>ROI—For cultural resources, the ROI is SNL/CA.</p> <p>SNL/CA—Neither the SNL/CA site nor the adjoining properties contain any known archeological, historical, or cultural features, therefore no cumulative impacts to cultural resources are anticipated.</p>
Air Quality	<p>ROI—Total emission of criteria pollutants from the Bay Area was approximately 1.5 million tons in 2000. Total emission of criteria pollutants from LLNL was approximately 34 tons in 2000.</p> <p>SNL/CA—For criteria (8 tons/yr) and toxic air (3 tons/yr) pollutants (with the exception of 1,4-dioxane), emissions are well below 1 percent of Bay Area emissions for the same pollutants. SNL/CA 1,4-dioxane emissions are less than 1.5 percent of Bay Area 1,4-dioxane emissions. The air pollutant contribution from a maximum of 1,530 vehicles at SNL/CA would be small.</p>
Infrastructure	<p>ROI—The city of Livermore handles 1.8 billion gallons of wastewater per year. For a city the size of Livermore, 8 billion gallons of water would be used per year. LLNL water use expected in 2002 has been estimated at 261 MGY. Total power consumption for 2002 at LLNL has been estimated at 474 million kWh.</p> <p>SNL/CA—Maximum SNL/CA utility projections are water use of 91.8 M gal, wastewater discharges of 29.1 M gal, electrical use 48,800 MWh, and natural gas use of 94 M ft³.</p>
Transportation	<p>ROI—Average Annual Daily Traffic, Greenville Road—117,000 Average Annual Daily Traffic, Vasco Road—145,000 Estimated LLNL commuters—8,000 (16,000 trips/day)</p> <p>SNL/CA—Estimated SNL/CA commuters—1,500 (3,000 trips/day)</p>
Waste Generation	<p>ROI—Radioactive waste total, DOE Annual—40,000 m³ Radioactive waste total, LLNL Annual—70 m³ Hazardous waste total, State of California Annual—427,302 tons Hazardous waste total, LLNL Annual—200 tons.</p> <p>SNL/CA— Radioactive waste total, Annual—10 m³ Hazardous waste total, Annual—118 tons.</p>

Table 6-1. Comparison of Potential Cumulative Impact Data by Resource Area

Discipline Area	Summary of Cumulative Impacts
Noise	ROI —Traffic is the primary source of noise within the ROI. At LLNL, no noise standards are being exceeded. SNL/CA —Cumulative effects of noise from SNL/CA operations occur during new facility construction would be expected to increase background noise levels.
Human Health and Worker Safety	ROI —The calculated total potential dose to the maximally exposed individual from all LLNL operations was 0.038 mrem in 2000. SNL/CA —There are no SNL/CA sources of radioactive air emissions.
Socioeconomics	ROI —The population density in the three-county ROI was 2,956,155 people in 2000. Employment at LLNL decreased from a peak of about 11,200 workers in 1989 to approximately 8,000 in 2001. SNL/CA —Under the Maximum Operations Alternative, 1,530 workers would be employed.
Environmental Justice	ROI —Minority and low-income populations are found in the local area; however, no impacts to these populations were noted in the available documentation. SNL/CA —No incremental impacts would be expected.

Sources: DOE 1992a, 1999a, 2001a, GMA 2002a, LLNL 2001a

EIS: Environmental Impact Study

EPA: The U.S. Environmental Protection Agency

ft³: cubic feet

kg/yr: kilograms per year

kWh: kilowatt hour

LLNL: Lawrence Livermore National Laboratory

MCL: maximum contaminant level

M gal: millions of gallons

MGY: million gallons per year

mrem: millirem

MWh: megawatt hour

rem: Roentgen equivalent, man

ROI: region of influence

SNL/CA: Sandia National Laboratories, California

6.2.1 LAND USE AND VISUAL RESOURCES

SNL/CA land use and visual resources are those which are associated with an industrial park. In general, land use and visual resources would remain the same. No incremental cumulative impact would be expected. NNSA recognizes that adjacent public land use (encroachment of single-family homes) would continue, and those agricultural and undeveloped lands in the ROI (Livermore and Alameda County) are increasingly being converted into residential, commercial and light industrial land uses.

