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6

Environmental Impacts of Transportation

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6. ENVIRONMENTAL IMPACTS OF TRANSPORTATION

This chapter describes the potential environmental consequences of transporting spent nuclear fuel and high-level radioactive waste from 72 commercial and 5 U.S. Department of Energy (DOE) sites to the Yucca Mountain site under the Proposed Action. This chapter also separately describes the impacts of transportation activities in the State of Nevada.

This environmental impact statement (EIS) analyzes a Proposed Action to construct, operate and monitor, and eventually close a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste at Yucca Mountain. The EIS also analyzes a No-Action Alternative, under which DOE would not build a repository at the Yucca Mountain site, and spent nuclear fuel and high-level radioactive waste would remain at 72 commercial and 5 DOE sites across the United States. The No-Action Alternative is included in the EIS to provide a baseline for comparison with the Proposed Action. DOE has developed the information about the potential environmental impacts that could result from either the Proposed Action or the No-Action Alternative to inform the Secretary of Energy’s determination whether to recommend Yucca Mountain as the site of this Nation’s first monitored geologic repository for spent nuclear fuel and high-level radioactive waste. In making that determination, the Secretary would consider not only the potential environmental impacts identified in this EIS, but also other factors as provided in the Nuclear Waste Policy Act, as amended.

As part of the Proposed Action, the EIS analyzes the potential impacts of transporting spent nuclear fuel and high-level radioactive waste to the Yucca Mountain site from 77 sites across the United States. This analysis includes information on such matters as the comparative impacts of truck and rail transportation, alternative intermodal (rail to truck) transfer station locations, associated heavy-haul truck routes, and alternative rail transport corridors in Nevada. Although it is uncertain at this time when DOE would make any transportation-related decisions, DOE believes that the EIS provides the information necessary to make decisions regarding the basic approaches (for example, mostly rail or mostly truck shipments), as well as the choice among alternative transportation corridors. However, follow-on implementing decisions, such as selection of a specific rail alignment within a corridor, or the specific location of an intermodal transfer station or the need to upgrade the associated heavy-haul routes, would require additional field surveys, state and local government consultations, environmental and engineering analyses, and National Environmental Policy Act reviews.

The analysis evaluated potential impacts from two basic national transportation activities—the loading of spent nuclear fuel and high-level radioactive waste in heavily shielded shipping casks certified by the U.S. Nuclear Regulatory Commission at commercial and DOE facilities, and the transportation of these materials to Yucca Mountain using legal-weight truck or rail shipments. The Nevada transportation activities include the transportation of spent nuclear fuel and high-level radioactive waste shipments from the State borders to Yucca Mountain. Nevada transportation also includes the transportation of materials, equipment, and personnel to and from Yucca Mountain for the construction, operation and monitoring, and eventual closure of the proposed repository. The analysis also evaluated the potential impacts of the possible construction of an intermodal transfer station and related highway upgrades that might be needed for heavy-haul trucks, and the possible construction of a branch rail line to Yucca Mountain. Section 6.1 provides a summary of both national and Nevada transportation activities. Chapter 2, Section 2.1.2, also contains detailed descriptions of national transportation and Nevada transportation activities.

Section 6.2 assesses and compares the potential impacts of national transportation from the 77 sites to Yucca Mountain. Because the mode of transportation used to ship from each site would depend on several factors that DOE does not control (for example, future capabilities of shipping sites, rail service to shipping sites, and labor agreements), DOE recognizes that it cannot predict the specific transportation mode (truck or rail) of each shipment to the repository. Therefore, this section evaluates the potential impacts of two national transportation modes (legal-weight truck and rail), which are represented in this section by two analytical scenarios—*mostly legal-weight truck* and *mostly rail*—to address the range of impacts that could occur in Nevada for the transportation modes that DOE could ultimately use. In addition, as part of the mostly rail scenario, this section assesses short hauls of commercial spent nuclear fuel in heavy-haul trucks or barges that could occur from some commercial sites to railheads.

Section 6.3 assesses potential impacts from transportation activities in Nevada. This section uses three analytical scenarios—*mostly legal-weight truck* (corresponding to that portion of the national transportation scenario that would occur in Nevada), *mostly heavy-haul truck*, and *mostly rail*—to address the range of impacts that could occur in Nevada for the transportation modes that DOE could ultimately employ. In addition, Section 6.3 evaluates the potential consequences in Nevada of using legal-weight trucks on existing routes, one of five potential highway routes for heavy-haul trucks, or one of five potential branch rail lines. The potential highway routes for heavy-haul trucks and potential branch rail corridors are called *implementing alternatives*. The EIS includes information, such as the comparative impacts of truck and rail transportation, alternative intermodal (rail to truck) transfer station locations, associated heavy-haul truck routes, and alternative rail transport corridors in Nevada, that might not lead to near-term decisions. It is uncertain at this time when DOE would make these transportation-related decisions. If and when it is appropriate to make such decisions, DOE believes that the EIS provides the information necessary to make these decisions. However, measures to implement those decisions, such as selection of a specific rail alignment within a corridor, or the specific location of an intermodal transfer station or the need to upgrade the associated heavy-haul routes, would require additional field surveys, State of Nevada and local government consultations, environmental and engineering analyses, and National Environmental Policy Act reviews.

National transportation and Nevada transportation modes must be integrated to operate effectively, as shown in Figure 6-1. Therefore, this analysis used only certain combinations of the national and Nevada transportation modes. Figure 6-2 shows the relationship of the rail and truck modes to the national and Nevada transportation analysis scenarios and the Nevada transportation implementing alternatives.

Appendix J contains details on transportation analysis methods and results. Chapter 4 evaluates potential environmental impacts from the offsite manufacturing of shipping casks for commercial and DOE (including naval) spent nuclear fuel and DOE high-level radioactive waste; the receipt and unloading of shipping casks; the preparation at the repository of empty casks for reshipment; and the construction and operation of a cask maintenance facility at the proposed Yucca Mountain Repository. Chapter 8 discusses cumulative impacts of transportation for the Proposed Action and anticipated future transportation activities that could affect members of the public and workers.

6.1 Summary of Impacts of Transportation

6.1.1 OVERVIEW OF NATIONAL TRANSPORTATION IMPACTS

This section provides an overview of the potential impacts of using the Nation's highways and railroads to transport spent nuclear fuel and high-level radioactive waste from 72 commercial and 5 DOE sites to the repository at Yucca Mountain. Detailed discussions of national transportation impacts are in Section 6.2 and analytical methods are in Appendix J. All potential impacts are related to the health and safety of populations and hypothetical maximally exposed individual members of the general public and workers. This summary includes estimated impacts from loading operations, incident-free transportation, and accidents for the mostly legal-weight truck and mostly rail national transportation scenarios. (National transportation includes transportation in Nevada to Yucca Mountain.)

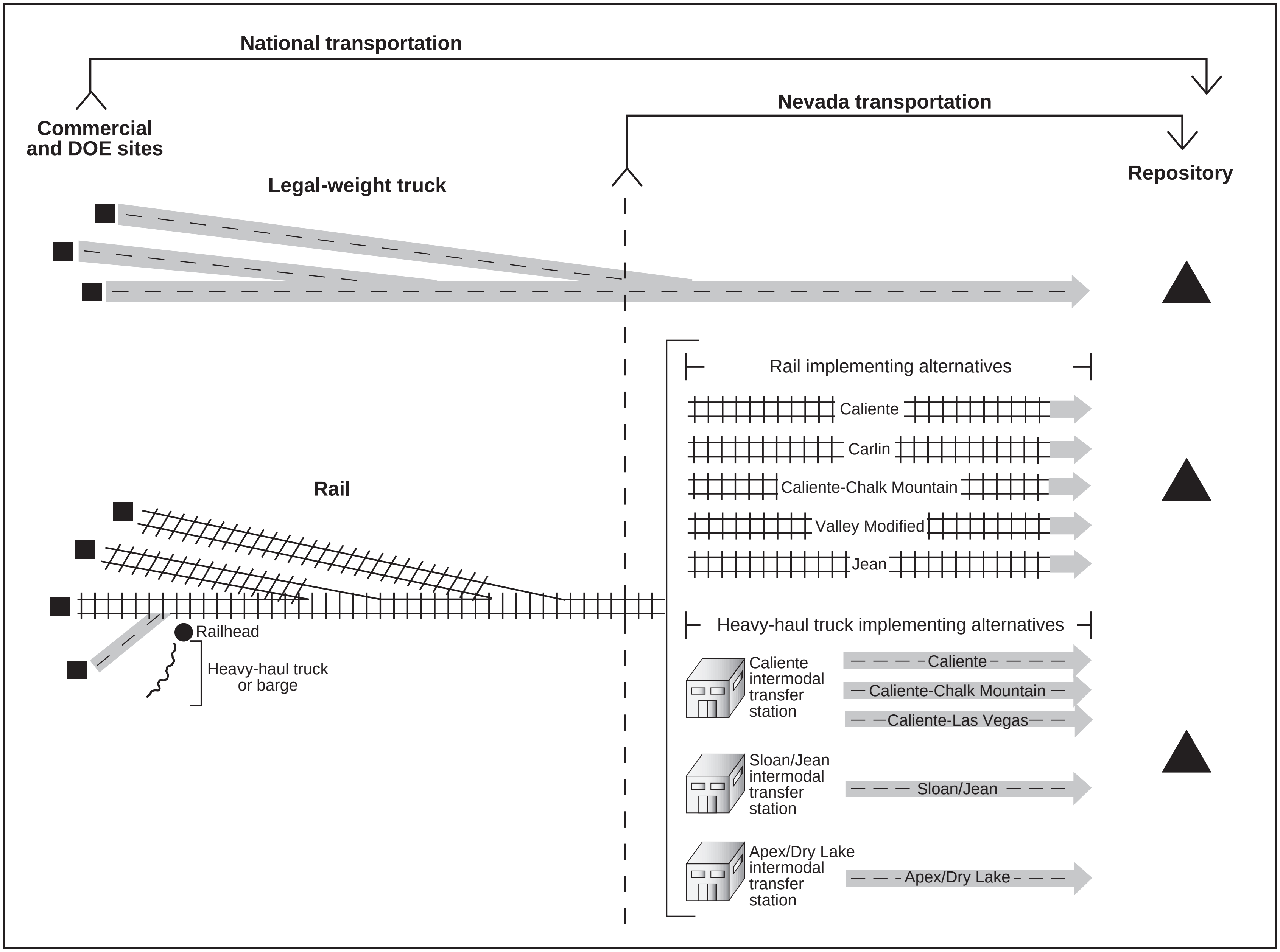


Figure 6-1. Relationship of Nevada and national transportation.

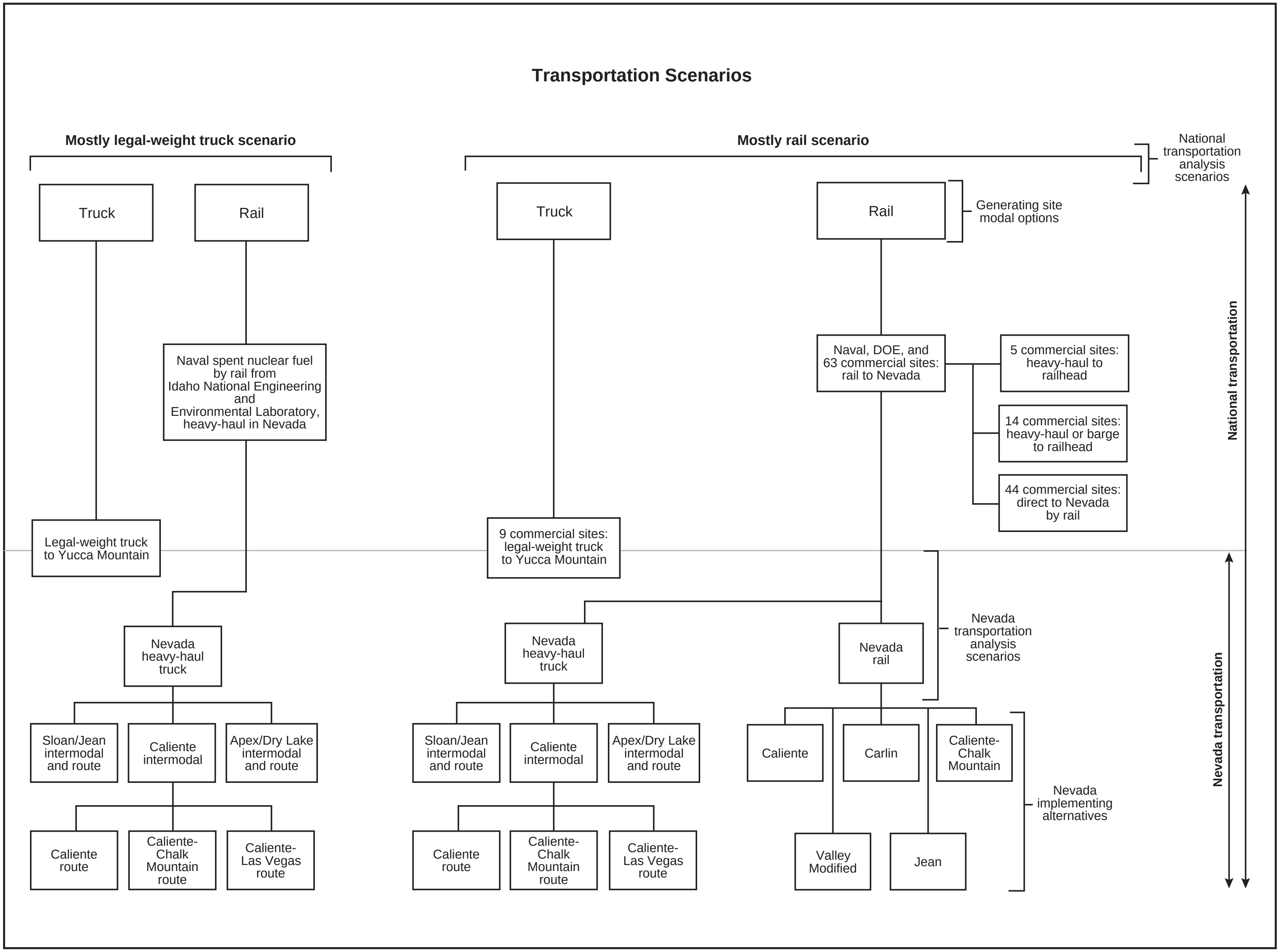


Figure 6-2. Relationship between transportation modes, national and Nevada analytical scenarios, and Nevada transportation implementing alternatives.

IMPLEMENTING ALTERNATIVES AND SCENARIOS

Implementing alternatives and scenarios are used to describe the range of reasonably foreseeable transportation actions with environmental impacts that could result from the Proposed Action.

Implementing alternatives represent feasible selections that DOE could make based in part on this EIS (for example, selecting a branch rail line corridor or an intermodal transfer station location and an associated route for heavy-haul trucks). Analytical scenarios, on the other hand, are feasible combinations of actions that DOE would have limited ability to direct (for example selecting the use of rail or truck casks for shipments from a specific nuclear powerplant). The scenarios are selected such that the analysis results bound the range of impacts that could result from the Proposed Action.

The transportation modes that make up the analytical scenarios and implementing alternatives include the following:

Legal-weight truck transportation: Legal-weight trucks have gross vehicle weights, including cargo, that do not exceed 80,000 pounds, which is the loaded weight limit for commercial vehicles operated on Interstate and U.S. highways without special state-issued permits. In addition, these vehicles would have dimensions that are within the constraints of Federal and state regulation limits.

Permitted overweight, overdimension truck transportation: Semi- and tandem tractor-trailer trucks with gross vehicle weights over 80,000 pounds must obtain permits from state highway authorities to use public highways. States often permit vehicles that have gross weights above 80,000 pounds as *overweight, overdimension* vehicles with operating restrictions to protect public safety. Nine-axle tractor-trailer trucks (steering axle and three drive axles on the tractor and three axles on the trailer) with weights greater than 80,000 pounds that meet Federal bridge formulas and dimensional limits can carry payloads of 70,000 pounds.

Rail transportation: Rail transportation includes railroad transportation of spent nuclear fuel and high-level radioactive waste in large rail transportation casks (rail casks). The casks would be placed on railroad cars at commercial and DOE sites or at nearby intermodal transfer facilities for shipment on trains operated by commercial railroad companies over existing tracks. Because of the weight of the casks, only one cask would be transported on a railcar.

Heavy-haul truck transportation: Heavy-haul truck transportation includes the movement of large rail casks—both loaded and empty—on large heavy-haul trucks traveling on existing highways. For the transportation of spent fuel and high-level radioactive waste rail casks, these vehicles would weigh as much as 500,000 pounds; they would be more than 100 feet long and 10 to 12 feet wide, and would stand as high as 15 feet above the road surface. Heavy-haul trucks would require special permits issued by a state transportation agency. The permits would normally restrict the times of operation (typically daylight, non-rush-hour), operating speeds, and highways used [see TRW (1999d, Request #031)].

Barge transportation: Barge transportation would be the transportation of loaded and empty rail casks between a commercial facility and a nearby railhead using navigable waterways. Barge terminals would have intermodal transfer capabilities sufficient to transfer casks from barges to railcars.

Estimated national transportation impacts are based on 24 years of transportation activities during the Proposed Action and average annual shipments of about 2,100 (2,100 truck, 13 rail) for the mostly legal-weight truck scenario and 560 (450 rail, 110 truck) for the mostly rail scenario. From all causes, about 23 fatalities could occur in the nationwide general population from incident-free transportation activities of the mostly legal-weight truck scenario and about 6 fatalities from the mostly rail scenario during the 24-year transportation period (impacts of a maximum reasonably foreseeable accident are not included).

Impacts of Loading Operations

All spent nuclear fuel and high-level radioactive waste would be loaded onto trucks or railcars at the 77 sites for transport to the Yucca Mountain site. Some health and safety impacts would be associated with these loading operations. There would be small (0.04 latent cancer fatality) impacts to members of the public from loading operations. Over the 24 years of the Proposed Action, an estimated 6 and 2 latent cancer fatalities, respectively, could occur in involved worker populations from radiation exposure for the mostly legal-weight truck and mostly rail scenarios. The probability of a latent cancer fatality to the maximally exposed involved worker would be about 0.005 for both scenarios. No worker fatalities from industrial accidents would be expected. No or very small impacts to workers or members of the public would be expected from postulated loading accidents. About 0.5 traffic fatality could occur in the worker population from commuting under the mostly legal-weight truck scenario, while about 0.2 traffic fatality could occur under the mostly rail scenario. Loading operations and potential impacts are discussed further in Section 6.2.2.

Impacts of Incident-Free Transportation

Incident-free transportation is the expected norm for transportation of spent nuclear fuel and high-level radioactive waste to the Yucca Mountain site. Impacts of incident-free transportation would include those from external radiation emitted from transportation casks and vehicle exhaust emissions along the transportation routes.

Over the 24 years of the Proposed Action, an estimated 18 latent cancer fatalities could occur in the general population along transportation routes from radiation exposure under the mostly legal-weight truck scenario and an estimated 2 latent cancer fatalities could occur under the mostly rail scenario. Under the mostly legal-weight truck and mostly rail scenarios, the probability of a latent cancer fatality to the maximally exposed member of the public would be no more than 0.0012 and 0.00016, respectively. Under these same scenarios, about 0.6 and 0.3 vehicle emission-related fatality, respectively, could occur in the general population along transportation routes.

For involved workers, an estimated 5 latent cancer fatalities could occur in the involved worker population from radiation exposure for the mostly legal-weight truck scenario, and an estimated 1 latent cancer fatality could occur for the mostly rail scenario. The probability of a latent cancer fatality to the maximally exposed involved worker would be no more than 0.02 for either the mostly legal-weight truck or mostly rail scenarios. DOE expects impacts to noninvolved workers to be low, smaller than those to involved workers.

The differences in incident-free impacts between the mostly legal-weight truck and mostly rail scenarios are principally because of (1) the difference in the number of shipments for the two scenarios, and (2) differences in analysis assumptions about the numbers of in-transit stops, the number of potentially exposed persons, and their proximity to shipping casks that could result in external radiation exposure.

No environmental justice impacts were identified for incident-free transportation. Incident-free national transportation and the potential impacts to workers and the public are discussed further in Section 6.2.3.

Impacts of Transportation Accidents

The analysis evaluated transportation accident impacts to human health and safety, collectively including the health and safety of the public and transportation workers. Thus, impacts to populations from transportation accidents would include impacts to affected workers. Because of the large differences between the populations of transportation workers and the general public, radiological accident risks and

TRANSPORTATION RADIOLOGICAL ACCIDENT RISK

Transportation radiological accident risk is determined by calculating the number of latent cancer fatalities that would be caused per rem of exposure to radioactive materials from transportation accidents and multiplying this value by the probability of the accidents.

An estimated 0.0005 cancer would be caused by exposure to a dose of 1 rem. An individual exposed to a dose of 0.3 rem per year, which is approximately equal to background radiation, for a lifetime of 72 years would have a lifetime exposure of about 22 rem. This dose would result in a risk of a latent cancer fatality of 0.01. This is a probability of 1 in 100 of death over a lifetime from exposure to radiation approximately equal to natural background radiation and medical sources.

If each person in a population of 1,000 was exposed to a dose of 22 rem, the population dose would be 22,000 person-rem. Using 0.0005 latent cancer fatality per rem of dose, an analysis would estimate 11 latent cancer fatalities from this population dose.

consequences for workers would be a very small fraction of the risks and consequences evaluated for the public.

Accident impacts include the consequences where shipping casks could be breached with subsequent release of radioactive material to nearby individuals and populations. In addition, there could be impacts to individuals from "normal" traffic accidents, in which there would be no release of radioactive material from shipping casks and only those directly involved in the accident would be affected. The analysis examined radiological consequences under the maximum reasonably foreseeable accident scenario, and overall accident risk. The maximum reasonably foreseeable accident scenario is the one with the greatest potential consequences. It must also have an occurrence likelihood of 1 in 10 million per year or greater to be considered "reasonably foreseeable." Accident risk considers the potential consequences of all accident scenarios and their occurrence likelihood, from accident scenarios that are likely to occur but would have no release of radioactive material to those accident scenarios that are extremely unlikely to occur but could have large consequences (for example, the maximum reasonably foreseeable accident scenario).

The overall radiological accident risk, as described in Appendix J, Section J.1.4.2.1, from all accident scenarios over the 24 years of transportation activities during the Proposed Action would be about 0.07 latent cancer fatality for the mostly legal-weight truck scenario and about 0.02 latent cancer fatality for the mostly rail scenario. These estimated latent cancer fatalities would occur in the hypothetically exposed population residing within 80 kilometers (50 miles) of the accident site.

The maximum reasonably foreseeable accident scenario for the mostly legal-weight truck scenario would result in about 5 latent cancer fatalities in the exposed population. It is postulated to involve a release of radioactive material from a truck cask in an urbanized area under stable (still air) weather conditions. The probability of this accident scenario would be about 0.00000019 per year (a rate of about 2 in 10 million years). The maximum reasonably foreseeable accident scenario for the mostly rail scenario would result in about 31 latent cancer fatalities in the exposed population. It is postulated to involve a release of radioactive material from a rail cask in an urbanized area under stable (still air) weather conditions. The probability of this accident scenario would be about 0.00000014 per year (a rate of about 1.4 in 10 million years). The probability of a latent cancer fatality occurring in the hypothetical maximally exposed individual would be about 0.002 for the mostly legal-weight truck scenario and about 0.013 for the mostly rail scenario.

Nationwide, during the 24 years of the Proposed Action transportation activities, about 4 fatalities could result from traffic accidents under the mostly legal-weight truck scenario. For the same time period, about 4 fatalities could also result from traffic accidents under the mostly rail scenario. These fatalities would all be related to physical injuries associated with traffic accidents, not radiological impacts.

No environmental justice impacts were identified for transportation accident scenarios. Transportation accident scenarios and potential impacts are discussed further in Section 6.2.4.

6.1.2 OVERVIEW OF NEVADA TRANSPORTATION IMPACTS

This section provides an overview of the environmental impacts associated with transportation of spent nuclear fuel and high-level radioactive waste in the State of Nevada. Although this section provides a more detailed, regional subset of some of the information gathered and analyses conducted for national transportation (see Section 6.1.1), it also includes information analyzed specifically for Nevada. This includes impacts from construction and operation of branch rail lines, heavy-haul truck routes and intermodal transfer stations, commuter transportation for construction and operations activities, and transportation of other materials in support of Yucca Mountain operations. Detailed discussions of potential impacts in Nevada are in Section 6.3 and Appendix J. The following areas were evaluated for potential impacts in Nevada from Yucca Mountain transportation activities:

- Transporting spent nuclear fuel and high-level radioactive waste by legal-weight truck in Nevada
- Constructing a branch rail line in Nevada and using it to transport spent nuclear fuel and high-level radioactive waste by rail to the repository
- Upgrading highways in Nevada for use by heavy-haul trucks to transport spent nuclear fuel and high-level radioactive waste to the repository
- Constructing and operating an intermodal transfer station in Nevada
- Transporting materials, consumables, supplies, equipment, waste, and people to support construction, operation and monitoring, and closure of the repository

Overviews are presented for the 12 environmental resource areas analyzed in this chapter and for the transportation of other materials and supplies, which is presented in further detail in Appendix J. The summaries provide information for assessing the relative impacts in these resource areas from the mostly legal-weight truck transportation scenario, the five implementing alternatives for rail transportation, and the five implementing alternatives for heavy-haul truck transportation.

6.1.2.1 Land Use

Land-use impacts would be greatest for the mostly rail scenario, with disturbed land areas ranging from about 5 square kilometers (1,200 acres) for the Valley Modified route to 19 square kilometers (5,000 acres) for the Carlin route (see Figure 6-3). The Carlin route would also affect the most private land [7 square kilometers (1,730 acres)]. Disturbed land area would be very similar for all of the heavy-haul implementing alternatives, ranging from 0.2 to 0.28 square kilometers (50 to 70 acres). No more than 0.2 square kilometers of private land would be affected for any route. There would be no land-use impacts from legal-weight trucks using existing highways. Land-use impacts are discussed for Nevada transportation rail implementing alternatives and for Nevada transportation heavy-haul truck implementing alternatives in Sections 6.3.2 and 6.3.3, respectively.

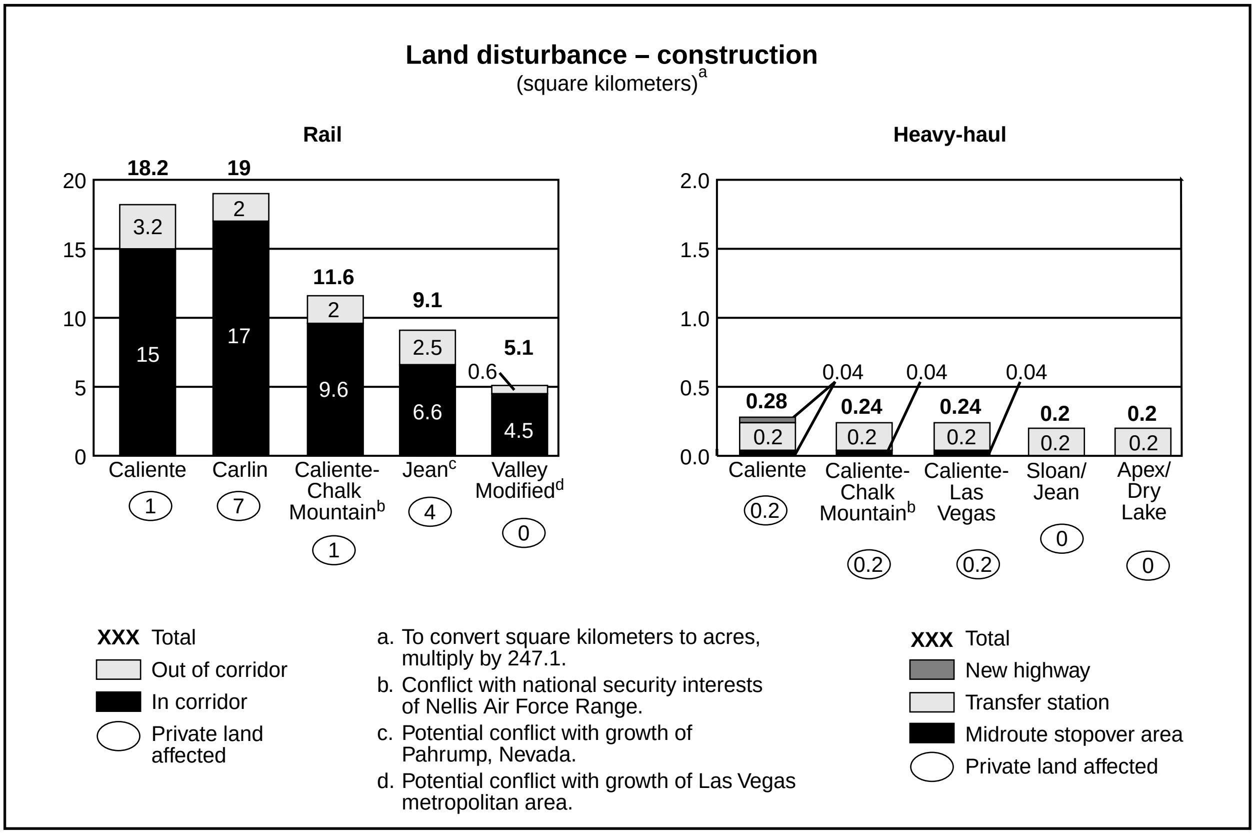


Figure 6-3. Land disturbed for construction of branch rail lines and upgrades to Nevada highways for heavy-haul use.

The U.S. Air Force has identified national security issues regarding a Chalk Mountain rail corridor or Caliente-Chalk Mountain route for heavy-haul trucks, citing interference with Nellis Air Force Range testing and training activities (Henderson 1997, all). In response to Air Force concerns, DOE regards these routes as "non-preferred alternatives." The Jean and Valley Modified rail corridors could have conflicts with the future community growth of Pahrump and Las Vegas, respectively. Potential rail and legal-weight and heavy-haul truck routes could pass through or near the Moapa and Las Vegas Paiute Indian Reservations.

6.1.2.2 Air Quality

The main air pollutants would be fugitive dust and equipment emissions (mainly carbon monoxide and nitrogen dioxide) from construction or upgrade activities associated with the rail and heavy-haul truck implementing alternatives, and vehicle emissions associated with legal-weight truck, heavy-haul truck, and rail transportation. None of these emissions are expected to exceed applicable annual or short-term air quality limits. Dust (such as PM_{10} and $PM_{2.5}$) from construction would be suppressed by the use of best management practices such as water spraying. Pollutants from vehicle traffic would be small in all cases, although the largest repository-related source of vehicle emissions would be the vehicles used by employees commuting to and from the Yucca Mountain site. This traffic would originate in and return to the Las Vegas area and be a minor contributor to traffic emissions in the Las Vegas Valley. Air quality impacts are discussed for Nevada transportation rail implementing alternatives and for Nevada transportation heavy-haul truck implementing alternatives in Sections 6.3.2 and 6.3.3, respectively.

6.1.2.3 Hydrology

Surface-water resources are most prevalent among the Caliente and Carlin rail corridors and could be affected by construction activities. The potential Caliente intermodal transfer station is about 0.19 kilometer (0.12 mile) from a perennial stream, and the Caliente, Caliente-Chalk Mountain, and Caliente-Las Vegas routes for heavy-haul trucks would pass within 1 kilometer (0.6 mile) of water resources. Surface-water impacts during construction would be avoided by implementing good management practices to prevent and mitigate spills of pollutants and would avoid, minimize, or otherwise mitigate possible changes to stream flows. Therefore, DOE does not anticipate impacts to surface waters from the construction of a rail or heavy-haul truck implementing alternative. In addition, surface-water impacts would be unlikely from legal-weight truck, rail, or heavy-haul truck operations or the operation of an intermodal transfer station.

Potential for groundwater impacts would be limited. There would be the potential for temporary withdrawals of water from groundwater sources during the construction of a branch rail line or upgrades to highways and construction of an intermodal transfer station. Estimated water use would be greater for construction of branch rail lines than for upgrades for heavy-haul truck routes (see Figure 6-4). Such withdrawals would require temporary permits from the State of Nevada. If groundwater could not be withdrawn for construction, water would be transported from permitted sources to the construction sites by truck.

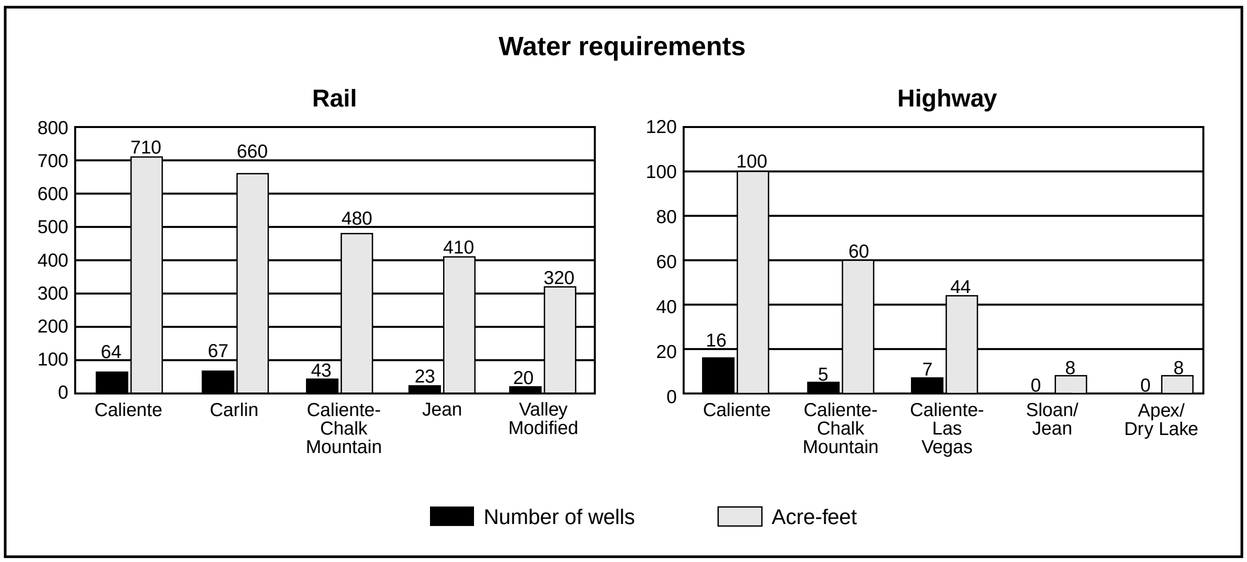


Figure 6-4. Water and number of wells required for construction of branch rail lines and upgrades to Nevada highways for heavy-haul use.

Legal-weight truck shipments, operations of a branch rail line, or operations of heavy-haul trucks, including the operation of an intermodal transfer station, would not affect groundwater resources. Hydrology impacts are discussed for Nevada transportation rail implementing alternatives and for Nevada transportation heavy-haul truck implementing alternatives in Sections 6.3.2 and 6.3.3, respectively.

6.1.2.4 Biological Resources and Soils

Loss of habitat from construction of a branch rail line would be the greatest potential impact to biological resources, potentially affecting the desert tortoise, a threatened species. Loss of desert tortoise habitat would be approximately 2.4 square kilometers (590 acres) for the Caliente-Chalk Mountain route, 3 square kilometers (740 acres) for the Caliente and Carlin routes, 5 square kilometers (1,200 acres) for the Valley Modified route, and more than 11 square kilometers (2,700 acres) for the Jean route. All of these potential routes have low abundance of desert tortoise except for some limited areas of the Jean route where abundance is higher. The potential for impacts from upgrading Nevada highways for heavy-haul truck use would be small because modifications to roads would occur in previously disturbed rights-of-way. An intermodal transfer station constructed in association with a heavy-haul truck implementing alternative would potentially disturb only about 0.2 square kilometer (50 acres) of potential desert tortoise habitat. Other special status species could be affected based on the route chosen. Impacts from operations, with the exception of infrequent wildlife kills by vehicles, would be unlikely. As with heavy-haul trucks, legal-weight truck shipments that used existing highways would cause only very small impacts to biological resources.

For highway upgrades, DOE or the State of Nevada would reduce concerns about soil contamination or erosion as a result of implementing alternatives for transportation by incorporating appropriate considerations during construction. These considerations would include the proper control of hazardous materials and use of dust suppression and other control techniques to reduce erosion. As a result, the implementing alternatives for transportation in Nevada would be unlikely to have impacts on soil. Impacts to biological resources and soils are discussed for Nevada transportation rail implementing alternatives and for Nevada transportation heavy-haul truck implementing alternatives in Sections 6.3.2 and 6.3.3, respectively.

6.1.2.5 Cultural Resources

Based on available information, the construction and operation of a branch rail line in any of the candidate corridors could present the potential for direct or indirect impacts (such as crushing or disturbing of sites; soil erosion exposing or covering sites) to archaeological resources, including those related to Native American culture. None of the five potential rail corridors passes through reservation lands. Additional archaeological surveys and ethnographic studies would be needed for any of the five rail corridors to determine impacts and mitigation needs. The determination of the potential for impacts to archaeological resources and Native American cultural values from the upgrading and use of Nevada highways for heavy-haul truck shipments would also require more study. The Caliente-Las Vegas, Sloan/Jean, and Apex/Dry Lake routes for heavy-haul trucks follow a portion of U.S. Highway 95 that passes through approximately 1.6 kilometer (1 mile) of the Las Vegas Paiute Indian Reservation. The Caliente-Las Vegas route segment on U.S. Highway 93 passes within about 5 kilometers (3 miles) of the Moapa Indian Reservation. An Apex/Dry Lake intermodal transfer station would be within 3 kilometers (2 miles) of the Moapa Indian Reservation. Legal-weight trucks arriving from the northeast on I-15 and rail transportation arriving from the northeast on the existing Union Pacific railroad mainline would pass through the Moapa Indian Reservation. The American Indian Writers Subgroup has commented that ethnographic field studies will be needed to determine potential impacts to Native American cultural values (AIWS 1998, page 4-6).

6.1.2.6 Occupational and Public Health and Safety

Impacts to occupational and public health and safety include industrial safety impacts to workers from construction and operations, radiological impacts to workers and the general public from external radiation exposure and exposure to vehicle emissions during normal operations and incident-free transportation, radiological impacts from transportation accident scenarios, radiological impacts from hypothetical severe accident scenarios that would breach shipping casks, and impacts from traffic accidents.

Potential industrial safety impacts to workers from construction and operations are shown in Table 6-1. Postulated fatalities from industrial accidents would be higher for rail than for heavy-haul trucks, but

Table 6-1. Industrial safety impacts to workers from construction and operation of Nevada transportation implementing alternatives.[a]

Impact	Branch rail line[b]				
	Caliente	Carlin	Caliente-Chalk Mountain	Jean	Valley Modified
Total recordable cases	250	240	220	170	130
Lost workday cases	130	120	110	90	70
Fatalities (industrial accidents)	1.3	1.2	1.0	0.9	0.5
	Heavy-haul truck[b]				
	Caliente	Caliente-Chalk Mountain	Caliente-Las Vegas	Sloan/Jean	Apex/Dry Lake
Total recordable cases	340	330	300	180	180
Lost workday cases	190	180	160	100	100
Fatalities (industrial accidents)	0.7	0.6	0.6	0.4	0.4

a. Impacts are totals for 24 years of operations. There are no impacts for the legal-weight truck scenario.
b. Includes impacts to workers at an intermodal transfer station.

more recordable cases and lost workday cases were postulated to occur for heavy-haul trucks. The industrial safety-related fatalities were postulated to occur during construction of four of the five branch rail lines, while none were predicted for upgrades to routes for heavy-haul trucks and construction of an intermodal transfer station. No industrial safety-related fatalities would be expected to occur during operations.

Potential radiological impacts and vehicle emission-related impacts from normal operations and incident-free transportation in Nevada for each of the rail and heavy-haul truck implementing alternatives and for the mostly legal-weight truck scenario are presented in Table 6-2. Radiological impacts to members of the public from external radiation exposure and risks from exposure to vehicle emissions during incident-free transportation would be lowest for rail, intermediate for heavy-haul trucks, and highest for legal-weight truck transportation, where 1.4 latent cancer fatalities were estimated to occur over 24 years. Impacts from vehicle emissions would be low in all cases (0.028 or fewer fatalities).

The overall radiological accident risk from all accidents over the 24 years of transportation activities in Nevada would be no higher than about 0.002 latent cancer fatality in the potentially exposed population within 80 kilometers (50 miles). Accident risk would be highest for the heavy-haul implementing alternatives and lower for the mostly legal-weight truck scenario and rail implementing alternatives. The Jean rail and Sloan/Jean heavy-haul truck implementing alternatives would have higher accident risks than other implementing alternatives. The estimated accident risks are presented in Table 6-2. More operations jobs would be created to support heavy-haul truck transportation than for rail transportation. Socioeconomic impacts from operations activities would also be small except for Lincoln County, where impacts would be moderate. However, these impacts would not be greater than historic short-term socioeconomic changes that have occurred in the county in the past.

The Nuclear Regulatory Commission published a draft Addendum 1 (NRC 1999, all) to NUREG-1437, Volume 1, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (NRC 1996, all) to provide a technical basis to amend Commission regulations with the objective of improving the efficiency of renewing nuclear plant operating licenses by documenting well-understood environmental impacts to avoid repetitive reviews. The addendum addresses two aspects of spent nuclear fuel transportation that the original analysis did not address—the cumulative impacts of transportation of commercial spent nuclear fuel in the vicinity of the proposed repository at Yucca Mountain, and the impacts of transporting higher-burnup fuel. The results of the EIS analysis appear to be consistent with the Nuclear Regulatory Commission conclusion in the addendum, which is that “radiological and accident

Table 6-2. Worker and public health and safety impacts from Nevada transportation implementing alternatives.[a]

Impact	Legal-weight truck	Branch rail line[b] Caliente	Carlin	Caliente-Chalk Mountain	Jean	Valley Modified
Workers						
Maximally exposed individual probability of LCF[c]	0.02	0.02	0.02	0.02	0.02	0.02
Worker population LCFs	0.63	0.17	0.19	0.16	0.16	0.15
Public						
Maximally exposed individual probability of LCF	0.00012	0.00016	0.00016	0.00016	0.00016	0.00016
General population LCFs	1.4	0.20	0.21	0.19	0.21	0.19
Vehicle emissions-related health effects (fatalities)	0.05	0.0019	0.025	0.0017	0.014	0.0018
Accident risk						
Population LCFs	0.00006	0.000047	0.000051	0.000045	0.000076	0.000045
Maximum reasonably foreseeable accident scenario						
Population LCFs	4.7	31	31	31	31	31
Maximally exposed individual probability of LCF	0.002	0.013	0.013	0.013	0.013	0.013
Traffic accident fatalities	0.46	2.0	2.0	1.6	1.3	1.0
		Heavy-haul truck[b]				
		Caliente	Caliente-Chalk Mountain	Caliente-Las Vegas	Sloan/Jean	Apex/Dry Lake
Workers						
Maximally exposed individual probability of LCF[c]		0.02	0.02	0.02	0.02	0.02
Worker population LCFs		0.31	0.29	0.30	0.29	0.28
Public						
Maximally exposed individual probability of LCF		0.00016	0.00016	0.00016	0.00016	0.00016
General population LCFs		1.0	0.62	0.77	0.51	0.47
Vehicle emissions-related health effects (fatalities)		0.0053	0.0033	0.0041	0.015	0.0030
Accident risk						
Population LCFs		0.0001	0.0001	0.0004	0.002	0.0003
Maximum reasonably foreseeable accident scenario						
Population LCFs		31	31	31	31	31
Maximally exposed individual probability of LCF		0.013	0.013	0.013	0.013	0.013
Traffic accident fatalities		6.3	3.3	4.0	2.3	2.3

a. Impacts are totals for 24 years of operations.
b. Includes impacts to workers at an intermodal transfer station.
c. LCF = latent cancer fatality.

risks of SNF [spent nuclear fuel] transport in the vicinity of Las Vegas are within regulatory limits and small."

6.1.2.7 Socioeconomics

Socioeconomic impacts of transportation would take place from construction and operation of branch rail lines and heavy-haul routes, including intermodal transfer stations. Figure 6-5 shows regional workforce changes for construction and operations activities. The largest number of jobs would be created by construction of branch rail lines. Because of the large population and workforce in the socioeconomic region of influence (principally Clark County), impacts from construction activities would be small for the rail and heavy-haul truck implementing alternatives except for Lincoln County (the two rail corridors and three heavy-haul truck routes originating in Caliente). Impacts in Lincoln County would be moderate; however, these impacts would not be greater than historic short-term socioeconomic changes in the county. In general, regional workforce changes from construction would be small and transient; changes in per capita real disposable income would be smaller. Changes to the baseline regional populations would be unlikely to have consequences.

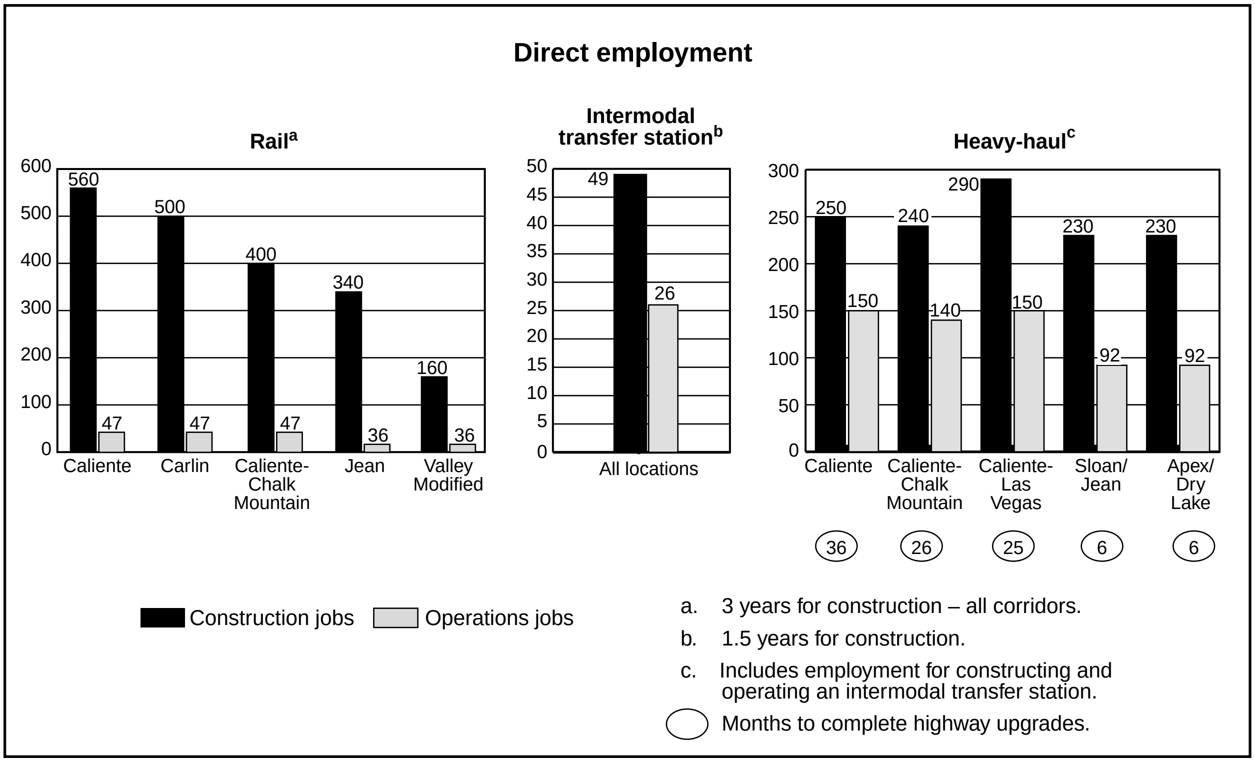


Figure 6-5. Impacts to employment from Nevada transportation alternatives.

More operations jobs would be created to support heavy-haul truck transportation than for rail transportation. Socioeconomic impacts from operations activities would also be small except for Lincoln County, where impacts would be moderate. However, these impacts would not be greater than historic short-term socioeconomic changes that have occurred in the county in the past.

6.1.2.8 Noise

Noise from the construction of a branch rail line or upgrades to highways for heavy-haul trucks would be transient and not excessive. In addition, noise from trains, which would occur during as many as five weekly round trips, would not be excessively disruptive. Heavy-haul truck operations would use existing highways that already had traffic, including semi-trailer trucks. There could be a need to identify the location of potential residents to refine the present assessment. The American Indian Writers Subgroup identified noise from transportation as a concern because of its effects on ceremonies and the solitude necessary for healing and praying.

6.1.2.9 Aesthetics

Studies have identified a potential visual resource impact for the northeastern portion of the Jean rail corridor that passes through the Spring Mountains. The character of Class II lands (defined in Chapter 3, Section 3.1.10) in that part of the corridor would change, possibly in conflict with visual resource management goals. No other rail corridors would have large or lasting aesthetic impacts. The upgrades of existing highways would present short-term aesthetic impacts during construction but these would be temporary and transient, resulting largely from widening the highways. Routes originating in Caliente could cause impacts on the Class II lands of Kershaw Ryan State Park, the entrance of which is on the east side of the Meadow Valley Wash across from a potential location for an intermodal transfer station. However, the character of this area of the Meadow Valley Wash has been modified by the Union Pacific rail line, the City of Caliente water treatment facility, and agricultural uses of lands in the vicinity. All heavy-haul truck routes and all branch rail lines except Carlin would pass through Class III lands. Aesthetic conditions would not be affected by legal-weight trucks on existing, well-traveled highways.

6.1.2.10 Utilities, Energy, and Materials

Impacts to utility, energy, and material resources from the construction and operation of any of the rail or heavy-haul truck implementing alternatives would be small compared to usage in Nevada. For example, Nevada fossil-fuel consumption during 1996 was about 3.8 billion liters (1 billion gallons) [BTS 1999a, Table MF-21]. By comparison the largest fossil-fuel use for any of the implementing alternatives would be about 50 million liters (13 million gallons), less than 2 percent of the Nevada annual use. Similarly, concrete use for the largest implementing alternative would be about 120,000 metric tons (51,000 cubic meters), also less than 2 percent of the Nevada annual use of 7.4 million metric tons (3.2 million cubic meters) (Sherwood 1998, all). Figures 6-6 and 6-7 compare the use of resources for construction of the rail and heavy-haul truck implementing alternatives, respectively.

6.1.2.11 Wastes

Wastes from the construction of an intermodal transfer station and upgrades to highways or from the construction of a branch rail line in Nevada would be recovered for recycling, placed in permitted industrial landfills, or reused. In addition, hazardous wastes, if any, would be sent to a permitted hazardous waste facility. The operation of an intermodal transfer station and heavy-haul trucks or of a branch rail line would produce small quantities of waste. The quantities from legal-weight truck operations in Nevada would also be small. Thus, impacts from the wastes generated during Nevada transportation to support the Proposed Action would be small.

6.1.2.12 Environmental Justice

This section uses the results of analyses from other disciplines to determine if disproportionately high and adverse impacts on minority or low-income populations would be likely to occur from transportation activities. DOE does not expect disproportionately high and adverse impacts to minority or low-income populations from the Proposed Action. The environmental justice analysis involved a two-stage assessment of the potential for disproportionately high and adverse impacts on minority and low-income populations:

- First, a review of the activities included in the Proposed Action to determine if they would be likely to result in high and adverse human health impacts or in environmental impacts that could affect human populations

- Second, if the first-stage review identified high and adverse impacts to human populations in general, an analysis of these impacts as described above to determine if they could be disproportionately high and adverse for minority or low-income populations

If the first-stage review does not identify impacts to human populations, a second-stage analysis for potential environmental justice impacts is not required because there would not be high and adverse impacts to any part of the human population, including minority and low-income populations.

No potentially disproportionately high and adverse impacts to minority or low-income populations were identified in areas of land use; air quality; hydrology; biological resources and soils; socioeconomics; aesthetics; and occupational and public health and safety for construction or operations under the mostly legal-weight truck scenario in Nevada or any of the 10 rail and heavy-haul truck transportation

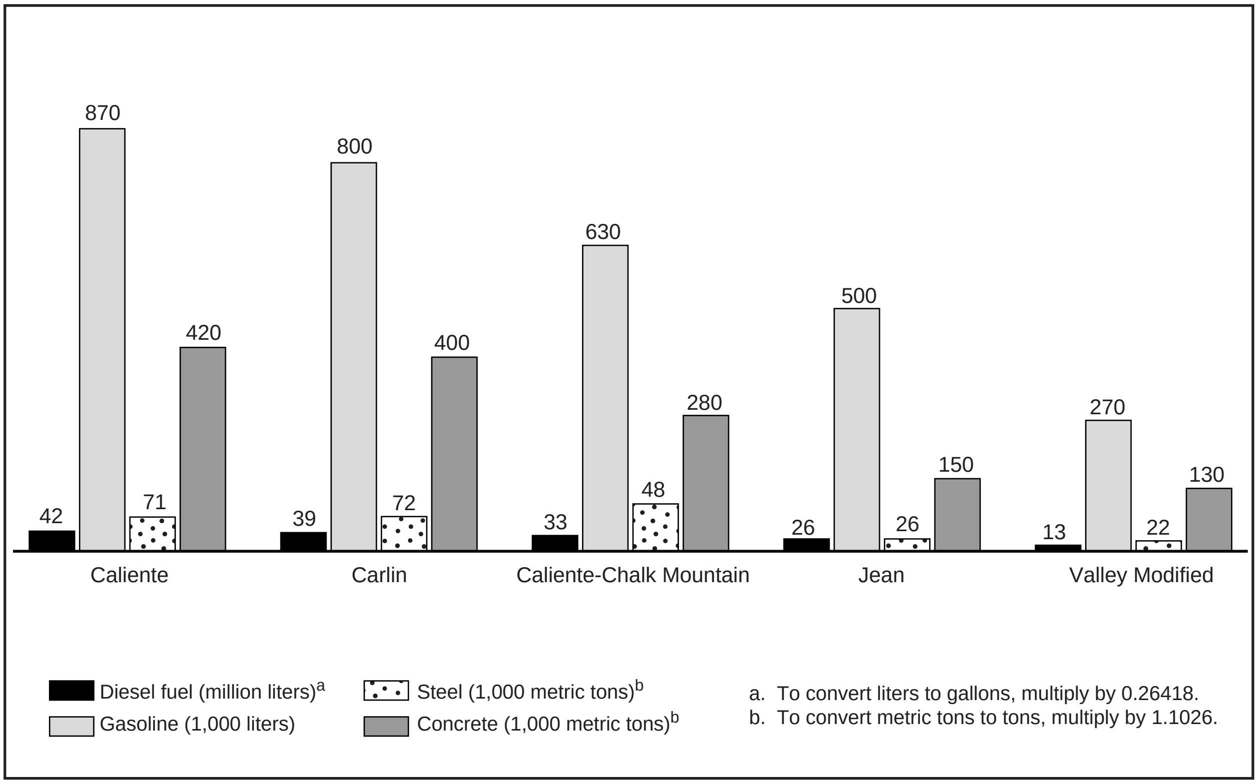


Figure 6-6. Utility, energy, and material use for construction of a branch rail line in Nevada.

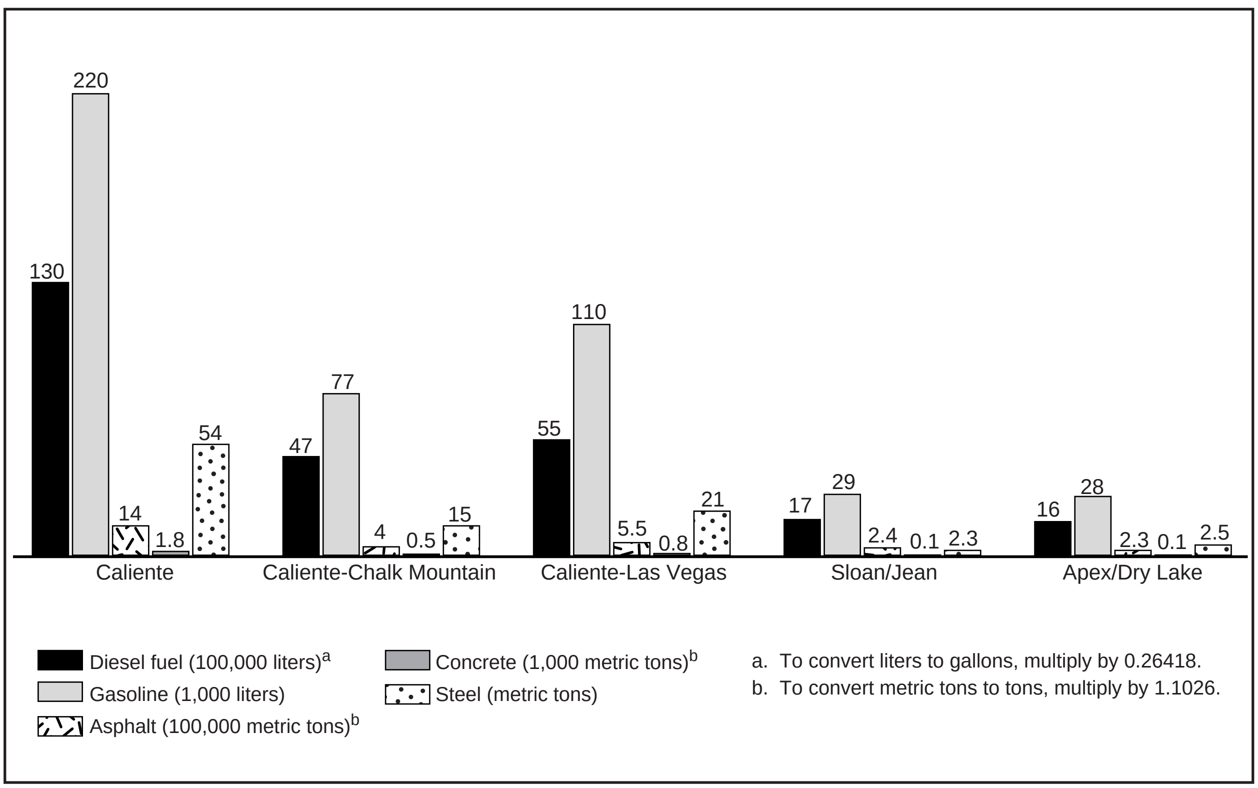


Figure 6-7. Utility, energy, and material use for upgrading of Nevada highways for heavy-haul truck use.

implementing alternatives. Potential visual resource (aesthetic) impacts were identified for the Jean rail corridor but these were determined to not be disproportionate. Potential impacts to cultural resources and noise impacts to Native American values have not been determined in all areas and may require further ethnographic study. However, no potentially disproportionately high and adverse impacts would occur in these areas for legal-weight truck transportation that would use existing highways. If DOE identified potentially high and adverse impacts for a corridor or route, it would mitigate them (as discussed in Chapter 9).

Because impacts to humans and other impacts that could affect minority or low-income populations or populations of Native Americans would not be disproportionately high and adverse, including mitigation as needed, an additional environmental justice analysis is not required. Chapter 4, Section 4.1.13.4, contains an environmental justice discussion of a Native American perspective on the Proposed Action.

6.1.3 TRANSPORTATION OF OTHER MATERIALS AND PERSONNEL

Other types of transportation activities associated with the Proposed Action would involve the transportation of personnel and of materials other than the spent nuclear fuel and high-level radioactive waste discussed above. These other materials include construction materials and consumables for repository construction and operation, including disposal containers; waste including low-level waste, construction and demolition debris, sanitary and industrial solid waste, and hazardous waste; and office and laboratory supplies, mail, and laboratory samples.

Detailed analyses of the impacts of these transportation activities are provided in Appendix J. Overall, transportation of these materials and personnel could result in as many as 8 additional traffic fatalities. During operations, the additional traffic in the Las Vegas Valley would result in increased emissions of carbon monoxide. Because the Las Vegas Valley is a nonattainment area for carbon monoxide, an air quality conformity analysis may be required because estimated emissions are near the General Conformity Rule emission threshold (40 CFR Part 93). Impacts in other environmental resource areas would be unlikely to occur.

6.2 National Transportation

This section describes national transportation impacts from shipping spent nuclear fuel and high-level radioactive waste from 72 commercial and 5 DOE sites throughout the United States to the proposed Yucca Mountain Repository. This section includes the following:

- Definition and an overview of the analysis scenarios (Section 6.2.1)
- Impacts to workers and the public from spent nuclear fuel and high-level radioactive waste loading operations at commercial and DOE sites (Section 6.2.2)
- Potential incident-free (routine) radiological impacts and vehicle emission impacts (Section 6.2.3)
- Potential accident scenario impacts (Section 6.2.4)

National transportation of spent nuclear fuel and high-level radioactive waste, which would use existing highways and railroads, would average 14.2 million truck kilometers (8.8 million miles) per year for the mostly truck case and 3.5 million railcar kilometers (2.2 million miles) per year for the mostly rail case. Barges used to ship rail casks to nearby railheads from commercial sites not served by a railroad could travel an average of as much as 10,700 kilometers (6,650 miles) per year. The national yearly average for total highway and railroad traffic is 186 billion truck kilometers (116 billion miles) and 49 billion railcar kilometers (30 billion miles) (BTS 1998, page 5)]. Spent nuclear fuel and high-level radioactive waste transportation would represent a very small fraction of the total national highway and railroad traffic (0.008 percent of truck kilometers and 0.007 percent of railcar kilometers). Domestic waterborne trade in 1995 accounted for about 1 billion metric tons (910 million tons) (MARAD 1998, all). This represents about 1 million barge shipments per year. Thus, shipments of spent nuclear fuel by barge would only be a very small fraction of the total annual domestic waterborne commerce.

With the exception of occupational and public health and safety impacts, which are evaluated in this section, the environmental impacts of this small fraction of all national transportation would be very small in comparison to the impacts of other nationwide transportation activities. Thus, the national transportation of spent nuclear fuel and high-level radioactive waste would have very small impacts on land use and ownership; air quality; hydrology; biological resources and soils; cultural resources; socioeconomics; noise; aesthetics; utilities, energy, and materials; or waste management.

Radiological impacts of accidents on biological resources would be very small. The analysis focused the impacts from accidents on human health and safety. A severe accident scenario, such as the maximum reasonably foreseeable accident scenarios discussed in Section 6.2.4.2, that would cause a release of contaminated materials would be very unlikely. The probabilities of the severe accident scenarios discussed in Section 6.2.4.2 are less than 2 in 10 million per year for both the mostly legal-weight truck and mostly rail transportation scenarios. Because of the low probability of occurrence, an accident scenario during the transport of spent nuclear fuel and high-level radioactive waste would be unlikely to cause adverse impacts to any endangered or threatened species, and impacts to other plants and animals would be small. Therefore, the analysis did not evaluate the impacts for these environmental parameters for national transportation activities further.

6.2.1 ANALYSIS SCENARIOS AND METHODS

Under the mostly legal-weight truck scenario for national transportation, DOE would transport shipments (with the exception of naval spent nuclear fuel and possibly some DOE high-level radioactive waste) by legal-weight truck to Nevada. Naval spent nuclear fuel would be shipped by rail from the Idaho National Engineering and Environmental Laboratory. Under the mostly-legal weight truck scenario, DOE assumed that some shipments of DOE high-level radioactive waste would use overweight trucks. With the exception of permit requirements and operating restrictions, the vehicles for these shipments would be similar to legal-weight truck shipments but might weigh as much as 52,200 kilograms (115,000 pounds).

MOSTLY LEGAL-WEIGHT TRUCK AND MOSTLY RAIL SCENARIOS

The Department does not anticipate that either the mostly legal-weight truck or the mostly rail scenario represents the actual mix of truck or rail transportation modes it would use. Nonetheless, DOE used these scenarios as a basis for the analysis of potential impacts to ensure the analysis addressed the range of possible transportation impacts. Thus, the estimated numbers of shipments for the mostly legal-weight truck and mostly rail scenarios represent only the two extremes in the possible mix of transportation modes. Therefore, the analysis provides estimates that cover the range of potential impacts to human health and safety and to the environment for the transportation modes DOE could use for the Proposed Action.

States routinely issue special permits for trucks weighing up to 58,600 kilograms (129,000 pounds). Figure 6-8 shows the relationship of Interstate Highways, many of which would be preferred routes (see 49 CFR 397.101) for legal-weight truck shipments, and the locations of the commercial and DOE sites and Yucca Mountain.

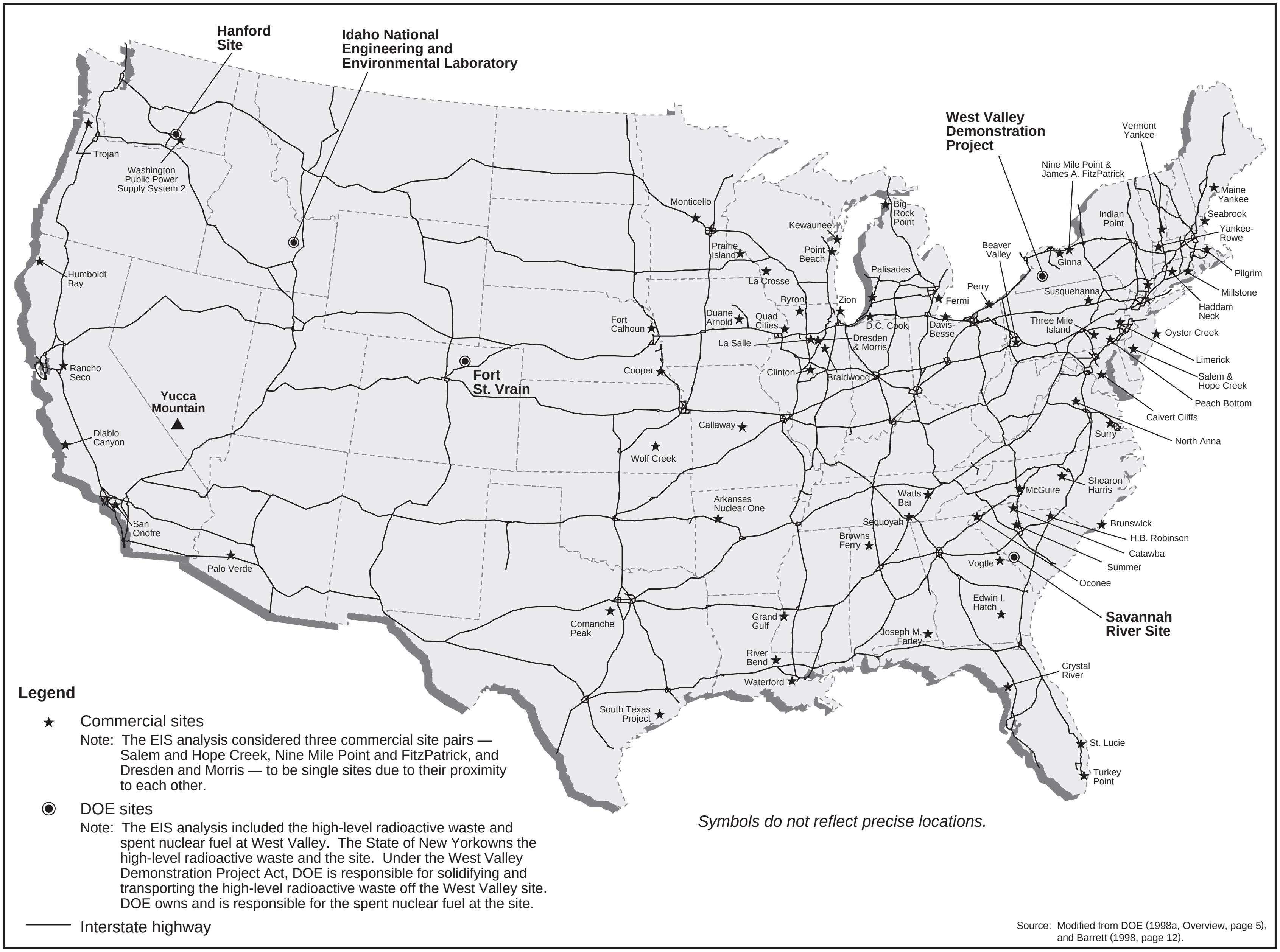


Figure 6-8. Commercial and DOE sites and Yucca Mountain in relation to the U.S. Interstate Highway System.

Under the national transportation mostly rail scenario, DOE would transport shipments (with the exception of commercial spent nuclear fuel at 9 sites that do not have the capability to load a rail cask) by rail to Nevada. In addition, this scenario assumes that 19 commercial sites that have the capability to handle and load rail casks, but that do not have railroad service, would make shipments to nearby railheads by barge or heavy-haul truck. Barge shipments of rail casks containing spent nuclear fuel could be possible from 14 commercial sites that are on or near navigable waterways. Figure 6-9 shows the relationship of mainline railroads, many of which would be used for rail shipments, and the locations of the commercial and DOE sites and Yucca Mountain.

This section evaluates radiological and nonradiological impacts to workers and the public from routine transportation operations and from accidents. DOE used a number of computer models and programs to estimate these impacts; Appendix J describes the analysis assumptions and models.

The CALVIN model (TRW 1998l, page 2 to 22) was used to estimate the number of shipments of commercial spent nuclear fuel for both the mostly legal-weight truck and mostly rail scenarios. The CALVIN program used commercial spent nuclear fuel inventories and characteristics from the *Report on the Status of the Final 1995 RW-859 Data Set* (DOE 1996i, all) (see Appendix A) to estimate the number of shipments. For DOE spent nuclear fuel and high-level radioactive waste, the analysis used inventories and characteristics for materials to be shipped under the Proposed Action that were reported by the DOE sites in 1998 (see Appendix A) to estimate the number of shipments. Chapter 2, Section 2.1.2, and Appendix J discuss the number of shipments.

The transportation analyses used the following computer programs:

- HIGHWAY (Johnson et al. 1993a, all) to identify the highway routes that it could use to transport spent nuclear fuel and high-level radioactive waste. All of the routes would satisfy U.S. Department of Transportation route selection regulations.
- INTERLINE (Johnson et al. 1993b, all) to identify rail and barge routes for the analysis.
- RADTRAN4 (Neuhauser and Kanipe 1992, all) to estimate radiological dose risk to populations and transportation workers during routine operations. This program also estimated radiological dose risks to populations and transportation workers from accidents.
- RISKIND (Yuan et al. 1995, all) to estimate radiological doses to the maximally exposed individuals and to the population during routine transportation. This program also estimated radiological doses to the maximally exposed individuals and to the population from transportation accidents.

6.2.2 IMPACTS FROM LOADING OPERATIONS

This section describes potential impacts from loading spent nuclear fuel and high-level radioactive waste in transportation casks and on transportation vehicles at the 72 commercial and 5 DOE sites. It also describes methods for estimating radiological and industrial hazard impacts from routine loading operations and radiological impacts of loading accidents to workers and members of the public. During loading operations, radiological impacts to workers could occur from normal operations and accidents. In addition, workers could experience impacts from industrial hazards. Members of the public could experience radiological impacts if a loading accident occurred but would not experience impacts from industrial hazards, including hazards associated with nonradioactive hazardous materials. Nonradioactive hazardous materials would be used only in small quantities, if at all, in loading operations. Chapter 4 addresses impacts from unloading operations at the repository.

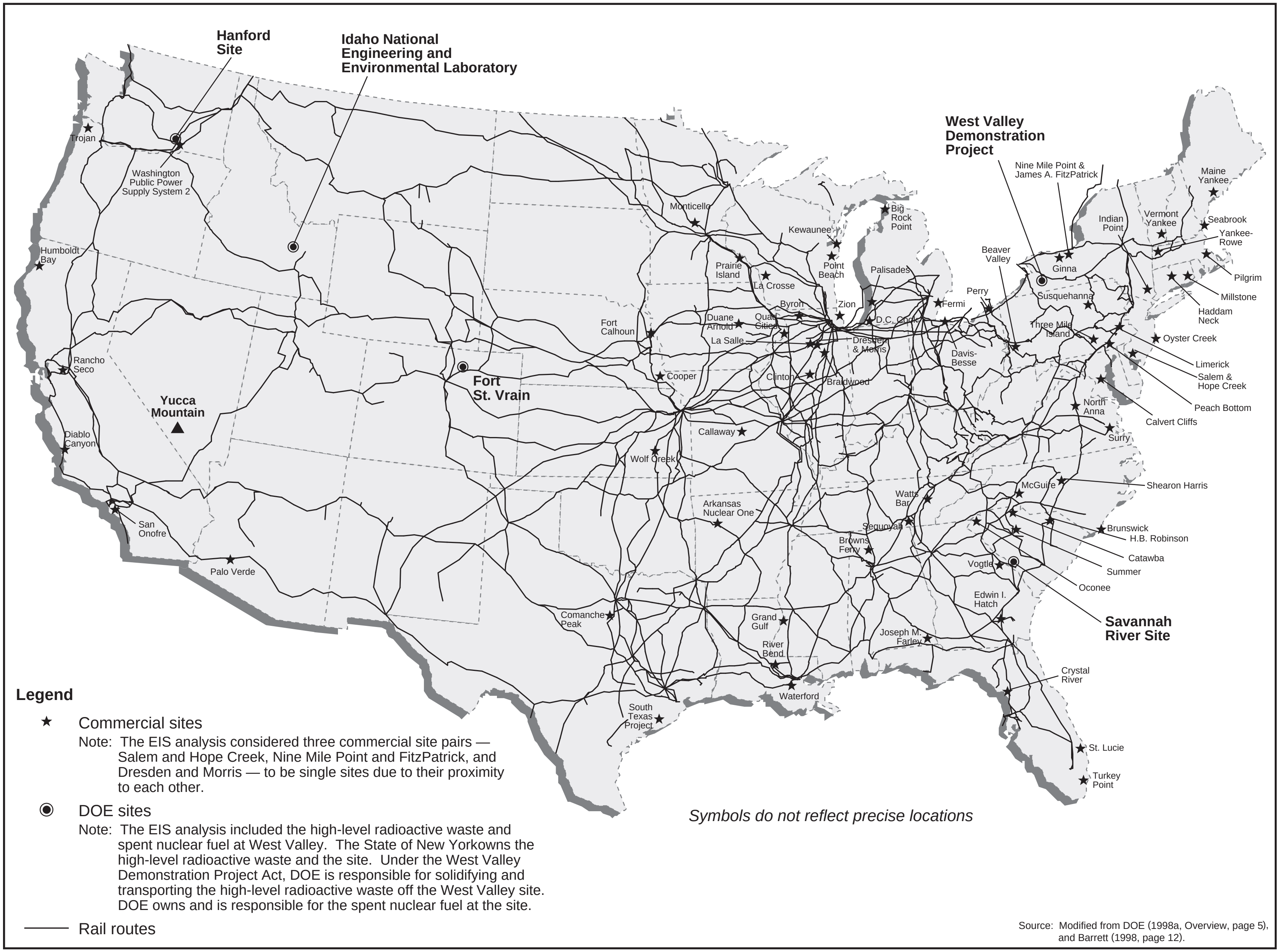


Figure 6-9. Commercial and DOE sites and Yucca Mountain in relation to the U.S. railroad system.

6.2.2.1 Radiological Impacts of Routine Operations

Radiological impacts to members of the public from routine operations would be very small. An earlier DOE analysis estimated that public dose from loading operations would be less than 0.001 person-rem per metric ton of uranium loaded (DOE 1986b, Volume 2, Figure 2.9, page 2.42) but did not provide a definite estimated lower value (see Appendix J for more information). Therefore, to be conservative this analysis estimated the dose to the public from loading operations by multiplying the value of 0.001 person-rem per metric ton uranium by the 70,000 metric tons of spent nuclear fuel and high-level radioactive waste DOE would transport under the Proposed Action. [DOE (1986b, Volume 2, all) uses the term "metric ton uranium," which is essentially the same as metric tons of heavy metal for commercial spent nuclear fuel.] The resulting population dose is 70 person-rem, which, based on conversion factors recommended by the International Commission on Radiological Protection, would result in 0.04 latent cancer fatality.

Table 6-3 lists estimated involved worker impacts from loading spent nuclear fuel at commercial sites and loading DOE spent nuclear fuel and high-level radioactive waste at DOE facilities for shipment to the Yucca Mountain site under the Proposed Action. The impacts assume worker rotation and other administrative actions would follow guidance similar to that in the DOE *Radiological Control Manual* (DOE 1994c, Article 211) that would limit doses to individual workers to 500 millirem per year. The maximum individual dose would be 12 rem over the 24 years of loading operations for individuals who worked the entire duration of repository operations. The estimated probability of a latent cancer fatality for an involved worker from this dose would be about 0.005 (5 chances in 1,000).

Table 6-3. Estimated radiological impacts to involved workers from loading operations.[a]

Impact	Mostly rail	Mostly legal-weight truck
Maximally exposed individual		
Dose (rem)	12	12
Probability of LCF[b]	0.005	0.005
Involved worker population[c]		
Dose (person-rem)	5,200	14,200
Number of LCFs	2	6

a. Numbers are rounded.
b. LCF = latent cancer fatality.
c. All involved workers at all facilities, preparing about 13,400 shipments under the mostly rail scenario and about 49,800 shipments under the mostly legal-weight truck scenario over 24 years.

As many as 2 latent cancer fatalities from the mostly rail scenario and about 6 latent cancer fatalities from the legal-weight truck scenario could result in the involved worker population over 24 years. The mostly legal-weight truck scenario would result in more potential impacts than the mostly rail scenario because of the increased exposure time needed to load more transportation casks. DOE expects impacts to noninvolved workers to be even smaller than those to involved workers. Using information from the earlier studies (Schneider et al. 1987, all; Smith, Daling, and Faletti 1992, all; DOE 1986b, Volume 2, all), DOE estimated 0.04 latent cancer fatality to members of the public from routine loading operations.

6.2.2.2 Impacts from Industrial Hazards

Table 6-4 lists estimated impacts to involved workers from industrial hazards over 24 years of loading operations at the 77 sites. Fatalities from industrial hazards would be unlikely from loading activities under either national transportation scenario. The mostly legal-weight truck scenario would have about double the estimated number of total recordable cases and lost workday cases of the mostly rail scenario because there would be more shipments and more work time (full-time work years). Using the assumption that the noninvolved workforce would be 25 percent of the number of involved workers, the analysis determined that impacts to noninvolved workers would be about 25 percent of those listed in Table 6-4. In addition to industrial safety impacts, traffic fatality impacts to commuting workers during commuting and operations were estimated. Traffic involving commuting workers could result in 0.5 fatality under the mostly legal-weight truck scenario and 0.2 fatality under the mostly rail scenario.

Table 6-4. Impacts to involved workers[a] from industrial hazards during loading operations.[b]

Impact	Mostly rail	Mostly legal-weight truck
Total recordable cases[c]	65	150
Lost workdays[d]	29	66
Fatalities[e]	0.06	0.14

a. Includes all involved workers at all facilities during 24 years of repository operations. During the 24 years of shipments to the proposed repository, these workers would put in 1,700 work years (2,080 hours per work year) preparing about 13,400 shipments under the mostly rail scenario and 3,900 work years preparing about 49,500 legal-weight truck shipments and 300 naval spent nuclear fuel rail shipments under the mostly legal-weight truck scenario. Impacts in the noninvolved workforce would be about 25 percent of those listed.
b. Numbers are rounded to two significant digits.
c. Total recordable cases (injury and illness) based on a 1992-1997 DOE site loss incident rate of 0.03 (DOE 1999c, DOE and Contractor Injury and Illness Experience).
d. Lost workday cases based on a 1992-1997 DOE site loss incident rate of 0.013.
e. Fatalities based on a 1988-1997 DOE site loss incident rate of 0.000029.

6.2.3 NATIONAL TRANSPORTATION IMPACTS

The following sections discuss the impacts of transporting spent nuclear fuel and high-level radioactive waste to the proposed Yucca Mountain Repository under the mostly legal-weight truck and mostly rail scenarios. The analysis in this section addresses the impacts of incident-free transportation. Section 6.2.4 discusses accidents, and Appendix J contains the details on the analysis and its assumptions.

6.2.3.1 Impacts from Incident-Free Transportation – National Mostly Legal-Weight Truck Transportation Scenario

This section addresses radiological and nonradiological impacts to populations and maximally exposed individuals for incident-free transportation of spent nuclear fuel and high-level radioactive waste for the mostly-legal weight truck scenario.

Incident-Free Radiological Impacts to Populations. Table 6-5 lists the incident-free population dose and latent cancer fatalities to workers and the public for the mostly legal-weight truck scenario. The impacts include those for the shipment of naval spent nuclear fuel by rail to Nevada, intermodal transfer of rail casks to heavy-haul trucks, and subsequent heavy-haul transportation to the proposed repository. Section 6.3.3 and Appendix J contain additional information on worker impacts from intermodal transfer operations. Worker impacts would include radiological exposures of security escorts for legal-weight truck, rail, and heavy-haul truck shipments and from the transfer of naval spent nuclear fuel shipments from rail to heavy-haul truck. The collective dose to the security escorts, who would travel in separate vehicles, would be about 250 person-rem for legal-weight truck shipments. Doses to escorts of rail shipments of naval spent nuclear fuel, who would travel in railcars in sight of but separated from the cask cars, followed by escorted heavy-haul truck shipments in Nevada would be about 27 person-rem. (See Appendix J, Section J.1.3.2.2.2.)

Table 6-5. Population doses and impacts from incident-free transportation for national mostly legal-weight truck scenario.[a]

Category	Legal-weight truck shipments	Rail shipments of naval spent nuclear fuel[b]
Involved workers		
Collective dose (person-rem)	11,000	65
Estimated LCFs[c]	4.5	0.03
Public		
Collective dose (person-rem)	35,000	45
Estimated LCFs	18	0.02

a. Impacts are totals for shipments over 24 years.
b. Includes impacts from intermodal transfer operations (see Section 6.3.3.1).
c. LCF = latent cancer fatality.

The estimated radiological impacts would be 5 latent cancer fatalities for workers and 18 latent cancer fatalities for members of the public for the 24 years of operation. The population within 800 meters

(0.5 mile) of routes would be about 7.2 million. About 1.6 million members of this population would be likely to incur fatal cancers from all other causes (ACS 1998, page 10).

Incident-Free Radiological Impacts to Maximally Exposed Individuals. Table 6-6 lists estimates of doses and radiological impacts for maximally exposed individuals for the legal-weight truck scenario (which considers drivers and security escorts). The risks are calculated for the 24 years of shipment activities. Appendix J discusses analysis methods and assumptions. State inspectors who conducted frequent inspections of shipments of spent nuclear fuel and high-level radioactive waste and transportation vehicle operating crews would receive the highest annual radiation doses.

Table 6-6. Estimated doses and radiological impacts to maximally exposed individuals for national mostly legal-weight truck scenario.[a,b]

Individual	Dose (rem)	Probability of latent fatal cancer
Involved workers		
Crew member (including driver)	48[c]	0.02
Inspector	48[c]	0.02
Railyard crew member	0.13	0.00006
Public		
Resident along route	0.0054	0.000003
Person in traffic jam	0.04[d]	0.00002
Person at service station	2.4[e]	0.0012
Resident near rail stop	0.009	0.000005

a. The assumed external dose rate is 10 millirem per hour at 2 meters (6.6 feet) from the vehicle for all shipments.
b. Totals for 24 years of operations.
c. Assumes 2-rem-per-year dose limit.
d. Person in a traffic jam is assumed to be exposed one time only.
e. Assumes the person works at the service station for all 24 years of operations.

Impacts to the maximally exposed individuals in the general public would be very low. The highest impacts, to a service station employee, would still be very low (Table 6-6); the analysis estimated that a maximally exposed individual at a service station would receive 2.4 rem over 24 years under the legal-weight truck scenario. This estimate conservatively assumed the person would be exposed to 430 truck shipments each year for 24 years. For perspective, under the mostly legal-weight truck scenario, which assumes an average of 2,100 legal-weight truck shipments per year, about 430 truck shipments would pass through the Mercury, Nevada, gate to the Nevada Test Site in 1,800 hours. A worker at a truck stop along the route to Mercury would work about 1,800 hours per year. Thus, if every shipment stopped at that truck stop, the maximum number of shipments the worker would be exposed to in a year would be 430.

Impacts from Vehicle Emissions. Table 6-7 lists the estimated number of fatalities that vehicle emissions from shipments to the Yucca Mountain site would cause. These potential impacts would result principally from exposure to increases in levels of pollutants in urban areas where the additional pollutants would come from vehicles transporting spent nuclear fuel and high-level radioactive waste and the accompanying escort vehicles. In the context of the number of vehicle kilometers from shipments to the Yucca Mountain site, these emissions would be very small in comparison to the emissions from other vehicles.

6.2.3.2 Impacts from Incident-Free Transportation – National Mostly Rail Transportation Scenario

This section addresses radiological and nonradiological impacts to populations and maximally exposed individuals from the incident-free transportation of spent nuclear fuel and high-level radioactive waste for

Table 6-7. Population health impacts from vehicle emissions during incident-free transportation for national mostly legal-weight truck scenario.[a]

Category	Legal-weight truck shipments	Rail shipments of naval spent nuclear fuel	Total[b]
Estimated vehicle emission-related fatalities	0.6	0.002	0.6

a. Impacts are totals for shipments over 24 years.
b. Total differs due to rounding.

the mostly rail national transportation scenario. In addition, it identifies impacts of legal-weight truck shipments that would occur under the mostly rail scenario for the nine commercial sites that do not have the capability to load rail casks (about 2,600 legal-weight truck shipments over 24 years).

For this analysis, DOE assumed that it would use either a branch rail line or heavy-haul trucks in Nevada to transport rail casks to and from the repository. Accordingly, the results indicate the range of impacts for the rail and heavy-haul truck implementing alternatives that DOE could use for transportation to the repository after rail shipments arrived in Nevada. Section 6.3 and Appendix J present more information on the analysis of the environmental impacts of the Nevada rail and heavy-haul implementing alternatives. Appendix J also presents a comparison of the effects of using dedicated trains or general freight services for rail shipments.

The mostly rail scenario assumes that the 19 commercial sites not served by a railroad but with the capability to handle rail casks would use heavy-haul trucks to transport the casks to railheads for transfer to railcars. In addition, 14 of the 19 sites are adjacent to navigable waterways. At some of the 14 sites on navigable waterways, barges could be used for the initial trip segments (see Appendix J). The impacts estimated by the analysis include the impacts of heavy-haul truck or barge shipments of rail casks from the 19 sites to nearby railheads.

The analysis assumed that the truck shipments of spent nuclear fuel and high-level radioactive waste would make periodic stops for state inspections, changes of drivers, rest, and fuel. Rail shipments would also make periodic stops. However, the assumed frequency of the stops and the numbers of people nearby would be different from those for truck shipments and would result in a lower dose.

Incident-Free Radiological Impacts to Populations. Table 6-8 lists incident-free radiological impacts that would occur during the routine transportation of spent nuclear fuel and high-level radioactive waste under the mostly rail national transportation scenario. Because national impacts would result from transportation from the commercial and DOE sites to the repository, they include impacts from a Nevada rail or heavy-haul truck implementing alternative. For the case in which rail shipments would continue in Nevada, total impacts to members of the general public would differ depending on the implementing alternative (see Section 6.3.2 for additional details). The range of values listed in Table 6-8 includes the range of impacts from the Nevada implementing alternatives.

Impacts to members of the public from legal-weight truck shipments under the mostly rail transportation scenario would be greater than those for rail shipments. About 90 percent of the estimated impacts would involve persons at in-transit stops.

About 2 latent cancer fatalities would result from shipments of spent nuclear fuel and high-level radioactive waste under the mostly rail scenario over 24 years. The latent cancer fatalities would occur over the lifetimes of individuals in the exposed population. The population within 800 meters (0.5 mile) of routes in which these 2 fatalities would occur would be approximately 13 million. Approximately 2.9 million members of this population would incur fatal cancers from all other causes (ACS 1998, page 10).

Table 6-8. Population doses and radiological impacts from incident-free transportation for national mostly rail scenario.[a]

Category	Legal-weight truck shipments	Rail shipments[b]	Totals[c]
Involved workers			
Collective dose (person-rem)	850	1,100 - 1,500	1,900 - 2,300
Estimated LCFs[d]	0.34	0.43 - 0.59	0.77 - 0.93
Public			
Collective dose (person-rem)	2,400	880 - 2,600	3,300 - 5,000
Estimated LCFs	1.2	0.44 - 1.3	1.6 - 2.5

a. Impacts are totals for 24 years (2010 to 2033).
b. Barge transportation to a railhead on navigable waterways could be used for transportation from 14 commercial sites that do not have rail service but can load a rail cask. See Appendix J.
c. Totals might differ from sums of values due to rounding.
d. LCF = latent cancer fatality.

Incident-Free Radiological Impacts to Maximally Exposed Individuals. Table 6-9 lists the results of risk calculations for maximally exposed individuals for the mostly rail transportation scenario over 24 years. Truck and rail crew members would receive the highest doses. The mostly rail scenario would require transport crews for legal-weight trucks (2,600 total shipments over 24 years) and for rail shipments. Individual crew members who operated legal-weight trucks and escorts for rail shipments could be exposed to as much as 48 rem over 24 years of operations (maximum exposure of 2 rem each year). State inspectors who would conduct frequent inspections of rail shipments could receive annual radiation doses as high as 1.5 rem.

Table 6-9. Estimated doses and radiological impacts to maximally exposed individuals for national mostly rail scenario.[a,b]

Receptor	Dose (rem)	Probability of latent fatal cancer
Involved workers		
Crew member (rail, heavy-haul truck, or legal-weight truck)	48[c]	0.02
Inspector (rail)	35	0.014
Railyard crew member	4.4	0.0018
Public		
Resident along route (rail)	0.003	0.000002
Person in traffic jam (legal-weight truck)	0.04	0.00002
Person at service station (legal-weight truck)	0.14	0.00007
Resident near rail stop	0.31	0.00016

a. The assumed external dose rate is 10 millirem per hour at 2 meters (6.6 feet) from the vehicle for all shipments.
b. Totals for 24 years.
c. Assumes 2-rem-per-year dose limit.

Impacts from Vehicle Emissions. Fewer than 1 fatality (0.3) would result from exposure to vehicle emissions over 24 years under the mostly rail scenario. This potential increase would result principally from exposure of people in urban areas to very small increases in levels of pollutants caused by vehicles transporting spent nuclear fuel and high-level radioactive waste.

6.2.4 ACCIDENT SCENARIOS

6.2.4.1 Loading Accident Scenarios

The analysis used existing information from several different sources (TRW 1994b, all; CP&L 1989, all; PGE 1996, all; DOE 1997b, all) to estimate potential radiological impacts from accidents involving the loading of spent nuclear fuel or high-level radioactive waste for shipment and handling of shipping casks.

As summarized below, the results in these sources indicate that there would be no or very small potential radiological consequences from accidents in all cases. Appendix J presents a description of typical operations for loading spent nuclear fuel in a shipping cask at a commercial facility.

Lift-handling incidents involving spent nuclear fuel in a transfer facility would have an estimated probability of 0.0001 (1 in 10,000) per handling operation (TRW 1994b, pages 3 to 8). The estimated collective dose to workers from the incidents would be no more than 0.1 person-rem, and it would be much less to the public.

The total number of high-level radioactive waste canisters potentially handled would be approximately the same as the number of spent nuclear fuel canisters, and handling operations would be similar. DOE expects the consequences of handling incidents that involved high-level radioactive waste would be less than those involving spent nuclear fuel (Kappes 1998, page 3). Thus, impacts from high-level waste handling would be less than the estimated 0.1-person-rem from a spent nuclear fuel handling accident.