6.2.2 GEOLOGY AND SOILS

Within the ROI (LLNL and SNL/CA) existing soil contamination has occurred from operations. However, present and planned activities are designed to minimize contamination at both LLNL and SNL/CA. The cleanup of these soils is performed to a level that meets State of California approved health risk-based standards (which vary depending on the chemicals of concern) corresponding to the intended future uses of the site. Analyses indicate no significant risk to the general public (see Section 5.3.2.3). Existing contamination at LLNL is being cleaned up under the remediation program (LLNL 2001). Sampling and analysis of the vadose zone showed no evidence of contamination that would significantly affect ground-

water (DOE 2001a). As a result, the cumulative effect of soil contamination is not considered appreciable. No other geological or soil impacts were found to have an incremental cumulative effect.

6.2.3 WATER RESOURCES

For water resources, the ROI includes the Spring and Mocho I subbasins of the Livermore Valley for groundwater, and Arroyo Seco for surface water. Impacts analyzed include groundwater and surface water (including storm water) quality and quantity.

Because groundwater would not be used, the cumulative impact of the Maximum Operations Alternative on groundwater quantities would not be expected to result in discernible cumulative impacts. Groundwater contamination has occurred from DOE-related operations at LLNL and cleanup measures are underway. Any cleanup measures undertaken as a result of groundwater cleanup at either LLNL or SNL/CA would result in an improvement in groundwater quality. No substantial long-term cumulative impacts would be expected.

For surface water, an increase of 27.7 acres of impervious area, representing an increase of 56 percent, is projected for the Maximum Operations and Planned Utilization

and Operations Alternatives. This would add to the quantity of storm water runoff being transported directly or indirectly into the Arroyo Seco. Floodplain maps indicate that along most of the channel on SNL/CA property, the entire 100-year discharge is contained within the existing channel. However, the area between A Street and Thunderbird Lane is subject to flooding (GMA 2001b). The *Arroyo Seco Management Plan* (GMA 2002a) includes active channel improvements and stream zone management activities that would reduce current flood and erosion risk. Because the increase in impervious area at SNL/CA would be offset by floodplain and channel improvements, the effects of the Maximum Operations or Planned Utilization and Operations Alternative would not result in significant cumulative impacts.

Impacts to water quality from storm water runoff would be minimal. Cleanup actions planned, underway, or completed at the Environmental Restoration (ER) sites at SNL/CA and within the ROI are intended to remove any potential source of surface water contamination, and the cleanup activities themselves are not expected to negatively affect surface water quality.

6.2.4 CULTURAL RESOURCES

Neither the SNL/CA site nor the adjoining properties contain any known archeological, historical, or cultural features; therefore, no cumulative impacts to cultural resources would be anticipated.

6.2.5 INFRASTRUCTURE

The SWEA found the infrastructure system, including utilities, at SNL/CA has more than adequate capacity. Any increases within the ROI, including the city of Livermore and LLNL, would be relatively minor (see Table 6-1).

6.2.6 HUMAN HEALTH AND WORKER SAFETY

For radiological doses within the ROI, including the city of Livermore and Alameda County, only one facility (LLNL) has potential for radiological air emissions with associated impacts of a public dose. The calculated total potential dose to the maximally exposed individual from all LLNL operations using tritium was 0.038 millirem (mrem) in 2000, or about 0.4 percent of the U.S. Environmental Protection Agency (EPA) regulatory standards, and about 1/8000 of the dose received by individuals from natural background radiation (LLNL 2001). There are no SNL/CA sources of radioactive air emissions and

thus no radiation exposure or cumulative impacts to the offsite population from SNL/CA operations. Collective doses to involved workers and worker injuries are not cumulative because they impact only individuals.

6.2.7 WASTE GENERATION

The SWEA found the waste generation impact of the Maximum Operations Alternative would be less than impacts of fiscal year (FY) 2000 operations, generally small, and masked by ROI waste generation. For radioactive waste, SNL/CA would generate only 14 percent of DOE operations locally and 0.025 percent of DOE operations nationally. For hazardous waste, SNL/CA would generate only 0.028 percent within California. For municipal solid waste, the EPA determined that California has over 10 years of remaining landfill capacity. NNSA recognizes landfill space can have a cumulative impact, however, land disposal is not expected to result in critical shortages.