Reports on independent spent fuel storage installations and previous DOE analyses provide further evidence of the low probable impacts associated with a loading accident. Safety analysis reports prepared for independent spent fuel storage installations at the Trojan Nuclear Station and the Brunswick Steam Electric Plant concluded that there would be no or low radiological consequences from accidents that could occur at such facilities (PGE 1996, Section 8.2; CP&L 1989, Section 8.2). This analysis examined the potential magnitude of impacts from spent nuclear fuel storage facility operations. Only one event (loss of air outlet shielding blocks on a horizontal storage module, which a tornado projectile could cause) could result in a dose to an offsite member of the public. The estimated dose to an individual at a distance of 200 meters (656 feet) would be 0.0013 rem (a 0.0000007 probability—7 in 10 million—of a latent cancer fatality) from direct and air-scattered (skyshine) radiation for a single horizontal storage module. The estimated dose to involved workers to recover from the event would be less than 0.09 person-rem (0.00002 latent cancer fatality). No other credible accidents involving a horizontal storage module had associated radiological consequences (NUTECH 1989, Section 10.2.3). Similarly, previous DOE analyses (DOE 1997b, all; TRW 1994b, all) indicate that radiological consequences from accidents involving spent nuclear fuel and high-level radioactive waste management activities would be very small (Table 6-10). The low consequences listed in Table 6-10 are consistent with the results from an earlier DOE analysis (DOE 1986b, Volume 2, page xvii).

6.2.4.2 Transportation Accident Scenarios

Accidents could occur during the transportation of spent nuclear fuel and high-level radioactive waste. This section describes the risks and impacts to the public and workers from accident scenarios that are highly unlikely but that would have severe consequences (called *maximum reasonably foreseeable accident scenarios*) to accident scenarios that are more likely but that would have less severe consequences. The impacts would include those to the population and to hypothetical maximally exposed individuals. The following paragraphs describe the analysis approach. Appendix J contains more details.

The analysis did not address accident impacts to workers apart from impacts to the public. For example, fatalities from train and truck accident scenarios would include fatalities for vehicle operators. The collective radiological risk from accidents to highway vehicle and train crews would be much less than for the public because of the large difference in the numbers of individuals that could be affected. In addition, based on national accident statistics, motor carrier and train operators are much less likely to be fatalities in accidents than operators of other vehicles (NHTSA 1998, page 30).

The specific number, location, and severity of an accident can be predicted only in general terms of the likelihood of occurrence (the probability). Similarly, the weather conditions at the time an accident

Table 6-10. Radiological consequences of accidents associated with handling and loading operations.

Affected group	Impact (per year)[a]	24-year impact	Source
Involved workers			
Maximally exposed involved worker			
Dose (rem)	0.0005	0.01	--[b]
Probability of LCF[c]	0.0000002	0.000005	--
Worker population			
Collective dose (person-rem)	0.1	2.4	TRW (1994b, pages 3 to 8)
Number of LCFs	0.00004	0.001	--
Noninvolved workers			
Maximally exposed noninvolved worker			
Dose (rem)	0.0002	0.005	--
Probability of LCF	0.00000005	0.000001	--
Worker population	No information available		
Public			
Maximally exposed individual			
Dose (rem)	0.0013	0.03	NUTECH (1989, Section 10.2.3)
Probability of LCF	0.0000007	0.00002	--
Population			
Collective dose (person-rem)	0.000074	0.002	TRW (1994b, page 3-8)
Number of LCFs	0.00000004	0.000001	--

a. Average annual impact for 24 years.
b. -- = determined by analysis.
c. LCF = latent cancer fatality.

occurs cannot be precisely predicted. Therefore, the EIS analysis evaluated a variety of accident scenarios and conditions to understand the influence of various conditions on environmental impacts. The analysis of impacts to populations along routes assumed that an accident could occur at any location along a route.

MAXIMUM REASONABLY FORESEEABLE ACCIDENT SCENARIOS

Maximum reasonably foreseeable impacts from accident scenarios for the transportation of spent nuclear fuel and high-level radioactive waste would be characterized by extremes of mechanical (impact) forces, heat (fire), and other conditions that would lead to the highest reasonably foreseeable consequences. For postulated accident scenarios such as these, the forces and heat would exceed the design limits of transportation cask structures and materials. (The performance of transportation casks was demonstrated through a combination of tests and analyses.) In addition, these forces and heat would be applied to the structures and surfaces of a cask in a way that would cause the greatest damage and bring about releases of radioactive materials to the environment. The most severe accident scenarios analyzed in this chapter would release radioactive material. These accident scenarios correspond to those in the highest accident severity category, which represent events that would be very unlikely but, if they occurred, would result in human health effect consequences.

In general, this EIS considers accidents with conditions that have a chance of occurring more often than 1 in 10 million times in a year to be reasonably foreseeable. Accidents and conditions less likely than this are not considered to be reasonably foreseeable.

THE MODAL STUDY

Factors other than the environment can cause uncertainties in the prediction of accident impacts. Uncertainty can be the result of limited data and the computer programs used to predict accident impacts. To assess potential impacts of severe highway and railroad transportation accident scenarios, DOE used conservative estimates developed for the *Shipping Container Response to Severe Highway and Railway Accident Conditions* [Fischer et al. (1987, all); also called the *Modal Study*] for fractions of shipping cask contents (spent nuclear fuel or high-level radioactive waste) that such accident scenarios could release to the environment. The Modal Study was a large-scale, multiyear study of the degree of safety provided by shipping casks certified by the U.S. Nuclear Regulatory Commission for the transportation of spent nuclear fuel. The Lawrence Livermore National Laboratory conducted the study, which the Commission sponsored. One of the study's major purposes was to assess the adequacy of the Commission regulations for the packaging and transportation of radioactive materials.

The State of Nevada and the Nevada Nuclear Waste Project Office have commented that the study's projections of amounts of radioactive materials that accident scenarios would release and the probabilities of release in severe accident scenarios might significantly underestimate releases and probabilities in real accidents. The Nuclear Waste Project Office based its comments on its assessment that:

- Cask design and accident scenario parameters were significantly oversimplified.
- A great deal of data was "created" to fill missing data on the probabilities of different accident conditions.
- The interactions of physical stresses in shipping cask structures were not fully analyzed.
- Failure to examine the impact of human error limited the applicability of the analysis to the real world.
- Computer simulations of cask impacts on surfaces did not replicate a phenomenon known as "slap down."
- The treatment of spent fuel damage was too simplistic.
- The portrayal of the spent fuel was deficient.
- Available data on cladding and fuel damage were not referenced or utilized.

The Nuclear Waste Project Office did not suggest the use of alternative analyses or models and did not offer differing values for use in estimating consequences or risks of severe accidents. In addition, its comments did not identify examples of actual accident conditions and damage to structures that could support different values for release fractions or release probabilities.

In responding to comments from an independent peer group that the Nuclear Regulatory Commission asked to review the study, the authors of the Modal Study observed that a detailed analysis would reduce conservatism and show that the actual radiological hazard is lower than the hazard calculated in the study.

An assessment of uncertainty in the Modal Study recognized many of the limitations that the Nuclear Waste Project Office pointed out—limited data and information on past accidents, limitations of using mathematical models to model complex physical phenomena, and limitations on the resources to perform the analysis. Recognizing the uncertainties, the study authors stated that they tried to use realistic, yet conservative, models and probabilities. They observed that if the objective had been the precise definition of spent fuel transportation risks, they would need many improvements to calculate the probability and radioactive release estimates and to quantify the uncertainties in the estimates. The improvements would include tests to benchmark computer models; more sophisticated models of rock surfaces; improved probability distributions of accident parameters; and the consideration of human factors. These modifications were not considered because the objective was to estimate the level of safety in the shipment of spent fuel using casks licensed to Nuclear Regulatory Commission standards, and because the radiological risk in spent fuel shipments would be a small component of the total risks associated with the shipments. Therefore, DOE concluded that the most appropriate data available for the analysis of severe accidents are in the Modal Study.

TRANSPORTATION EMERGENCIES

DOE would, as requested, assist state, tribal, and local governments in several ways to reduce the consequences of accidents related to the transportation of spent nuclear fuel and high-level radioactive waste. Under Section 180(c) of the Nuclear Waste Policy Act, the Department would provide technical assistance and funding to train state, local, and tribal public safety officials in relation to such transportation. The training would cover safe transport procedures and emergency response. DOE would also require its transportation contractors to comply with ANSI N14.27-1986(R1993), *Carrier and Shipper Responsibilities and Emergency Response Procedures for Highway Transportation Accidents Involving Truckload Quantities of Radioactive Materials*. This standard requires the preparation of an emergency response plan and describes appropriate provisions of information and assistance to emergency responders. The standard also requires the carrier to provide appropriate resources for dealing with the consequences of the accident including isolating and cleaning up spills, and to maintain working contact with the responsible governmental authority until the latter has declared the incident to be satisfactorily resolved and closed. In addition, DOE maintains an active emergency response program through eight Regional Coordinating Offices across the United States. These offices are capable of responding to transportation radiological emergencies and are on call 24 hours a day. They respond to requests for radiological assistance from state or tribal authorities. Other DOE programs have provided training for transportation emergencies for many areas (for example, Colorado and South Carolina to support preparation or transportation for the Foreign Research Reactor and Waste Isolation Pilot Plant programs).

The analysis considered six categories of increasingly severe and increasingly unlikely accident scenarios. Appendix J describes those categories and their derivations. Further, the analysis hypothesized one accident scenario to represent each category, along with a corresponding projection for the amount of radioactive material the accident scenario would release from a transportation cask. In addition, the analysis estimated impacts of postulated releases from accident scenarios in three population zones—urban, suburban, and rural—under two meteorological (weather) conditions—stable (slowly dispersing) conditions that would not be exceeded (more still) about 95 percent of the time and neutral (moving air) conditions that would not be exceeded about 50 percent of the time. The analysis determined radiological risks from possible accident scenarios by multiplying the estimated impacts of each accident type by the likelihood of the accident scenario occurring in a population zone under a set of weather conditions, and summing the results for the 36 possible combinations of accident scenarios, population zones, and weather conditions. The analysis determined the likelihood that an accident scenario would occur in a population zone by using state-specific accident data, the lengths of routes in the population zones in states through which the routes would pass, and the numbers of shipments that would use the routes. Four of the scenarios would not have a probability greater than 1 chance in 10 million, so they were not considered further.

In addition, the analysis estimated impacts from an unlikely but severe accident scenario called a *maximum reasonably foreseeable accident* scenario to provide perspective about the consequences for a population that might live nearby. For maximum reasonably foreseeable accident scenarios, the analysis selected the accident scenario from the 32 possible combinations of weather conditions, population zones, and transportation mode that would have a likelihood greater than 1 in 10 million per year and would have the greatest consequences. For analysis of maximum reasonably foreseeable accident scenarios, the number of possible accident scenario combinations discussed above was reduced from 32 to 23 because suburban and urban population zones were considered jointly (see Appendix J).

6.2.4.2.1 *Impacts from Accidents – National Mostly Legal-Weight Truck Scenario*

This section summarizes the potential impacts and risks associated with accidents under the legal-weight truck scenario. The impacts and risks include those associated with the legal-weight truck and rail shipments to Nevada plus the transfer of the spent nuclear fuel and high-level waste to heavy-haul trucks and its transportation in Nevada. The section summarizes radiological impacts for six accident scenario categories, under two types of weather conditions, and in three population densities (urban, suburban, and rural), in terms of a collective dose risk and consequence (latent cancer fatalities). It describes the potential impacts from the maximum reasonably foreseeable accident scenario separately. It also describes nonradiological impacts in terms of accident fatalities.

Radiological Impacts to Populations from Accidents. The collective radiological accident dose risk as described in Appendix J, Section J.1.4.2.1, would be 134 person-rem for the population within 80 kilometers (50 miles) along the transportation routes. This calculated risk would be the total for 24 years of shipment operations (2010 to 2033). It would result in an estimated 0.07 latent cancer fatality, or approximately 7 chances in 100 of 1 latent cancer fatality for the population within 80 kilometers of the routes that the shipments would use. The accident risk for legal-weight truck shipments dominates the total risk, contributing more than 99.9 percent of the population dose and risk in comparison to the risk associated with the 300 proposed shipments of naval spent nuclear fuel.

Consequences of Maximum Reasonably Foreseeable Accident Scenario. The analysis evaluated the impacts of a maximum reasonably foreseeable accident scenario in urbanized and rural population zones for both legal-weight truck and rail shipments under the mostly legal-weight truck scenario. The maximum reasonably foreseeable transportation accident scenario that would have the greatest consequences for the mostly legal-weight truck scenario would be a legal-weight truck accident under stable (slowly dispersing atmospheric conditions that would not be exceeded 95 percent of the time) meteorological conditions in an urban area. Severe accidents in other population zones under stable or neutral weather conditions (atmospheric conditions that would not be exceeded 50 percent of the time) would have smaller consequences. The accident scenario assumes a breach of the shipping cask and the release of a portion of its contents to the air. This accident in combination with stable atmospheric conditions would be very unlikely (1.9 in 10 million per year). Table 6-11 summarizes the impacts of the accident scenario. This accident scenario could cause 5 latent cancer fatalities; in comparison, a population of 5 million within 80 kilometers (50 miles) of the center of a large U.S. metropolitan area such as that assumed in the analysis would be likely to experience more than 10,000 cancer fatalities each year from other causes (ACS 1998, page 10). For this accident scenario, the analysis projected that most of the dose to a population would come from inhalation, cloudshine, and groundshine sources. The maximally exposed individual, assumed to be about 360 meters (1,180 feet) from the accident, would receive a dose of about 3.9 rem (Table 6-11).

Table 6-11. Estimated radiological impacts of maximum reasonably foreseeable accident scenario for national mostly legal-weight truck scenario.

Impact	Urbanized area (stable atmospheric conditions)
Accident scenario probability (annual)	0.00000019 (about 1.9 in 10 million)
Impacts to population	
Population dose (person-rem)	9,400
Latent cancer fatalities	4.7
Impacts to maximally exposed individual	
Maximally exposed individual dose (rem)	3.9
Probability of a latent cancer fatality	0.002

Impacts from Traffic Accidents. Approximately 4 (3.9) traffic fatalities could occur in the course of transporting spent nuclear fuel and high-level radioactive waste under the mostly legal-weight truck national transportation scenario during the 24 years of operations for the Proposed Action. Essentially all of these fatalities would be from truck operations; none would occur from the 300 railcar shipments of naval spent nuclear fuel. The fatalities would be principally from traffic accidents; half would involve trucks transporting loaded casks to the repository and half would involve returning shipments of empty casks. The fatalities would occur over 24 years and approximately 350 million kilometers (220 million miles) of highway travel, which would include escort vehicle travel. Based on information extrapolated from the U.S. Department of Transportation Bureau of Transportation Statistics (BTS 1998, page 20), during the same 24-year period, about 1 million deaths would be likely to occur in traffic accidents on U.S. highways.

6.2.4.2.2 *Impacts from Accidents – National Mostly Rail Transportation Scenario*

This section discusses the results of the analysis of radiological impacts to populations and maximally exposed individuals and of traffic fatalities that would arise from accidents during the transportation of spent nuclear fuel and high-level radioactive waste for the national mostly rail transportation scenario.

DOE used the models and calculations described in Appendix J to estimate the impacts from rail accidents, and included impacts postulated to occur during the transportation of commercial spent nuclear fuel by legal-weight trucks from 9 commercial sites that do not have the capability to handle or load large rail casks. The analysis also included the impacts from accidents for heavy-haul truck or barge shipments to nearby railheads from 19 commercial sites that have the capability to load a rail cask but are not served by a railroad. DOE used the models and calculations described in Appendix J to estimate the impacts. Appendix J presents additional information on heavy-haul truck and barge transportation from the 19 commercial sites.

Accident Radiological Impacts for Populations. The collective radiological accident dose would be between 42 and 47 person-rem for the population within 80 kilometers (50 miles) along routes for the national mostly rail transportation scenario. The range of 42 to 47 person-rem reflects differences in rail and heavy-haul truck implementing alternatives that DOE could use in Nevada. This is the total for 24 years of shipment operations. This population dose would be likely to cause 0.024 latent cancer fatality.

Radiological risks from accidents for the mostly rail scenario would include impacts associated with about 10,815 railcar shipments (one cask to a railcar) and 2,600 legal-weight truck shipments. The accident risk for the legal-weight truck shipments would be about 20 percent of the total population dose and risk for the mostly rail scenario. National rail transportation of spent nuclear fuel and high-level radioactive waste would account for the remaining 80 percent of the population dose and risk to the public.

Impacts of Maximum Reasonably Foreseeable Accident Scenario. The analysis evaluated the impacts of a maximum reasonably foreseeable accident scenario in urbanized areas or rural population zones and under stable and neutral atmospheric conditions. The maximum reasonably foreseeable accident scenario under the mostly rail scenario would involve a release of a fraction of the contents of a rail cask in an urban area under stable meteorological conditions (slowly dispersing atmospheric conditions that would not be exceeded 95 percent of the time), where atmospheric dispersion of contaminants would occur more slowly only 5 percent of the time. This accident scenario would have a likelihood of about 1.4 in 10 million per year, and would result in about 31 latent cancer fatalities in the population (Table 6-12). The maximally exposed individual, assumed to be about 360 meters (1,180 feet) from the accident, would receive a dose of about 26 rem (Table 6-12).

Impacts From Traffic Accidents. The analysis estimated that across the United States, approximately 4 (3.6) traffic and train accident fatalities could occur during transportation of spent nuclear fuel and high-level radioactive waste under the national mostly rail transportation scenario. Half of the fatalities would occur during the return of empty casks to commercial and DOE sites. Essentially all of the fatalities would involve train operations; about half would involve highway vehicles hit by trains. There would be about a 40-percent chance of 1 fatality from the 2,600 legal-weight truck shipments of commercial spent nuclear fuel. These fatalities could happen during the 24 years of transportation operations involving approximately 84 million kilometers (52 million miles) of railcar travel and 22 million kilometers (14 million miles) of highway travel. On the basis of data presented by the Bureau of Transportation Statistics (BTS 1998, page 20), during the same 24-year period, about 1 million people will die in traffic accidents on U.S. highways.

Table 6-12. Estimated impacts from maximum reasonably foreseeable accident scenario for national mostly rail transportation scenario.

Impact	Urbanized area (stable atmospheric conditions)
Accident probability	0.00000014 per year (about 1.4 in 10 million)
Impacts to populations	
Population dose (person-rem)	61,000
Latent cancer fatalities	31
Impacts to maximally exposed individuals	
Maximally exposed individual dose (rem)	26
Probability of a latent cancer fatality	0.013

6.2.4.2.3 *Impacts of Acts of Sabotage*

The analysis considered the impacts of successful sabotage attempts on a cask. A sabotage event cannot be characterized as a random event and was, therefore, not addressed in the same way as an accident, which would be random. However, the analysis evaluated the consequences of possible credible sabotage events and found them to be comparable with the impacts of maximum reasonably foreseeable accident events. A study conducted by Sandia National Laboratories (Luna, Neuhauser, and Vigil 1999, all) estimated the amounts and characteristics of releases of radioactive materials from rail and truck casks subjected to the effects of two different high-energy density devices.

Devices considered in the Sandia study (Luna, Neuhauser, Vigil 1999, all) included possible devices that might be used in acts of sabotage against shipping casks. (Note: The shield walls of shipping casks for spent nuclear fuel and high-level radioactive waste are similar to the massive layered construction used in armored vehicles such as tanks.) These kinds of devices were demonstrated by the study to be capable of penetrating a cask's shield wall, leading to the dispersal of contaminants to the environment.

The truck cask design selected for analysis was the General Atomics GA-4 Legal-Weight Truck Cask. This cask, which uses uranium for shielding, is a state-of-the-art design recently certified by the Nuclear Regulatory Commission to ship four pressurized-water reactor nuclear fuel assemblies (NRC 1998, all). The rail cask design used was based on the conceptual design developed by DOE for the dual-purpose canister system. This design is representative of large rail casks that could be certified for shipping spent nuclear fuel and high-level radioactive waste.

DOE used the RISKIND code (Yuan et al. 1995, all) to evaluate the radiological health and safety impacts of the estimated releases of radioactive materials. The analysis used assumptions about the concentrations of radioisotopes in spent nuclear fuel, population densities, and atmospheric conditions (weather) used to evaluate the maximum reasonably foreseeable accidents.

Because it is not possible to forecast the location or the environmental conditions that might exist for acts of sabotage, the analysis determined impacts for urbanized areas (see Appendix J, Section J.1.4.2.1) under neutral (average) weather conditions.

For legal-weight truck shipments, the analysis estimated that a sabotage event occurring in an urbanized area could result in a population dose of 31,000 person-rem. This dose would cause an estimated 15 fatal cancers among the population of exposed individuals. A maximally exposed individual 150 meters (490 feet) from the event would receive a dose of 67 rem, which would increase the risk of a fatal cancer by about 7 percent.

The impacts estimated for an act of sabotage involving a rail shipment would be less than those estimated for a legal-weight truck shipment. The smaller impact for the rail shipment would be because less of the radionuclides would be released from a rail transportation cask than from a legal-weight truck transportation cask. For rail shipments, the analysis estimated that a sabotage event in an urbanized area could result in a population dose of 4,900 person-rem. This dose would be likely to cause 2.4 fatal cancers among the population of exposed individuals. A maximally exposed individual 140 meters (460 feet) from the event would receive a dose of 11 rem, which would increase the risk of a fatal cancer by about 0.6 percent.

The estimated impacts would be greater for an act of sabotage against a legal-weight truck shipment than against a rail shipment, even though the amount of spent nuclear fuel in a rail cask would be as much as six times that in a truck cask. The greater impacts would be a result of the estimate that an event involving the smaller truck cask would release greater quantities of radioactive materials (Luna, Neuhauser, Vigil 1999, all).

6.2.5 ENVIRONMENTAL JUSTICE

Shipments of spent nuclear fuel and high-level radioactive waste would use the Nation's existing railroads and highways. DOE expects that the impacts to land use; air quality; hydrology; biological resources and soils; cultural resources; socioeconomics; noise; aesthetics; utilities, energy, and materials; and waste management would be small. In addition, as described in the preceding sections, incident-free transportation and the risks from transportation accidents (the maximum reasonably foreseeable accident scenario would have 1.9 chances in 10 million of occurring per year) would not present a large health or safety risk to the population as a whole, or to workers or individuals along national transportation routes. The low effect on the population as a whole also would be likely for any segment of the population, including minorities, low-income groups, and members of Native American tribes.

A previous DOE analysis of the potential for environmental justice concerns from the transportation of DOE spent nuclear fuel to the Idaho National Engineering and Environmental Laboratory (DOE 1995a, Volume 1, pages L-2 and L-36) also concluded that impacts to minority and low-income populations and to populations of Native Americans in Idaho would not be disproportionately high and adverse. As part of that analysis, DOE consulted with the Shoshone Bannock Tribe to analyze impacts to tribal members because the shipments in question would cross the Fort Hall Reservation. The analysis (DOE 1995a, Volume 3, Part A, page 3-32) concluded that risks to the health and safety of the potentially affected tribal population in Idaho from incident-free transportation and from accidents would be very low.

Based on the analysis of incident-free transportation and transportation accidents in this EIS and the results of a transportation analysis conducted by DOE in a previous programmatic EIS, and the fact that DOE has identified no subsection of the population that would be disproportionately affected by transportation related to the Proposed Action, DOE has concluded that no disproportionately high and adverse impacts would be likely on minority or low-income populations from the national transportation of spent nuclear fuel and high-level radioactive waste to Yucca Mountain. Chapter 4, Section 4.1.13.4, contains a discussion of a Native American perspective on the Proposed Action.

6.3 Nevada Transportation

The analysis of impacts from national transportation includes those from transportation activities in the State of Nevada. This section discusses Nevada transportation impacts separately. Spent nuclear fuel and high-level radioactive waste shipped to the repository by legal-weight truck would continue in the same vehicles to the Yucca Mountain site. Material that traveled by rail would either continue to the repository on a newly constructed branch rail line or transfer to heavy-haul trucks at an intermodal transfer station that DOE would build in Nevada for shipment on existing highways that could require upgrades. Selection of a specific rail alignment within a corridor, or the specific location of an intermodal transfer station or the need to upgrade the associated heavy-haul routes, would require additional field surveys, environmental and engineering analysis, state and local government consultation, and National Environmental Policy Act reviews.

This section describes potential impacts of three transportation scenarios and their respective implementing alternatives. The three transportation scenarios are (1) mostly legal-weight truck (corresponding to that portion of the national impacts that would occur in Nevada), (2) mostly rail, and (3) mostly heavy-haul truck.

The mostly legal-weight truck scenario does not include implementing alternatives. Under this scenario, highway shipments would be restricted to specific routes that satisfy the regulations of the U.S. Department of Transportation (49 CFR Part 397). Because the State of Nevada has not designated alternative preferred routes, only one combination of routes for legal-weight truck shipments would satisfy U.S. Department of Transportation routing regulations (I-15 to U.S. Highway 95 to Yucca Mountain). This scenario assumes that over 24 years approximately 300 shipments of naval spent nuclear fuel would arrive in Nevada by rail from the Idaho National Engineering and Environmental Laboratory and that heavy-haul trucks would transport them to the repository from a railhead.

The mostly rail scenario has five implementing alternatives, each of which includes a corridor alignment for a branch rail line in Nevada. Each implementing alternative includes the construction and operation of a rail line. These alternatives would include about 2,600 legal-weight truck shipments (about 110 per year) from 9 commercial sites that do not have the capability to load rail casks.

The mostly heavy-haul truck scenario has implementing alternatives for five different routes on existing Nevada highways. The highways would have to be upgraded to enable heavy-haul trucks routinely to transport rail casks containing spent nuclear fuel and high-level radioactive waste from an intermodal transfer station to the repository. Each heavy-haul truck alternative includes the construction and operation of an intermodal transfer station that DOE would use to transfer loaded rail casks from railcars to heavy-haul trucks and empty rail casks from the trucks to railcars. The analysis considered three potential intermodal transfer station locations. Each heavy-haul implementing alternative would also include 2,600 legal-weight truck shipments over 24 years from the 9 commercial sites that cannot load rail casks.

Chapter 2, Section 2.1.3.3, contains detailed descriptions of the transportation scenarios and implementing alternatives in Nevada. Sections 6.3.1 through 6.3.3 discuss potential impacts for the three Nevada transportation scenarios. Section 6.3.1 discusses potential environmental impacts that could occur in Nevada for the national mostly legal-weight truck scenario. Section 6.3.2 discusses potential environmental impacts for each of the five Nevada rail transportation implementing alternatives, including those from the construction and operation of a branch rail line, and the impacts of 2,600 legal-weight truck shipments over 24 years. Section 6.3.3 discusses potential impacts of each of the five Nevada heavy-haul truck transportation implementing alternatives, including upgrading Nevada highways, the associated activities of constructing and operating an intermodal transfer station, and the impacts of 2,600 legal-weight truck shipments over the 24 years of operations. Appendix J presents an analysis of impacts of transporting people and materials that would be necessary to implement the Proposed Action. Appendix J also discusses the methods used to analyze impacts for the 12 resource areas.

The EIS analysis evaluated potential impacts that would occur in Nevada from the construction and operation of a branch rail line or from upgrades to highways and construction and operation of an intermodal transfer station for the following environmental resource areas: land use and ownership; air quality; hydrology (surface water and groundwater); biological resources and soils; cultural resources; occupational and public health and safety; socioeconomics; noise; aesthetics; utilities, energy, and materials; waste management; and environmental justice. The following paragraphs describe the methods used to evaluate potential impacts to these resource areas for each of the three Nevada transportation scenarios—legal-weight truck, rail, and heavy-haul truck—and their applicable implementing alternatives.

Land Use and Ownership

DOE determined that information useful for an evaluation of land-use and ownership impacts should identify the current ownership of the land that its activities could disturb, and the present and anticipated future uses of the land. The region of influence for land-use and ownership impacts was defined as land areas that would be disturbed or whose ownership or use would change as a result of the construction and use of a branch rail line, intermodal transfer station, midroute stopover for heavy-haul trucks, and an alternative truck route near Beatty, Nevada.

Air Quality

The evaluation of impacts to air quality considered potential emissions of criteria pollutants [nitrogen dioxide, sulfur dioxide, carbon monoxide, and particulates with aerodynamic diameters of less than 10 and 2.5 micrometers (PM_{10} and $PM_{2.5}$)] and ozone, the percentage of applicable standards and limits, and the potential for releases of these pollutants in the Las Vegas Valley. The region of influence for the air quality analysis included (1) the Las Vegas Valley for implementing alternatives that could contribute to the levels of carbon monoxide and PM_{10}, which are already in nonattainment of standards (FHWA 1996, pages 3-53 and 3-54), during the construction and operation of a branch rail line or highway for heavy-haul trucks, and (2) the atmosphere in the vicinity of the sources of criteria pollutants that transportation-related construction and operation activities would emit.

Hydrology

The analysis evaluated surface-water and groundwater impacts separately. The attributes used to assess surface-water impacts were the potential for introduction and movement of contaminants, potential for changes to runoff and infiltration rates, alterations in natural drainage, and potential for flooding or dredging and filling actions to aggravate or worsen any of these conditions. The region of influence for surface-water impacts included areas near construction activities, areas that would be affected by permanent changes in flow, and areas downstream of construction.

The analysis addressed the potential for a change in infiltration rates that could affect groundwater, the potential for introduction of contaminants, availability for use for construction and, if available, potential that such use would affect other users. The region of influence for this analysis included groundwater reservoirs.

Biological Resources and Soils

The evaluation of impacts to biological resources considered the potential for conflicts with areas of critical environmental concern; special status species (plants and animals), including their habitats; and jurisdictional waters of the United States, including wetlands and riparian areas. The evaluation also considered the potential for impacts to migratory patterns and populations of big game animals. The region of influence for this analysis included the following:

- Habitat, including jurisdictional waters of the United States, including wetlands and riparian areas
- Migratory ranges of big game animals that could be affected by the presence of a branch rail line

The analysis assessed soil impacts to determine the potential to increase erosion rates by water or wind. The region of influence for the analysis of soil impacts included areas where construction would take place and downwind or downgradient areas that would be affected by eroded soil.

Cultural Resources

The evaluation of impacts on cultural resources considered the potential for disrupting, or modifying the character of, archaeological or historic sites, artifacts, and other cultural resources.

The region of influence for the analysis included the lands in the 400-meter (1,300-foot)-wide rail corridors, lands near highways that would be upgraded for heavy-haul truck use, and sites where an intermodal transfer station could be constructed and operated.

Occupational and Public Health and Safety

The analysis of impacts to occupational and public health and safety from transportation-related activities in Nevada used the same methods, assumptions, attributes, and regions of influence used for the analysis of impacts of national transportation of spent nuclear fuel and high-level radioactive waste. However, it used the rail and highway accident rates reported for the State of Nevada (Saricks and Tompkins 1999, Table 4).

In addition, the analysis included potential impacts from industrial hazards to Nevada workers from constructing and operating a branch rail line, upgrading highways for use by heavy-haul trucks, and constructing and operating an intermodal transfer station. The region of influence for the analysis included branch rail line and highway construction work sites and highways that workers and other construction-related vehicle traffic would use.

The analysis considered potential radiological impacts from intermodal transfer station operations.

Socioeconomics

The analysis of socioeconomic impacts considered changes in employment, personal income, population, Gross Regional Product, and state and local government expenditures. The region of influence for the analysis included Clark, Lincoln, and Nye Counties. The other Nevada counties were included collectively.

Noise

Nevada does not have a noise code, so the analysis used daytime and nighttime noise standards adopted by most states for residential and commercial areas to evaluate the impacts of noise from construction and operation activities. The region of influence considered in the analysis included inhabited commercial and residential areas where noise from construction and noise from trains or trucks would have the potential to exceed 45 dBA.

Aesthetics

The analysis of potential impacts on aesthetic resources considered Bureau of Land Management ratings for land areas (BLM 1986, all). The regions of influence used in the analysis included the landscapes along the potential rail corridors and highway routes and near possible locations of intermodal transfer stations with aesthetic quality that construction and operations could affect.

The analysis of impacts was based on visual sensitivity ratings of viewsheds in Nevada and the Bureau of Land Management Visual Resource Management System objectives. It established ratings for scenery based on the number and types of users, public interest in the area, and adjacent land uses. The ratings are based on the scenic quality classes in the Bureau of Land Management Visual Resource Management System (BLM 1986, all).

Utilities, Energy, and Materials

The attributes used to assess impacts to utilities, energy, and materials included the requirements for electric power, fossil fuel for construction, and key consumable construction materials. The analysis compared needs to available capacity. The region of influence included the local, regional, and national supply infrastructure that would have to satisfy the needs.

Waste Management

Evaluations of impacts of waste management considered the quantities of nonhazardous industrial, sanitary, hazardous, mixed, and radioactive wastes that would be generated. The region of influence included construction areas and camps and facilities that would support transportation operations such as locomotive and railcar maintenance facilities.

Environmental Justice

The analysis of environmental justice for the Nevada transportation scenarios is identical to that described for national transportation in Section 6.2.5. Section 6.3.4 describes the results of that analysis for the Nevada transportation scenarios.

6.3.1 IMPACTS OF THE NEVADA MOSTLY LEGAL-WEIGHT TRUCK TRANSPORTATION SCENARIO

Legal-weight truck shipments in Nevada of spent nuclear fuel and high-level radioactive waste to the Yucca Mountain site would use existing highways and would be a very small fraction of the total traffic [less than 1.2 million kilometers (750 thousand miles) per year for legal-weight truck shipments in Nevada in comparison to an estimated 1.2 billion kilometers (750 million miles) per year of commercial vehicle traffic on I-15 and U.S. Highway 95 in southern Nevada]. As a consequence, impacts to land use; hydrology; air quality; biological resources; cultural resources; socioeconomics; noise; aesthetics; utilities, energy, and materials; and waste management would not be large. Nonetheless, because of concern about additional threats to populations of desert tortoises, this section addresses the potential for impacts to this threatened species. This section focuses on impacts to occupational and public health and safety in Nevada. Section 6.3.4 contains a consolidated discussion of the potential for transportation activities to cause environmental justice impacts.

6.3.1.1 Impacts to Biological Resources

Legal-weight truck shipments in Nevada to a Yucca Mountain Repository would involve travel over highways that cross desert tortoise habitat, but none of the routes would cross habitat that the Fish and Wildlife Service has designated as critical for the recovery of this threatened species (50 CFR 17.95). Over the course of 24 years of operations under the Proposed Action and 49,500 shipments, vehicles probably would kill individual desert tortoises. However, under this scenario legal-weight trucks would contribute only about 1 percent to the daily traffic of vehicles to and from the repository site and only about 0.15 percent of all commercial truck traffic along I-15 and U.S. 95 in southern Nevada. Thus, any desert tortoises killed by trucks transporting spent nuclear fuel or high-level radioactive waste probably would be only a small fraction of all desert tortoises killed on highways. Loss of individual desert tortoises due to legal-weight truck shipments would not be a large threat to the conservation of this species.

6.3.1.2 Impacts to Occupational and Public Health and Safety

6.3.1.2.1 *Impacts from Incident-Free Transportation*

This section addresses radiological impacts to populations and maximally exposed individuals in Nevada from the incident-free transportation of spent nuclear fuel and high-level radioactive waste for the mostly legal-weight truck scenario. It includes potential impacts from exposure to vehicle emissions in Nevada.

Incident-Free Radiological Impacts to Populations. Table 6-13 lists the incident-free population dose and radiological impacts for the Nevada mostly legal-weight truck scenario. The impacts include those from the shipment of naval spent nuclear fuel by rail in Nevada, intermodal transfer activities, and subsequent heavy-haul truck transportation to the proposed repository. The analysis included the radiological impacts of intermodal transfer operations for naval spent nuclear fuel shipments. Occupational impacts would include estimated radiological exposures to security escorts for legal-weight truck, rail, and heavy-haul truck shipments. The estimated radiological impacts would be 0.6 latent cancer fatality for workers and 1.4 latent cancer fatalities for members of the public over the 24 years of operation.

Table 6-13. Population doses and radiological health impacts from incident-free transportation for Nevada mostly legal-weight truck scenario.[a]

Category	Legal-weight truck shipments	Rail shipments of naval spent nuclear fuel[b]	Totals[c]
Involved workers			
Collective dose (person-rem)	1,600	32	1,600
Estimated LCFs[d]	0.62	0.01	0.63
Public			
Collective dose (person-rem)	2,800	26	2,800
Estimated LCFs	1.4	0.01	1.4

a. Impacts are totals for shipments over 24 years.
b. Includes impacts at intermodal transfer stations.
c. Totals might differ from sums of values due to rounding.
d. LCF = latent cancer fatality.

Incident-Free Radiological Impacts to Maximally Exposed Individuals. Table 6-14 lists estimates of dose and radiological impacts for maximally exposed individuals for the Nevada legal-weight truck scenario from 24 years of shipment activity. The analysis used the assumptions presented in Section 6.2.1 and Appendix J.

The analysis assumed the annual dose to state inspectors who conducted frequent inspections of shipments of spent nuclear fuel and high-level radioactive waste would be limited to 2 rem.

The analysis estimated that a maximally exposed individual at a service station would receive 2.4 person-rem over 24 years under the legal-weight truck scenario. This estimate conservatively assumed the person would be exposed to 430 truck shipments each year for 24 years. For perspective, under the mostly legal-weight truck scenario, which assumes an average of 2,100 legal-weight truck shipments per year, about 430 truck shipments would pass through the Mercury, Nevada, gate to the Nevada Test Site in

Table 6-14. Estimated doses and radiological health impacts to maximally exposed individuals during incident-free transportation for Nevada mostly legal-weight truck scenario.[a,b]

Individual	Dose (rem)	Probability of latent fatal cancer
Involved workers		
Crew member	48[c]	0.02
Inspector	48[c]	0.02
Railyard crew member	0.13	0.00006
Public		
Resident along route	0.005	0.000003
Person in traffic jam	0.04[d]	0.00002
Person at service station	2.4[e]	0.0001
Resident near rail stop	0.009	0.000005

a. The assumed external dose rate is 10 millirem per hour at 2 meters (6.6 feet) from the vehicle for all shipments.
b. Impacts are totals over 24 years.
c. Assumes 2-rem-per-year dose limit.
d. Single occurrence.
e. Assumes the person works at the service station for all 24 years of repository operations.

1,800 hours. A worker at a truck stop along the route to Mercury would work about 1,800 hours per year. Thus, if every shipment stopped at that truck stop, the maximum number of shipments the worker would be exposed to in a year would be 430.

Impacts from Vehicle Emissions. There is potential for human health impacts to people in Nevada who would be exposed to pollutants emitted from vehicles transporting spent nuclear fuel and high-level radioactive waste, including escort vehicles. Table 6-15 lists the estimated number of vehicle emission-related fatalities from legal-weight trucks, heavy-haul trucks, escort vehicles, and rail locomotives under the mostly legal-weight truck scenario. Trucks would be the major contributors. No vehicle emission-related fatality (0.0055) would be likely.

Table 6-15. Population health impacts from vehicle emissions during incident-free transportation for Nevada mostly legal-weight truck scenario.[a]

Category	Legal-weight truck shipments	Rail shipments of naval spent nuclear fuel[b]	Total
Vehicle emission-related fatalities	0.005	0.0005	0.0055

a. Impacts are totals for shipments over 24 years.
b. Includes heavy-haul truck shipments in Nevada.

6.3.1.2.2 *Impacts from Accidents – Nevada Legal-Weight Truck Scenario*

This section discusses radiological impacts to populations and maximally exposed individuals in Nevada and the potential number of traffic accident fatalities from accidents during the transportation of spent nuclear fuel and high-level radioactive waste for the mostly legal-weight truck scenario. The analysis of accident impacts under this scenario includes impacts from accidents that would occur during the transportation of naval spent nuclear fuel by rail in Nevada to an intermodal transfer station and by heavy-haul truck to the repository. Section 6.3.3 discusses impacts to workers from industrial hazards during the operation of an intermodal transfer station for shipments of naval spent nuclear fuel.

Radiological Impacts from Accidents. The calculated collective radiological accident dose risk would be 0.5 person-rem for the population in Nevada within 80 kilometers (50 miles) along the routes under the mostly legal-weight truck transportation scenario. This is the total dose risk for 24 years of shipment operations (2010 to 2033), and would result in 0.0002 latent cancer fatality in the exposed population. The radiological risk from accidents would include impacts from approximately 49,500 legal-weight truck shipments and 300 naval spent nuclear fuel rail shipments. The accident risk for legal-weight truck shipments would account for essentially all of the population dose and radiological impacts. Because DOE would not build a branch rail line to the repository under this scenario, the accident risk for rail shipments of naval spent nuclear fuel includes risks from accidents that could occur during intermodal transfers from railcars to heavy-haul trucks and during heavy-haul transportation in Nevada. Section 6.3.3 provides additional information on heavy-haul truck implementing alternatives for transporting rail casks in Nevada.

MAXIMUM REASONABLY FORESEEABLE ACCIDENT SCENARIOS IN NEVADA

Maximum reasonably foreseeable accident scenarios analyzed for transportation in Nevada were the same as maximum reasonably foreseeable accident scenarios analyzed in Section 6.2.4.2 for national transportation. That is, the EIS analysis assumed that an accident determined to be reasonably foreseeable for national transportation would occur in Nevada. Because the distances traveled in Nevada would be much less than the total national travel to deliver spent nuclear fuel and high-level radioactive waste to the Yucca Mountain site, the likelihoods of these accident scenarios occurring in the State would be less than those for the rest of the Nation. The likelihoods of two of these accident scenarios occurring in national travel are reported in Section 6.2.4.2.

Consequences of Maximum Reasonably Foreseeable Accident Scenarios. The analysis evaluated the impacts of a maximum reasonably foreseeable accident scenario presented in Section 6.2.4.2.1.

Impacts from Traffic Accidents. In Nevada, less than 1 (0.5) fatality from traffic accidents would be likely during the course of transporting spent nuclear fuel and high-level radioactive waste under the mostly legal-weight truck transportation scenario. This estimate includes traffic fatalities involving escort vehicles.

6.3.2 IMPACTS OF NEVADA RAIL TRANSPORTATION IMPLEMENTING ALTERNATIVES

This section describes the analysis of human health and safety and environmental impacts for five rail transportation implementing alternatives, each of which would use a newly constructed branch rail line in Nevada to transport spent nuclear fuel and high-level radioactive waste to the repository. The branch line would transport railcars carrying large shipping casks from a mainline railroad to the repository (loaded) and back (empty). DOE has identified five 0.4-kilometer (0.25-mile)-wide corridors of land—Caliente, Carlin, Caliente-Chalk Mountain, Jean, and Valley Modified—for the possible construction and operation of the branch line (Figure 6-10). Chapter 2, Section 2.1.3.3.2 describes the corridors. Chapter 3 discusses their affected environments.

Appendix J contains additional information on the characteristics of possible alignment variations of each corridor. Figure 6-10 shows these variations. Section 6.3.2.1 discusses impacts that would be common among the five possible corridors, and Section 6.3.2.2 discusses impacts that would be unique for each corridor.

DOE identified the five rail corridors through a process of screening the potential rail alignments it had studied in past years.

- The *Feasibility Study for Transportation Facilities to Nevada Test Site* study (Holmes & Narver 1962, all) determined the technical and economic feasibility of constructing and operating a railroad from Las Vegas to Mercury.

- The *Preliminary Rail Access Study* (Tappen and Andrews 1990, all) identified 13 and evaluated 10 rail corridor alignment options. This study recommended the Carlin, Caliente, and Jean corridors for detailed evaluation.

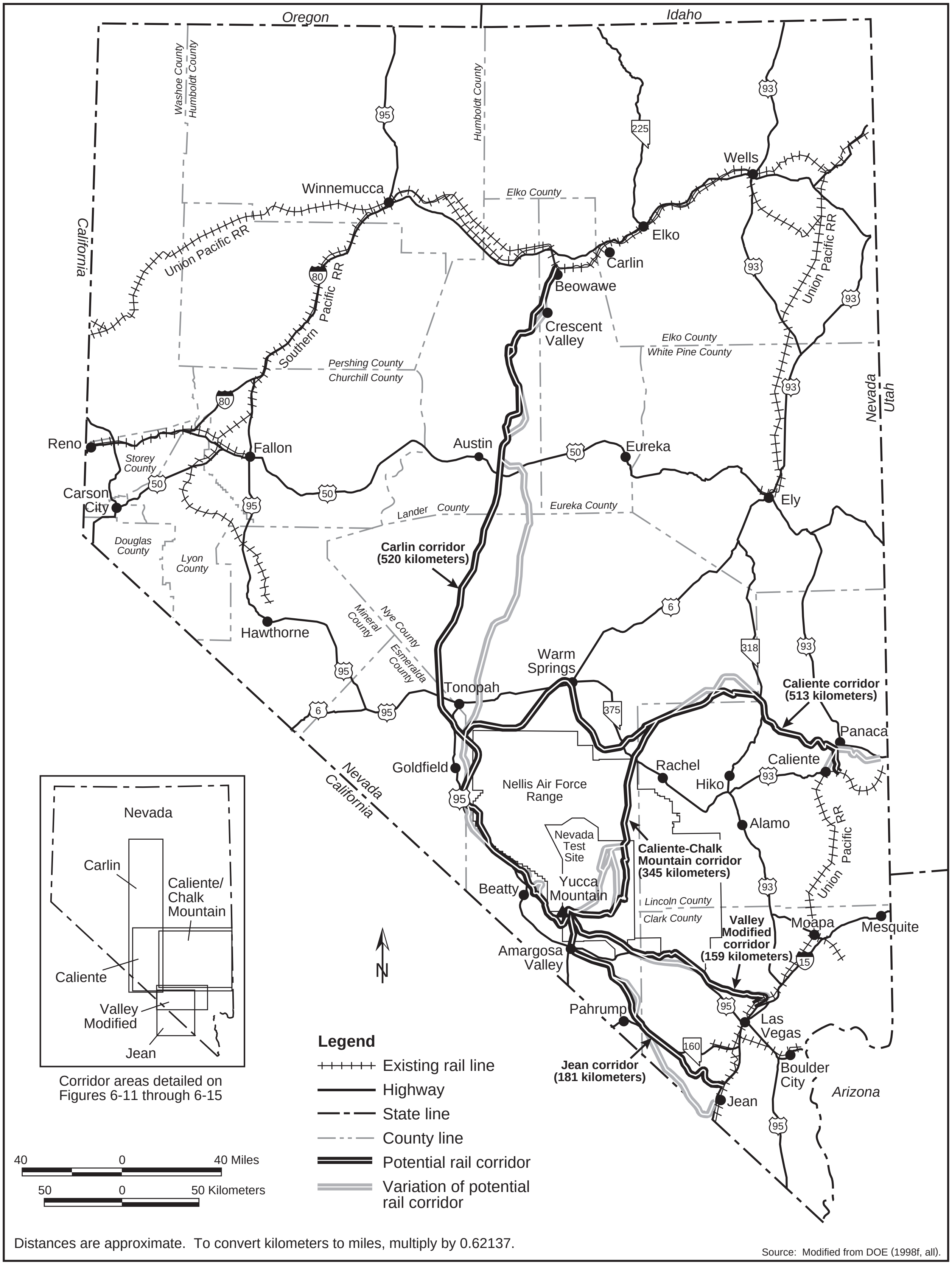


Figure 6-10. Potential Nevada rail routes to Yucca Mountain.

- *The Nevada Railroad System: Physical, Operational, and Accident Characteristics* (DOE 1991b, all) described the operational and physical characteristics of the current Nevada railroad system.

- The *High Speed Surface Transportation Between Las Vegas and the Nevada Test Site (NTS)* report (Raytheon 1994, all) explored the rationale for a potential high-speed rail corridor between Las Vegas and the Nevada Test Site to accommodate personnel.

- The *Nevada Potential Repository Preliminary Transportation Strategy*, *Study 1* (TRW 1995a, all), reevaluated 13 previously identified rail routes and evaluated a new route called the Valley Modified route. This study recommended four rail routes for detailed evaluation—the Caliente, Carlin, Jean, and Valley Modified routes.

- The *Nevada Potential Repository Preliminary Transportation Strategy*, *Study 2* (TRW 1996, all), further refined the analyses of potential rail corridor alignments in Study 1.

Public comments submitted to DOE during hearings on the scope of this EIS resulted in the addition of a fifth potential rail corridor—Caliente-Chalk Mountain.

The analysis of impacts for the five Nevada rail transportation implementing alternatives assumed the mostly rail transportation scenario. Therefore, the analysis included the impacts of legal-weight truck transportation from nine commercial sites that do not have the capability to handle or load a large rail cask. About 2,600 legal-weight truck shipments over 24 years would enter Nevada and travel to the repository. These shipments would use the same transport routes and carry about the same amounts of spent nuclear fuel per shipment as those described for the mostly legal-weight truck scenario (Section 6.3.1).

The analysis evaluated impacts to land use and ownership; air quality; hydrology; biological resources and soils; cultural resources; occupational and public health and safety; socioeconomics; noise; aesthetics; utilities, energy, and materials; and waste management. Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

6.3.2.1 Impacts Common to Nevada Branch Rail Line Implementing Alternatives

This section discusses impacts for the analysis areas listed above that would be common to all five branch rail line implementing alternatives. DOE evaluated these impacts as described in Section 6.3. The construction of the branch rail line would last about 2.5 years under each implementing alternative. Shipping operations in the rail corridor would begin at a mainline switching station where railcars carrying casks of spent nuclear fuel and high-level radioactive waste would switch from the mainline to the branch line for transport to the repository, and railcars carrying empty casks from the repository would switch to the mainline for transport back to the commercial and DOE sites. These shipments would continue for 24 years. Section 6.3.2.2 discusses impacts specific to each rail implementing alternative.

Land Use and Ownership

In calculating the amount of land affected by a rail corridor, the analysis assumed a corridor width of 400 meters (1,300 feet). The purpose of the 400-meter width was to provide sufficient space for final alignment to route the rail line around sensitive land features. Actual construction and operation in the corridor would mostly require less than about 60 meters (200 feet) of the 400-meter width. Thus, about 15 percent of the land in the corridor would be disturbed by construction at most. The analysis also assumed that about 2 square kilometers (500 acres) of land outside the corridor would be disturbed during the construction of a branch rail line for construction roads and camps and other construction-related activities.

In relation to rail line operations, train and track inspection and maintenance activities would be confined to the areas that construction activities had disturbed, so no additional disturbance would occur.

The rail corridors have possible alignment variations with slightly different land ownerships and projected disturbances. These possible variations in the corridor alignments would make little difference in land-use impacts, so this section does not discuss them in detail.

Each corridor has areas the public uses and areas available for sale and transfer. As a consequence, the rail line could result in limited access to areas currently in use by the public. Similarly, because of the corridor interface with grazing lands and wildlife areas, the rail line could create a barrier to livestock movement. Impacts to wildlife are discussed later in this section.

The analysis indicates no conflicts with commercial use and no identified conflicts with scientific studies for any of the proposed corridors. At present, the public land in each corridor, with the exception of portions of the Caliente-Chalk Mountain corridor, is open to mining and offroad vehicle use.

The potential land-use conflicts of greatest concern are those that would present long-term conflicts with other uses. One conflict in this category concerns the Caliente-Chalk Mountain corridor, which, according to the Air Force, would conflict with the national security mission on the Nellis Air Force Range (Henderson 1997, all). These lands were withdrawn for use as a high-hazard military weapons training and testing area; Air Force restrictions limit transportation options across these lands.

Air Quality

Construction. The construction of a branch rail line would comply with all applicable air quality regulations and associated requirements in the construction permits. Construction activities would increase pollutant concentrations in the areas near the rail corridor. Fuel use by construction equipment would emit carbon monoxide, nitrogen dioxide, sulfur dioxide, and particulate matter with diameters of 10 micrometers or less (PM_{10}) and 2.5 micrometers or less ($PM_{2.5}$). Construction activities would also emit PM_{10} in the form of fugitive dust from excavation and truck traffic. The emissions would be temporary and would cover a very large area as construction moved along the length of the corridor.

Operations. Fuel use by diesel train engines would emit carbon monoxide, nitrogen dioxide, PM_{10}, and $PM_{2.5}$. Based on the Federal standards for locomotives (EPA 1997a, all), there would be no significant emissions of sulfur dioxide.

No air quality impacts would be unique to the branch rail line implementing alternatives with the exception of the Valley Modified corridor, as described in Section 6.3.2.2.5.

Hydrology

This section describes impacts to surface water and groundwater.

Surface Water

Construction. Construction-related impacts could involve the possible release and spread of contaminants by precipitation or intermittent runoff events or, for corridors near surface water, possible release to the surface water, the alteration of natural drainage patterns or runoff rates that could affect downgradient resources, and the need for dredging or filling of perennial or ephemeral streams.

Construction-related materials that could cause contamination would consist of petroleum products (fuels and lubricants) and coolants (antifreeze) necessary to support equipment operations. In addition, remote work camps would include some bulk storage of these materials, and supply trucks would routinely bring new materials and remove used materials (lubricants and coolants) from the construction sites. These activities would present some potential for spills and releases. Regulatory requirements on reporting and remediating spills and properly disposing of or recycling used materials would result in a low probability of spills. If a spill occurred, the potential for contamination to enter flowing surface water would present the greatest risk of a large migration of a contaminant before remediation took place. If there was no routinely flowing surface water (most areas along the corridors), released material would not travel far or affect critical resources before remediation occurred. During construction activities, water spraying would control dust and achieve soil compaction criteria, but water would not be used in quantities large enough to support surface-water flow and possible contaminant transport for any distance.

During construction, a contractor would move large amounts of soil and rock to develop the track platform (subgrade) and the access road. These construction activities could block storm drainage channels temporarily. However, the contractor would use standard engineering design and best management practices to place culverts, as appropriate, to move runoff water from one side of the track or road to the other. These culverts or other means of runoff control would be put in place early in the construction effort, because standing water in the work area would generally hinder progress.

Depending on site-specific conditions, construction could include regrading such that a number of minor drainage channels would collect in a single culvert, resulting in water flowing from a single location on the downstream side rather than across a broader area. This would cause some localized changes in drainage patterns but probably would occur only in areas where natural drainage channels are small.

Operations. The use of a completed branch rail line would have little impact on surface waters beyond the permanent drainage alterations from construction. The road and rail beds probably would have runoff rates different from those of the natural terrain but, given the relatively small size of the potentially affected areas in a single drainage system, there would be little impact on overall runoff quantities.

There would be no surface-water impacts unique to any of the branch rail line implementing alternatives with the exception of their relative proximity to surface-water resources.

Appendix L contains a floodplain/wetlands assessment that examines the effects of branch rail line construction, operation, and maintenance on the following floodplains in the vicinity of Yucca Mountain: Fortymile Wash, Busted Butte Wash, Drill Hole Wash, and Midway Valley Wash. There are no delineated wetlands at Yucca Mountain.

If DOE selected rail to transport spent nuclear fuel and high-level radioactive waste to the Yucca Mountain site, it would also select one of five routes (Figure 6-10). DOE would then prepare a more detailed floodplain/wetlands assessment of the selected alternative. The assessment in Appendix L presents a comparison of what is known about the floodplains, springs, and riparian areas and at the three alternative intermodal transfer station sites and along their associated heavy-haul routes. In general, wetlands have not been delineated along the alternative intermodal transfer station sites.

Groundwater

Construction. Potential groundwater impacts from rail line construction could include changes to infiltration rates, new sources of contamination that could migrate to groundwater, and depletion of groundwater resources resulting from increased demand. However, the potential for impacts would be spread over a large geographic area, so the probability would be low for a resource in a single area to receive adverse impacts. The above discussion of impacts to surface water identifies potential contaminants that branch rail line construction could release. These contaminants would be the same for groundwater.

Construction activities would disturb and loosen the ground, which could produce greater infiltration rates. However, this situation would be short-lived as the access road and railbed materials became compacted and less porous. In either case, localized changes in infiltration probably would cause no noticeable change in the amount of recharge in the area.

The analysis assumed that a number of wells would be required to support construction and that they would be installed along the rail corridor. It also assumed a 1-year period for construction activities in the vicinity of each well. Water withdrawal from these wells would not contribute to the depletion of a particular groundwater basin for two reasons: (1) the demand would be relatively short-term because it would stop when construction was complete, and (2) annual demands would be limited to a fraction of the perennial yields of the aquifers that would supply the water (see Table 3-35). In addition, the Nevada State Engineer would approve water production from any well installed to support rail corridor construction. To grant approval, the State Engineer would have to determine that the short-term demand would not cause adverse impacts for other uses and users of the groundwater resource.

For the case in which water was obtained from a source other than a newly installed well and brought to the construction site by truck, water would be obtained from appropriated sources. That is, the water would be from allocations that the Nevada State Engineer had previously determined did not adversely affect groundwater resources.

Impacts on groundwater would differ among the implementing alternatives. These impacts, which Section 6.3.2.2 describes for the implementing alternatives, would include the projected water needs to support the construction of each candidate rail corridor and the estimated number of wells DOE would install along each corridor to meet that need.

Operations. The use of a completed railway corridor would have little impact on groundwater resources. There would be no continued need for water along the corridor, and possible changes to recharge, if any, would be the same as those at the completion of construction.

Biological Resources and Soils

Construction. Construction activities would generally disturb no more than about 15 percent of the land inside a 400-meter (1,300-foot)-wide corridor. Vegetation would be cleared in an area generally less than 60 meters (200 feet) wide in the corridor to enable the construction of the railroad and a parallel access road. Vegetation would also be cleared from borrow areas and covered in disposal areas for excavated materials. Land for construction camps and in small areas where wells would be drilled would also be cleared of vegetation.

Impacts to biological resources from the construction of a branch rail line would occur due to a loss of habitat for some terrestrial species. Individuals of some species would be displaced or killed by construction activities. After the selection of a rail corridor, DOE would perform preconstruction surveys of potentially disturbed areas to identify and locate special status species that would need to be protected during construction.

Construction could affect the following biological resources:

- *Game and Game Habitat.* Each candidate rail corridor would cross or be near [within 5 kilometers (3 miles)] several areas the Bureau of Land Management and the Nevada Division of Wildlife have designated as game habitat (TRW 1999k, pages 3-23 to 3-32). Construction activities in these areas would result in a loss of some habitat. Each rail corridor has the potential to disrupt movement patterns of game animals. The design of fences, if built along the rail corridor, would accommodate the movement of these animals. Large animals including game species (elk, bighorn sheep, mule deer, etc.), wild horses, and burros probably would avoid contact with humans at construction locations and would temporarily move to other areas during construction. Numerous special status species occur along each of the proposed branch rail lines. Construction of a branch rail line could lead to habitat loss and fragmentation for the special status species, as well as to mortality of individuals.

- *Special Status Species.* The construction of a branch rail line in any of the five rail corridors would involve the loss of varying amounts [1.4 to 6.3 square kilometers (350 to 1,600 acres)] of desert tortoise habitat. None of the corridors cross areas designated by the Fish and Wildlife Service as critical desert tortoise habitat (50 CFR 17.95). The abundance of tortoises varies from very low to medium along the proposed corridors (Karl 1980, pages 75 to 87; Karl 1981, pages 76 to 92; Rautenstrauch and O’Farrell 1998, pages 407 to 411), but some desert tortoise deaths could occur during land-clearing operations. Loss of habitat and mortality of individuals of other special status species along specific routes could also occur.

- *Wetlands and Riparian Areas.* Each corridor could affect a number of wetlands, springs, and riparian areas (TRW 1999k, pages 3-23 to 3-32). These areas are generally important for biological resources and typically have high biodiversity. Potential impacts to these areas include destruction, alteration, or fragmentation of habitat; increased siltation in streams during construction; changes in stream flow; and loss of biodiversity.

All of the candidate rail corridors cross perennial or ephemeral streams that may be classified as jurisdictional waters of the United States. Section 404 of the Clean Water Act regulates discharges of dredged or fill material into such waters. After the selection of a rail corridor, DOE would identify any jurisdictional waters of the United States that the construction of a rail line would affect; develop a plan to avoid when possible, and otherwise minimize, impacts to those waters; and, as applicable, obtain an individual or regional permit from the U.S. Army Corps of Engineers for the discharge of dredged or fill material. By implementing the plan and complying with other permit requirements, DOE would ensure that impacts to waters of the United States would be small.

The general design criteria for a branch rail line would include a requirement that a 100-year flood would not inundate the rails at channels fed by sizable drainage areas. During the operation and monitoring phase of the repository, conditions more intense than those that would generate a 100-year storm could occur in the area. Such conditions, depending on their intensity, could wash out access roads and possibly even the rail line. Although DOE would have to repair these structures, there is no reason to believe that such an occurrence would unduly affect area resources. If necessary, a permit would be obtained from the U.S. Army Corps of Engineers for discharge of dredge and fill material to repair the rail line. There would be no contamination that floodwaters could spread and, with the exception of areas of steep terrain, debris would not travel far. The operation of a branch rail line would stop during conditions that could lead to the flooding of track areas and would not resume until DOE had made necessary repairs.

Soil impacts from rail line construction would be primarily the direct impacts of land disturbance in the selected corridor. The amount of land disturbance, both inside and outside the corridor, would vary by corridor. The disturbed areas probably would be subject to an increase in erosion potential for at least some of the construction phase. DOE would use dust suppression measures to reduce this potential. As construction proceeded, the railbed would be covered with ballast rock, which would virtually halt erosion from that area, and the access roads would be compacted, which would reduce erosion. As construction ended, disturbed areas (other than the railbed and access roads) would slowly recover. Other permanent erosion control systems would be installed as appropriate. Introduction of contaminants into the soil is also a potential concern. Proper control of hazardous materials during construction and prompt response to spills or releases would, however, reduce this concern. Impacts to soils would be limited to these areas disturbed and would be transitory and small.

Operations. Impacts to biological resources from shipments of spent nuclear fuel and high-level radioactive waste to the proposed repository along any of the five rail corridors would include periodic disturbances of wildlife from trains going by and from personnel servicing the corridor. Trains probably would kill individuals of some species.

Rail operations would not lead to additional habitat losses, although maintenance activities would prevent habitat recovery in the narrow band occupied by the rail line and access road. Operations could affect individuals of some species, but losses would be unlikely to affect the regional population of any species. Passing trains could disrupt wildlife but such effects would be transitory.

The use of a completed railway would not be likely to have an impact on soils. The rail track and roadbed would be maintained throughout the operations phase, including repairs of erosion damage to the access road and railbed.

Cultural Resources

Construction. Table 3-36 lists the cultural resource information currently available in each corridor that branch rail line construction could affect. Direct impacts to these cultural resources (such as disturbing the sites or crushing artifacts) could occur from a variety of construction-related activities, including building the rail line and the right-of-way. In addition, rail line construction activities would include borrow areas, areas for the disposal of excavated material, construction camps, and access roads that would be outside the defined right-of-way. Because archaeological sites sometimes include buried components, ground-disturbing actions could uncover previously unidentified cultural materials. If cultural resources were encountered, a qualified archaeologist would participate in directing activities to ensure that the resources would be properly protected or the impact mitigated. DOE would use procedures to avoid or reduce direct impacts to cultural resources in construction areas where surface-disturbing activities would occur (see Chapter 9).

Indirect impacts, such as non-project-related disturbances of archaeological sites by purposeful or accidental actions of project employees, could occur from construction activities as a result of increased access and increased numbers of workers near cultural resource sites. These factors would increase the probability for either intentional or inadvertent indirect impacts to cultural resources.

The EIS analysis identified no potential impacts to Native American resources along the corridors. However, systematic studies have not been completed to identify sites, resources, or areas that might hold traditional value for Native American peoples or communities. The corridors would not affect identified cultural resources on reservations because they would not pass through reservations. However, AIWS (1999, page 4-6) states that all wetlands are important cultural resources. If sites or resources important to Native Americans were discovered in the future, either in or near an identified right-of-way, adverse effects could occur through direct means, such as construction activities, or indirectly through visual or auditory impacts.

Operations. No additional direct or indirect impacts would be likely at archaeological and historic sites from the operation of the rail line.

At present, no specific impacts to Native American resources, traditional cultural properties, or other cultural values from rail operations have been identified. In general, the Consolidated Group of Tribes and Organizations has noted that the rail corridors pass through the traditional holy lands of the Southern Paiute, and that many of the corridors correspond, or are adjacent, to ancient pathways and trail systems. Native Americans believe that operation of a branch rail line that transports spent nuclear fuel and high-level radioactive waste would constitute adverse impacts to traditional values and have identified it as a very important concern. They have requested that the tribes and groups that make up the Consolidated Group of Tribes and Organizations be consulted regularly on transportation issues and scheduling to ensure impacts would be small.

Other than those described above, there would be no cultural impacts unique to any of the branch rail line implementing alternatives.

Occupational and Public Health and Safety

Incident-Free Transportation. Incident-free impacts of rail transportation in Nevada would be unique for each of the five Nevada rail transportation implementing alternatives; these are discussed for each implementing alternative in Section 6.3.2.2. That section also lists the incident-free impacts that would occur in Nevada from 2,600 legal-weight truck shipments, although they would be common among the rail implementing alternatives.

Accidents. Accident risks and maximum reasonably foreseeable accidents for rail shipments of spent nuclear fuel and high-level radioactive waste would be common to the Nevada rail transportation implementing alternatives. This section, therefore, discusses these risks.

Table 6-16 lists accident risks for transporting spent nuclear fuel and high-level radioactive waste in Nevada for the five Nevada rail transportation implementing alternatives. The data show that the risks, which are listed for 24 years of operations, would be low for each alternative. These risks include risks associated with transporting 2,600 legal-weight truck shipments made from the commercial sites that could not load rail casks. Small variations in the risk values, principally evident for the Jean branch rail line, are a result of risks that would be associated with transporting rail casks arriving from the east on the Union Pacific Railroad’s mainline through the Las Vegas metropolitan area. The values that would apply for a Valley Modified or Caliente-Chalk Mountain branch line would be lower because of a shorter corridor (Valley Modified), or a more remote and mid-length corridor (Caliente-Chalk Mountain).

Table 6-16. Estimated health impacts[a] to the public from potential accident scenarios for Nevada rail implementing alternatives.

Risk	Caliente	Carlin	Caliente-Chalk Mountain	Jean	Valley Modified
Radiological accident risk					
Dose-risk (person-rem)	0.09	0.10	0.09	0.15	0.09
LCFs[b]	0.00005	0.00005	0.00004	0.00008	0.00004
Traffic fatalities	0.13	0.15	0.11	0.11	0.10

a. Data are reported for 24 years of operations.
b. LCFs = latent cancer fatalities.

Consequences of Maximum Reasonably Foreseeable Accidents. The national transportation analysis evaluated impacts of maximum reasonably foreseeable accidents (see Section 6.2.4.2).

Socioeconomics

There would be no socioeconomic impacts common to all the branch rail line implementing alternatives. Section 6.3.2.2 describes socioeconomic impacts for each implementing alternative.

Noise

Construction. Occupational Health and Safety Administration regulations (29 CFR) establish hearing protection standards for workers. DOE would meet these standards for workers involved in building a branch rail line in any of the five corridors. Estimated noise levels for railroad construction would range from 62 to 74 A-weighted decibels (dBA) within 150 meters (500 feet) of the noise source and from 54 to 67 dBA at 600 meters (2,000 feet) (ICC 1992, page 4-97). Trips to borrow and spoil areas would be another source of noise. Rail line construction would occur primarily during daylight hours, so nighttime noise would not be an issue unless there was a need to use accelerated construction to meet schedule constraints. There is a possibility that the construction of some structures associated with the rail line would occur during hours not in the normal workday, but the frequency and associated noise levels would be unlikely to be great. Because construction would progress along a corridor, construction noise would be transient in nearby communities. Noise levels could approach generally accepted limits for residential and commercial areas, but this would be for a brief time. Because there are no permanent residences, construction noise would not be an issue for activities inside the boundaries of Nellis Air Force Range, the Nevada Test Site, or the land withdrawal area that DOE analyzed for the proposed repository.

Operations. About five rail round trips (10 one-way trips) of spent nuclear fuel, high-level radioactive waste, or other material would occur weekly on the branch rail line during normal operations. To estimate noise impacts, the analysis assumed that trains would travel as fast as 80 kilometers (50 miles) an hour. The equivalent-continuous (average) sound level at 2,000 meters (6,600 feet) from a train consisting of two locomotives and 10 cars traveling at 80 kilometers an hour would be 51 dBA (Hanson, Saurenman, and Towers 1991, pages 1 to 8). The estimated noise level at 200 meters (660 feet) would be 62 dBA (Hanson, Saurenman, and Towers 1991, pages 1 to 8). Humans immediately outside a 400-meter (1,300-foot) corridor and the region of influence boundary would experience infrequent exposure to rail noise. In the more isolated regions, few people would be affected. Trains traveling through communities would normally operate at reduced speed, so their noise levels would decrease.

Noise impacts unique to the branch rail line implementing alternatives, with the exception of the Valley Modified implementing alternative (described in Section 6.3.2.2.5), would be unlikely.

Aesthetics

Construction. The greatest impact on visual resources from the construction of a rail line would be the presence of workers, camps, vehicles, large earth-moving equipment, laydown yards, and dust generation. These activities, however, would have a limited duration (about 2.5 years). Construction would progress along the selected corridor from its starting point to the proposed repository. Only a small portion of the overall construction time would be spent in one place; the exception to this would be places where major structures, such as bridges, would be built. In general, an individual construction camp would be active only for part of the 2.5-year construction period; after the completion of construction in an area, the camp would close.

Dust generation would be controlled by implementing best management practices such as misting or spraying disturbed areas. Construction activities would not exceed the criteria in the Bureau of Land Management Visual Resource Management guidelines (BLM 1986, all). If the rail line crossed Class II lands, more stringent management requirements would be necessary to retain the existing character of the landscape. The short duration of branch rail line construction activities, combined with the use of best management practices, would mitigate the impacts of activities that could exceed the management requirements for Class II lands. Visual impacts to scenic quality Class C lands on the Nevada Test Site would not occur because of the remoteness and inaccessibility of the location.

Operations. During proposed repository operations, visual impacts would be due to the existence of the branch rail line, access road, and borrow pits in the landscape and the passage of trains to and from the repository. The passage of 10 trains a week (coming and returning) would have a small impact, temporarily attracting the attention of the casual observer. In addition, the noise generated by the trains would attract attention to them, temporarily increasing their impact on the scenic quality of the landscape. There would be no aesthetic impacts unique to any of the branch rail line implementing alternatives.

Utilities, Energy, and Materials

Construction. Because all five corridors pass through sparsely populated areas with little access to support services, portable generators would provide electricity to support construction activities. The total fossil-fuel consumption in Nevada was about 3.8 billion liters (1 billion gallons) in 1996 (BTS 1999a, Table MF-21). Fuel consumption estimates for construction of heavy-haul routes indicate low impacts compared to the statewide consumption of petroleum fuel.

Steel for rails and concrete, principally for rail ties, bridges, and drainage structures, and rock for ballast would be the primary materials consumed in the construction of a branch rail line. DOE would buy precast concrete railbed ties, culverts, bridge beams, and overpass components from a number of suppliers. Actual onsite pouring of concrete [less than 120,000 metric tons (132,000 tons)] would account for less than 30 percent of the total mass of concrete and would be less than 2 percent of the concrete used in Nevada in 1998 (Sherwood 1998, all). Because DOE would buy precast concrete components from suppliers and because onsite concrete construction would involve a small amount of material for some abutments, the localized impact of concrete use in rail corridor construction would not be great for any of the corridors.

Because sources for rails and railroad ties are well established in the southwest and nationally, none of the quantities of materials required for constructing a rail line in Nevada would create demand or supply impacts in southern Nevada (Zocher 1998, all).

Impacts on utilities, energy, and materials differ among the implementing alternatives, as described in Section 6.3.2.2.

Operations. Impacts to utilities, energy, and materials from the operation of a branch rail line in Nevada would be small. Use of fossil fuel for train operations would be small. Chapter 10 discusses fossil fuel used for rail operations. No impacts would be unique to any of the branch rail line implementing alternatives.

Waste Management

Construction. The construction of a branch rail line would require construction materials such as rail ties and steel; rock ballast; concrete; oils, lubricants, and coolants for heavy machinery; and compressed gasses (hazardous materials) for welding. Construction in any of the five corridors would result in small amounts of wastes that would require disposal. Most would be nonhazardous industrial wastes or construction debris that DOE would dispose of in permitted industrial landfills or in permitted construction debris landfills, respectively. Hazardous waste such as lubricants and solvents would be shipped to a permitted hazardous waste treatment and disposal facility for appropriate disposition. In addition, much of the residual material from rail line construction would be saved for reuse or would be recycled. Excess excavated materials such as soil and rock would be placed in spoil areas that would be included in the amount of disturbed land. A commercial vendor would provide portable restroom facilities and manage the sanitary sewage. This waste would be handled such that there would be no adverse impacts from construction.

Operations. The use of a rail line in any of the five corridors would result in wastes from the maintenance of railroad equipment and track. These wastes would include waste lubricants from equipment and machinery; solvents, paint, and other hazardous material; sanitary waste; and industrial wastes typical for operations of a small branch rail line. Management and disposition of these wastes would comply with applicable environmental, occupational safety, and public safety regulations. Thus, waste would be handled such that there would be no impacts from rail corridor operations.

There would be no waste management impacts unique to any of the branch rail line implementing alternatives.

6.3.2.2 Specific Impacts of Rail Corridor Implementing Alternatives

6.3.2.2.1 *Caliente Rail Corridor Implementing Alternative*

The Caliente corridor originates at an existing siding to the Union Pacific mainline railroad at Eccles siding near Caliente, Nevada (Figure 2-30). The corridor travels west, traversing the Chief, North Pahroc, Golden Gate, and Kawich Mountain Ranges. The Caliente and Carlin corridors converge near the northwest boundary of the Nellis Air Force Range. Past this point, the corridors are identical. The Caliente corridor is 513 kilometers (319 miles) long from the Union Pacific line connection to the Yucca Mountain site. Figure 6-11 shows the alignment for this corridor, along with possible variations identified by engineering studies (TRW 1999d, page 2, Item 6). The alignment variations provide flexibility in addressing engineering, land-use, or environmental resource issues that could arise in a future, more detailed survey along the corridor. Appendix J assesses the attributes of these alignment variations. This section addresses impacts that would occur along the corridor alignment shown in Figure 6-11. With the exception of the differences identified in Appendix J, the impacts would be generally the same among the possible alignments.

Construction of a branch rail line in the Caliente corridor would require approximately 2.5 years. Construction would take place simultaneously at multiple locations along the corridor. An estimated six construction camps at roughly equal distances along the corridor would provide temporary living accommodations for construction workers and construction support facilities.

The following sections address impacts that would occur to land use; biological resources and soils; hydrology including surface water and groundwater; occupational and public health and safety; socioeconomics; noise; and utilities, energy, and materials. Impacts that would occur to air quality, cultural resources, aesthetics, and waste management would be the same as those described in Section 6.3.2.1 and are not repeated here. Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

Land Use and Ownership

Construction. Table 6-17 summarizes the amount of land required for the Caliente corridor, its ownership, and the estimated amount of land that would be disturbed.

This branch rail line would cross several telephone, pipeline, highway, and power line rights-of-way. It also would cross six Bureau of Land Management grazing allotments (Reveille, Ralston, Stone Cabin, Montezuma, Magruder Mountain, and Razorback), seven wild horse and burro herd management areas, five areas leased for oil and gas exploration and extraction, and four areas designated as available for sale or transfer (TRW 1999f, Table 3).

If DOE decided to build and operate a branch rail line in the Caliente corridor, it would consult with the Bureau of Land Management, the U.S. Air Force, and other affected agencies to help ensure that it avoided or mitigated potential land-use conflicts associated with the alignment of a right-of-way. Because Public Law 99-606 withdrew and reserved the Nellis Air Force Range for use by the Secretary of the Air Force, the Secretary would need to concur with a decision to build and operate a branch rail line

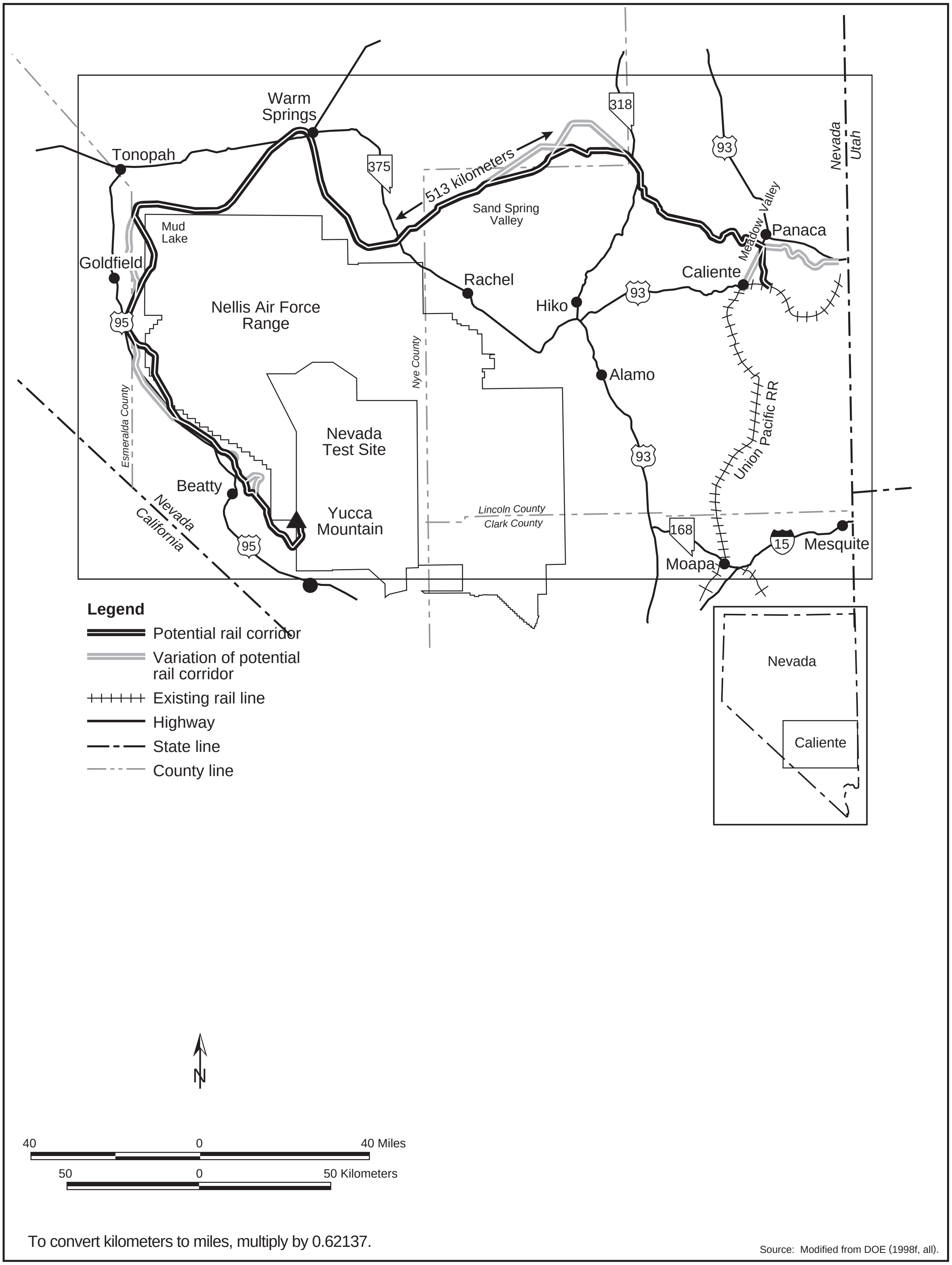


Figure 6-11. Caliente rail corridor.

Table 6-17. Land use in the Caliente rail corridor.

Factor	Amount
Corridor length (kilometers)[a]	513
Land area in 400-meter[b]-wide corridor (square kilometers)[c]	210
Land ownership [square kilometers (percent)]	
Bureau of Land Management	180 (88)[d]
Air Force	20 (10)
DOE	4 (2)
Private	Small (~ 1)
Other	None
Disturbed land (square kilometers)	
Inside corridor	14.8
Outside corridor	3.2

a. To convert kilometers to miles, multiply by 0.62137.
b. 400 meters = about 0.25 mile.
c. To convert square kilometers to acres, multiply by 247.1.
d. Percentages do not total 100 due to rounding.

through the Range before DOE could build and operate this line. Alternatively, DOE could choose the corridor variations shown on Figure 6-11 that avoid crossing Nellis Air Force Range lands.

Based on currently available information, DOE is not aware of any conflicts with existing or planned land uses that would occur as a result of construction of a branch rail line in the Caliente corridor. Although there are no known community development plans that would conflict with the rail line, the presence of a rail line could influence future development and land use along the railroad in the communities of Beatty, Caliente, Goldfield, Scotty's Junction, and Warm Springs (that is, zoning and land use might differ depending on the presence or absence of a railroad). Construction of a branch rail line within the Caliente corridor would require conversion of land within existing grazing allotments and wild horse or wild horse and burro management areas; however, because the railroad would be unlikely to interfere with animal movements, the functionality of these areas would not be affected.

Operations. Rail corridor operations would involve the same land-use and ownership considerations as those discussed above for construction. No unique impacts were identified.

Hydrology

Surface Water

Surface-water resources along the Caliente rail corridor are discussed in Chapter 3, Section 3.2.2.1.3, and summarized in Table 6-18. As discussed in Section 6.3.2.1, impacts during construction or operations from the possible spread of construction-related materials by precipitation or intermittent runoff events, releases to surface water, or the alteration of natural drainage patterns or runoff rates that could affect downgradient resources would be unlikely.

Table 6-18. Surface-water resources along Caliente corridor.[a,b]

Resources in 400-meter[c] corridor			Resources outside corridor within 1 kilometer[d]		
Spring	Stream/ riparian area	Reservoir	Spring	Stream/ riparian area	Reservoir
1	4	--[e]	6	--	--

a. Source: reduced from Table 3-35.
b. Resources are the number of locations; that is, a general location with more than one spring was counted as one water resource.
c. 400 meters = about 0.25 mile.
d. 1 kilometer = about 0.6 mile.
e. -- = none.

Groundwater

Construction. The water used during construction would come largely from groundwater resources. The annual demands would be a fraction of the perennial yields of most producing aquifers (see Chapter 3, Section 3.2.2.1.3, for estimated perennial yields for the hydrographic areas over which the Caliente rail corridor would pass).

The amount of water needed for the construction of a rail line in the Caliente corridor for soil compaction and dust control would be about 880,000 cubic meters (710 acre-feet) (LeFever 1998a, all). For planning purposes, DOE assumed that this water would come from 64 wells installed along the rail corridor. The average amount of water withdrawn from each well would be approximately 13,700 cubic meters (11 acre-feet). Chapter 3, Section 3.2.2.1.3, discusses the hydrographic areas over which the Caliente rail corridor would pass, their perennial yields, and whether the State of Nevada considers each a Designated Groundwater Basin. If the hydrographic area is a Designated Groundwater Basin, permitted groundwater rights approach or exceed the estimated perennial yield, depleting water resources or requiring additional administration. Table 6-19 summarizes the status of the hydrographic areas associated with the Caliente rail corridor and the approximate portion of the corridor that would pass over Designated Groundwater Basins.

HYDROGRAPHIC AREA

The Nevada Division of Water Planning has divided the State into groundwater basins, or *hydrographic areas*. These areas are used in the management of groundwater resources. Hydrographic areas are generally based on topographic divides (that is, they typically comprise a valley, a portion of a valley, or a terminal basin), but can also be based on administrative divisions. The State classifies a hydrographic area as a Designated Groundwater Basin when the permitted water rights (or appropriations) approach or exceed the area's estimated perennial yield and the water resources are depleted or require additional administration. The Division of Water Planning's home page *http://www.state.nv.us/cnr/ndwp* identifies the hydrographic areas that are Designated Groundwater Basins.

The withdrawal of 13,700 cubic meters (11 acre-feet) a year from a well would have little impact on the hydrographic areas associated with the Caliente rail corridor based on their perennial yields (Chapter 3, Section 3.2.2.1.3). However, the installation of 64 wells along the corridor would mean that many hydrographic areas would have multiple wells. As Table 6-19 indicates, about 40 percent of the corridor length would be over Designated Groundwater Basins, which the Nevada State Engineer's office watches carefully for groundwater depletion. This does not mean that DOE could not obtain water appropriations in these areas; the State Engineer would have the authority to approve such appropriations. Because the DOE requests would be for a short-term construction action, the State Engineer would have even more discretion. Rather than spacing the wells evenly along the corridor, DOE could use locations that would make maximum use of groundwater areas that are not Designated Groundwater Basins. Another option would be to lease temporary water rights from individuals along the corridor. Obtaining a water appropriation from the State Engineer for short-term construction use or using an approved allocation should ensure that groundwater resources would not be adversely affected.

Table 6-19. Hydrographic areas along Caliente rail corridor.

	Designated Groundwater Basins	
Hydrographic areas	Number	Percent of corridor length
18	6	40

As an alternative, DOE could transport water by truck to meet construction needs. The construction of a branch rail line in the Caliente corridor would require about 47,000 tanker-truck loads of water or about eight truckloads each day for each work camp along the corridor. Again, water obtained from permitted sources, which would be within allocations determined by the Nevada State Engineer, would not affect groundwater resources.

Operations. Operations along a completed rail line would have little impact on groundwater resources. There would be no changes in recharge beyond those at the completion of construction.

Biological Resources and Soils

Construction. The construction of a rail line in the Caliente corridor would disturb approximately 18 square kilometers (4,500 acres) of land (Table 6-17). More than 50 kilometers (31 miles) along the southern end of the corridor is in desert tortoise habitat. Assuming that a maximum of about 0.06 square kilometer (15 acres) of land would be disturbed for each kilometer of rail line, construction activities would disturb about 3 square kilometers (740 acres) of desert tortoise habitat, none of which is classified as critical habitat. In addition, these activities could kill individual desert tortoises; however, their abundance is low in this area (Karl 1981, pages 76 to 92; Rautenstrauch and O'Farrell 1998, pages 407 to 411) so losses would be few. The only other Federally listed species near the corridor is the Railroad Valley springfish (Federally threatened), which has been found about 3 kilometers (1.9 miles) north of the corridor, and it should not be affected. This corridor would cross a portion of the Meadow Valley Wash, which is habitat for the Meadow Valley Wash speckled dace and the Meadow Valley Wash desert sucker. Construction of a branch rail line in this corridor could temporarily affect populations of these fish by increasing the sediment load in the wash during construction. Four other special status species occur along this route but could be avoided during land-clearing activities (TRW 1999k, page 3-23) and, therefore, would not be affected.

The rail corridor crosses 13 areas designated as game habitat and 8 areas designated as wild horse and burro management areas (see Chapter 3, Section 3.2.2.1.4). Construction activities would reduce habitat in these areas. Wild horses, burros, and game animals near these areas during construction would be disturbed and their migration routes could be disrupted.

At least one spring, one river, and three riparian areas are within the 0.4-kilometer (0.25-mile) corridor (Table 6-18). Although formal delineations have not been conducted, these springs and riparian areas may be jurisdictional wetlands or other waters of the United States. Construction could increase sedimentation in these areas. In addition, the corridor crosses a number of ephemeral streams that could be classified as waters of the United States. DOE would work with the U.S. Army Corps of Engineers to minimize impacts to these areas and would obtain individual or regional permits if necessary.

Construction activities would temporarily disturb about 18 square kilometers (4,500 acres) of soils in and adjacent to the corridor. The impacts to soils of disturbing 18 square kilometers along the 530-kilometer (329-mile)-long corridor would be transitory and small.

Operations. Impacts from operations would include periodic disturbances of wildlife from passing trains and from personnel servicing the corridor. Trains probably would kill individuals of some species but losses would be unlikely to affect regional populations of any species. No additional habitat loss would occur during operations.

Occupational and Public Health and Safety

Construction. Industrial safety impacts on workers from the construction and use of the Caliente branch rail line would be small. The analysis evaluated the potential for impacts in terms of total reportable cases of injury and illness, lost workday cases, and fatality risks to workers and the public from construction and operation activities. Table 6-20 lists these results.

The analysis also evaluated traffic fatality impacts that would occur during the moving of equipment and materials for construction, worker commutes to and from construction sites, and transport of water to construction sites if wells were not available. Table 6-21 lists these results.

Operations. Incident-free radiological impacts would occur during the routine transportation of spent nuclear fuel and high-level radioactive waste in the Caliente rail corridor. Table 6-22 lists the incident-free impacts, which include transportation along the Caliente corridor and along railways in Nevada leading to a Caliente branch line. The table includes the impacts of 2,600 legal-weight truck shipments from commercial sites that do not have the capability to load rail casks.

Socioeconomics

Construction. There would be socioeconomic impacts associated with construction of a branch rail line in the Caliente corridor. The projected length of the corridor—513 kilometers (319 miles)—is the most important factor for determining the number of workers that would be required. To construct a branch rail line in this corridor would require 560 workers (annual average) (TRW 1999d, Rail Files, Item 1) and 5 construction camps.

Table 6-20. Impacts to workers from industrial hazards during rail construction and operations in the Caliente corridor.

Group and industrial hazard category	Construction[a]	Operations[b]
Involved workers		
Total recordable cases[c]	110	120
Lost workday cases	56	68
Fatalities	1.1	0.2
Noninvolved workers		
Total recordable cases	7	6
Lost workday cases	4	3
Fatalities	0.01	0.01
Totals[d]		
Total recordable cases	120	130
Lost workday cases	60	71
Fatalities	1.1	0.23

a. Totals for 2.5 years of construction.
b. Totals for 24 years of operations.
c. Total recordable cases includes injury and illness.
d. Totals might differ from sums due to rounding.

Table 6-21. Estimated number of fatalities from construction material delivery vehicles and construction and operations worker commuting traffic for the Caliente rail corridor.

Activity	Kilometers[a]	Traffic fatalities	Emissions fatalities
Construction			
Material delivery vehicles	19,000,000	0.3	0.0014
Commuting workers	85,000,000	0.9	0.0061
Subtotals	*104,000,000*	*1.2*	*0.0075*
Operations			
Commuting workers	68,000,000	0.7	0.005
Totals	***172,000,000***	***1.9***	***0.013***

a. To convert kilometers to miles, multiply by 0.62137.

Table 6-22. Health impacts from incident-free Nevada transportation for the Caliente rail corridor implementing alternative.[a]

Category	Legal-weight truck shipments	Rail shipments	Totals[b]
Involved workers			
Collective dose (person-rem)	220	210	430
Estimated LCFs[c]	0.09	0.08	0.17
Public			
Collective dose (person-rem)	270	120	390
Estimated LCFs	0.14	0.06	0.20
Estimated vehicle emission-related fatalities	0.00014	0.0018	0.0019

a. Impacts are totals for 24 years (2010 to 2033).
b. Totals might differ due to rounding.
c. LCF = latent cancer fatality.

DOE anticipates that the total direct and indirect employment would peak in 2007 at about 1,200 for the corridor. Population increases in Nevada from the construction of a branch rail line, which would lag behind increases in employment, would peak in 2009 at about 900. Real disposable income, Gross Regional Product, and State and local government expenditures would rise. The expected peak changes due to the Caliente corridor would be increases of $27.7 million in real disposable income, $48.6 million in Gross Regional Product, and $2.5 million in state and local expenditures. (All dollar values reported in this section are in 1992 constant dollars unless otherwise stated.)