6.2.8 NOISE

Activities under the Maximum Operations Alternative would result in incremental levels of noise due to increased vehicle traffic, normal SNL/CA operations (including the firing range), and construction. Vehicle traffic and normal operations would likely result in a greater frequency of noise at current levels of intensity, similar to those presently experienced, whereas construction would be expected to increase peak noise levels.

Nearby housing construction, East Avenue construction, and LLNL operations would also contribute to ambient background noise levels.

Noise would remain within current decibel ranges, but increase in duration or frequency. The small incremental effect resulting from SNL/CA activities would not contribute appreciable cumulative impacts.

6.2.9 SOCIOECONOMICS

The population density of the area within the ROI is high. The SWEA found the socioeconomic impact is beneficial, and small (0.2 percent) (see Table 6-1).

6.2.10 ENVIRONMENTAL JUSTICE

Based on the SWEA analyses of all the resource areas and topic areas, impacts that would result during the course of normal operations would not pose disproportionately high and adverse health or environmental

Maximally Exposed Individual

A hypothetical person at a location where he or she could potentially receive the maximum dose of radiation.

impacts on minority and low-income populations within the ROI (15-mile radius from SNL/CA). No incremental impacts would be expected.

6.3 RESOURCES WITH POTENTIAL CUMULATIVE IMPACTS

Potential impacts to biological resources, air quality, and transportation pose incremental changes in this assessment. The following discussion summarizes the baseline condition (Maximum Operations Alternative) of each of the areas discussed in detail.

6.3.1 BIOLOGICAL RESOURCES

SNL/CA serves as a refuge for wildlife in the general area, providing open space, habitat, and protection. Implementation of the three major features of the Maximum Operations Alternative that could affect biological resources, the Arroyo Seco Improvement Program, construction in undeveloped areas, and fire management in grasslands areas, would likely serve to improve wildlife habitat to a small extent. While there would be some small loss of terrestrial habitat due to construction, implementation of the Arroyo Seco Improvement Program would enhance the diversity and utilization of this corridor and the biological value of the site as a whole. Continued operation under the Maximum Operations Alternative would perpetuate the provision of habitat and its protection. When taken in context with the continuing area-wide conversion of wildlife habitat for agricultural, residential, and commercial and industrial use, the incremental effect of the proposed action would likely be very positive, particularly in the long term.

6.3.2 AIR QUALITY

Data reported in 1999 indicated that the City of Livermore has the worst air quality in the San Francisco Bay Area in terms of ozone and particulate matter (Livermore

2001). Current growth rates in the ROI (Livermore Valley Basin) would negatively impact air quality. Much of the air quality problem is from traffic emissions. The estimated number of daily commuters to SNL/CA during FY2001 is 700 to 1,000 vehicles. Under the Maximum Operations Alternative, it is estimated that a 53 percent increase in daily commuter traffic would occur, resulting in 1,071 to 1,530 vehicles. SNL/CA traffic-related emissions would represent less than 2 percent of emissions from DOE-related traffic. Correspondingly, the SNL/CA incremental contribution to the ROI would be less than one percent.

In general criteria and toxic air pollutants emissions are well below 1 percent of Bay Area emissions (see Section 5.5.6). SNL/CA would account for approximately 7 to 20 percent of DOE-related criteria pollutant emissions in the Livermore area. For toxic air pollutants, because of the difference in operations between LLNL and SNL/CA the emissions are not directly comparable. Cumulative impacts to air quality are minimal with respect to criteria and toxic air pollutants from SNL/CA operations.

6.3.3 TRANSPORTATION

Data reported in 2001 indicated that Vasco Road and Greenville Road Average Annual Daily Traffic was 145,000 and 117,000 vehicles, respectively (see Table 6-1). SNL/CA commuters would represent less than 1.1 percent under the Maximum Operations Alternative. Current growth rates for the ROI are much higher than the resulting increase in SNL/CA commuter traffic.

6.4 CONCLUSION

The effects of the Maximum Operations Alternative, when combined with those effects of other actions defined in the scope of this chapter, do not result in cumulatively significant impacts.

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