Impacts to employment, population, real disposable income, Gross Regional Product, and State and local government expenditures would be low for Clark and Nye Counties, as would increases in population and State and local government expenditures for Lincoln County. Impacts to employment, real disposable income, and Gross Regional Product in Lincoln County would be moderate compared to baseline values, increasing by about 4 percent, 2 percent, and 2 percent, respectively, in 2007. Although these impacts would be moderate for Lincoln County, they would not exceed historic short-term changes in growth.

Operations. The estimated direct employment for the Caliente branch line operations would be 47 workers. Total direct and indirect peak employment would be 130.

The greatest estimated real disposable income increase attributable to operation, which was projected to occur in 2033, the last year of operation, would be $5.4 million. The increase in Gross Regional Product in 2026, the year in which the increase would be greatest in comparison to the baseline, would be $9.1 million. Annual State and local government expenditures would be much lower than those reported above for construction.

Impacts to employment, population, real disposable income, Gross Regional Product, and State and local government expenditures from the operation of a Caliente branch rail line would be low for Clark and Nye Counties. Peak impacts to employment, population, real disposable income, Gross Regional Product, and State and local government expenditures in Lincoln Country would be moderate compared to baseline values, which would range from a 1.5- to 6.4-percent increase above the baseline. Although these impacts would be moderate for Lincoln County, they would be positive and would not exceed historic short-term changes in growth.

Noise

Most of the corridor would pass through undeveloped Bureau of Land Management land, where the only human inhabitants would be isolated ranchers or persons involved with outdoor recreation. Communities in the region of influence include Caliente, Panaca, Goldfield, and Beatty. Principally because of the populations in these communities, there would be a potential for noise impacts from both construction and operations.

Utilities, Energy, and Materials

Table 6-23 lists the use of fossil fuel and other materials for the construction of a Caliente branch rail line.

Table 6-23. Construction utilities, energy, and materials for a Caliente branch rail line used over 2.5 years.

Length (kilometers)[a]	Diesel fuel use (million liters)[b]	Gasoline use (thousand liters)	Steel (thousand metric tons)[c]	Concrete (thousand metric tons)[c]
513	42	870	71	420

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. To convert metric tons to tons, multiply by 1.1023.

6.3.2.2.2 *Carlin Rail Corridor Implementing Alternative*

The Carlin corridor originates at the Union Pacific main line railroad near Beowawe in north-central Nevada. Figure 6-12 shows the alignment of this corridor along with possible variations identified by engineering studies (TRW 1999d, Rail Files, Item 6). The alignment variations provide flexibility in addressing engineering, land-use, or environmental resource issues that could arise in a future, more detailed survey along the corridor. Appendix J assesses the attributes of these alignment variations. This section addresses impacts that would occur along the corridor alignment shown in Figure 6-12. With the

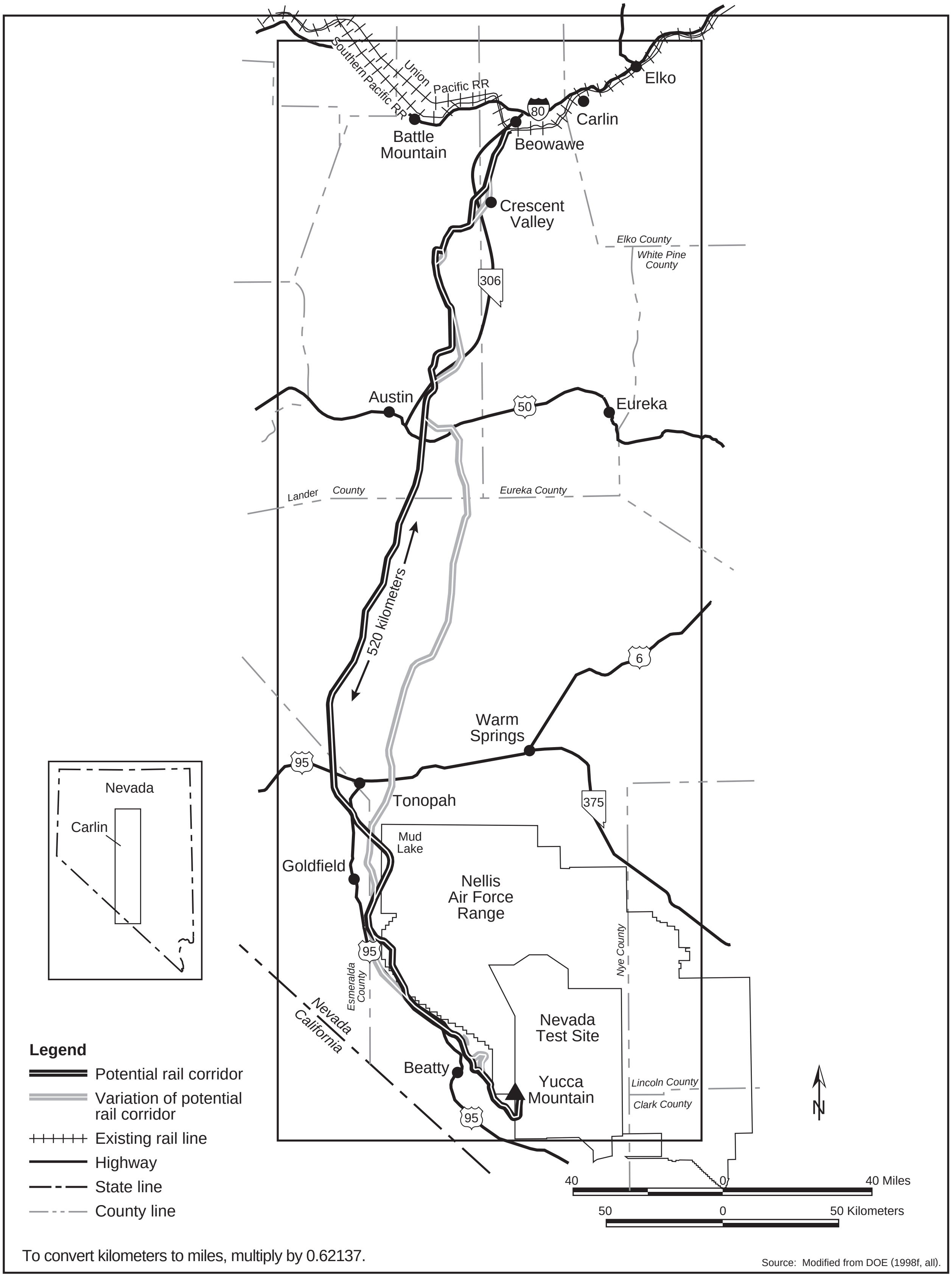


Figure 6-12. Carlin rail corridor.

exception of the differences identified in Appendix J, the impacts would be generally the same among the possible corridor alignments.

The corridor travels south through Crescent, Grass, and Big Smokey Valleys, passing west of the City of Tonopah and east of the City of Goldfield. The corridor then travels south following and periodically crossing the western boundary of the Nellis Air Force Range, passing through Oasis Valley and Beatty Wash. It travels along Fortymile Wash to the proposed repository location. The corridor is about 520 kilometers (323 miles) long from its link with the Union Pacific line to the Yucca Mountain site.

The construction of a branch rail line in the Carlin corridor would require approximately 2.5 years. Construction would take place simultaneously at multiple locations along the corridor. DOE would establish an estimated five construction camps at roughly equal distances along the corridor. These camps would provide temporary living accommodations for construction workers and construction support facilities.

The following sections address impacts that would occur to land use; biological resources and soils; hydrology including surface water and groundwater; occupational and public health and safety; socioeconomics; noise; and utilities, energy, and materials. Impacts that would occur to air quality, cultural resources, aesthetics, and waste management would be the same as those common impacts discussed in Section 6.3.2.1 and are, therefore, not repeated here. Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

Land Use and Ownership

Construction. Table 6-24 summarizes the amount of land required for the Carlin corridor, its ownership, and the estimated amount of land that would be disturbed.

The corridor crosses several telephone, highway, and utility rights-of-way. It also crosses 12 Bureau of Land Management grazing allotments (Carico Lake, Dry Creek, Grass Valley, Kingston, Simpson Park, Wildcat Canyon, Smoky, Francisco, San Antone, Montezuma, Magruder Mountain, and Razorback) and 5 wild horse and burro herd management areas. Other areas crossed by the corridor include the Bates Mountain antelope release area, three designated riparian habitats, and the Simpson Park habitat management area. It does not cross any oil or gas exploration and extraction areas.

Table 6-24. Land use in the Carlin rail corridor.

Factor	Amount
Corridor length (kilometers)[a]	520
Land area in 400-meter[b]*-wide corridor (square kilometers)*[c]	210
Land ownership [square kilometers (percent)]	
Bureau of Land Management	180 (85)[d]
Air Force	19 (9)
DOE	4 (2)
Private	7 (3.4)
Other	None
Disturbed land (square kilometers)	
Inside corridor	17
Outside corridor	2

a. To convert kilometers to miles, multiply by 0.62137.
b. 400 meters = about 0.25 mile.
c. To convert square kilometers to acres, multiply by 247.1.
d. Percentages do not total 100 due to rounding.

If DOE decided to build and operate a branch rail line in the Carlin corridor, it would consult with the Bureau of Land Management, the U.S. Air Force, and other affected agencies to help ensure that it avoided or mitigated potential land-use conflicts associated with alignment of a right-of-way. Because Public Law 99-606 withdrew and reserved the Nellis Air Force Range for use by the Secretary of the Air Force, the Secretary would need to concur with a decision to build and operate a branch rail line through the Range before DOE could build and operate this line.

Based on currently available information, DOE is not aware of any conflicts with existing or planned land uses that would occur as a result of construction of a branch rail line in the Carlin corridor. Although there are no known community development plans that would conflict with the rail line, the presence of a rail line could influence future development and land use along the railroad in the communities of Austin, Beatty, Carver's Station, Cortez, Crescent Valley, Gold Acres, Goldfield, Manhattan, Round Mountain, Scotty's Junction, Tenabo, and Tonopah (that is, zoning and land use might differ depending on the presence or absence of a railroad). Construction of a branch rail line within the Carlin corridor would require conversion of land within existing grazing allotments and wild horse or wild horse and burro management areas; however, because the railroad would be unlikely to interfere with animal movements, the functionality of these areas would not be affected.

Operations. Rail corridor operations would involve the same land-use and ownership considerations discussed above for construction. The analysis identified no unique impacts for operations.

Hydrology

Surface Water

Surface-water resources along the Carlin rail corridor are discussed in Chapter 3, Section 3.2.2, and summarized in Table 6-25. As discussed in Section 6.3.2.1, impacts during construction or operations from the possible spread of construction-related materials by precipitation or intermittent runoff events, releases to surface waters, and the alteration of natural drainage patterns or runoff rates that could affect downgradient resources would be unlikely.

Table 6-25. Surface-water resources along Carlin rail corridor.[a,b]

Resources in 400-meter[c] corridor			Resources outside corridor within 1 kilometer[d]		
Spring	Stream/ riparian area	Reservoir	Spring	Stream/ riparian area	Reservoir
1	5	--[e]	10	2	1

a. Source: reduced from Table 3-35.
b. Water resources are the number of locations; that is, if a general location has more than one spring, it was counted as one water resource.
c. 400 meters = about 0.25 mile.
d. 1 kilometer = about 0.6 mile.
e. -- = none.

Groundwater

Construction. The water used during construction would come largely from groundwater resources. The annual demands would be a fraction of the perennial yields of most producing aquifers (see Chapter 3, Section 3.2.2.1.3, for estimated perennial yields for the hydrographic areas over which the Carlin rail corridor passes).

The estimated amount of water needed for the construction of a rail line in the Carlin corridor for soil compaction and dust control would be about 810,000 cubic meters (660 acre-feet) (LeFever 1998a, all). For planning purposes, DOE assumed that this water would come from 67 groundwater wells installed along the rail corridor. The average amount of water withdrawn from each well would be approximately 12,100 cubic meters (10 acre-feet).

Chapter 3, Section 3.2.2.1.3, discusses the hydrographic areas over which the corridor would pass, their perennial yields, and whether the State of Nevada considers each a Designated Groundwater Basin. If the hydrographic area is a Designated Groundwater Basin, permitted groundwater rights approach or exceed the estimated perennial yield, depleting water resources or requiring additional administration. Table 6-26 summarizes the status of the hydrographic areas associated with the Carlin rail corridor, and the approximate portion of the corridor that passes over Designated Groundwater Basins.

Table 6-26. Hydrographic areas along Carlin rail corridor.

	Designated Groundwater Basins	
Hydrographic areas	Number	Percent of corridor length
11	5	70

The withdrawal of about 12,000 cubic meters (10 acre-feet) a year from a well would have little impact on the hydrographic areas associated with the corridor based on their perennial yields (Chapter 3, Section 3.2.2.1.3). However, the installation of 67 wells along the corridor would mean that many hydrographic areas would have multiple wells. As indicated in Table 6-26, about 70 percent of the corridor length is in Designated Groundwater Basins, which the Nevada State Engineer's office watches carefully for groundwater depletion. This does not mean that DOE could not obtain water appropriations in these areas; the State Engineer would have the authority to approve such appropriations. Because the DOE requests would be for a short-term construction action, the State Engineer would have even more discretion. Rather than spacing the wells evenly along the corridor, DOE could use locations that would make maximum use of groundwater areas that are not Designated Groundwater Basins. With such a large portion of the corridor over these basins, however, this would mean that DOE would truck water for long distances. Another option would be to lease temporary water rights from individuals along the corridor. Obtaining a water appropriation from the State Engineer for short-term construction use or using an approved allocation would ensure no adverse effects to groundwater resources.

As an alternative, DOE could transport water by truck to meet construction needs. The construction of a branch rail line in the Carlin corridor would require about 43,000 tanker-truck loads of water or about 9 truckloads each day for each work camp along the corridor. Again, water obtained from permitted sources, which would be within allocations determined by the Nevada State Engineer, would not affect groundwater resources.

Operations. Operations along a completed rail line would have little impact on groundwater resources. Possible changes in recharge, if any, would be the same as those at the completion of construction.

Biological Resources and Soils

Construction. The construction of a rail line in the Carlin corridor would disturb approximately 19 square kilometers (4,700 acres) (Table 6-24). More than 50 kilometers (31 miles) of its length along the southern end of the corridor occurs in desert tortoise habitat. Construction activities would disturb about 3 square kilometers (740 acres) of this habitat, assuming the maximum rate of 0.06 square kilometer (15 acres) disturbed per linear kilometer of railroad. In addition, construction activities could kill individual desert tortoises; however, the abundance of this species is low in this area (Karl 1981, pages 76 to 92; Rautenstrauch and O'Farrell 1998, pages 407 to 411) so losses would be few. Three other special status species are found along this route but could be avoided during land-clearing activities and should not be affected.

This rail corridor would cross seven areas designated as game habitat and six areas designated as wild horse and burro management areas (see Chapter 3, Section 3.2.2.1.4). Construction activities would reduce habitat in these areas. Wild horses, burros, and game animals near these areas during construction would be disturbed, and their migration routes could be disrupted.

One spring, one river, and five riparian areas are within the 0.4-kilometer (0.25-mile)-wide corridor (Table 6-25). Although no formal delineations have been conducted, these areas may be jurisdictional wetlands or other waters of the United States. Construction could increase sedimentation in these areas. In addition, the corridor crosses a number of ephemeral streams that may be classified as waters of the United States. DOE would work with the U.S. Army Corps of Engineers to minimize impacts to these areas and would obtain individual or regional permits if necessary.

Construction activities would temporarily disturb about 19 square kilometers (4,700 acres) of soils in and adjacent to the corridor. The impacts to soils of disturbing 19 square kilometers (4,700 acres) along the 520-kilometer (323-mile)-long corridor would be transitory and small.

Operations. Impacts from operations would include periodic disturbance of wildlife from passing trains and from personnel servicing the corridor. Trains probably would kill individuals of some species but losses would be unlikely to affect regional populations of any species. No additional habitat loss would occur during operations. Impacts on soils would be small.

Occupational and Public Health and Safety

Construction. Industrial safety impacts on workers from the construction and use of the Carlin branch rail line would be small (see Table 6-27). The analysis evaluated the potential for impacts in terms of total reportable cases of injury, lost workday cases, and fatalities to workers from construction and operation activities.

The analysis also evaluated traffic fatality impacts that would occur during the moving of equipment and materials for construction, worker commutes to and from construction sites, and transport of water to construction sites if wells were not available. Table 6-28 lists these results.

Operations. Incident-free radiological impacts would occur during the routine transportation of spent nuclear fuel and high-level radioactive waste in the Carlin rail corridor. Table 6-29 lists the incident-free impacts, which would include transportation along the Carlin corridor and transportation along railways in Nevada that led to a Carlin branch line. The table includes the impacts of 2,600 legal-weight truck shipments from commercial sites that do not have the capability to load rail casks.

Table 6-27. Impacts to workers from industrial hazards during rail construction and operations for the Carlin corridor.

Group and industrial hazard category	Construction[a]	Operations[b]
Involved workers		
Total recordable cases[c]	100	120
Lost workday cases	50	68
Fatalities	1	0.23
Noninvolved workers		
Total recordable cases	6	6
Lost workday cases	3	3
Fatalities	0.01	0.01
Totals[d]		
Total recordable cases	110	130
Lost workday cases	53	71
Fatalities	1	0.23

a. Totals for 2.5 years for construction.
b. Totals for 24 years for operations.
c. Total recordable cases includes injury and illness.
d. Totals might differ from sums due to rounding.

Table 6-28. Estimated number of fatalities from construction material delivery vehicles and construction and operations worker commuting traffic for the Carlin rail corridor.

Activity	Kilometers[a]	Traffic fatalities	Emissions fatalities
Construction[b]			
Material delivery vehicles	19,000,000	0.3	0.0014
Commuting workers	76,000,000	0.8	0.0055
Subtotals	*95,000,000*	*1.1*	*0.0068*
Operations[c]			
Commuting workers	68,000,000	0.7	0.005
Totals	***163,000,000***	***1.8***	***0.012***

a. To convert kilometers to miles, multiply by 0.62137.
b. Totals for 2.5 years for construction.
c. Totals for 24 years for operations.

Socioeconomics

Construction. There would be socioeconomic impacts associated with the construction of a branch rail line in the Carlin corridor. The projected length of the corridor, 520 kilometers (323 miles), would determine the number of workers that would be required. The construction of a branch rail line in this corridor would require 500 workers (annual average) (TRW 1999d, Rail Files, Item 1) and 5 construction camps.

Table 6-29. Health impacts from incident-free Nevada transportation for the Carlin corridor implementing alternative.[a]

Category	Legal-weight truck shipments	Rail shipments	Totals[b]
Involved workers			
Collective dose (person-rem)	220	250	470
Estimated latent cancer fatalities	0.09	0.11	0.19
Public			
Collective dose (person-rem)	270	150	420
Estimated latent cancer fatalities	0.13	0.08	0.21
Estimated vehicle emission-related fatalities	0.00014	0.0024	0.0025

a. Impacts are totals for 24 years (2010 to 2033).
b. Totals might differ from sums due to rounding.

DOE anticipates that total direct and indirect construction employment would peak in 2007 at about 1,100. Population increases in Nevada from construction, which would lag behind increases in employment, would be likely to peak in 2009. The increase from constructing a Carlin branch rail line would be 790. In addition, real disposable income, Gross Regional Product, and State and local government expenditures would rise. The expected peak changes would be increases of $24.5 million in real disposable income, and $43.5 million in Gross Regional Product in 2007, and $2.2 million in State and local expenditures in 2009. (All dollar values reported in this section are in 1992 constant dollars unless otherwise stated.)

Impacts to employment, population, real disposable income, Gross Regional Product, and State and local government expenditures for construction of a branch rail line in the Carlin corridor would be low for all affected counties.

Operations. Estimated employment for operations in the Carlin corridor would be 47. The total estimated direct and indirect employment from these operations at its peak would be about 140.

The estimated increase in real disposable income in 2029 through 2033 compared to the baseline would be $6.0 million. The increase in Gross Regional Product in 2029 through 2033, the years when the analysis predicted the impacts would be greatest in comparison to the baseline, for the Carlin line would be about $9.4 million. This peak reflects the gradual increase in shipping that would occur over the 24 years of shipping. Annual State and local government expenditures would be much lower than those reported above for construction.

Impacts to employment, population, real disposable income, Gross Regional Product, and State and local government expenditures from operating a Carlin branch rail line would be low for all affected counties.

Noise

Most of the Carlin corridor would pass through undeveloped Bureau of Land Management land, where the only human inhabitants would be isolated ranchers or persons involved with outdoor recreation. There are small communities such as Crescent, Beowawe, and Hadley in the region of influence. For this corridor, noise impacts would be unlikely during construction and operation.

Utilities, Energy, and Materials

Table 6-30 lists the projected use of fossil fuels and other materials in the construction of a Carlin branch rail line.

Table 6-30. Construction utilities, energy, and materials for a Carlin branch rail line used during 2.5 years.

Length (kilometers)[a]	Diesel fuel use (million liters)[b]	Gasoline use (thousand liters)	Steel (thousand metric tons)[c]	Concrete (thousand metric tons)
520	39	800	72	400

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. To convert metric tons to tons, multiply by 1.1023.

6.3.2.2.3 *Caliente-Chalk Mountain Rail Corridor Implementing Alternative*

The Caliente-Chalk Mountain corridor is identical to the Caliente corridor until it reaches the northern boundary of the Nellis Air Force Range. At this point the Caliente-Chalk Mountain corridor turns south through the Nellis Air Force Range and the Nevada Test Site to the Yucca Mountain site. Figure 6-13 shows the alignment of this corridor along with possible variations identified by engineering studies (TRW 1999d, Page 1, Item 1). The alignment variations provide flexibility in addressing engineering, land-use, or environmental resource issues that could arise in a future, more detailed survey along the corridor. Appendix J assesses the attributes of these alignment variations. This section addresses impacts that would occur along the corridor alignment shown in Figure 6-13. With the exception of differences identified in Appendix J, the impacts would be generally the same among the possible corridor alignments. The corridor is 345 kilometers (214 miles) long from its link at the Union Pacific railroad near Caliente to Yucca Mountain.

The construction of a branch rail line in the corridor would require approximately 2.5 years. Construction would take place simultaneously at a number of locations. An estimated four construction camps would be established at roughly equal distances along the corridor. These camps would provide temporary living accommodations for construction workers and construction support facilities.

The following sections address impacts that would occur to land use; biological resources and soils; hydrology including surface water and groundwater; occupational and public health and safety; socioeconomics; noise; and utilities, energy, and materials. Impacts that would occur to air quality, cultural resources, aesthetics, and waste management would be the same as those discussed in Section 6.3.2.1 and are, therefore, not repeated here. Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

Land Use and Ownership

Construction. Table 6-31 summarizes the amount of land required for the Caliente-Chalk Mountain corridor, its ownership, and the estimated amount of land that would be disturbed.

The Caliente-Chalk Mountain corridor would involve several road, power line, and utility rights-of-way before it entered the Nellis Air Force Range and then the Nevada Test Site. Variations of the corridor alignment would provide flexibility to address engineering, land-use, or environmental constraints due to Nevada

Table 6-31. Land use in the Caliente-Chalk Mountain rail corridor.

Factor	Amount
Corridor length (kilometers)[a]	345
Land area in 400-meter[b]*-wide corridor (square kilometers)*[c]	140
Land ownership [square kilometers (percent)]	
BLM	76 (55)[d]
Air Force	22 (16)
DOE	40 (29)
Private	0.8 (0.6)
Other	None
Disturbed land (square kilometers)	
Inside corridor	10
Outside corridor	2

a. To convert kilometers to miles, multiply by 0.62137.
b. 400 meters = about 0.25 miles.
c. To convert square kilometers to acres, multiply by 247.1.
d. Percentages do not total 100 due to rounding.

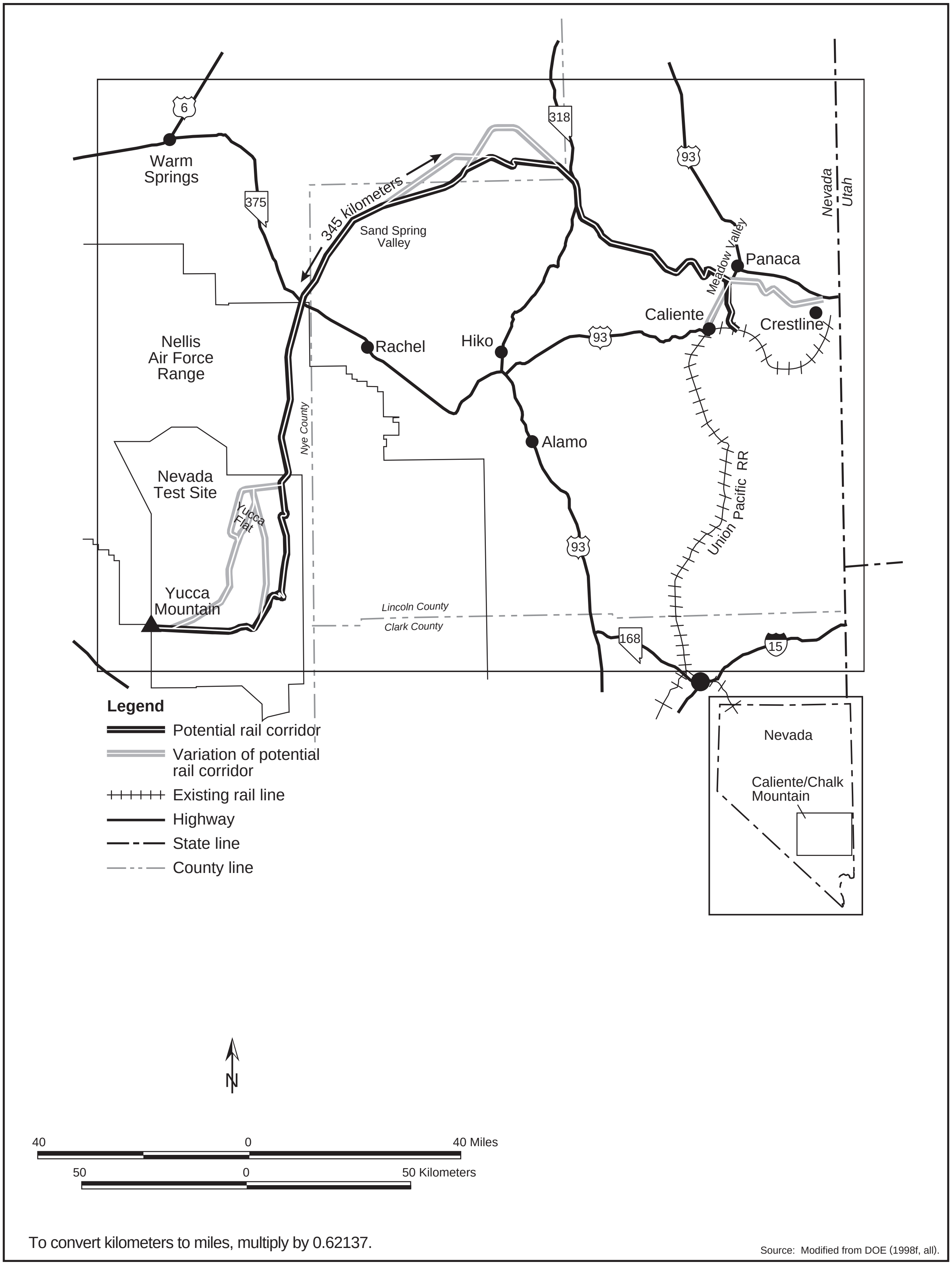


Figure 6-13. Caliente-Chalk Mountain rail corridor.

Test Site surface areas and associated facilities and radiologically contaminated areas. The corridor would also cross five oil and gas leases.

The Caliente-Chalk Mountain corridor would involve the most land controlled by the Nellis Air Force Range, which, according to the Air Force, would affect Air Force operations. Because Public Law 99-606 withdrew and reserved the Nellis Air Force Range for use by the Secretary of the Air Force, the Secretary would need to concur with a decision to build and operate a branch rail line through the Range before DOE could build and operate this line. The Air Force has identified national security issues related to a Chalk Mountain route (Henderson 1997, all), citing interference with Nellis Air Force Range testing and training activities. In response to Air Force concerns, DOE regards the route as a "non-preferred alternative."

Hydrology

Surface Water

Chapter 3, Section 3.2.2, discusses surface-water resources along the Caliente-Chalk Mountain corridor; Table 6-32 summarizes these resources. As discussed in Section 6.3.2.1, impacts during construction or operations from the possible spread of construction-related materials by precipitation or intermittent runoff events, releases to surface waters, and the alteration of natural drainage patterns or runoff rates that could affect downgradient resources would be unlikely.

Table 6-32. Surface-water resources along Caliente-Chalk Mountain corridor.[a,b]

Resources in 400-meter[c] corridor			Resources outside corridor within 1 kilometer[d]		
Spring	Stream/ riparian area	Reservoir	Spring	Stream/ riparian area	Reservoir
--[e]	2	--	6	--	--

a. Source: reduced from Table 3-35.
b. Resources are the number of locations; that is, a general location with more than one spring was counted as one water resource.
c. 400 meters = about 0.25 mile.
d. 1 kilometer = about 0.6 mile.
e. -- = none.

Groundwater

Construction. The water used during construction would come largely from groundwater resources. The annual demands would be a fraction of the perennial yields of most producing aquifers (Chapter 3, Section 3.2.2.1.3, discusses estimated perennial yields for the hydrographic areas over which the Caliente-Chalk Mountain rail corridor passes).

The estimated amount of water needed for construction of a rail line in the corridor for soil compaction and dust control would be about 594,000 cubic meters (480 acre-feet) (LeFever 1998a, all). For planning purposes, DOE assumed that this water would come from 43 wells installed along the corridor. The average amount of water withdrawn from each well would be approximately 14,000 cubic meters (11 acre-feet).

Chapter 3, Section 3.2.2.1.3, discusses the hydrographic areas over which the corridor would pass, their perennial yields, and if the State of Nevada considers each a Designated Groundwater Basin. If the hydrographic area is a Designated Groundwater Basin, permitted groundwater rights approach or exceed the estimated perennial yield, depleting the basin and water resources or requiring additional administration. Table 6-33 summarizes the status of the hydrographic areas associated with the Caliente-Chalk Mountain rail corridor and the approximate portion of the corridor that passes over Designated Groundwater Basins.

Table 6-33. Hydrographic areas along Caliente-Chalk Mountain rail corridor.

	Designated Groundwater Basins	
Hydrographic areas	Number	Percent of corridor length
11	2	30

The withdrawal of about 14,000 cubic meters (11 acre-feet) a year from a well would have little impact on the hydrographic areas associated with the corridor based on their perennial yields (Chapter 3, Section 3.2.2.1.3). However, the installation of 43 wells along the corridor would mean that many hydrographic areas would have multiple wells. As listed in Table 6-33, about 30 percent of the corridor length is over Designated Groundwater Basins, which the Nevada State Engineer's office watches carefully for groundwater depletion. This does not mean that DOE could not obtain water appropriations in these areas; the State Engineer would have the authority to approve such appropriations. Because the DOE requests would be for a short-term construction action, the State Engineer would have even more discretion. Rather than spacing the wells evenly along the corridor, DOE could use well locations that would make maximum use of groundwater areas that are not Designated Groundwater Basins. Another option would be to lease temporary water rights from individuals along the corridor. Obtaining a water appropriation from the State Engineer for short-term construction use or using an approved allocation should ensure that groundwater resources did not receive adverse impacts.

As an alternative, DOE could transport water by truck to meet construction needs. The construction of a branch rail line in the Caliente-Chalk Mountain corridor would require about 32,000 tanker-truck loads of water or about eight truckloads each day for each work camp area along the corridor. Again, water obtained from permitted sources, which would provide water in allocations determined by the Nevada State Engineer, would not affect groundwater resources.

Operations. Operations along a completed rail line would have little impact on groundwater resources. Possible changes in recharge, if any, would be the same as those at the completion of construction.

Biological Resources and Soils

Construction. The construction of a rail line in the Caliente-Chalk Mountain corridor would disturb about 12 square kilometers (3,000 acres) of land (Table 6-31). About 40 kilometers (25 miles) of the corridor length at its southern end crosses desert tortoise habitat. Assuming that 0.06 square kilometer (15 acres) would be disturbed for each linear kilometer of railroad, construction activities would disturb about 2.4 square kilometers (590 acres) of desert tortoise habitat. Such activities could kill individual desert tortoises; however, their abundance is low in this area (Rautenstrauch and O'Farrell 1998, pages 407 to 411) so losses would be few. This corridor crosses a portion of the Meadow Valley Wash, which is habitat for an unnamed subspecies of the Meadow Valley Wash speckled dace and the Meadow Valley Wash desert sucker (see Chapter 3, Section 3.2.2.1.4). The construction of a branch rail line near Caliente could temporarily affect populations of these fish by increasing the sediment load in the wash during construction. Three special status plant species are found along this route but could be avoided during land-clearing activities and should not be affected.

This rail corridor would cross six areas designated as game habitat and two areas designated as wild horse or wild horse and burro management areas. Construction activities would reduce habitat in these areas. Game animals, burros, and horses near areas of active construction would be disturbed and their migration routes could be disrupted.

Two riparian areas are within the 0.4-kilometer (0.25-mile)-wide corridor (Table 6-32). Although no formal delineations have been conducted, these areas may be jurisdictional wetlands or other waters of the United States. Construction could increase sedimentation in these areas. The corridor also crosses a number of ephemeral streams that may be classified as waters of the United States. DOE would work with the U.S. Army Corps of Engineers to minimize impacts to these areas and would obtain individual or regional permits if necessary.

Soils in and adjacent to the corridor would be disturbed on approximately 12 square kilometers (3,000 acres) of land. The impacts of disturbing 12 square kilometers of soil along the 345-kilometer (214-mile)-long corridor would be transitory and small.

Operations. Impacts from operations would include periodic disturbances of wildlife from passing trains and from personnel servicing the corridor. Trains probably would kill individuals of some species but losses would be unlikely to affect regional populations of any species. No additional habitat loss would occur during operations. Impacts on soils would be small.

Occupational and Public Health and Safety

Construction. Industrial safety impacts on workers from the construction and use of the Caliente-Chalk Mountain branch rail line would be small (Table 6-34). The analysis evaluated the potential for impacts in terms of total reportable cases of injury, lost workday cases, and fatalities to workers and the public from construction and operation activities. The analysis also evaluated traffic fatality impacts that would occur in moving equipment and materials for construction, worker commutes to and from construction sites, and transport of water to construction sites if wells were not available. Table 6-35 lists these results.

Table 6-34. Impacts to workers from industrial hazards during rail construction and operations for the Caliente-Chalk Mountain corridor.

Group and industrial hazard category	Construction[a]	Operations[b]
Involved workers		
Total recordable cases[c]	80	120
Lost workday cases	40	68
Fatalities	0.8	0.23
Noninvolved workers		
Total recordable cases	5	6
Lost workday cases	3	3
Fatalities	0.01	0.01
Totals[d]		
Total recordable cases	85	130
Lost workday cases	43	71
Fatalities	0.8	0.23

a. Totals for 2.5 years for construction.
b. Totals for 24 years for operations.
c. Total recordable cases includes injury and illness.
d. Totals might differ from sums due to rounding.

Operations. Incident-free radiological impacts would occur during the routine transportation of spent nuclear fuel and high-level radioactive waste in the Caliente-Chalk Mountain rail corridor.

Table 6-36 lists the incident-free impacts, which include transportation along the corridor and along railways in Nevada leading to a Caliente-Chalk Mountain branch line. The table includes the impacts of 2,600 legal-weight truck shipments from commercial sites that do not have the capability to load rail casks.

Table 6-35. Estimated number of fatalities from construction material delivery vehicles and construction and operations worker commuting traffic for the Caliente-Chalk Mountain rail corridor.

Activity	Kilometers[a]	Traffic fatalities	Emissions fatalities
Construction[b]			
Material delivery vehicles	13,000,000	0.2	0.001
Commuting workers	61,000,000	0.6	0.0044
Subtotals	*74,000,000*	*0.8*	*0.0049*
Operations[c]			
Commuting workers	68,000,000	0.7	0.005
Totals	***142,000,000***	***1.5***	***0.01***

a. To convert kilometers to miles, multiply by 0.62137.
b. Totals for 2.5 years for construction.
c. Totals for 24 years for operations.

Table 6-36. Health impacts from incident-free Nevada transportation for the Caliente-Chalk Mountain implementing alternative.[a]

Category	Legal-weight truck shipments	Rail shipments	Totals[b]
Involved workers			
Collective dose (person-rem)	220	170	390
Estimated latent cancer fatalities	0.09	0.07	0.16
Public			
Collective dose (person-rem)	270	110	380
Estimated latent cancer fatalities	0.13	0.06	0.19
Estimated vehicle emission-related fatalities	0.00014	0.0016	0.0017

a. Impacts are totals for 24 years (2010 to 2033).
b. Totals might differ from sums of values due to rounding.

Socioeconomics

Construction. There would be socioeconomic impacts associated with the construction of a branch rail line in the Caliente-Chalk Mountain corridor. The length of the corridor, 345 kilometers (214 miles), determines the number of workers that would be required. The construction of a branch rail line in this corridor would require 400 workers and four construction camps (TRW 1999d, Rail Files, Item 1).

Based on analyses it conducted using the Regional Economic Models, Inc., system (REMI 1999, all), DOE anticipates that the total direct and indirect construction employment would peak in 2007 at about 910. Population increases in Nevada from construction, which would lag behind increases in employment, would be likely to peak two years later in 2009. The increase in population attributable to the Caliente-Chalk Mountain corridor would be about 640. Real disposable income, Gross Regional Product, and State and local government expenditures would rise. The expected peak year changes for a branch rail line in the Caliente-Chalk Mountain corridor would be increases of $19.2 million in real disposable income, $34.9 million in Gross Regional Product, and $1.9 million in State and local expenditures. (All dollar values reported in this section are in 1992 constant dollars unless otherwise stated.)

The impacts to employment, population, real disposable income, Gross Regional Product, and State and local government expenditures for constructing a branch rail line in the Caliente-Chalk Mountain corridor would be low for Clark and Nye Counties, as would increases in population in Lincoln County. Impacts to employment, real disposable income, and Gross Regional Product in Lincoln County would be moderate compared to baseline values ranging from 1 percent to 5.7 percent of the baseline. Although these impacts would be moderate in Lincoln County, they would not exceed historic short-term changes in growth.

Operations. Estimated employment for operations in the Caliente-Chalk Mountain corridor would be 47. The estimated peak total direct and indirect employment from these operations would be about 120.

The greatest estimated real disposable income increase attributable to the operation of the Caliente-Chalk Mountain branch line, which was projected to occur in 2033, would be $4.9 million. The increase in Gross Regional Product in 2029, the year in which increases would be greatest as a percentage of the baseline, would be $8.6 million. Annual State and local government expenditures would be much lower than those for construction.

The impacts to employment, population, real disposable income, Gross Regional Product, and State and local government expenditures from operating a Caliente-Chalk Mountain branch rail line would be low for Clark and Nye Counties. Impacts to employment, population, real disposable income, State and local government expenditures, and Gross Regional Product in Lincoln County would be moderate compared to baseline values ranging from about 1.5 percent to 6.4 percent of the baseline. These impacts would be moderate for Lincoln County; they would not exceed historic short-term changes in growth.

Noise

Almost half of the Caliente-Chalk Mountain corridor is on Nellis Air Force Range and Nevada Test Site land, where community response to noise would not be an issue. The communities of Caliente and Panaca could be affected. Because the corridor passes through or near these communities, it could have noise impacts from both construction and operation.

Utilities, Energy, and Materials

Table 6-37 lists the use of fossil fuels and other materials in the construction of a Caliente-Chalk Mountain branch rail line.

Table 6-37. Construction utilities, energy, and materials for a Caliente-Chalk Mountain branch rail line.

Length (kilometers)[a]	Diesel fuel use (million liters)[b]	Gasoline use (thousand liters)	Steel (thousand metric tons)[c]	Concrete thousand metric tons)
345	33	630	48	280

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. To convert metric tons to tons, multiply by 1.1023.

6.3.2.2.4 *Jean Rail Corridor Implementing Alternative*

The Jean corridor originates at the existing Union Pacific mainline railroad near Jean, Nevada. It travels northwest, passing near the Towns of Pahrump and Amargosa Valley before reaching the Yucca Mountain site. The corridor is about 181 kilometers (112 miles) long from its link at the Union Pacific line to the site. Figure 6-14 shows the alignment of this corridor along with possible variations identified by engineering studies (TRW 1999d, page 1, Item 6). The alignment variations provide flexibility in addressing engineering, land-use, or environmental resource issues that could arise in a future, more detailed survey along the corridor. Appendix J assesses the attributes of these alignment variations. This section addresses impacts that would occur along the corridor alignment shown in Figure 6-14. With the exception of differences identified in Appendix J, the impacts would be generally the same among the possible corridor alignments.

The construction of a branch rail line in the corridor would require approximately 2.5 years. Construction would take place simultaneously at a number of locations. An estimated two construction camps would be established at roughly equal distances along the corridor. These camps would provide temporary living accommodations for construction workers and construction support facilities.

The following sections address impacts that would occur to land use; biological resources and soils; hydrology, including surface water and groundwater; occupational and public health and safety; socioeconomics; noise; and utilities, energy, and materials. Impacts that would occur to air quality, cultural resources, aesthetics, and waste management would be the same as those discussed in Section 6.3.2.1 and are, therefore, not repeated here. Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

Land Use and Ownership

Construction. Table 6-38 summarizes the amount of land required for the Jean corridor, its ownership, and the estimated amount of land that would be disturbed.

The corridor crosses eight Bureau of Land Management grazing allotments (Mount Stirling, Spring Mountain, Stump Springs, Table Mountain, Wheeler Wash, and three unnamed and unallotted areas); two wild horse and burro herd management areas (both in Pahrump Valley); the Old Spanish Trail/Mormon Road special recreation management area; and four areas designated as available for sale or transfer. It

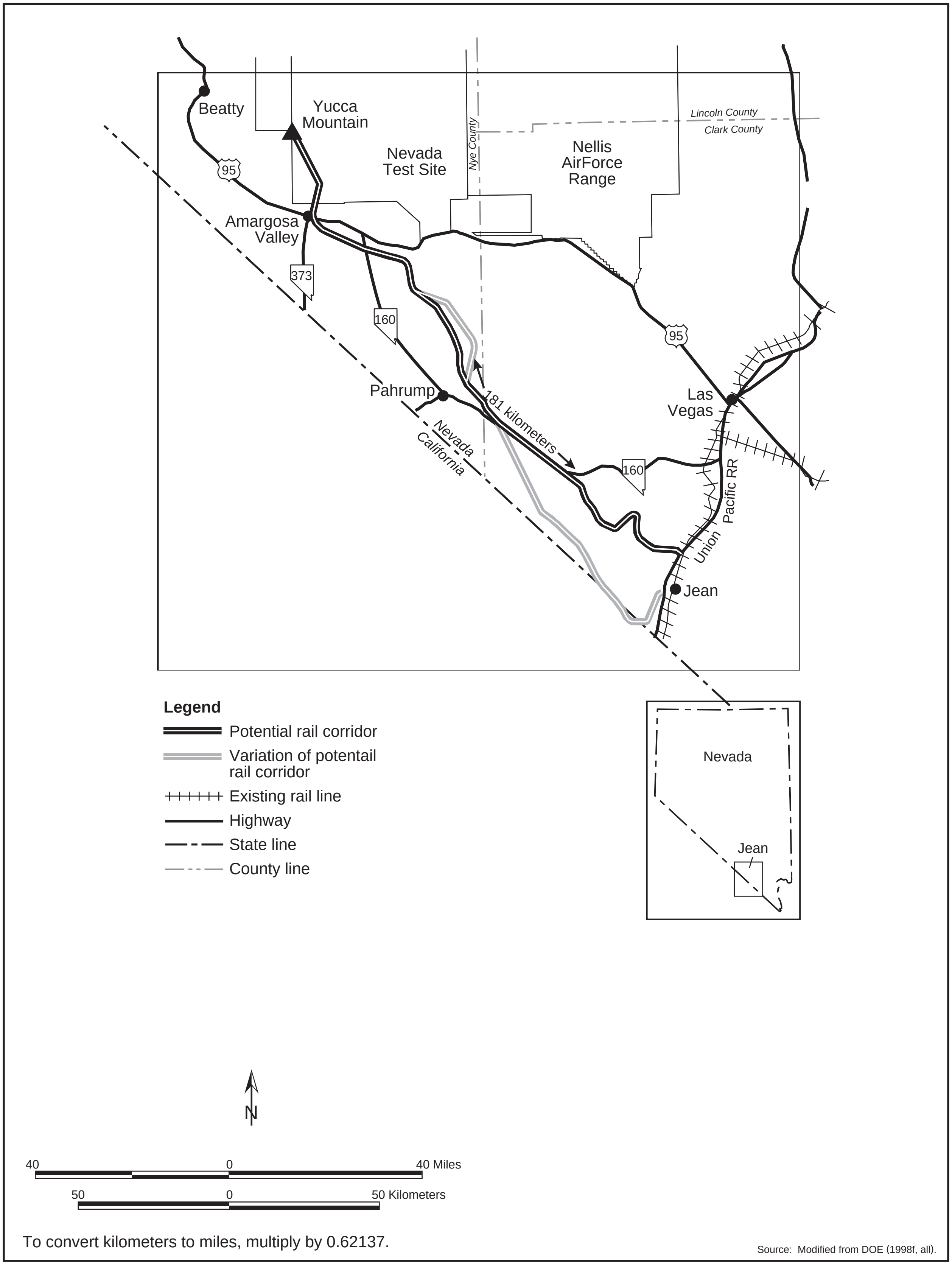


Figure 6-14. Jean rail corridor.

Table 6-38. Land use in the Jean rail corridor.

Factor	Amount
Corridor length (kilometers)[a]	181
Land area in 400-meter[b]*-wide corridor (square kilometers)*[c]	72
Land ownership [square kilometers (percent)]	
Bureau of Land Management	60 (83)
Air Force	None
DOE	8.5 (12)
Private	3.6 (5)
Other	None
Disturbed land (square kilometers)	
Inside corridor	6.5
Outside corridor	2.5

a. To convert kilometers to miles, multiply by 0.62137.
b. 400 meters = about 0.25 mile.
c. To convert square kilometers to acres, multiply by 247.1.

also crosses several telephone, pipeline, highway, and power line rights-of-way. It is within 1.6 kilometers (1 mile) of the Toiyabe National Forest and three mines (Bluejay, Snowstorm, and Pilgram). In the vicinity of Pahrump, a rail line in the Jean corridor could conflict with town growth.

During the construction and operation and monitoring phases of the Proposed Action, there would be a potential for encroachment of the Jean rail corridor by private interest. If encroachment occurred, conflicts could result as impediments to the full use of the land. Areas most likely for use by private interests are those already privately owned and those that are currently designated for sale or transfer by the Bureau of Land Management.

If DOE decided to build and operate a branch rail line in the Jean corridor, it would consult with the Bureau of Land Management and other affected agencies to help ensure that it avoided or mitigated potential land-use conflicts associated with alignment of a right-of-way.

Based on currently available information, DOE is not aware of any conflicts with existing or planned land uses that would occur as a result of construction of a branch rail line in the Jean corridor. Although there are no known community development plans that would conflict with the rail line, the presence of a rail line could influence future development and land use along the railroad in the communities of Amargosa Valley, Goodsprings, Jean, Johnnie, and Pahrump (that is, zoning and land use might differ depending on the presence or absence of a railroad). Construction of a branch rail line within the Jean corridor would require conversion of land within existing grazing allotments and wild horse or wild horse and burro management areas; however, because the railroad would be unlikely to interfere with animal movements, the functionality of these areas would not be affected.

Operations. Rail corridor operations would involve the same land-use and ownership considerations discussed above for construction. No unique impacts for operations were identified.

Hydrology

Surface Water

Chapter 3, Section 3.2.2, notes that there are no surface-water resources along the Jean rail corridor.

Groundwater

Construction. The water used during construction would come largely from groundwater resources. The annual demands would be a fraction of the perennial yields of most producing aquifers (Chapter 3, Section 3.2.2.1.3, discusses estimated perennial yields for the hydrographic areas over which the Jean corridor passes).

The estimated amount of water needed for construction of a rail line in the corridor for soil compaction and dust control would be about 500,000 cubic meters (410 acre-feet) (LeFever 1998a, all). For planning purposes, DOE assumed that this water would come from 23 wells installed along the corridor. The average amount of water withdrawn from each well would be approximately 22,000 cubic meters (18 acre-feet).

Chapter 3, Section 3.2.2.1.3, discusses the hydrographic areas over which the corridor would pass, their perennial yields, and whether the State of Nevada considers each a Designated Groundwater Basin. If the hydrographic area is a Designated Groundwater Basin, permitted groundwater rights approach or exceed the estimated perennial yield, depleting the basin and water resources or requiring additional administration. Table 6-39 summarizes the status of the hydrographic areas associated with the Jean rail corridor and the approximate portion of the corridor that passes over Designated Groundwater Basins.

Table 6-39. Hydrographic areas along Jean rail corridor.

	Designated Groundwater Basins	
Hydrographic areas	Number	Percent of corridor length
6	5	90

The withdrawal of 22,000 cubic meters (18 acre-feet) a year from a well would have little impact on the hydrographic areas associated with the corridor based on their perennial yields (Chapter 3, Section 3.2.2.1.3). However, the installation of 23 wells along the corridor would mean that several of the hydrographic areas would have multiple wells. As indicated in Table 6-39, about 90 percent of the corridor length is over Designated Groundwater Basins, which the Nevada State Engineer's office watches carefully for groundwater depletion. This does not mean that DOE could not obtain water appropriations in these areas; the State Engineer would have the authority to approve such appropriations. Because the DOE requests would be for a short-term construction action, the State Engineer would have even more discretion. Rather than spacing the wells evenly along the corridor, DOE could use locations that would make maximum use of groundwater areas that are not Designated Groundwater basins. With such a large portion of the corridor over these basins, however, this would mean trucking water for long distances. Another option would be to lease temporary water rights from individuals along the corridor. Obtaining a water appropriation from the State Engineer for short-term construction use or using an approved allocation should ensure that groundwater resources are not adversely affected.

As an alternative, DOE could transport water by truck to meet construction needs. The construction of a branch rail line in the Jean corridor would require about 27,000 tanker-truck loads of water or about 14 truckloads each day for each work camp area along the corridor. Again, water obtained from permitted sources, which would provide water within allocations determined by the Nevada State Engineer, would not affect groundwater resources.

Operations. Operations along a completed rail line would have little impact on groundwater resources. Possible changes in recharge, if any, would be the same as those at the completion of construction.

Biological Resources and Soils

Construction. Approximately 9 square kilometers (2,200 acres) of land would be disturbed during the construction of a rail line in the Jean corridor (Table 6-38). This corridor passes through desert tortoise habitat along its entire length, so construction activities would disturb approximately 9 square kilometers of desert tortoise habitat. Construction activities could kill individual desert tortoises. Desert tortoise abundance is low along much of this corridor; however, some areas in the Ivanpah, Goodsprings, Mesquite, and Pahrump Valleys have higher abundance (BLM 1992, Map 3-13; Rautenstrauch and O'Farrell 1998, pages 407 to 411). Two other special status species are found along this route but could be avoided during land-clearing activities and should not be affected.

This rail corridor crosses ten areas designated as game habitat and three areas designated as wild horse and burro management areas (TRW 1999k, page 3-28). Construction activities would reduce habitat in these areas. Wild horses, burros, and game animals near these areas during construction would be disturbed and their migration routes could be disrupted.

No springs, perennial streams, or riparian areas occur along this corridor. The corridor crosses a number of ephemeral streams that may be waters of the United States, although no formal delineations have been conducted (TRW 1999k, page 3-29). DOE would work with the U.S. Army Corps of Engineers to minimize impacts to these areas and would obtain individual or regional permits if necessary.

Soils in and adjacent to the corridor would be disturbed on approximately 9 square kilometers (2,200 acres) during construction of a railroad. This impact to soils along the 181-kilometer (110-mile)-long corridor would be transitory and small.

Operations. Impacts from operations would include periodic disturbances of wildlife from passing trains and from personnel servicing the corridor. Trains probably would kill individuals of some species but losses would be unlikely to affect regional populations of any species. No additional habitat loss would occur during operations. Impacts on soils would be small.

Occupational and Public Health and Safety

Construction. Industrial safety impacts on workers from the construction and use of the Jean branch rail line would be small (Table 6-40). The analysis evaluated the potential for impacts in terms of total reportable cases of injury, lost workday cases, and fatalities to workers from construction and operation activities. The analysis also evaluated traffic fatality impacts that would occur during the moving of equipment and materials for construction, worker commutes to and from construction sites, and transport of water to construction sites if wells were not available. Table 6-41 lists these results.

Table 6-40. Impacts to workers from industrial hazards during rail construction and operations for the Jean corridor.

Group and industrial hazard category	Construction[a]	Operations[b]
Involved workers		
Total recordable cases[c]	68	95
Lost workday cases	34	52
Fatalities	0.7	0.2
Noninvolved workers		
Total recordable cases	4	4
Lost workday cases	2	2
Fatalities	0	0
Totals		
Total recordable cases	72	99
Lost workday cases	36	54
Fatalities	0.7	0.2

a. Totals for 2.5 years for construction.
b. Totals for 24 years for operations.
c. Total recordable cases includes injury and illness.

Operations. Incident-free radiological impacts would occur during the routine transportation of spent nuclear fuel and high-level radioactive waste in using the Jean rail corridor. Table 6-42 lists the incident-free impacts, which include transportation along the corridor and along railways in Nevada leading to a Jean branch line. The table includes the impacts of 2,600 legal-weight truck shipments from commercial sites that do not have the capability to load rail casks.

Table 6-41. Estimated number of fatalities from construction material delivery vehicles and construction and operations worker commuting traffic for the Jean rail corridor.

Jean	Kilometers[a]	Traffic fatalities	Emissions fatalities
Construction[b]			
Materials delivery vehicles	10,000,000	0.2	0.00072
Commuting workers	52,000,000	0.5	0.0038
Subtotals	*62,000,000*	*0.7*	*0.0045*
Operations[c]			
Commuting workers	52,000,000	0.5	0.0038
Totals	***114,000,000***	***1.2***	***0.0082***

a. To convert kilometers to miles, multiply by 0.62137.
b. Totals for 2.5 years for construction.
c. Totals for 24 years for operations.

Table 6-42. Health impacts from incident-free Nevada transportation for the Jean corridor implementing alternative.[a]

Category	Legal-weight truck shipments	Rail shipments	Totals[b]
Involved workers			
Collective dose (person-rem)	220	180	400
Estimated latent cancer fatalities	0.09	0.07	0.16
Public			
Collective dose (person-rem)	270	160	430
Estimated latent cancer fatalities	0.13	0.08	0.21
Estimated vehicle emission-related fatalities	0.00014	0.014	0.014

a. Impacts are totals for 24 years (2010 to 2033).
b. Totals might differ from sums of values due to rounding.

Socioeconomics

Construction. There would be socioeconomic impacts associated with the construction of a branch rail line in the Jean corridor. The projected length of the corridor, 181 kilometers (112 miles), determines the number of workers that would be required. The construction of a branch rail line in this corridor would require about 340 workers and 2 construction camps (TRW 1999d, Rail Files, Item 1).

DOE anticipates that the total direct and indirect employment would peak in 2007 at about 720. Population increases in Nevada, which would lag behind increases in employment, would be likely to peak in 2009. The estimated increase attributed to the Jean corridor would be about 530. Real disposable income, Gross Regional Product, and State and local government expenditures would also rise. The expected changes would be increases of about $16.3 million in real disposable income, about $29 million in Gross Regional Product, and about $1.4 million in State and local expenditures. (All dollar values reported in this section are in 1992 constant dollars unless otherwise stated.)

The impacts to employment, population, real disposable income, Gross Regional Product, and State and local government expenditures for constructing a branch rail line in the Jean corridor would be low for all counties affected.

Operations. Estimated employment for operations in the Jean corridor would be 36. The total estimated direct and indirect employment from these operations would be about 70.

The greatest estimated real disposable income increase attributable to the operation of a Jean branch line would occur in 2024 and would be about $3.1 million. The increase in Gross Regional Product in 2025, the year in which impacts would be greatest, would be about $6.0 million. Annual State and local government expenditures would be much lower than those reported for construction.

The impacts to employment, population, real disposable income, Gross Regional Product, and State and local government expenditures from operating a Jean branch rail line would be low for all counties affected.

Noise

The Jean corridor would pass the small communities of Amargosa Valley, Goodsprings, Jean, and Pahrump. In addition, the potential for development in the Las Vegas area and the fact that the corridor passes through private land could lead to noise impacts during both construction and operation because of the relatively large number of potential nearby inhabitants.

Utilities, Energy, and Materials

Table 6-43 lists the use of fossil fuels and other materials in the construction of a Jean branch rail line.

Table 6-43. Construction utilities, energy, and materials for a Jean branch rail line.

Route	Length (kilometers)[a]	Diesel fuel use (million liters)[b]	Gasoline use (thousand liters)	Steel (thousand metric tons)[c]	Concrete (thousand metric tons)
Jean	181	26	500	26	150

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. To convert metric tons to tons, multiply by 1.1023.

6.3.2.2.5 *Valley Modified Rail Corridor Implementing Alternative*

The Valley Modified corridor originates near the existing Apex rail siding off the Union Pacific mainline railroad. It travels northwest passing north of the City of Las Vegas, north of the Town of Indian Springs, parallel to U.S. 95 before entering the southwest corner of the Nevada Test Site and reaching the Yucca Mountain site. The corridor is about 159 kilometers (98 miles) long from its link with the Union Pacific line to the site. Figure 6-15 shows the alignment of this corridor along with possible variations identified by engineering studies (TRW 1999d, page 1, Item 6). The alignment variations provide flexibility in addressing engineering, land-use, or environmental resource issues that could arise in a future, more detailed survey along the corridor. Appendix J assesses the attributes of these alignment variations. This section addresses impacts that would occur along the corridor alignment shown in Figure 6-15. With the exception of differences identified in Appendix J, the impacts would be generally the same among the possible corridor alignments.

The construction of a branch rail line in the corridor would require approximately 2.5 years. Construction would take place simultaneously at a number of locations along the corridor. Two construction camps would be established to provide temporary living accommodations for construction workers and construction support facilities.

The following sections address impacts that would occur to land use; air quality; biological resources and soils; hydrology including surface water and groundwater; cultural resources; occupational and public health and safety; socioeconomics; noise; and utilities, energy, and materials. Impacts that would occur to aesthetics, and waste management would be the same as those discussed in Section 6.3.2.1 and are, therefore, not repeated here. Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

Land Use and Ownership

Construction. Table 6-44 summarizes the amount of land required for the Valley Modified corridor, its ownership, and the estimated amount of land that would be disturbed.

The corridor crosses three Bureau of Land Management grazing allotments (Wheeler Slope, Indian Springs, and Las Vegas Valley), two wilderness study areas (Nellis ABC and Quail Spring, both recommended by the Bureau as unsuitable for inclusion in the National Wilderness System), and one area designated as available for sale or transfer (TRW 1999f, Table 7). It also crosses several telephone, pipeline, highway, and power line rights-of-way, and the Nellis Air Force Base small arms range.

Table 6-44. Land use in the Valley Modified rail corridor.

Factor	Amount
Corridor length (kilometers)[a]	159
Land area in 400-meter[b]*-wide corridor (square kilometers)*[c]	64
Land ownership [square kilometers (percent)]	
Bureau of Land Management	32 (50)
Air Force	10 (15)
DOE	21 (35)
Private	None
Other	None
Disturbed land (square kilometers)	
Inside corridor	4.4
Outside corridor	0.6

a. To convert kilometers to miles, multiply by 0.62137.
b. 400 meters = about 0.25 mile.
c. To convert square kilometers to acres, multiply by 247.1.

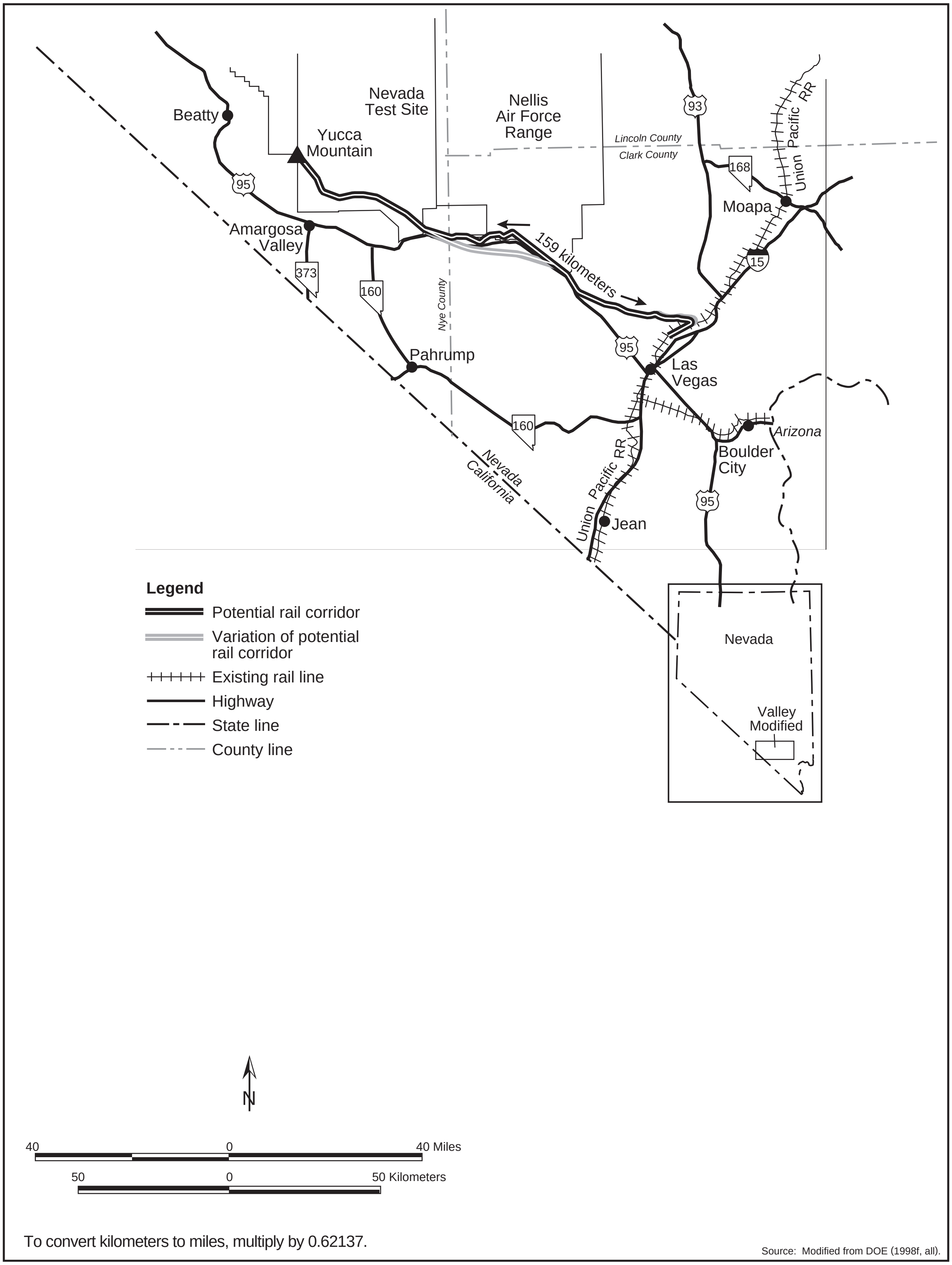


Figure 6-15. Valley Modified rail corridor.

The corridor also passes along the Las Vegas metropolitan area's northern boundary, in an area that is currently undergoing growth and where future commercial and residential growth might occur. However, metropolitan area growth might not extend to the corridor area until after the operations phase of the repository when there would no longer be a need for a branch rail line. The corridor also passes within about 1.6 kilometers (1 mile) of the Las Vegas Paiute Indian Reservation north of Las Vegas.

During the construction and operation and monitoring phases of the Proposed Action, there would be a potential for encroachment of the Valley Modified rail corridor by private interests. If encroachment occurred, conflicts could result as impediments to the full use of lands. Areas most likely for use by private interests are those currently designated for sale or transfer by the Bureau of Land Management.

If DOE decided to build and operate a branch rail line in the Valley Modified corridor, it would consult with the Bureau of Land Management, U.S. Air Force, other affected agencies, and other DOE program operations on the Nevada Test Site to help ensure that it avoided or mitigated potential land-use conflicts associated with alignment of a right-of-way.

Based on currently available information, DOE is not aware of any conflicts with existing or planned land uses that would occur as a result of construction of a branch rail line in the Valley Modified corridor. Although there are no known community development plans that would conflict with the rail line, the presence of a rail line could influence future development and land use along the railroad in the communities of Indian Springs and North Las Vegas (that is, zoning and land use might differ depending on the presence or absence of a railroad). Construction of a branch rail line within the Valley Modified corridor would require conversion of land within existing grazing allotments and wild horse or wild horse and burro management areas; however, because the railroad would be unlikely to interfere with animal movements, the functionality of these areas would not be affected.

Operations. Rail corridor operations would involve the same land-use and ownership considerations discussed above for construction. No unique impacts for operations were identified.

Air Quality

Construction. The Valley Modified rail corridor would involve construction in the Las Vegas Valley airshed, which is in nonattainment for particulate matter (PM_{10}) and carbon monoxide (FHWA 1996, pages 3-53 and 3-54). To assess nonradiological air quality impacts from branch line construction in this airshed, DOE reviewed the environmental impact statement that Clark County prepared for the construction of the Northern and Western Las Vegas Beltway project.

An evaluation of environmental impacts of the construction of the Las Vegas Beltway observed that Federal air quality conformity criteria require that "[t]he project must not cause or contribute to new violations and/or increase the severity of existing carbon monoxide and PM_{10} violations" (FHWA 1996, page 4-38). The EIS for the Las Vegas Beltway project commented that "the study area is largely undeveloped at this time. Carbon monoxide Urban Airshed Modeling by the Clark County Department of Comprehensive Planning has shown that the area substantially affected by the project has low existing ambient carbon monoxide concentration levels."

In relation to PM_{10}, the Clark County EIS states (FHWA 1996, page 4-38):

> *[t]he Clark County Health District, Air Pollution Control division has an extensive array of particulate matter and fugitive dust control and mitigation regulations. Transportation facility construction in the Las Vegas Valley must comply with these Health District requirements. The Tier 2 EIS will address those dust control and mitigation measures appropriate to the facility's design concept and scope. The Health District's PM_{10} emissions control measures will be included in the final plans, specifications and estimates for the development of a facility within the selected corridor.*

The total amount of land disturbed by the construction of a branch rail line in the Valley Modified corridor would be approximately the same as that disturbed by the construction of the Northern and Western Las Vegas Beltway. As a consequence, air quality impacts from branch rail line construction activities in the Las Vegas Valley airshed would be less than those for the beltway project. If DOE selected the Valley Modified corridor for the construction and operation of a branch rail line, the final plans, specifications, and estimates would include the Clark County Health District PM_{10} emissions control measures.

Operations. Fuel consumption by diesel train engines operating along the rail corridor would emit carbon monoxide, nitrogen dioxide, and particulate matter (PM_{10} and $PM_{2.5}$). Based on the Federal standards for locomotives (EPA 1997a, page 3), there would be no significant emissions of sulfur dioxide.

In attainment areas, the pollutant concentrations in the air would increase slightly during the passage of a train, but the emissions from one or two trains a day would not exceed the ambient air quality standards. However, the Valley Modified rail corridor would include a route through the Las Vegas Valley airshed, which is in nonattainment for carbon monoxide and PM_{10}. The air quality impacts to this airshed from train operation along the Valley Modified rail corridor would be a small contribution in comparison to the amount of pollutants emitted by automotive travel in the basin. Thus, emissions from train operations in the Las Vegas Valley airshed would not produce further violations of the ambient air quality standards.

Hydrology

Surface Water

Chapter 3, Section 3.2.2, notes that there are no surface-water resources along the Valley Modified corridor.

Groundwater

Construction. The water used during construction would come largely from groundwater resources. The annual demands would be a fraction of the perennial yields of most producing aquifers (Chapter 3, Section 3.2.2.1.3, discusses estimated perennial yields for the hydrographic areas over which the Valley Modified corridor passes).

The estimated amount of water needed for construction of a rail line in the Valley Modified corridor for soil compaction and dust control would be about 395,000 cubic meters (320 acre-feet) (LeFever 1998a, all). For planning purposes, DOE assumed that this water would come from 20 groundwater wells installed along the corridor. The average amount of water withdrawn from each well would be approximately 20,000 cubic meters (16 acre-feet). Chapter 3, Section 3.2.2.1.3, discusses the hydrographic areas over which the Valley Modified rail corridor would pass, their perennial yields, and whether the State of Nevada considers each a Designated Groundwater Basin. If the hydrographic area is a Designated Groundwater Basin, permitted groundwater rights approach or exceed the estimated perennial yield, depleting the basin and water resources or requiring additional administration. Table 6-45 summarizes the designation status of the hydrographic areas associated with the Valley Modified rail corridor and the approximate portion of the corridor that passes over Designated Groundwater Basins.

Table 6-45. Hydrographic areas along Valley Modified rail corridor.

	Designated Groundwater Basins	
Hydrographic areas	Number	Percent of corridor length
6	3	70

The withdrawal of 20,000 cubic meters (16 acre-feet) a year from a well would have little impact on the hydrographic areas associated with the corridor based on their perennial yields (Chapter 3, Section 3.2.2.1.3). However, the installation of 20 wells along the corridor would mean that hydrographic areas would have multiple wells. As indicated in Table 6-45, about 70 percent of the corridor length is over Designated Groundwater Basins, which the Nevada State Engineer's office watches carefully for groundwater depletion. This does not mean that DOE could not obtain water appropriations in these areas; the State Engineer would have the authority to approve such appropriations. Because the DOE requests would be for a short-term construction action, the State Engineer would have even more discretion. Rather than spacing the wells evenly along the corridor, DOE could use locations that would make maximum use of groundwater areas that are not Designated Groundwater Basins. With such a large portion of the corridor over these basins, however, this would mean trucking water for long distances. Another option would be to lease temporary water rights from individuals along the corridor. Obtaining a water appropriation from the State Engineer for short-term construction use or using an approved allocation should ensure that groundwater resources are not adversely affected.

As an alternative, DOE could transport water by truck to meet construction needs. The construction of a branch rail line in the Valley Modified corridor would require about 21,000 tanker-truck loads of water or about 20 truckloads each day. Again, water obtained from permitted sources, which would provide water in allocations determined by the Nevada State Engineer, would not affect groundwater resources.

Operations. Operations along a completed rail line would have little impact on groundwater resources. Possible changes in recharge, if any, would be the same as those at the completion of construction.

Biological Resources and Soils

Construction. The construction of a rail line in the Valley Modified corridor would disturb approximately 5 square kilometers (1,200 acres) of land (Table 6-44). This corridor passes through desert tortoise habitat along its entire length, so construction activities would disturb approximately 5 square kilometers of desert tortoise habitat. Construction activities could kill individual desert tortoises. However, desert tortoise abundance is low along this corridor (BLM 1992, Map 3-13; Rautenstrauch and O'Farrell 1998, pages 407 to 411) so losses would be few. Populations of two special status plant species occur along the corridor but could be avoided during land-clearing activities and should not be affected.

There is one herd management area but no designated game habitat along this corridor (TRW 1999k, page 3-29). Construction activities would reduce habitat in this area. Wild horses and burros near this area during construction would be disturbed and their migration routes could be disrupted.

No springs, perennial streams, or riparian areas occur along this corridor. The corridor crosses a number of ephemeral streams that may be classified as waters of the United States, although no formal delineations have been conducted (TRW 1999k, page 3-29). DOE would work with the U.S. Army Corps of Engineers to minimize impacts to these areas and would obtain individual or regional permits, if necessary.

Soils in and adjacent to the corridor would be disturbed on approximately 5 square kilometers (1,200 acres) of land during construction of the railroad. Impacts to 5 square kilometers (1,200 acres) of soils along the 159-kilometer (99-mile)-long corridor would be transitory and small.

Operations. Impacts from operations would include periodic disturbance of wildlife from passing trains and from personnel servicing the corridor. Trains probably would kill individuals of some species but losses would be unlikely to affect regional populations of any species. No additional habitat loss would occur during operations. Impacts to soils would be small.

Cultural Resources

Construction. Because no systematic field studies have been completed for any of the rail corridors, specific impacts to culturally important sites, areas, or resources cannot be determined at this time.

The Valley Modified corridor would pass by the Las Vegas Paiute Indian Reservation in the northeastern part of the Las Vegas Valley. The corridor would not affect identified cultural resources on the reservation. If construction activities identified sites or resources important to Native Americans in the future, either in or near a right-of-way, adverse effects could occur. DOE would consult with Native American officials to develop appropriate mitigations for such impacts.

Operations. No additional direct or indirect impacts on archeological and historic sites or to Native American resources, traditional cultural properties, or ethnic cultural values from rail operation have been identified.

Occupational and Public Health and Safety

Construction. Industrial safety impacts on workers from the construction and use of the Valley Modified branch rail line would be small (Table 6-46). The analysis evaluated the potential for impacts in terms of total reportable cases of injury, lost workday cases, and fatalities to workers from construction and operation activities. The analysis also evaluated traffic fatality impacts that would occur during the moving of equipment and materials for construction, worker commutes to and from construction sites, and transport of water to construction sites if wells were not available (Table 6-47).

Operations. Incident-free radiological impacts would occur during the routine transportation of spent nuclear fuel and high-level radioactive waste in the Valley Modified rail corridor. Table 6-48 lists the incident-free impacts, which include transportation along the Valley Modified corridor and along railways in Nevada leading to a Valley Modified branch line. The table includes the impacts of 2,600 legal-weight truck shipments from commercial sites that do not have the capability to load rail casks.

Table 6-46. Impacts to workers from industrial hazards during rail construction and operations for the Valley Modified corridor.

Group and industrial hazard category	Construction[a]	Operations[b]
Involved worker		
Total recordable cases[c]	32	95
Lost workday cases	16	52
Fatalities	0.3	0.2
Noninvolved worker		
Total recordable cases	2	4
Lost workday cases	1	2
Fatalities	0	0
Totals		
Total recordable cases	34	99
Lost workday cases	17	54
Fatalities	0.3	0.2

a. Totals for 2.5 years for construction.
b. Totals for 24 years for operations.
c. Total recordable cases includes injuries and illness.

Table 6-47. Estimated number of fatalities from construction material delivery vehicles and construction and operations worker commuting traffic for the Valley Modified rail corridor.

Activity	Kilometers[a]	Traffic fatalities	Emissions fatalities
Construction[b]			
Material delivery vehicles	7,000,000	0.1	0.00054
Commuting workers	24,000,000	0.3	0.0017
Subtotals	*31,000,000*	*0.4*	*0.0022*
Operations[c]			
Commuting workers	52,000,000	0.5	0.004
Totals	***84,000,000***	***0.9***	***0.006***

a. To convert kilometers to miles, multiply by 0.62137.
b. Totals for 2.5 years for construction.
c. Totals for 24 years for operations.

Table 6-48. Health impacts from incident-free Nevada transportation for the Valley Modified corridor implementing alternative.[a]

Category	Legal-weight truck shipments	Rail shipments	Totals[b]
Involved workers			
Collective dose (person-rem)	220	160	380
Estimated latent cancer fatalities	0.09	0.06	0.15
Public			
Collective dose (person-rem)	270	110	380
Estimated latent cancer fatalities	0.13	0.06	0.19
Estimated vehicle emission-related fatalities	0.00014	0.0017	0.0018

a. Impacts are totals for 24 years (2010 to 2033).
b. Totals might differ from sums of values due to rounding.

Socioeconomics

Construction. There would be socioeconomic impacts associated with the construction of a branch rail line in the Valley Modified corridor. The length of the corridor, 159 kilometers (98 miles), determines the number of workers that would be required. The construction of a branch rail line in this corridor would require 160 workers and 2 construction camps (DOE 1999d, Rail Files, Item 1).

DOE anticipates that the total direct and indirect construction employment would peak in 2007 at about 335. Population increases in Nevada would be likely to peak two years later in 2009. The estimated peak increase attributed to building a Valley Modified branch rail line would be about 240. Real disposable income, Gross Regional Product, and State and local government expenditures would also rise. The expected changes for the Valley Modified corridor would be increases of about $8.1 million in real disposable income, $13.9 million in Gross National Product, and $600,000 in State and local expenditures. (All dollar values reported in this section are in 1992 constant dollars unless otherwise stated.)

The impacts to employment, population, real disposable income, Gross Regional Product, and State and local government expenditures for building a branch rail line in the Valley Modified corridor would be low for the affected counties.

Operations. Estimated employment for operation of a Valley Modified branch rail line would be 36. Total estimated direct and indirect employment from these operations would be about 57 at its peak.

Estimated real disposable income increase attributable to operations would be greatest in 2033, the last year of operation, and would be about $2.4 million. The increase in Gross Regional Product in 2029, when impacts would be greatest in comparison to the baseline, would be about $5.4 million. Annual State and local government expenditures would be lower than those reported above for construction.

The impacts to employment, population, real disposable income, gross regional product, and State and local government expenditures from operating a Valley Modified branch rail line would be low for the affected counties.

Noise

Because of the large population in the Las Vegas Valley, this corridor would have a potential for noise impacts in the region north of Las Vegas, particularly as urban growth moves in that direction. In addition, Indian Springs could receive noise impacts from this option.

Utilities, Energy, and Materials

Table 6-49 lists the use of fossil fuels and other materials in the construction of a Valley Modified branch rail line.

Table 6-49. Construction utilities, energy, and materials for a Valley Modified branch rail line.

Route	Length (kilometers)[a]	Diesel fuel use (million liters)[b]	Gasoline use (thousand liters)	Steel (thousand metric tons)[c]	Concrete (thousand metric tons)
Valley Modified	159	13	270	22	130

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. To convert metric tons to tons, multiply by 1.1023.

6.3.3 IMPACTS OF NEVADA HEAVY-HAUL TRUCK TRANSPORTATION IMPLEMENTING ALTERNATIVES

This section describes the analysis of human health and safety and environmental impacts for five implementing alternatives that would employ heavy-haul trucks to transport rail shipping casks containing spent nuclear fuel and high-level radioactive waste in Nevada. DOE has identified five highway routes in Nevada for potential use by the heavy-haul trucks to transport the casks. The casks would be transported to the repository from an intermodal transfer station along a mainline railroad where they would be loaded onto the heavy-haul trucks from railcars. The trucks would also transport empty casks from the repository back to the intermodal transfer station for loading back onto railcars. DOE would locate an intermodal transfer station at one of three potential locations in Nevada near existing rail lines and highways: (1) near Caliente, (2) northeast of Las Vegas (Apex/Dry Lake), or (3) southwest of Las Vegas (Sloan/Jean). Caliente is the originating location for three of the routes that heavy-haul trucks could use to ship spent nuclear fuel and high-level radioactive waste to the repository. There is one potential route each associated with the Apex/Dry Lake and Sloan/Jean locations (Figure 6-16).

For convenience and as shown in the figure, the five highway routes have been named the Caliente, Caliente-Chalk Mountain, Caliente-Las Vegas, Apex/Dry Lake, and Sloan/Jean routes. DOE considers these routes to be feasible for heavy-haul trucks to use in transporting large rail casks to and from the repository. The routes were compiled from a selection of highways in Nevada that the State has designated for use by heavy-haul trucks (TRW 1999d, Request #046). They include highways that were identified in a study by the College of Engineering at the University of Nevada, Reno, for the Nevada Department of Transportation (Ardila-Coulson 1989, all). This study provided a “preliminary identification of Nevada highway routes that could be used to transport current shipments of Highway Route-Controlled Quantities of Radioactive Materials and high-level radioactive waste.” They also include highways studied by the Transportation Research Center at the University of Nevada, Las Vegas, that characterized “rail and highway routes which may be used for shipments of high-level nuclear waste to a proposed repository at Yucca Mountain, Nevada” (Souleyrette, Sathisan, and di Bartolo 1991, all).

This section evaluates impacts in Nevada for each route and associated intermodal transfer station. The evaluation addresses (1) upgrading highways to accommodate frequent heavy-haul truck shipments, (2) constructing and operating an intermodal transfer station, and (3) making heavy-haul truck shipments. With the exception of Interstate System Highways, upgrades to existing Nevada highways would be necessary to accommodate the heavy-haul trucks.

The analysis of impacts for each of the five Nevada heavy-haul truck implementing alternatives assumed the national mostly rail transportation scenario. Therefore, the analysis included the impacts of legal-weight truck transportation from nine commercial generators that do not have the capability to handle or

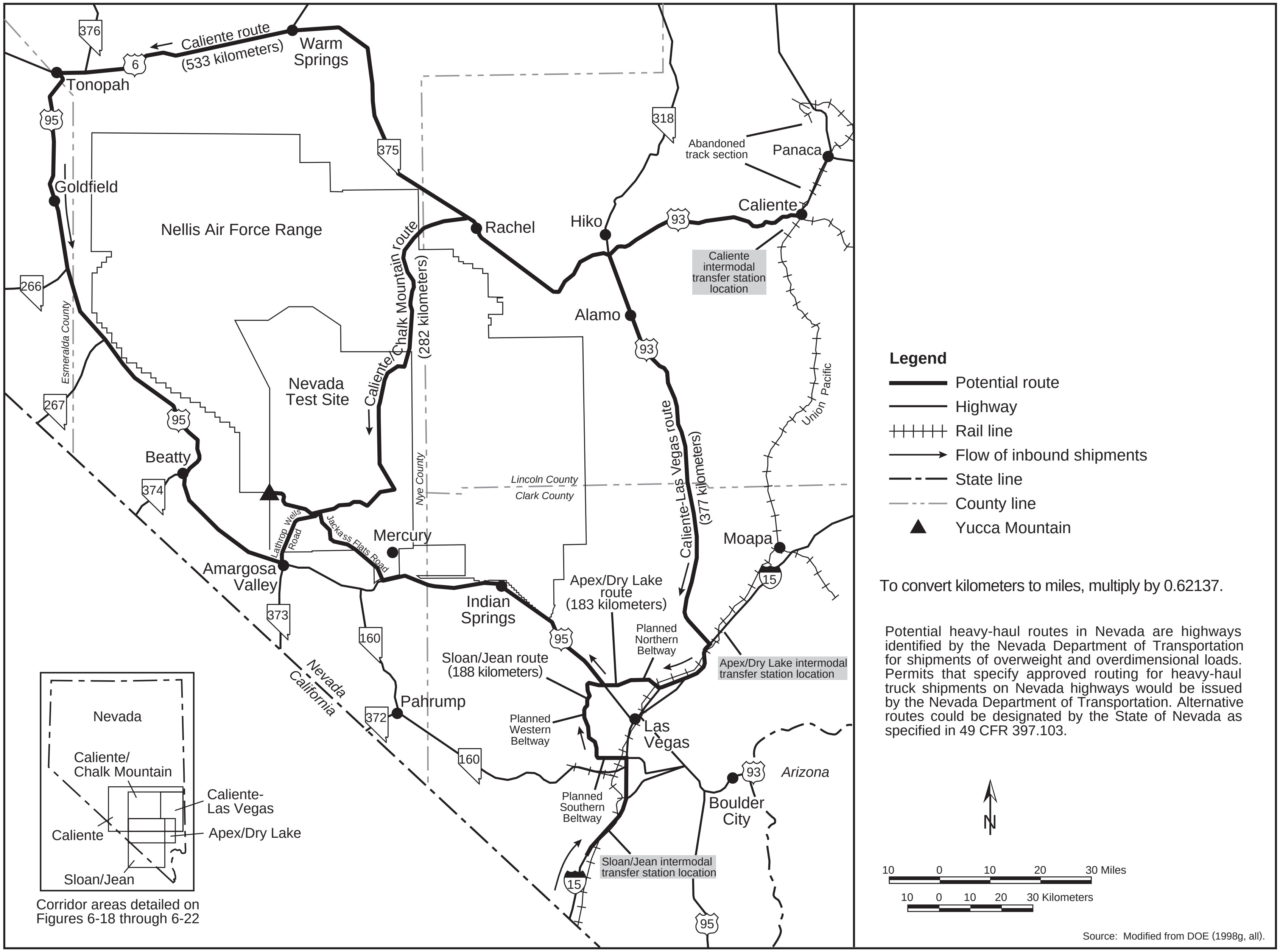


Figure 6-16. Potential routes in Nevada for heavy-haul trucks.

load a large rail cask. About 2,600 legal-weight truck shipments would enter Nevada and travel to the repository. These trucks would use the same transport routes and carry about the same amounts of spent nuclear fuel per shipment as those for the mostly legal-weight truck scenario discussed in Section 6.3.1.

The analysis evaluates impacts for the following environmental resource areas: land use and ownership; air quality; hydrology; biological resources and soils; cultural resources; occupational and public health and safety; socioeconomics; noise; aesthetics; utilities, energy, and materials; and waste management.

Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

6.3.3.1 Impacts Common to Nevada Heavy-Haul Truck Implementing Alternatives

Nevada highways upgraded for heavy-haul truck use would allow routine, safe use in year-round operations. Upgrades would include reconstruction of some highway sections, especially in areas where spring and fall thaws and freezes make the highways susceptible to damage by heavy vehicles (frost-restricted areas). In addition, new turnout lanes at frequent intervals along two-lane highways would allow other traffic to pass the slower heavy-haul vehicles. Highway shoulders would be widened and road surfaces would be improved in many areas. Interstate highways would not be improved because they already meet standards that upgrades to other Nevada highways for heavy-haul truck shipments would follow.

Even with the highway upgrades, heavy-haul trucks would cause delays for other vehicles because of their size and slower travel speeds. On most of the highways in Nevada that heavy-haul shipments would use, traffic volumes are classified as *level of service Class A* (DOE 1998m, page 3-11), which means that traffic flows freely without delay (see Chapter 3, Section 3.2.2.2.11, for a description of all levels of service). The addition of 11 one-way trips each week to the traffic flow on these highways would not lead to a change in the average level of service. However, some traffic in lanes traveling with the vehicles would experience delays and short queues could form between turnout areas. In congested areas, such as the Las Vegas metropolitan area, where the level of service for the planned Las Vegas Beltway could be Class C or lower during non-rush-hour times, large slow-moving vehicles with their accompanying escort vehicles could present a temporary but large obstruction to traffic flow. Because disruptions on congested highways often continue after the removal of the cause, the duration of a traffic flow disruption would be longer than the time the vehicle would travel on the highway.

An intermodal transfer station would be common to all five heavy-haul truck implementing alternatives. Figure 6-17 shows the locations in Nevada that DOE is considering for such a station. Station construction would take about 1.5 years. The station would be a fenced area of about 250 by 250 meters (820 by 820 feet) and a rail siding that would be about 2 kilometers (1.25 miles) long. The estimated total area occupied by the facility and support areas would be 200,000 square meters (50 acres). It would

INTERMODAL TRANSFER STATION AND NAVAL SPENT NUCLEAR FUEL

Under the mostly legal-weight truck scenario, DOE would use the services of a commercial intermodal operator for the transfer of naval spent nuclear fuel shipments. This EIS assumed that DOE would not build an intermodal transfer station to handle those shipments. Because only 300 naval spent nuclear fuel casks would arrive in Nevada by rail over 24 years, the impacts of intermodal transfer operations would be considerably less than those for the mostly rail scenario. On average, the intermodal transfers would occur for about 2 weeks every 5 months to remove five casks from each train shipment. A staff of 20 would work only during these rail shipments.

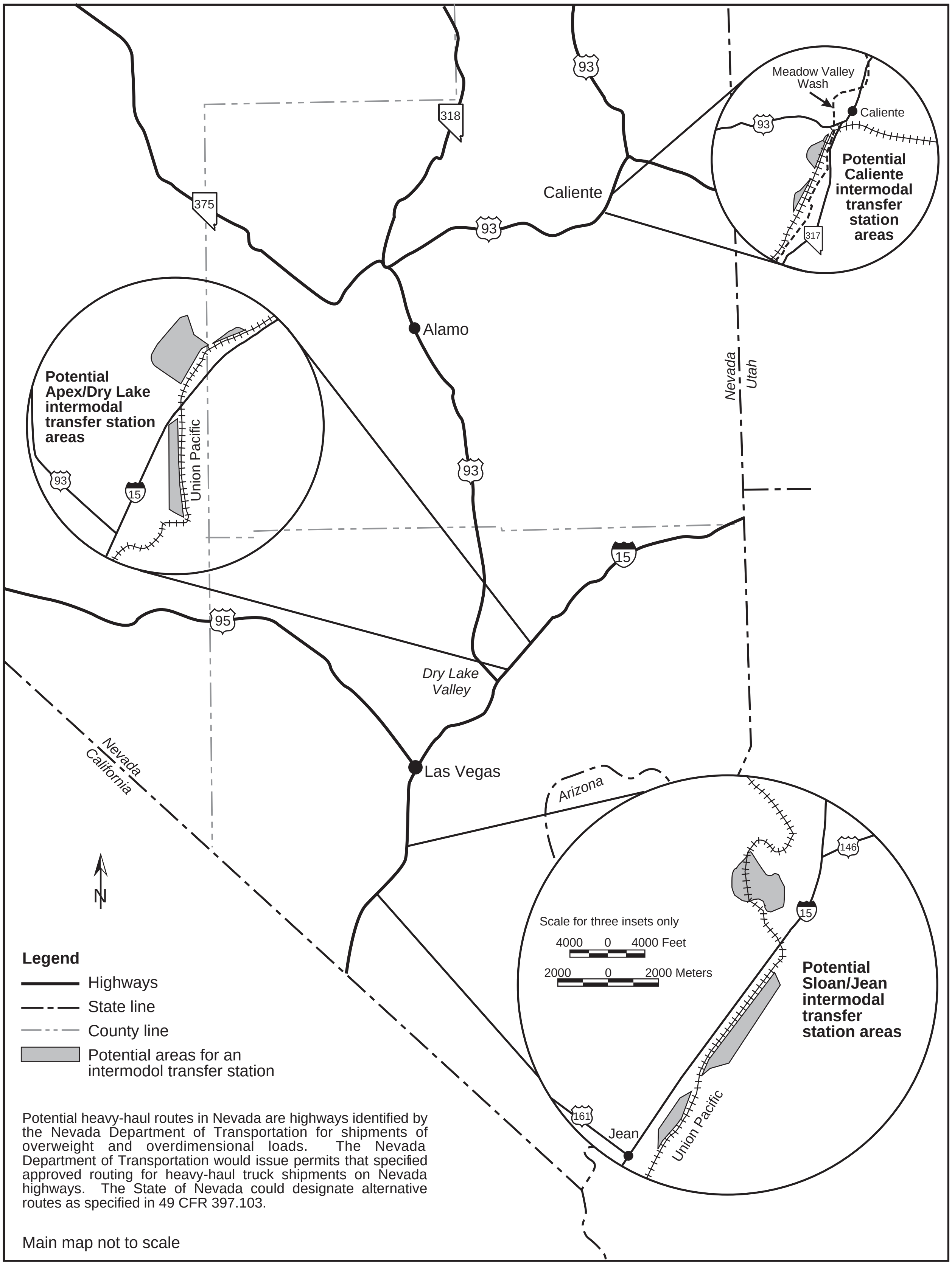


Figure 6-17. Potential locations for an intermodal transfer station.

include rail tracks, two shipping cask transfer cranes (one on a gantry rail and a backup rubber-tired vehicle), an office building, and a maintenance and security building. It would also have connecting tracks to an existing mainline railroad and storage and transfer tracks inside the station boundary. The maintenance building would provide space for routine service and minor repairs to the heavy-haul trailers and tractors. The station would have power, water, and other services. Diesel generators would provide a backup electric power source. The station would have the capacity to allow an intermodal transfer rate of 22 rail casks a week (11 loaded casks to the repository, 11 empty casks returned to the commercial and DOE sites).

Operations at an intermodal transfer station would include switching railcars carrying spent nuclear fuel and high-level radioactive waste casks from mainline railroad trains to the station's side track; queuing railcars on the side track for movement to the intermodal transfer area; moving railcars carrying loaded casks from the side track into position to transfer the casks to heavy-haul trucks; and using the facility crane to transfer loaded casks from railcars to heavy-haul trucks. The station would reverse this sequence of operations for empty casks returning from the repository.

This section discusses impacts for the analysis areas that would be common to all five heavy-haul truck implementing alternatives. It includes impacts for upgrading Nevada highways for use by heavy-haul trucks, constructing and operating an intermodal transfer station, and heavy-haul truck transportation of shipping casks, both loaded and empty. DOE evaluated these impacts as described in Section 6.3. Section 6.3.3.2 discusses impacts that would be unique to each heavy-haul truck transportation implementing alternative.

Land Use and Ownership

Highway Construction. With the exception of about 2 kilometers (1.2 miles) of new highway near Beatty, Nevada, for the Caliente route, upgrades to Nevada highways for use by heavy-haul trucks would involve improvements to existing roads and bridges. Areas disturbed by these activities would be adjacent to existing highway rights-of-way. Therefore, land disturbance would be limited to widening existing road shoulders by about 2 meters (6.6 feet), adding truck-lane pull-outs at intervals along the route, and increasing the height of overpasses. Borrow material (earth, gravel, and rock) to perform the initial upgrades would come largely from existing Nevada Department of Transportation facilities. Except for highways on the Nellis Air Force Range or Nevada Test Site, that Department would direct the highway improvements.

Intermodal Transfer Station Construction. Land-use impacts from an intermodal transfer station would center around the station because the railroad lines and the highways that DOE would use already exist and their intended use would not change. The construction of an intermodal transfer station would change the land uses and organizational control of about 0.2 square kilometer (50 acres) of property. This land would become the responsibility of DOE or possibly a transportation operating company. The rail line and station fencing could create barriers to wildlife and public access.

Heavy-Haul Truck and Intermodal Transfer Station Operations. Intermodal transfer station operations (arriving and departing trains, arriving and departing heavy-haul trucks, intermodal transfers, and maintenance and inspection activities) would be confined to the same areas that were disturbed during construction, so no additional disturbance would take place. Other land-use conflicts during the operation of an intermodal transfer station would be associated with fences that could create barriers to the movement of livestock and wildlife. Such restrictions would occur for any of the areas evaluated.

Only limited land-use impacts would result from heavy-haul truck operations on Nevada highways. Erosion along these highways would be managed as it is now. Because additional road construction would not be needed, additional land and soil disturbance would not occur.

Other land-use and ownership impacts differ among the implementing alternatives. These impacts are described in Section 6.3.3.2.

Air Quality

Highway Construction. Fuel consumption during construction activities would result in releases of criteria pollutants [carbon monoxide, nitrogen dioxide, sulfur dioxide, and particulate matter (PM_{10} and $PM_{2.5}$). Construction activities would also release particulate matter in the form of fugitive dust from such activities as excavation and truck traffic. Most of the road upgrades would occur in areas that are in attainment for all criteria pollutants. Road upgrade activities along the routes selected for heavy-haul truck use (including construction of a midroute stopover for routes originating in Caliente) would increase pollutant concentrations in the areas near the upgrade. However, because construction would be a moving source along various portions of the route, emissions would be transient and spread over a very large area.

Intermodal Transfer Station Construction. Table 6-50 lists estimated annual emissions from the construction of an intermodal transfer station. These estimates would apply to each of the three potential site areas. During station construction, fuel use by heavy equipment would emit carbon monoxide, nitrogen dioxide, sulfur dioxide, PM_{10}, and $PM_{2.5}$. Excavation and truck traffic would result in releases of particulate matter in the form of fugitive dust. The amount of fugitive dust would depend on the amount of disturbed land. Building the intermodal transfer station would disturb about 0.2 square kilometer (50 acres). The analysis assumed that construction activities would affect only 10 percent of the total disturbed land area at any time.

Table 6-50. Annual criteria pollutant releases from construction of an intermodal transfer station (kilograms per year).[a]

Pollutant	Construction emission (annual)	GCR[b] emission threshold	Percent of GCR emission threshold
Nitrogen dioxide	3,400	NA[c]	NA
Sulfur dioxide	320	NA	NA
Carbon monoxide	2,100	91,000	2.3
PM_{10}	31,000	64,000 (serious)	48

a. To convert kilograms to tons, multiply by 0.00110023.
b. GCR = General Conformity Rule (40 CFR 93). Applies for releases of pollutants in areas in nonattainment.
c. NA = not applicable.

Table 6-50 lists the percentage of each pollutant in relation to the General Conformity Rule emission threshold. The estimated annual releases from the construction of the intermodal transfer station would be 48 percent of the General Conformity Rule emission threshold (see 40 CFR 93) for PM_{10} and 2.3 percent for carbon monoxide.

Ozone would not be directly released during the construction of the intermodal transfer station. However, ozone precursors (nitrogen dioxide and volatile organic carbon compounds) would be released due to fuel use by construction equipment. The estimated annual emission rates of nitrogen dioxide and volatile organic carbon compounds would be small (40 CFR 52.21). The construction of the intermodal transfer facility, therefore, would not be a significant source of ozone.

Heavy-Haul Truck and Intermodal Transfer Station Operations. Fuel use by heavy-haul trucks would result in emissions of carbon monoxide, nitrogen dioxide, and PM_{10}. Based on the Federal standards for heavy-duty trucks (EPA 1997b, pages E-1 to E-3), emission of sulfur dioxide is not of concern. In attainment areas, the pollutant concentration in the area around the route would increase slightly during the passage of the trucks but would not exceed the standards.

Table 6-51 lists estimated annual emissions from the operation of an intermodal transfer station. These estimates would apply to each location. The station would emit carbon monoxide, nitrogen dioxide, and PM_{10} from the operation of a yard locomotive. Based on Federal standards for locomotives (EPA 1997b, page 73), emissions of sulfur dioxide are not included among emissions of greatest concern.

Table 6-51. Annual emissions of criteria pollutants from operation of an intermodal transfer station over 24 years (kilograms per year).[a]

Pollutant	Operation[b] emissions (annual)	PSD limit[c]	Percent of PSD limit	GCR[d] emission threshold	Percent of GCR emission threshold
Nitrogen dioxide	34,000	230,000	15	NA[e]	NA
Sulfur dioxide	(f)	230,000	(f)	NA	NA
Carbon monoxide	8,600	230,000	3.8	91,000	9.4
Particulate matter (PM_{10})	980	230,000	0.43	64,000	1.5

a. To convert kilograms to tons, multiply by 0.0011023.
b. Operations emissions from a switchyard locomotive and heavy-haul trucks.
c. PSD limit = Prevention of Signification Deterioration definition of a major stationary source (40 CFR 52.21); applies for releases of criteria pollutants during operation.
d. GCR = General Conformity Rule (40 CFR Part 93); applies for releases of pollutants in areas in nonattainment.
e. NA = not applicable.
f. Sulfur dioxide from locomotives is not included among emission constituents of greatest concern (EPA 1997b, page 73).

The estimated annual releases for the operation of the intermodal transfer station would be about 15 percent or less of the definition of a major stationary source (see Chapter 3, Section 3.1.2.1, or 40 CFR 52.21). The operation of a midroute stopover would result only in small releases of pollutants.

The operation of a yard locomotive would not emit ozone directly, but would emit ozone precursors (nitrogen dioxide and hydrocarbons). The estimated annual releases of the ozone precursors would be small; nitrogen dioxide would be about 15 percent of a major stationary source. Therefore, DOE does not expect the operation of the intermodal transfer facility to be a significant source of ozone.

Because the shipping casks would not be opened, there would be no radiological air quality impacts from normal operations at an intermodal transfer station.

Other air quality impacts would differ among the implementing alternatives (see Section 6.3.3.2).

Hydrology

This section describes impacts common to the five heavy-haul truck implementing alternatives (including upgrades to Nevada highways and construction of a midroute stopover and an intermodal transfer station at one of three locations) for surface water and groundwater.

Surface Water

Highway Construction. For road improvement work and construction of a midroute stopover, a contractor could place fuel tank trucks or trailers along the route to support equipment operations. Such a practice would present some potential for spills and releases. As long as the contractor met the regulatory requirements for reporting and remediating spills and properly disposing of or recycling used materials, the probability of unrecovered spills due to negligence or improper work practices would be low. If a release occurred, the potential for chemical contaminants (principally petroleum products) to enter flowing surface water before cleanup would be the largest risk.

A portable asphalt plant to support roadway improvement work would be located along the paving area. Aggregate crushing plants would be located in borrow areas. DOE assumes that the borrow areas would be those normally used by the Nevada Department of Transportation. Spills and releases of asphalt materials, which are predominantly petroleum products but include chemical additives, could occur in the course of operating an asphalt plant. Spill reporting and remediation requirements would be in place for these operations, as described above. Once asphalt was in place, it would be susceptible to minor leaching or bleeding while it cured, similar to the leaching or bleeding that occurs during road construction for other highway projects.

Intermodal Transfer Station Construction. Potential impacts to surface water would include (1) the possible spread of contamination by precipitation, intermittent runoff events, or, where present, releases to flowing water in the single perennial stream, and (2) the alteration of natural drainage patterns or runoff rates that could affect downgradient resources.

Materials that could contaminate surface water would be present during construction; these would consist primarily of petroleum products (fuels and lubricants) and coolants (antifreeze) to support equipment operations. There would not be much bulk storage of these materials. Fuel for vehicles would be purchased from nearby commercial vendors. Minor amounts of building materials such as paints, solvents, and thinners could be present during construction.

The construction of an intermodal transfer station would include stormwater runoff control, as necessary; the completed station would have a stormwater detention basin. These measures would minimize the potential for contaminated runoff to reach a stream.

Appendix L contains a floodplain/wetlands assessment that examines the effects of highway route construction, operation, and maintenance on the following floodplains in the vicinity of Yucca Mountain: Fortymile Wash, Busted Butte Wash, Drill Hole Wash, and Midway Valley Wash. There are no delineated wetlands at Yucca Mountain.

If DOE selected heavy-haul trucks to transport spent nuclear fuel and high-level radioactive waste to the Yucca Mountain site, it would also select one of five routes (Figure 6-16) and one of three alternative intermodal transfer station sites (Figure 3-17). DOE would then prepare a more detailed floodplain/wetlands assessment of the selected alternatives. The assessment in Appendix L presents a comparison of what is known about the floodplains, springs, and riparian areas along the five alternative routes for heavy-haul trucks and at the three alternative intermodal transfer station sites. In general, wetlands have not been delineated along the alternative highway routes or at the three alternative intermodal transfer station sites.

Heavy-Haul Truck and Intermodal Transfer Station Operations. Surface-water impacts during operations would be limited to those from maintaining and resurfacing highways and parking areas at a midroute stopover that the heavy-haul trucks would use. As discussed above, good construction practices overseen by the Nevada Department of Transportation would limit impacts that could result from spills of chemical contaminants in the course of highway maintenance and resurfacing activities. Contamination of surface water caused by contaminants leached from new asphalt would be similar to that which occurs in the periodic resurfacing of asphalt highways.

Operations at a completed intermodal transfer station would have little impact on surface waters beyond any permanent drainage alterations that occurred during construction. The station area runoff rates would differ from those of the natural or existing terrain but, given the relatively small size [0.2 square kilometer (50 acres)] of the potentially affected area, they would add little to overall runoff quantities for the area.

The general design criteria for a station would consider the potential for a 100-year flood. Because the spent nuclear fuel and high-level radioactive waste shipping casks would not be opened or otherwise disassembled, the use of industrial design standards for this facility would be appropriate. The analysis assumes that the station would have a diesel-powered generator to provide standby electric power and an associated diesel storage tank. The diesel tank would present a minor potential for spills and releases. Runoff retention areas would limit impacts of potential oil and diesel spills in parking areas.

Groundwater

Highway Construction. For highway upgrades, the most likely impacts would be changes to infiltration rates and new sources of contamination that could migrate to groundwater during construction. In this case, however, the potential for impacts would be small due to the relatively small areas affected by upgrading and the fact that highway construction [with the exception of 2 kilometers (1.2 miles) of new highway near Beatty, Nevada, and a midroute stopover], would be a modification of existing roadways. In addition, there would be no large sources of contamination.

Construction activities would disturb and loosen the ground, which could produce greater infiltration rates. However, this impact would be minor and short-lived as contractors completed their work and stabilized the disturbed areas.

Intermodal Transfer Station Construction. Construction activities for an intermodal transfer station would disturb and loosen the ground for some time, which could cause higher infiltration rates. However, this impact would be minor and short-lived as contractors completed the facility and stabilized the disturbed areas.

Water needs for construction would be met by trucking water to the site, installing a well (which would also be used for operations), or possibly by connection to a local water distribution system. In any case, water demand would be small for construction.

Heavy-Haul Truck and Intermodal Transfer Station Operations. The use of highways by heavy-haul trucks would have little impact on groundwater resources. There would be no continued need for water along the route, and there would be no changes to recharge beyond those at the completion of construction.

The operation of a completed midroute stopover and an intermodal transfer station would have little impact on groundwater. Infiltration rates would be as described above for the completion of construction; the relatively small size of the facilities would minimize changes. Potential sources of contamination at the intermodal transfer station would consist primarily of a diesel fuel tank for the standby generator and heavy equipment. Water demand at the station and the midroute stopover would be small, consisting primarily of the needs of the operators, and would be obtained by the methods described above for construction. This demand would cause no noticeable change in water consumption rates for the area.

Other impacts to hydrology would differ among the implementing alternatives, as described in Section 6.3.3.2.

Biological Resources and Soils

Highway Construction. Highway upgrade activities would involve improving existing road surfaces and possibly building a bridge near Beatty, Nevada (Caliente route), a midroute stopover (Caliente routes), and about 2 kilometers (1.2 miles) of new highway to handle heavier vehicles (TRW 1999d, Request #048). Areas disturbed by these activities would be in, adjacent to, or near existing rights-of-way. These areas would consist of habitats previously degraded by human activities, which would limit impacts associated with the routes. Slight alterations of habitat immediately adjacent to existing roads would have only small impacts on desert tortoises because work would occur in the existing right-of-way. Tortoise populations are depleted for more than a kilometer on either side of roads having average daily traffic greater than 180 vehicles (Bury and Germano 1984, pages 57 to 72). The modification of bridges and culverts over perennial streams, if necessary, could temporarily disrupt stream flow and increase sedimentation in downstream aquatic environments. DOE anticipates that preconstruction surveys of potentially disturbed areas would identify and locate sensitive biological resources and best management practices would minimize the impacts of highway upgrades.

All of the heavy-haul truck implementing alternatives cross perennial or ephemeral streams that may be classified as jurisdictional waters of the Unites States. Discharge of dredged or fill material into those waters is regulated under Section 404 of the Clean Water Act. After the selection of a heavy-haul truck implementing alternative, if requested, DOE would assist the Nevada Department of Transportation to identify any jurisdictional waters of the United States that highway upgrades would affect; develop a plan to avoid when possible, and otherwise minimize, impacts to those waters; and obtain, as appropriate, an individual or regional permit from the U.S. Army Corps of Engineers for the discharge of dredged or fill material. By implementing the mitigation plan and complying with other permit requirements, the Nevada Department of Transportation would ensure that impacts to wetlands and other waters of the United States would be small.

The primary soil impacts from improvements to highways would be land disturbance. Road improvements would consist of widening existing roadways, constructing turnouts and truck lanes at designated stretches along the routes, and improving existing intersections. Water would be applied during construction to suppress dust and compact the soil; this would reduce the potential for erosion. Drainage control along the route probably would remain as it is now. These combined measures would minimize the potential for adverse impacts to soils.

Intermodal Transfer Station Construction. The biological settings of the three potential sites for an intermodal transfer station differ; Section 6.3.3.2 addresses impacts for each of the Nevada heavy-haul transportation implementing alternatives.

Soil impacts from the construction of an intermodal transfer station would arise primarily from the direct impacts of land disturbance and would apply to each station site and route. Table 3-41 lists estimates of land area required for an intermodal transfer station. The disturbed areas probably would be subject to increased erosion for at least some of the construction phase. Water would be applied during construction to suppress dust and compact the soil; this would reduce the potential for erosion. At the beginning of station construction, the topsoil would be stripped and stockpiled; during construction, temporary erosion control systems would minimize erosion impacts. At the completion of construction, the topsoil would be replaced over areas not used for station facilities, the area disturbed surrounding the station would be revegetated, and other permanent erosion control systems would be installed as appropriate.

Heavy-Haul Truck and Intermodal Transfer Station Operations. Impacts to biological resources from operations along any of the five possible routes would be very small. Because existing roadways would not be greatly altered, operations and maintenance would not lead to additional habitat losses. Heavy-haul truck operations could kill individuals of some species, but losses would be unlikely to have a detectable impacts on the regional population of any species and would be small in comparison to losses caused due to other traffic on the highways. Passing trucks could disrupt wildlife, but such effects would be transitory. The use of an upgraded highway would have only a small impact on soils.

Impacts to biological resources from operations at an intermodal transfer station and a midroute stopover would be very small. Operations would not lead to additional habitat losses. Individuals of some species could be disturbed or killed by human activities at the station and stopover, but such losses would be unlikely to have a detectable impacts on the regional population of any species.

The use of a completed intermodal transfer station and midroute stopover should have only small impacts on soils. The station and stopover would be maintained throughout the operations period, including the repair of erosion damage to the grounds around the station and the rail siding.

Other impacts to biological resources would differ among the heavy-haul truck implementing alternatives, as described in Section 6.3.3.2.

Cultural Resources

Highway and Intermodal Transfer Station Construction. Impacts could occur, primarily from surface-disturbing activities, to archaeological, historic, and traditional Native American cultural sites from upgrading highways, constructing a midroute stopover, and building an intermodal transfer station. Limited cultural resource inventories have been performed along the potential routes, and no systematic ethnographic field studies have been completed near the potential sites for an intermodal transfer station.

For example, there are four known archaeological sites near each of the Caliente and the Apex/Dry Lake intermodal station locations; none of these eight sites has been evaluated for eligibility for the *National Register of Historic Places*.

Therefore, specific impacts to culturally important sites, areas, or resources cannot be determined at this time. For the selected route and intermodal transfer station location, the Nevada Department of Transportation and DOE would perform specific archaeological surveys for proposed ground-disturbing activities. Such studies would occur during the development of the engineering design and before highway improvements or station construction began.

Heavy-Haul Truck and Intermodal Transfer Station Operations. No additional direct or indirect impacts would be likely to archaeological and historic sites from the operation of an intermodal transfer station or along highways from operations of heavy-haul trucks. Nonetheless, and although existing highways would be used, Native Americans have expressed great concern about the transport of spent nuclear fuel and high-level radioactive waste through tribal lands and through the larger region that comprises their traditional holy lands (AIWS 1998, all). Use of the Caliente-Las Vegas, Apex/Dry Lake, or Sloan/Jean route would include travel on U.S. 95 across a 1.6-kilometer (1-mile) section of the Las Vegas Paiute Indian Reservation. The Caliente-Las Vegas and Apex/Dry Lake routes pass near the Moapa Indian Reservation.

There are no known cultural resource impacts unique to any of the implementing alternatives.

Occupational and Public Health and Safety

Highway Construction. Approximately 2 traffic-related fatalities could occur among workers and members of the public during the upgrading of Nevada highways for heavy-haul truck use. There would be no other common impacts for highway construction under any of the implementing alternatives. Section 6.3.3.2 describes impacts for the implementing alternatives. The construction of a midroute stopover for routes originating in Caliente would not add much to the impacts of highway construction discussed in Section 6.3.3.2.

Intermodal Transfer Station Construction. Impacts to workers from industrial hazards during the construction of an intermodal transfer station would be the same for all three possible locations. These impacts would be small (see Table 6-52). The analysis estimated impacts to workers in terms of total recordable cases of injury or illness, lost workday cases, and fatalities to workers. In addition, it estimated that there would be less than 1 (0.01) construction and construction workforce traffic-related fatality.

Heavy-Haul Truck and Intermodal Transfer Station Operations. Section 6.3.3.2 discusses impacts for heavy-haul truck transportation and operations for each of the heavy-haul truck implementing alternatives. Common impacts for intermodal transfer station operations would include those to workers from industrial hazards and exposure to ionizing radiation (radiological impacts). DOE has determined that, because worker exposures to hazardous or toxic materials would be unlikely, workers at the station would incur no impacts from such materials. Table 6-53 lists potential impacts to workers from industrial hazards. In addition, there would be less than one (0.5) traffic-related fatality involving intermodal transfer station workers during operations.

Table 6-52. Health impacts to workers from industrial hazards during construction of an intermodal transfer station.

Group	Total recordable cases[a]	Lost workday cases	Fatalities
Involved	4	2	0.01
Noninvolved[b]	0.3	0.1	0
Totals[c]	**4.3**	**2.1**	**0.01**

a. Total recordable cases includes injuries and illness.
b. Noninvolved worker impacts based on 25 percent of the involved worker level of effort.
c. Impacts are totals for 1.5 years.

Table 6-53. Health impacts to workers from industrial hazards during operation of an intermodal transfer station.

Group	Total recordable cases[a]	Lost workday cases	Fatalities
Involved	69	37	0.1
Noninvolved[b]	3.1	1.0	0
Totals[c]	**72**	**38**	**0.1**

a. Total recordable cases includes injuries and illness.
b. Noninvolved worker impacts based on 25 percent of the involved worker level of effort.
c. Totals for 24 years of operations.

Intermodal transfer station workers would be exposed to direct radiation from the shipping casks the station would handle. Involved worker exposures would occur during both the inbound (to the proposed repository) and outbound (to the commercial and DOE sites) portions of the shipment campaign. The involved worker group would include as many as 20 personnel performing station operational tasks over a total shipment campaign of about 21,630 casks (10,815 inbound and 10,815 outbound). The analysis assumed that noninvolved workers would not be exposed to direct radiation during intermodal transfer station operations. Table 6-54 lists doses and radiological impacts to an individual worker and the involved worker population. The estimated doses are based on involved worker doses from Smith, Daling, and Faletti (1992, page 4.2).

Table 6-54. Doses and radiological impacts to involved workers from intermodal transfer station operations.[a]

Group	Dose	Latent cancer fatality
Maximum individual worker	12 rem[b]	0.005[c]
Involved worker population	260 person-rem	0.11[d]

a. Totals for 24 years of operations.
b. Assumes annual doses to intermodal transfer station workers would be limited to 0.5 rem per year.
c. The estimated probability of a latent cancer fatality in an exposed individual.
d. The estimated number of latent cancer fatalities in an exposed involved worker population.

Table 6-54 indicates that the involved group of workers could incur a collective dose of about 260 person-rem over the operating period of the intermodal transfer station. The analysis estimated that about 0.1 latent cancer fatality would occur in the exposed worker population. The maximum individual dose accumulated by these workers was assumed to be 500 millirem per year or 12 rem for a worker who worked at the facility for the 24-year operating period. This dose would result in a 0.005 probability of a latent cancer fatality (about a 1-in-200 chance). The assumed annual average dose to an involved worker is the administrative limit on occupational dose that DOE established for its facilities (DOE 1994c, Article 211). Because vehicles would not be loaded or unloaded at a midroute stopover (Caliente routes), workers at the stopover would receive only small radiation doses.

Incident-Free Transportation. Incident-free impacts of heavy-haul truck transportation in Nevada would be unique for each of the five Nevada heavy-haul truck transportation implementing alternatives; these are discussed for each implementing alternative in Section 6.3.3.2. In addition, the incident-free impacts that would occur in Nevada from 2,600 legal-weight truck shipments, although common among the heavy-haul truck implementing alternatives, are reported along with the incident-free impacts for heavy-haul truck transportation in Section 6.3.3.2 for each heavy-haul truck implementing alternative.

Accidents. Accident risks and maximum reasonably foreseeable accidents for heavy-haul truck shipments of spent nuclear fuel and high-level radioactive waste would be the same among the Nevada heavy-haul truck transportation implementing alternatives, so this section discusses them.

Table 6-55 lists the accident risks from the transportation of spent nuclear fuel and high-level radioactive waste for the five Nevada heavy-haul truck transportation implementing alternatives. The data show that the risks, which are for 24 years of operations, are low for all five alternatives. These risks include those associated with transporting 2,600 legal-weight truck shipments from the commercial sites that do not have the capability to load rail casks. Small variations in the risk values, principally evident for a Sloan/Jean route, are in part a result of the risks associated with transporting rail casks arriving from the east on the Union Pacific Railroad's mainline through the Las Vegas metropolitan area to a Sloan/Jean intermodal transfer station. The values that would apply for a Caliente-Chalk Mountain or Apex/Dry Lake route are lower because of a shorter route (Apex/Dry Lake), or a more remote and mid-length route (Caliente-Chalk Mountain).

Table 6-55. Health impacts[a] to the public from accidents for Nevada heavy-haul truck implementing alternatives.

Risk	Caliente	Caliente-Chalk Mountain	Caliente-Las Vegas	Apex/Dry Lake	Sloan/Jean
Radiological accident risk					
Dose-risk (person-rem)	0.29	0.26	0.72	0.67	4.1
LCF[b]	0.0001	0.0001	0.0004	0.0003	0.002
Traffic fatalities	0.73	0.42	0.54	0.31	0.33

a. Impacts are reported for 24 years of operations.
b. LCF = latent cancer fatality.

Consequences of Maximum Reasonably Foreseeable Accident Scenarios. DOE evaluated the impacts of maximum reasonably foreseeable accident scenarios for national transportation (see Section 6.2).

Socioeconomics

DOE analyzed the socioeconomic impacts of Nevada heavy-haul truck transportation for impacts from expenditures to upgrade and maintain Nevada highways, operate heavy-haul trucks, construct and operate a midroute stopover for routes originating in Caliente, and construct and operate an intermodal transfer station.

Highway Construction. Socioeconomic impacts from upgrading highways in Nevada (including constructing a midroute stopover) would be transient, occurring over short periods. For the most part, the projected impacts of highway upgrade work would occur in Clark County, which the analysis assumed would be the home county for construction workforces. Section 6.3.3.2 discusses impacts to communities and counties along the five potential routes. The construction time and employment required to complete road upgrades would depend on the route.

Intermodal Transfer Station Construction. If a decision was made to construct an intermodal transfer station, DOE anticipates that preliminary architecture and engineering work would begin in 2007, followed by the start of construction at the selected site in 2008. Construction would last about one and one-half years and would require 49 workers. For this analysis, DOE assumed that construction workers would probably come from Clark County.

The total increase in employment (direct and indirect) that would result from the project would peak in 2008 and would include about 130 workers. Population increases resulting from a net influx of new workers would peak in 2009 with about 70 additional residents. These employment and population increases, which would occur mostly in Clark County, would be small and temporary for the affected counties.

Increases in real disposable income from constructing an intermodal transfer station would peak in 2008 at between about $2.7 million and $3.1 million. The increase in Gross Regional Product would also peak in 2008 at between $7.5 million and $8.0 million. State and local government expenditures would peak in 2009 at about $200,000. These increases to real disposable income, Gross Regional Product, and government expenditures would be small for Clark County. (All dollar values reported in this section are in 1992 constant dollars unless otherwise stated.)

Highway Maintenance for Heavy-Haul Truck Operations. If DOE decided to use heavy-haul trucks, annual maintenance would be required after the completion of the highway upgrades. In addition, the routes would be resurfaced approximately every 8 years. Thus, highway expenditures for resurfacing a selected route would occur in approximately 2017, 2025, and 2033. The employment required for road maintenance would depend on the selected route. Section 6.3.3.2 discusses route-specific impacts.

Heavy-Haul Truck and Intermodal Transfer Station Operations. The socioeconomic impacts of operating heavy-haul trucks (including operating a midroute stopover for routes originating in Caliente) and an intermodal transfer station largely would occur in the county in which the station was located. Section 6.3.3.2 discusses these impacts.

Noise

Highway and Intermodal Transfer Station Construction. Impacts would occur from construction noise associated with upgrading road surfaces, constructing a midroute stopover, and constructing an intermodal transfer station. The upgrades and construction would include the use of earth-moving equipment (bulldozers, graders, loaders, dump trucks) and asphalt-laying equipment. The potential for noise impacts from construction would depend on the presence of humans along the routes and near the intermodal transfer station location. These persons would live in communities and possibly individual residences. Noise impacts from road upgrades and general construction would be transient and would move with the construction or end when the construction ended. The impacts, therefore, would be temporary for any location along affected highways. Construction noise, which would not occur at night, would be discernible (45 dBA) at distances as far as about 2,000 meters (6,600 feet).

The American Indian Writers Subgroup (AIWS 1998, page 2-19) has identified noise generated along transportation routes as a concern because it may affect ceremonies and the solitude necessary for healing and praying. Areas or sites of interest to Native Americans have not been identified along these routes.

Heavy-Haul Truck and Intermodal Transfer Station Operations. Heavy-haul trucks would be double-tractor vehicles that this analysis assumed would travel at speeds of 32 to 80 kilometers (20 to 50 miles) an hour. Noise levels probably would be greatest when loaded heavy-haul trucks were moving up grades at speeds as slow as 8 kilometers (5 miles) an hour. This would occur as the trucks approached the proposed repository site and on portions of the Caliente route (see Chapter 2, Section 2.1.3.3). At 48 kilometers (30 miles) an hour, the estimated noise from a single heavy-haul truck moving up a 5-percent grade would be 45 dBA at a distance of 630 meters (about 2,100 feet) from the road with no background traffic. Elevated truck noise would not be a consideration on the Nevada Test Site, the Nellis Air Force Range, or the repository site. Transportation workers would use hearing protection as required by Occupational Safety and Health Administration regulations.

During operations, DOE would transport 11 shipments a week of spent nuclear fuel and high-level radioactive waste to the proposed repository and 11 empty casks from the repository. Because the heavy-haul trucks probably would travel individually, elevated noise would occur during the brief time when a vehicle passed through communities. There would be no nighttime noise because trucks of this size would be restricted to operating during daylight hours. Truck noise at a midroute stopover would be similar to noise along the adjacent route. Therefore, the potential for adverse noise impacts from heavy-haul trucks would be low.

Noise associated with operations at an intermodal transfer station would occur as it received shipments and transferred them from railcars to heavy-haul trucks for transport to the proposed repository site. However, the baseline noise level is already elevated because of existing rail line operations at the potential station locations. Additional sources of noise at a station would include transferring railcars from trains into the station, moving the railcars in the station, and receiving returning empty transportation casks. Railcars could come to the station at night, so there would be a potential for nighttime sources of noise. However, shipments in the station could be handled during daylight hours, minimizing the potential for noise impacts.

Other noise impacts would differ among the implementing alternatives, as described in Section 6.3.3.2.

Aesthetics

Highway and Intermodal Transfer Station Construction. There could be impacts on visual resources during these activities because of the presence of workers, camps, vehicles, large earth-moving equipment, laydown yards, and dust generation. However, this phase would be of limited duration (approximately 18 months for an intermodal transfer station and up to 30 months for highway improvements). Dust generation would be controlled by implementing best management practices such as misting or spraying disturbed areas. Construction activities would not exceed the Bureau of Land Management Visual Resources Management guidelines (BLM 1986, all). If the route crosses Class II lands, more stringent management requirements would be necessary to retain the existing character of the landscape. However, the short duration of highway modification or construction activities, combined with the use of best management practices, would mitigate the impacts of activities, which could exceed the management requirements on any Class II lands.

Heavy-Haul Truck and Intermodal Transfer Station Operations. As many as 22 shipments would leave or arrive at the intermodal transfer station each week. Visual impacts would result from the presence of the station, increased worker activity in the area, the arrival and departure of trains, loading and unloading operations, and the arrival and departure of heavy-haul trucks. Some noise would occur from activities at the station, which could draw attention to it. These impacts would not exceed Class III objectives, which require only the partial retention of the existing character of the landscape.

Other aesthetic impacts would differ among the implementing alternatives, as described in Section 6.3.3.2.

Utilities, Energy, and Materials

Highway Construction. The amounts of utilities, energy, and materials needed would depend on the amount of upgrading to be done, which would be specific to each route. The amount of utilities, energy, and materials for each route is given in the following sections. All of the required amounts are much less than current use rates in Nevada. For example, fossil-fuel consumption in Nevada was about 3.8 billion liters in 1996 and none of the routes would require more than 0.5 percent of the annual consumption (BTS 1999a, Table MF-21).

Intermodal Transfer Station Construction. Intermodal transfer station design would be the same for any of the three sites and would include a small railyard with several sidings, a 180-metric-ton (200-ton) bridge crane, two steel prefabricated buildings (one for administration and one for maintenance), and a large paved area for heavy-haul truck parking and maneuvering. The basic facility would be a light industrial site with moderate utility requirements. During construction the electrical requirements would be supplied by portable generating equipment. Table 6-56 lists the materials that would be consumed during construction. The quantities of concrete, asphalt, and steel listed in the table are not substantial in comparison to annual use rates and would not affect the regional supply system. For example, the concrete required for an intermodal transfer station would be less than 1 percent of the concrete used in Nevada in 1998 (Sherwood 1998, all). Similarly, the demand for electricity and fossil fuel during construction would not be great. The construction of a midroute stopover for heavy-haul trucks (routes originating in Caliente) is accounted for in the specific route data included in the following sections.

Table 6-56. Construction utilities, energy, and materials for an intermodal transfer station over 1.5 years.

Electrical demand (kilowatts)	Fossil fuel (liters)[a]	Concrete (thousand metric tons)[b]	Asphalt (thousand metric tons)	Steel (thousand metric tons)
Onsite generation	Small	7.9	18	1.4

a. To convert liters to gallons, multiply by 0.26418.
b. To convert metric tons to tons, multiply by 1.1023.

Highway Maintenance for Heavy-Haul Truck Operations. Highways used by heavy-haul trucks would be maintained annually and resurfaced, on average, every 8 years. The amounts of utilities, energy, and materials for the annual and 8-year maintenance activities would be less than the initial amounts for upgrading the highways.

Heavy-Haul Truck and Intermodal Transfer Station Operations. The current estimate of electrical demand during the operation of an intermodal transfer station would be 165 kilowatts (TRW 1999d, Heavy-Haul Truck Files, Item 11). This would include 30 kilowatts for lighting, 50 kilowatts for each of the two buildings, 5 kilowatts for the guard station, and 30 kilowatts for the crane. The actual rate would be substantially less than peak capacity because operations would be intermittent. Only small amounts of fossil fuel would be used at an intermodal transfer station. Chapter 10 discusses fossil-fuel use for heavy-haul truck operations.

Other impacts on utilities, energy, and materials would differ among the implementing alternatives, as described in Section 6.3.3.2.

Waste Management

Highway Construction. Most wastes from upgrading highways, including constructing a midroute stopover, would be nonhazardous industrial or construction wastes that a contractor would dispose of in permitted industrial landfills or a permitted construction debris landfill, respectively. Hazardous waste such as lubricants and solvents or other hazardous materials would be shipped to a permitted hazardous waste treatment and disposal facility for appropriate disposition. In addition to disposition, much of the residual material from construction activities would be saved for reuse or recycled. Excess excavated materials such as soil and rock would be placed in spoil areas created for that purpose. A commercial vendor would provide portable restroom facilities and would manage the sanitary sewage.

Intermodal Transfer Station Construction. Construction would require traditional materials such as steel, lumber, and concrete that would result in debris that would require disposal or recycling. Excess construction materials would be salvaged. Construction debris would be disposed of in a local construction debris landfill. In addition, construction could require paints and resins that could become a hazardous waste if discarded. Hazardous waste would be shipped to a permitted treatment and disposal facility. A commercial vendor would provide portable restroom facilities and manage sanitary sewage. Waste quantities from construction would be about the same for all sites. The small impacts from disposing of the construction debris, hazardous waste, and sanitary sewage would be consistent for all station locations.

Highway Maintenance for Heavy-Haul Truck Operations. Periodic maintenance of highways and resurfacing every 8 years would generate construction wastes such as those discussed above for the initial highway improvements. Asphalt would be recycled.

Heavy-Haul Truck Operations. Heavy-haul truck operations along any of the five routes, including the operation of a midroute stopover for routes originating in Caliente, would result in wastes from vehicle maintenance and operation. These would include waste lubricants; solvents, paints, and other hazardous materials; sanitary waste; and industrial wastes typical of trucking company operations. Management and disposition of the wastes from operations would comply with applicable environmental and occupational and public safety regulations.

Intermodal Transfer Station Operations. Operations, regardless of the location, would generate (1) sanitary solid waste such as waste paper from office and personnel activities, (2) a small amount of hazardous waste from maintenance activities, and (3) potentially a small amount of low-level radioactive waste such as the smear wipes for radiological surveys of shipping casks and vehicles. In addition, the intermodal transfer station would generate sanitary sewage that DOE would dispose of in an onsite septic system or through connection to a municipal sewage facility.

The intermodal transfer station operator would dispose of sanitary solid waste in a local permitted landfill with available capacity. Hazardous and low-level radioactive waste, if any, would be shipped to treatment and disposal facilities with appropriate permits. The small quantities would have very little impact to the treatment and disposal facilities. Treatment and disposal capacity for hazardous waste would be above the expected demand until 2013 (EPA 1996b, pages 32, 33, 36, 46, 47, and 50). Disposal capacity for a broad range of low-level radioactive wastes would be available at two currently licensed facilities, and three additional disposal facilities are under license review (NRC 1997a, section on U.S. Low-Level Radioactive Waste Disposal).

There are no waste management impacts unique to any of the heavy-haul truck implementing alternatives.

6.3.3.2 Specific Impacts from Nevada Heavy-Haul Truck Implementing Alternatives

6.3.3.2.1 *Caliente Route Implementing Alternative*

The Caliente route (Figure 6-18) would be approximately 533 kilometers (331 miles) long. Heavy-haul trucks and escorts leaving an intermodal transfer station in the Caliente area would travel directly from the intermodal transfer station to U.S. Highway 93. The trucks would travel west on U.S. 93 to State Route 375, then on State Route 375 to the intersection with U.S. 6. The trucks would travel on U.S. 6 to the intersection with U.S. 95 in Tonopah. The trucks would travel into Beatty on U.S. 95 where an alternative truck route would be built because an existing intersection is too constricted to allow a turn. Heavy-haul vehicles would then travel south on U.S. 95 to the Lathrop Wells Road exit, which would access the Yucca Mountain site.

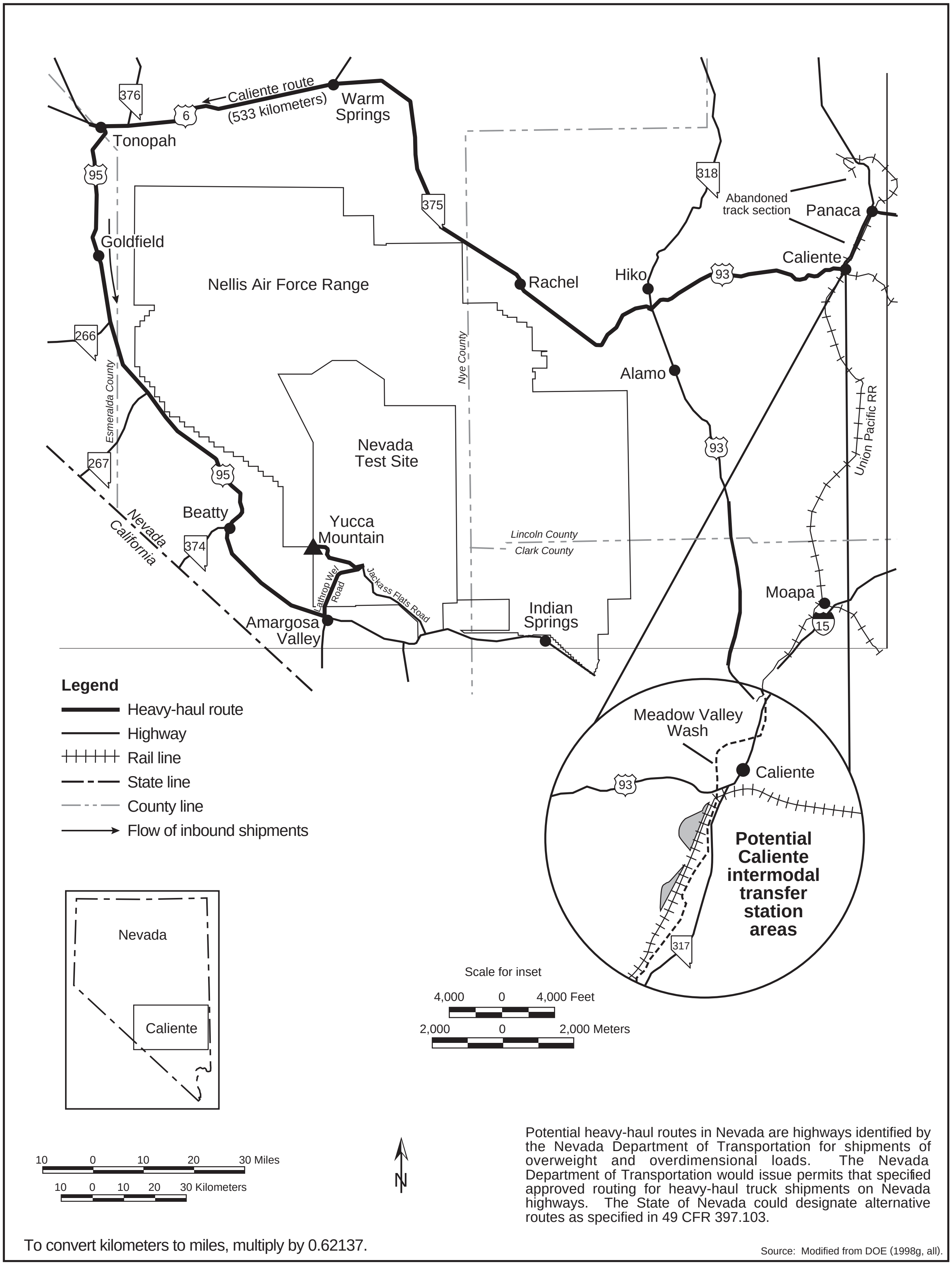


Figure 6-18. Caliente heavy-haul truck route.

Because of the estimated travel time associated with the Caliente route and the restrictions on nighttime travel for heavy-haul vehicles, DOE would construct a parking area along the route to enable these vehicles to park overnight. This parking area would be near U.S. 6 between Warm Springs and Tonopah.

The Caliente siting areas for an intermodal transfer station are south of the City of Caliente in the Meadow Valley Wash area. DOE has identified two areas along the west side of the canyon, with a combined area of 740,000 square meters (180 acres). Areas along the east side of the canyon would not be used to avoid disrupting Meadow Valley Wash and because of poor access to the Union Pacific rail line.

The following sections address impacts that would occur to land use; biological resources and soils; hydrology including surface water and groundwater; occupational and public health and safety; socioeconomics; noise; and utilities, energy, and materials. Impacts that would occur to air quality, cultural resources, aesthetics, and waste management would be the same as those discussed in Section 6.3.3.1 and are, therefore, not repeated here. Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

Land Use and Ownership

This section describes land-use impacts that could occur from the construction and operation of a Caliente intermodal transfer station and upgrade of highways and heavy-haul truck operation over the Caliente route. Chapter 3, Section 3.2.2.2.1, describes the Caliente intermodal transfer station site and associated route.

With the exception of a small portion of the most northern part of the site area for an intermodal transfer station, the area is on patented land owned by the City of Caliente. The remaining part of the northern site is administered by the Bureau of Land Management. The northern site also includes an existing wastewater treatment plant (TRW 1999f, page 21).

Construction. There would be no unique land-use impacts for an intermodal transfer station in Caliente, Nevada. Land-use impacts that would be common to all locations are discussed in Section 6.3.3.1.

In addition to the impacts on land use discussed in Section 6.3.3.1 for upgrading Nevada highways, approximately 0.04 square kilometer (10 acres) of land near Beatty, Nevada, would be acquired to construct approximately 2 kilometers (1.2 miles) of new highway. This section of highway would be needed to avoid conflicts between the requirement of wide turning areas for heavy-haul trucks and existing land uses in Beatty where U.S. 95 makes a 90-degree turn. In addition, approximately 0.04 square kilometer (10 acres) of land in the vicinity of Tonopah would be acquired for a midroute stopping area for heavy-haul trucks.

Operations. There would be no direct land-use impacts associated with the operation of the Caliente intermodal transfer station or the Caliente route for heavy-haul trucks other than those described in Section 6.3.3.1.

Hydrology

DOE anticipates that limited impacts to surface water and groundwater would occur in the course of improving Nevada highways so they could accommodate daily use by heavy-haul trucks. This section discusses these potential impacts as well as those from the construction and operation of an intermodal transfer station and heavy-haul truck operations over the Caliente route. Section 6.3.3.1 discusses the hydrology impacts that would be common to all of the heavy-haul truck implementing alternatives. This section focuses on the hydrology impacts that are unique to the Caliente route.

Surface Water

Section 6.3.3.1 discusses impacts to surface water from the construction and operation of an intermodal transfer station and upgrades to highways. The common impacts discussed apply to surface water along the Caliente route.

Groundwater

Construction. Section 6.3.3.1 discusses the impacts to groundwater from the construction of an intermodal transfer station. Groundwater impacts from upgrading highways would be limited to those caused by the use of water from construction wells. The upgrades to the Caliente route would require about 126,000 cubic meters (100 acre-feet) (LeFever 1998b, all) of water which, for planning purposes, was assumed to come from 16 wells.

The average amount of water withdrawn from each well would be about 7,900 cubic meters (6 acre-feet). Chapter 3, Section 3.2.2.2.3, identifies the hydrographic areas over which the Caliente route would pass, their perennial yields, and whether the State considers each a Designated Groundwater Basin. Table 6-57 summarizes the status of the hydrographic areas associated with the Caliente route. It also identifies the approximate portion of the route that would pass over Designated Groundwater Basins.

Table 6-57. Hydrographic areas along Caliente route.

	Designated Groundwater Basins	
Hydrographic areas	Number	Percent of corridor length
19	8	45

The withdrawal of 7,900 cubic meters (6 acre-feet) a year from a well would have little impact on the hydrographic areas associated with the Caliente route based on their perennial yields (Chapter 3, Section 3.2.2.2.3), even if multiple wells were placed in the same hydrographic area. As indicated in Table 6-57, about 45 percent of the route's length would be in areas with Designated Groundwater Basins, where the Nevada State Engineer's office carefully watches the potential for groundwater depletion. This does not mean that a contractor could not obtain water appropriations in these areas; the State Engineer would have the authority to approve such appropriations. Requests for water appropriations under this action would be for minor amounts and for a short-term construction action, which should provide the State Engineer even more discretion. Other options would be to lease temporary water rights from individuals along the route, ship water from other permitted resources by truck to construction sites (about 7,000 truckloads), or use a combination of these two actions. Obtaining a water appropriation from the State Engineer for short-term construction use or using an approved allocation would ensure that groundwater resources would not be adversely affected.

Operations. Section 6.3.3.1 discusses the impacts to groundwater from the operation of an intermodal transfer station, highway maintenance, and heavy-haul truck operations.

Biological Resources

Section 6.3.3.1 discusses the impacts to biological resources from the construction and operation of an intermodal transfer station and upgrades to highways that would be common to all intermodal transfer stations and associated routes. This section discusses the construction- and operations-related impacts that are unique to the Caliente intermodal station and route.

Construction. Potential Caliente intermodal transfer station siting locations include two areas along the west side of the Meadow Valley Wash canyon. The land cover types are agriculture and salt desert scrub (TRW 1999k, page 3-30). The construction site would disturb approximately 0.2 square kilometer (50 acres). No special status species occur in the proposed location of the Caliente intermodal transfer station. However, two species classified as sensitive by the Bureau of Land Management—the Meadow Valley Wash speckled dace and the Meadow Valley Wash desert sucker—occur in the adjacent Meadow

Valley Wash (TRW 1999k, page 3-30). The construction of an intermodal transfer station could affect these fish by increasing the sediment load in the wash during construction. There is no designated game habitat at the proposed location for the intermodal transfer station, but the adjacent Meadow Valley Wash is classified as important habitat for water fowl and Gambel's quail (TRW 1999k, page 3-30). Impacts to this habitat would be small.

Moist areas in the proposed location and the adjacent perennial stream and riparian habitat along Meadow Valley Wash could be classified as jurisdictional wetlands or other waters of the United States, although no formal wetlands delineation of the area has been conducted. If this site was selected, DOE would delineate the boundaries of any jurisdictional wetlands, develop a plan to mitigate impacts, and consult with the U.S. Army Corps of Engineers regarding the need to obtain a regional or individual permit under Section 404 of the Clean Water Act.

The predominant land cover types along the Caliente route are salt desert scrub, sagebrush, and creosote-bursage (TRW 1999k, page 3-30). The regional area for each vegetation type is extensive (Utah State University 1996, GAP data). Because areas disturbed by upgrade activities would be in or adjacent to the existing rights-of-way, and have been previously degraded by human activities, impacts would be small.

Three threatened or endangered species occur along the Caliente route (TRW 1999k, page 3-30). The desert tortoise occurs along the southern part of the route along U.S. 95 from Beatty to Yucca Mountain. Construction activities could kill or injure some tortoises; however, their abundance is low in this area (Karl 1981, pages 76 to 92; Rautenstrauch and O'Farrell 1998, pages 407 to 411) so losses would be small. One endangered species—the Hiko White River springfish—occurs in Crystal Springs (50 CFR 17.95). The outflow of the spring comes within about 10 meters (33 feet) of State Route 375 near its intersection with State Route 318 near U.S. 93 (TRW 1999k, page 3-31). The construction or widening of the road would be unlikely to affect this species, because construction activities would avoid the spring outflow channel and because no sediment would enter the stream. An introduced population of the threatened Railroad Valley springfish occurs in Warm Springs (FWS 1996, page 20), the outflow of which crosses U.S. 6. If improvements to the highway in the vicinity of the Warm Springs outflow were necessary, there could be temporary adverse impacts to this introduced population due to habitat disturbance and siltation. Six other special status species occur along this route (TRW 1999k, pages 3-30 and 3-31) but, because construction activities would be limited to the road and adjacent areas and care would be taken to ensure no sediments would enter streams, species should not be affected.

This route would cross eight areas designated as game habitat (TRW 1999k, page 3-31). The amount of habitat in these areas would be reduced slightly due to construction activities alongside existing roads. Game animals in these areas during construction could be disturbed.

Nineteen springs occur near this route (TRW 1999k, page 3-31). Areas around these springs may be jurisdictional wetlands or waters of the United States. However, no formal delineation has occurred. Construction could increase sedimentation in these areas. The corridor crosses a number of ephemeral streams that may be classified as waters of the United States. DOE would work with the State of Nevada and the U.S. Army Corps of Engineers to minimize impacts to these areas, and obtain individual or regional permits, as appropriate.

Impacts on soils would be transitory and small and would occur only along the shoulders of existing roads.

Operations. Impacts from operations would include periodic disturbances of wildlife from activities at the intermodal transfer station and additional truck traffic along the route. Trucks probably would kill individuals of some species but losses would be few and unlikely to affect regional populations of any species. No additional habitat loss would occur during operations. Impacts to soils would be small.

Occupational and Public Health and Safety

This section addresses potential impacts to occupational and public health and safety from upgrading highways and heavy-haul truck operations on the Caliente route. Impacts of the associated intermodal transfer station are the same for each heavy-haul truck implementing alternative and are in Section 6.3.3.1.

Construction. Industrial safety impacts on workers from the upgrade of highways and use of the Caliente route would be small (see Table 6-58). The analysis evaluated the potential for impacts in terms of total reportable cases of injury, lost workday cases, fatality risks for workers, and traffic-related fatalities due to commuting workers and transporting construction materials and equipment. Table 6-59 lists the estimated fatalities from construction vehicle and commuter traffic.

Table 6-58. Impacts to workers from industrial hazards during the Caliente route construction upgrades.

Group and industrial hazard category	Construction[a]	Operations[b]
Involved workers		
Total recordable cases[c]	28	290
Lost workday cases	13	160
Fatalities	0.2	0.5
Noninvolved workers[d]		
Total recordable cases	5	13
Lost workday cases	2	7
Fatalities	0.01	0.01
Totals[e]		
Total recordable cases	33	300
Lost workday cases	15	170
Fatalities	0.2	0.5

a. Impacts are totals for about 2 years.
b. Includes impacts from periodic resurfacing and maintenance; impacts are totals for 24 years.
c. Total recordable cases includes injury and illness.
d. The noninvolved worker impacts are based on 25 percent of the involved worker level of effort.
e. Totals might differ from sums due to rounding.

Operations. The incident-free radiological impacts listed in Table 6-60 would occur during the routine transportation of spent nuclear fuel and high-level radioactive waste using the Caliente route. These impacts include transportation along the highway route as well as transportation along railways in Nevada to the Caliente intermodal transfer station. The table includes the impacts of 2,600 legal-weight truck shipments from commercial sites that do not have the capability to load rail casks.

Socioeconomics

This section describes socioeconomic impacts that would occur from upgrading and using highways on the Caliente route and building an intermodal transfer station for heavy-haul truck transportation. It includes impacts from the operation of an intermodal transfer station at the Caliente site.

Construction. Socioeconomic impacts from upgrading highways for the Caliente route and building an intermodal transfer station would be transient, occurring over short periods and spread among the communities and counties along a route. Employment for route upgrades and intermodal transfer station construction would be about 250 workers. Upgrading the Caliente route would cost about $120 million (1998 dollars) and would require 36 months to complete. Constructing an intermodal transfer station would cost $24 million (1998 dollars) and require 1.5 years.

At its peak, increased employment for both construction workers (direct workers) and other workers who would be employed either because of highway upgrade and intermodal transfer station projects or as a result of the economic activity generated by the project (indirect workers) would be about 1,000. The change in employment for Clark, Nye, and the other Nevada counties except Lincoln County would be less than 1 percent of their employment bases. For Lincoln County, the increase in employment would be

Table 6-59. Estimated number of fatalities from construction material delivery vehicles and construction and operations worker commuting traffic for the Caliente route for heavy-haul trucks.

Activity	Kilometers[a]	Traffic fatalities	Vehicle emissions fatalities
Construction[b]			
Material delivery vehicles	180,000,000	3.1	0.013
Commuting workers	54,000,000	0.5	0.004
Subtotals[c]	*234,000,000*	*3.6*	*0.017*
Operations[d]			
Commuting workers	198,000,000	2.0	0.014
Totals	***432,000,000***	***5.6***	***0.031***

a. To convert kilometers to miles, multiply by 0.62137.
b. Impact totals are for about 2 years.
c. Totals might differ from sums due to rounding.
d. Impact totals are for 24 years.

Table 6-60. Health impacts from incident-free Nevada transportation for the Caliente route implementing alternative.[a]

Category	Legal-weight truck shipments[b]	Rail and heavy-haul truck shipments[c]	Totals[d]
Involved workers			
Collective dose (person-rem)	220	560	780
Estimated latent cancer fatalities	0.09	0.22	0.31
Public			
Collective dose (person-rem)	270	1,800	2,100
Estimated latent cancer fatalities	0.13	0.88	1.0
Estimated vehicle emission-related fatalities	0.00014	0.0052	0.0053

a. Impacts are totals for 24 years (2010 to 2033).
b. Impacts of 2,600 legal-weight truck shipments from nine commercial sites.
c. Includes impacts to workers at an intermodal transfer station and impacts to escorts.
d. Totals might differ from sums of values due to rounding.

as much as 2.3 percent of the county's employment base. The increase in employment in Lincoln County would be a moderate impact. However, it would be within historic short-term changes in employment for the county.

As a result of increased employment, population would be affected. The projected increases in population would reach a peak in 2009. During that year, the cumulative increase in population would be about 700. Population changes for Clark, Lincoln, or Nye County that would arise from increased employment would be less than 1 percent above the baseline. Thus, employment and population impacts arising from highway upgrade and intermodal transfer station construction projects would be small in comparison to existing employment and populations in the counties.

The increase in real disposable income of people in the affected counties would reach a peak in 2008 at $25.2 million. Gross Regional Product would peak in 2008 at $42.0 million. Increased State and local government expenditures resulting from highway upgrade and intermodal transfer station construction projects would reach their peak in 2009 at $2.0 million. (All dollar values reported in this section are in 1992 constant dollars unless otherwise stated.)

Changes to real disposable income and government expenditures would be small—less than 1 percent for Clark, Lincoln, Nye, and the other Nevada counties—as would changes to Gross Regional Product in Clark, Nye, and other counties. The change in Gross Regional Product in Lincoln County would be moderate, amounting to about 1.5 percent of the baseline but remaining within historic short-term changes in the county.

Operations. Operations at an intermodal transfer station and the use of heavy-haul trucks would begin in 2010 and last until 2033. An operations workforce of about 26 would be required for the intermodal transfer station. For the national mostly rail transportation scenario, the station would operate throughout the year. The workforce for heavy-haul truck operations over a Caliente route, including shipment escorts, would be about 120 workers. The analysis assumed that operations workers would reside in Clark, Lincoln, and Nye Counties.

Employment would be likely to remain relatively level throughout operations. Operations employment (direct and indirect) would average about 240 workers. About 90 of these workers would be in Lincoln County. The impact on population would be about 480 additional residents, with about 125 of these in Lincoln County. Employment and population increases for Lincoln County, which would experience the largest changes as a percentage of the baseline would be about 1.9 to 5.8 percent. These employment and population impacts during operations would be moderate in comparison to the existing employment and population levels for the county and would be within the range of historic changes in the county.

Real disposable income from operating an intermodal transfer station in Caliente and operating heavy-haul trucks based in Caliente would rise throughout operations, starting at $2.6 million in 2010 and rising to $11.7 million in 2033. Gross Regional Product would also rise during operations starting at $4.4 million in 2010 and increasing to $13.7 million in 2033. Annual State and local government expenditures would increase from $340,000 in 2010 to $2.6 million in 2033. Increases to real disposable income, Gross Regional Product, and government expenditures would be moderate in Lincoln County. Changes in real disposable income and government expenditures for the county would be about 2.7 and 1.7 percent, respectively. The projected change in Gross Regional Product for Lincoln County would be 4.0 percent; this would be within historic short-term changes for the county.

Because of the periodic need to resurface highways used by the heavy-haul trucks, employment would increase in the years these projects occurred. During those years, employment (direct and indirect) in the region would increase by about 250 for a Caliente route. Overall, employment changes from periodic (every 8 years) highway resurfacing projects would be less than 1 percent in Clark, Nye, and Lincoln Counties for the route. The impacts of the increases would be small.

Population increases would follow the increases in employment for highway resurfacing projects. Overall, the short-term increase in population in Nevada counties would be about 120 for a Caliente route. As a consequence, impacts to employment and population in affected counties in Nevada would be small and transient for highway resurfacing projects.

Noise

Section 6.3.3.1 discusses the noise impacts common to all heavy-haul truck implementing alternatives. This section focuses on noise impacts that would be unique to the Caliente heavy-haul truck implementing alternative.

Construction. The Caliente intermodal transfer station would border a wastewater treatment facility; there are no residences near the site. As a consequence, the potential for noise impacts from construction and operations would be nonexistent at this location.

Operations. For the Caliente route, the small rural communities of Amargosa Valley (at Lathrop Wells Road exit), Rachel, and Crystal Springs, and the Towns of Beatty, Goldfield, Tonopah, and Caliente would all fall within the 2,000-meter (6,560-foot) region of influence for construction noise. Noise impacts resulting from shipments along the Caliente route, based on community size and the number of affected communities, would be unlikely. Shipments would pass four established towns and three rural areas during transit to the Yucca Mountain site.

Utilities, Energy, and Materials

Section 6.3.3.1 discusses the utilities, energy, and materials impacts that would be common to the heavy-haul truck implementing alternatives. This section focuses on the utilities, energy, and materials impacts that would be unique to the Caliente heavy-haul truck implementing alternative.

Construction. The construction of the Caliente intermodal transfer station would have the same utilities, energy, and materials impacts as those discussed in Section 6.3.3.1.

Table 6-61 lists the estimated quantities of primary materials for the upgrade of Nevada highways for the Caliente route. These quantities are not likely to be very large in relation to the southern Nevada regional supply capacity (see Section 6.3.3.1).

Table 6-61. Utilities, energy, and materials required for upgrades along the Caliente route.

Route	Length (kilometers)[a]	Diesel fuel (million liters)[b]	Gasoline (thousand liters)	Asphalt (million metric tons)[c]	Concrete (thousand metric tons)	Steel[d] (metric tons)
Caliente	533	13.0	220	1.4	1.8	49.3

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. To convert metric tons to tons, multiply by 1.1023.
d. Steel includes rebar only.

Operations. Section 6.3.3.1 discusses the utilities, energy, and material needs for operation of an intermodal transfer station.

Fossil fuel that would be consumed by heavy-haul trucks during operations is discussed in Chapter 10, which addresses irreversible commitments of resources.

6.3.3.2.2 *Caliente-Chalk Mountain Route Implementing Alternative*

The Caliente-Chalk Mountain route (Figure 6-19) would be approximately 282 kilometers (175 miles) long. Heavy-haul trucks and escorts leaving an intermodal transfer station in the Caliente area would travel directly from the station to U.S. 93. The trucks would travel on U.S. 93 to State Route 375, then on State Route 375 to the Town of Rachel. Next they would head south on Valley Road through the Nellis Air Force Range past Chalk Mountain to the Groom Pass Gate to the Nevada Test Site.

Because of the estimated travel time associated with the Caliente-Chalk Mountain route and anticipated limits on travel on the Nellis Air Force Range, DOE would construct a parking area along the route near the northern boundary of the Nellis Air Force Range to enable these vehicles to park overnight.

Section 6.3.3.2.1 discusses the Caliente siting areas for an intermodal transfer station.

The following sections address impacts that would occur to land use; biological resources and soils; hydrology including surface water and groundwater; occupational and public health and safety; socioeconomics; noise; and utilities, energy, and materials. Impacts that would occur to air quality, cultural resources, aesthetics, and waste management would be the same as those discussed in Section 6.3.3.1 and are, therefore, not repeated here. Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

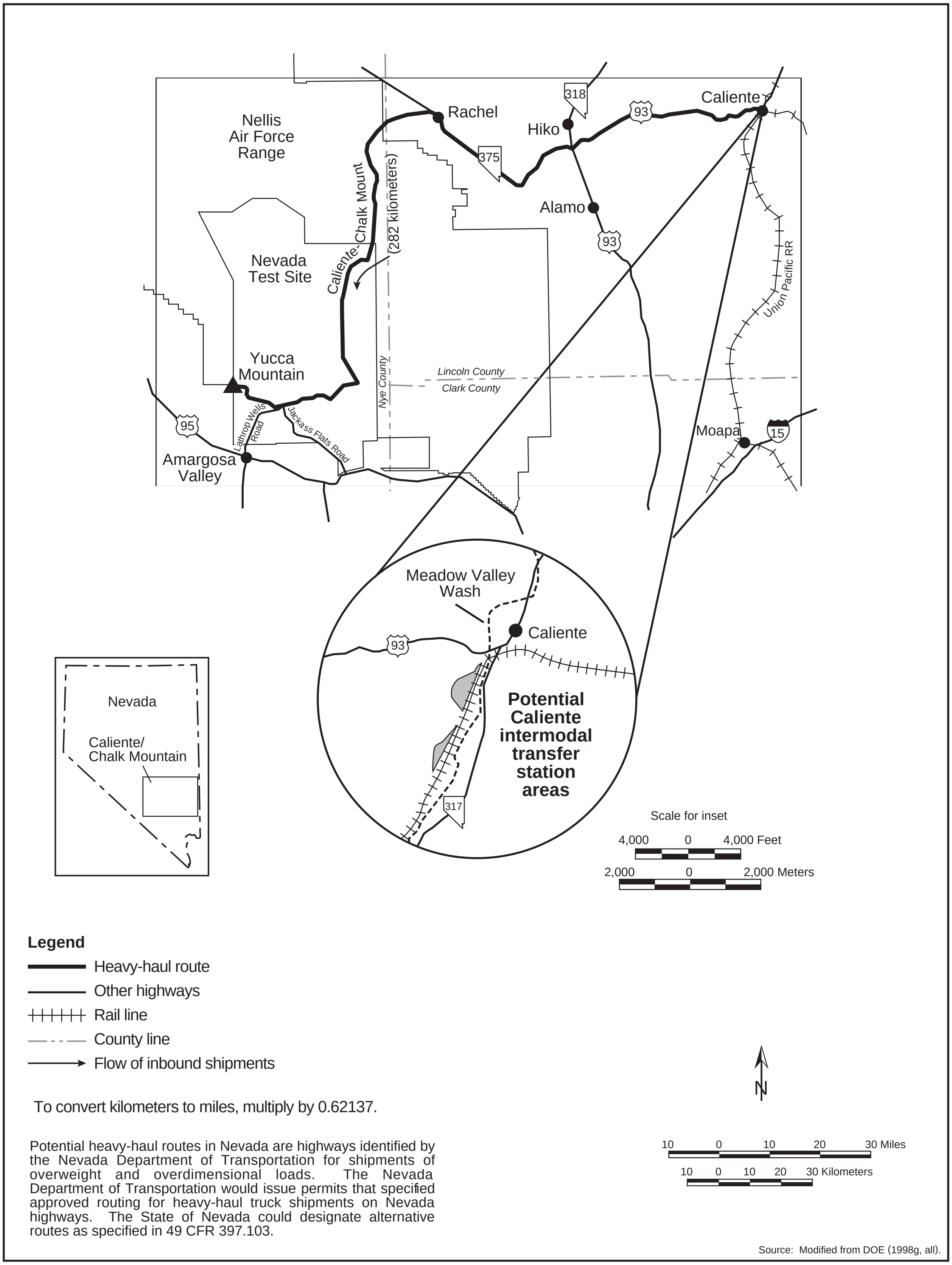


Figure 6-19. Caliente-Chalk Mountain heavy-haul truck route.

Land Use and Ownership

This section describes anticipated land-use impacts that could occur from the construction and operation of the Caliente intermodal transfer station, upgrades of highways, and heavy-haul truck operations over the Caliente-Chalk Mountain route. Chapter 3, Section 3.2.2.2.1, describes the Caliente intermodal transfer station site and the associated route.

Construction. Section 6.3.3.2.1 discusses Caliente intermodal transfer station impacts in relation to the current use of the land. Section 6.3.3.1 describes impacts on land use from upgrading highways for use by heavy-haul trucks.

In addition to the impacts on land use discussed in Section 6.3.3.1 for upgrading Nevada highways, approximately 0.04 square kilometer (10 acres) of land in the vicinity of the northern boundary of the Nellis Air Force Range would be acquired for a midroute stopping area for heavy-haul trucks.

The Caliente-Chalk Mountain route would involve land controlled by the Nellis Air Force Range, which, according to the Air Force, would affect Air Force operations. Because Public Law 99-606 withdrew and reserved the Nellis Air Force Range for use by the Secretary of the Air Force, the Secretary would need to concur with a decision to build and operate a branch rail line through the Range before DOE could build and operate this line. The Air Force has identified national security issues regarding a Caliente-Chalk Mountain route, citing interference with Nellis Air Force Range testing and training activities. In response to Air Force concerns, DOE has stated that it is acutely conscious of the security issues such a route would present and, because of the concerns expressed by the Air Force, regards the route as a "non-preferred alternative."

Operations. There would be no direct land-use impacts associated with the operation of the Caliente intermodal transfer station or the Caliente-Chalk Mountain route other than those described above and in Section 6.3.3.1.

Hydrology

DOE anticipates that limited impacts to surface water and groundwater would occur in the course of improving Nevada highways so that they could accommodate daily use by heavy-haul trucks. This section discusses these potential environmental impacts as well as those from the construction and operation of an intermodal transfer station and operation of the Caliente-Chalk Mountain route. Section 6.3.3.1 discusses the hydrological impacts that would be common to all the heavy-haul truck implementing alternatives. This section focuses on the hydrology impacts that would be unique to the Caliente-Chalk Mountain route.

Surface Water

Section 6.3.3.1 discusses the impacts to surface water from the construction and operation of an intermodal transfer station and upgrades to highways.

Groundwater

Construction. Section 6.3.3.1 discusses the impacts to groundwater from the construction of an intermodal transfer station. Groundwater impacts from upgrading highways would be limited to those caused by the use of water from construction wells. Upgrades to the Caliente-Chalk Mountain route would require about 75,000 cubic meters (60 acre-feet) of water (LeFever 1998b, all) that the analysis assumed would come from five wells.

The average amount of water withdrawn from each well would be about 15,000 cubic meters (12 acre-feet). Chapter 3, Section 3.2.2.2.3, identifies hydrographic areas over which the Caliente-Chalk Mountain route would pass, their perennial yields, and whether the State considers each a Designated Groundwater

Table 6-62. Hydrographic areas along Caliente-Chalk Mountain route.

Hydrographic areas	Designated Groundwater Basins: Number	Designated Groundwater Basins: Percent of corridor length
10	2	20

Basin. Table 6-62 summarizes the status of the hydrographic areas associated with the Caliente-Chalk Mountain heavy-haul route. It also identifies the approximate percentage of the route that would pass over Designated Groundwater Basins.

The withdrawal of 15,000 cubic meters (12 acre-feet) a year from a well would have little impact on the hydrographic areas associated with the Caliente-Chalk Mountain route based on their perennial yields (Chapter 3, Section 3.2.2.2.3), even if multiple wells were placed in the same hydrographic area. As indicated in Table 6-62, about 20 percent of the route's length would be in areas with Designated Groundwater Basins, which the Nevada State Engineer's office watches carefully for the potential for groundwater depletion. This does not mean that a contractor could not obtain water appropriations in these areas; the State Engineer would have the authority to approve such appropriations. The fact that requests for water appropriations under this action would be for minor amounts and for a short-term construction action should provide the State Engineer even more discretion. Other options would be to lease temporary water rights from individuals along the route, ship water from other permitted resources by truck (4,000 truckloads) to construction sites, or use a combination of these two actions. Obtaining a water appropriation from the State Engineer for short-term construction use or using an approved allocation should ensure that groundwater resources would not be adversely affected.

Operations. Section 6.3.3.1 discusses the impacts to groundwater from the operation of an intermodal transfer station, highway maintenance, and heavy-haul truck operations.

Biological Resources and Soils

Section 6.3.3.1 discusses impacts to biological resources from the construction and operation of an intermodal transfer station and upgrades to highways that would be common to all intermodal transfer stations and routes. This section discusses the construction- and operations-related impacts that would be unique to the Caliente intermodal station and Caliente-Chalk Mountain route.

Construction. Section 6.3.3.2.1 discusses potential Caliente intermodal transfer station siting locations and impacts to biological resources from station construction.

The predominant land cover types along the Caliente-Chalk Mountain route are salt desert scrub, blackbrush, sagebrush, and creosote-bursage (TRW 1999k, page 3-31). The regional area for each vegetation type is extensive (Utah State University 1996, GAP data). Because areas disturbed by highway upgrade activities would be in or adjacent to existing rights-of-way, and because these areas have been previously degraded by human activities, impacts would be small.

Two threatened or endangered species occur along the route (TRW 1999k, page 3-32). The desert tortoise occurs along the southern part of the route from the northern end of Frenchman Flat to Yucca Mountain. Construction activities could kill or injure desert tortoises; however, their abundance is low in this area (Rautenstrauch and O'Farrell 1998, pages 407 to 411), so losses would be few. One endangered species—the Hiko White River springfish—occurs in Crystal Springs (FWS 1998, page 16), which is about 10 meters (33 feet) south of State Route 375 near its intersection with Nevada 318 near U.S. 93. Construction or widening of the road is not likely to affect this species because construction activities would avoid the spring outflow channel and no sediment would enter the stream, which is critical habitat for this fish (50 CFR 17.95). Three other special status species occur along this route, but because construction activities would occur along existing roads, they should not be affected. Standard construction practices would be used to reduce erosion and runoff.

This route would cross six areas designated as game habitat (TRW 1999k, page 3-32). The amount of habitat in these areas would be reduced very slightly due to construction activities along existing roads. Game animals could be disturbed if they were in these areas during construction.

Three springs or riparian areas occur near this route (TRW 1999k, page 3-32). These springs and riparian areas may be jurisdictional wetlands or other waters of the United States; however, no formal delineation has occurred. Construction could increase sedimentation in these areas. The corridor crosses a number of ephemeral streams that may be classified as waters of the United States. DOE would work with the State of Nevada and the U.S. Army Corps of Engineers to minimize impacts to these areas and would obtain individual or regional permits, as appropriate.

Impacts to soils would be transitory and small and would occur only along the shoulders of existing roads.

Operations. Impacts from operations would include periodic disturbances of wildlife from additional truck traffic along this route. Trucks probably would kill individuals of some species but losses would be few and unlikely to affect regional populations of any species. No additional habitat loss would occur during operations. Impacts to soils would be small.

Occupational and Public Health and Safety

This section addresses potential impacts to occupational and public health and safety from upgrading highways and heavy-haul truck operations on the Caliente-Chalk Mountain route. Impacts of the associated intermodal transfer station in Caliente would be the same as those discussed in Section 6.3.3.1.

Construction. Industrial safety impacts to workers from upgrading highways for the Caliente-Chalk Mountain route would be small (Table 6-63). The analysis evaluated the potential for impacts in terms of total reportable cases of injury, lost workday cases, fatality risks for workers, and traffic-related fatalities related to commuting workers and the movement of construction materials and equipment. Table 6-64 lists the estimated fatalities from construction and commuter vehicle traffic.

Table 6-63. Impacts to workers from industrial hazards from upgrading highways along the Caliente-Chalk Mountain route.

Group and industrial hazard category	Construction[a]	Operations[b]
Involved workers		
Total recordable cases[c]	15	290
Lost workday cases	7	160
Fatalities	0.1	0.5
Noninvolved workers		
Total recordable cases	3	13
Lost workday cases	1	7
Fatalities	0.01	0.01
Totals[d]		
Total recordable cases	18	300
Lost workday cases	8	170
Fatalities	0.1	0.5

a. Impacts are totals over about 2 years.
b. Includes impacts from periodic maintenance and resurfacing. Impacts are totals over 24 years.
c. Total recordable cases includes injury and illness.
d. Totals might differ from sums due to rounding.

Operations. The incident-free radiological impacts listed in Table 6-65 would occur during the routine transportation of spent nuclear fuel and high-level radioactive waste using the Caliente-Chalk Mountain route. These impacts include transportation along the route and along railways in Nevada leading to an intermodal transfer station. The table includes the impacts of 2,600 legal-weight truck shipments from commercial sites that do not have the capability to load rail casks.

Socioeconomics

This section describes socioeconomic impacts that would occur from upgrading and using highways of the Caliente-Chalk Mountain route and building an intermodal transfer station for heavy-haul truck transportation. It includes the impacts from the operation of an intermodal transfer station at Caliente.

Table 6-64. Estimated number of fatalities from construction material delivery vehicles and construction and operations worker commuting traffic for the Caliente-Chalk Mountain route for heavy-haul trucks.

Activity	Kilometers[a]	Traffic fatalities	Vehicle emissions fatalities
Construction[b]			
Material delivery vehicles	45,000,000	0.8	0.0032
Commuting workers	30,000,000	0.3	0.0021
Subtotals	*75,000,000*	*1.1*	*0.0053*
Operations[c]			
Commuting workers	180,000,000	1.8	0.013
Totals[d]	***260,000,000***	***2.9***	***0.018***

a. To convert kilometers to miles, multiply by 0.62137.
b. Impacts are totals over about 2 years.
c. Impacts are totals over about 24 years.
d. Totals might differ from sums due to rounding.

Table 6-65. Impacts from incident-free transportation for the Caliente-Chalk Mountain heavy-haul truck implementing alternative.[a]

Category	Legal-weight truck shipments	Rail and heavy-haul truck shipments[b]	Totals[c]
Involved workers			
Collective dose (person-rem)	220	490	710
Estimated latent cancer fatalities	0.09	0.20	0.29
Public			
Collective dose (person-rem)	270	970	1,200
Estimated latent cancer fatalities	0.13	0.49	0.62
Estimated vehicle emission-related fatalities	0.00014	0.0032	0.0033

a. Impacts are totals for 24 years (2010 to 2033).
b. Includes impacts to workers at an intermodal transfer station and impacts to escorts.
c. Totals might differ from sums due to rounding.

Construction. Socioeconomic impacts from upgrading highways for the Caliente-Chalk Mountain route and building an intermodal transfer station would be transient, occurring over short periods and spread among the communities and counties along a route. Employment for route upgrades and intermodal transfer station construction would be about 240 workers. Upgrading this route would cost about $63 million (1998 dollars) and would require 26 months to complete. Constructing an intermodal transfer station would cost $24 million (1998 dollars) and require 1.5 years.

At its peak, increased employment for both construction workers (direct workers) and other workers who would be employed either because of highway upgrades and intermodal transfer station projects or as a result of the economic activity generated by the project (indirect workers) would be about 830. The change in employment for Clark, Nye, and the other Nevada counties except Lincoln County would be less than 1 percent of the counties' employment bases. For Lincoln County, the increase in employment would be as much as 2.6 percent of the employment base. The increase in employment in Lincoln County would be a moderate impact; however, it would be within historic short-term changes for the county.

As a result of increased employment, population would also be affected. Projected increases in population would reach a peak in 2009. During that year, the cumulative increase in population would be about 480. Population changes for Clark, Lincoln, or Nye County that would arise from increased employment would be less than 1 percent above the baseline. Thus, for the Caliente-Chalk Mountain route, employment and population impacts arising from highway upgrade and intermodal transfer station construction projects would be small in comparison to existing employment and populations in the counties.

The increase in real disposable income in the affected counties would peak at about $19.6 million in 2008. Gross Regional Product would peak in 2008 at $35.3 million. Increased State and local government expenditures resulting from highway improvement projects would reach their peak in 2009 at $1.3 million. Changes to government expenditures and real disposable income would be small—less than 1 percent for Clark, Lincoln, and Nye Counties. Changes to Gross Regional Product in the counties in Nevada except Lincoln County would also be small—less than 1 percent. Changes in Lincoln County of about 1.8 percent for Gross Regional Product would be moderate but within the range of historic short-term changes for the county. (All dollar values reported in this section are in 1992 constant dollars unless otherwise stated.)

Operations. Operations at an intermodal transfer station and the use of heavy-haul trucks would begin in 2010 and last until 2033. An operations workforce of 26 would be required for the intermodal transfer station. For the national mostly rail transportation scenario, the station would operate throughout the year. The workforce for heavy-haul truck operations over a Caliente-Chalk Mountain route, including shipment escorts, would be 110 workers. The analysis assumed that operations workers would reside in Lincoln County.

Employment would be likely to remain relatively level throughout operations. Operations employment (direct and indirect) would average about 230 workers. Under the assumptions of the analysis, about 135 workers would be employed in Lincoln County. The impact on population would be about 425 additional residents. Employment and population increases for Lincoln County, which would experience the largest changes, would be about 4.0 to 5.0 percent of the baseline. These employment and population impacts during operations would be moderate in comparison to the existing employment and population levels for the county and would be within the range of historic changes in the county.

Real disposable income from operating an intermodal transfer station in Caliente and operating heavy-haul trucks from it would rise throughout operations, starting at $2.4 million in 2010 and increasing to $10.5 million in 2033. Gross Regional Product would also rise during operations, starting at 4.3 million in 2010 and increasing to $12.9 million in 2033. Annual State and local government expenditures would increase from $350,000 in 2010 to $2.7 million in 2033. Increases to real disposable income, Gross Regional Product, and government expenditures would be moderate in Lincoln Country for the Caliente-Chalk Mountain route. Changes in real disposable income and government expenditure for the county would be about 3.2 and 2.4 percent, respectively. The projected change in Gross Regional Product for the county would be 5.8 percent.

Because of the periodic need to resurface the highways used by the heavy-haul trucks, employment would increase in the years during which these projects occurred. During those years, employment (direct and indirect) in the region would increase by about 130 for a Caliente-Chalk Mountain route. Overall, employment changes from periodic (every 8 years) highway-resurfacing projects would be less than 1 percent in Clark, Nye, Lincoln, and other Nevada counties for the route. The impact of these increases would be small.

Population increases would follow the increases in employment for highway resurfacing projects. Overall the short-term increase in population in Nevada counties would be about 320 for a Caliente-Chalk Mountain route. As a consequence, impacts to employment and population in affected counties in Nevada would be small and transient for highway resurfacing projects.

Noise

Section 6.3.3.1 discusses the noise impacts common to all the heavy-haul truck implementing alternatives. This section focuses on noise impacts that would be unique to the Caliente-Chalk Mountain heavy-haul truck implementing alternative.

Noise impacts of the Caliente intermodal transfer station would be the same as those discussed in Section 6.3.3.2.1. A large portion of the route would be inside the boundaries of the Nevada Test Site and the Nellis Air Force Range. The small rural communities of Crystal Spring and Rachel and the Town of Caliente would be within the 2,000-meter (6,560-foot) region of influence for construction noise.

Noise impacts resulting from shipments along the Caliente-Chalk Mountain route, based on community size and the number of affected communities, would be unlikely. The route passes one established town and two rural areas during transit to the Yucca Mountain site.

Utilities, Energy, and Materials

Section 6.3.3.1 discusses utilities, energy, and materials impacts that would be common to all the heavy-haul truck implementing alternatives. This section focuses on the utilities, energy and materials impacts that would be unique to the Caliente-Chalk Mountain heavy-haul truck implementing alternative.

Construction. The construction of the Caliente intermodal transfer station would have the same utilities, energy and materials impacts as those discussed in Section 6.3.3.1.

Table 6-66 lists the estimated quantities of primary materials for the upgrade of highways for the Caliente-Chalk Mountain route. These quantities are not likely to be very large in relation to the southern Nevada regional supply capacity (see Section 6.3.3.1).

Table 6-66. Utilities, energy, and materials required for upgrades along the Caliente-Chalk Mountain route.

Route	Length (kilometers)[a]	Diesel fuel (million liters)[b]	Gasoline (thousand liters)	Asphalt (million metric tons)[c]	Concrete (thousand metric tons)	Steel[d] (metric tons)
Caliente-Chalk Mountain	282	4.7	77	0.41	0.5	14.1

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. To convert metric tons to tons, multiply by 1.1023.
d. Steel includes rebar only.

Fossil fuel that would be consumed by heavy-haul trucks during operations is discussed in Chapter 10, which addresses irreversible commitment of resources.

Operations. Section 6.3.3.1 discusses the utilities, energy, and materials needs for the operation of an intermodal transfer station.

6.3.3.2.3 *Caliente-Las Vegas Route Implementing Alternative*

The Caliente-Las Vegas route (Figure 6-20) would be approximately 377 kilometers (234 miles) long. Heavy-haul trucks and escorts leaving an intermodal transfer station in the Caliente area would travel directly from the station to U.S. 93. The trucks would travel south on U.S. 93 to the intersection with I-15 northeast of Las Vegas. The trucks would then travel south on I-15 to the exit for the proposed Las Vegas Beltway, and would travel west on the beltway. They would exit the beltway to U.S. 95, and travel north on U.S. 95 to the Mercury entrance to the Nevada Test Site. The trucks would travel on Jackass Flats Road on the Nevada Test Site to the Yucca Mountain site.

Because of the estimated travel time associated with the Caliente-Las Vegas route and the restrictions on nighttime travel for heavy-haul vehicles, DOE would construct a parking area along the route to enable

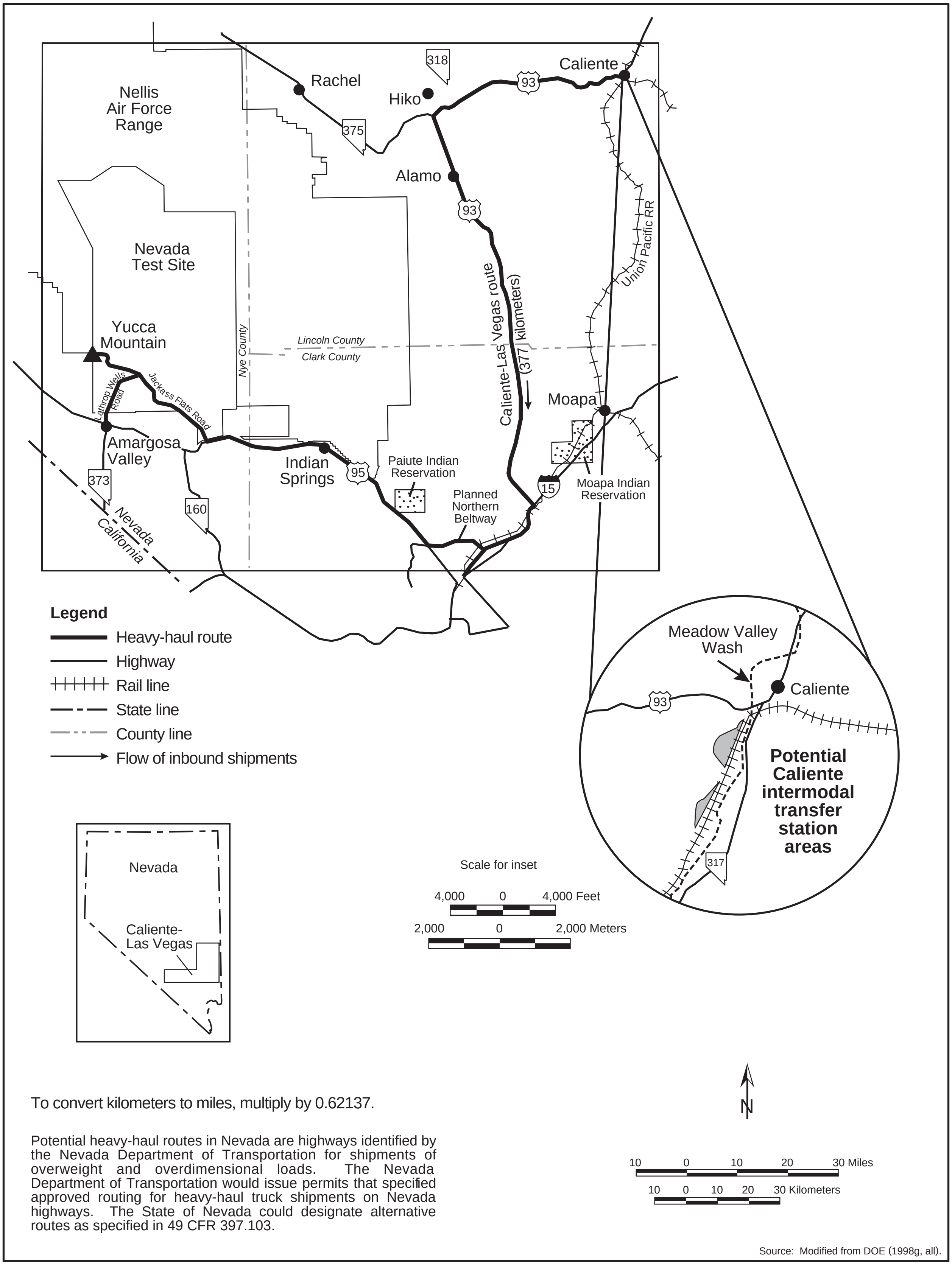


Figure 6-20. Caliente-Las Vegas heavy-haul truck route.

these vehicles to park overnight. This parking area would be near the U.S. 93 and I-15 intersection at Apex.

Section 6.3.3.2.1 discusses the Caliente siting areas for an intermodal transfer station.

The following sections address impacts that would occur to land use; air quality; biological resources and soils; hydrology including surface water and groundwater; cultural resources; occupational and public health and safety; socioeconomics; noise; and utilities, energy, and materials. Impacts that would occur to aesthetics and waste management would be the same as those discussed in Section 6.3.3.1 and are, therefore, not repeated here. Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

Land Use and Ownership

Chapter 3, Section 3.2.2.2.1, describes the Caliente intermodal transfer station site and associated truck route.

Construction. Section 6.3.3.2.1 discusses the Caliente intermodal station site area and impacts related to the current use of the land. Section 6.3.3.1.1 discusses the impacts on land use from upgrading Nevada highways for use by heavy-haul trucks.

In addition to the impacts on land use discussed in Section 6.3.3.1 for upgrading Nevada highways, approximately 0.04 square kilometer (10 acres) of land in the vicinity of Apex northeast of Las Vegas would be acquired for a midroute stopping area for heavy-haul trucks.

Operations. There would be no direct land-use impacts associated with the operation of the Caliente intermodal transfer station or use of the Caliente-Las Vegas route other than those described in Section 6.3.3.1.

Air Quality

This section describes anticipated nonradiological air quality impacts from the construction and operation of an intermodal transfer station and upgrades and heavy-haul truck operation along the Caliente-Las Vegas route. Such impacts would result from releases of criteria pollutants, including nitrogen dioxide, sulfur dioxide, carbon monoxide, and particulate matter (PM_{10} and $PM_{2.5}$).

Construction. Section 6.3.3.1 discusses air quality impacts for the construction of the Caliente intermodal transfer station, which would be a result of emissions from construction equipment and fugitive dust from earth excavation and construction vehicle traffic.

Section 6.3.3.1 also discusses air quality impacts likely to occur from upgrades of the Caliente-Las Vegas route for heavy-haul truck transport. These impacts would be a result of emissions from construction equipment and fugitive dust from earth excavation and construction vehicle traffic. Construction equipment design and controls would ensure that emissions did not exceed ambient air quality standards. Most of the road upgrades would occur in areas that are in attainment for all criteria pollutants. However, portions of the upgrades along the Caliente-Las Vegas route would occur in the Las Vegas Valley airshed, which is in nonattainment for carbon monoxide and PM_{10} (FHWA 1996, pages 3-53 and 3-54).

Operations. Section 6.3.3.1 discusses air quality impacts associated with the operation of the Caliente intermodal transfer station and from emissions of heavy-haul trucks. The Caliente-Las Vegas route would involve heavy-haul trucks passing through the Las Vegas Valley airshed. The air quality impacts to this airshed from the operation of four or five trucks a day would be very small in comparison to the amount of pollutants emitted by automobile travel and other commercial vehicles in the basin.

Hydrology

DOE anticipates that limited impacts to surface water and groundwater would occur in the course of improving Nevada highways so they could accommodate daily use by heavy-haul trucks. This section discusses these potential impacts as well as those from the construction and operation of an intermodal transfer station and operation of the Caliente-Las Vegas route. Section 6.3.3.1 discusses the hydrology impacts that would be common to all the heavy-haul truck implementing alternatives. This section focuses on the hydrology impacts that would be unique to the Caliente-Las Vegas heavy-haul truck implementing alternative.

Surface Water

Section 6.3.3.1 discusses impacts to surface water from the construction and operation of an intermodal transfer station and upgrades to highways. The common impacts discussed would apply to surface water along the Caliente-Las Vegas route.

Groundwater

Construction. Section 6.3.3.1 discusses impacts to groundwater from the construction of an intermodal transfer station. Groundwater impacts from upgrading highways would be limited to those caused by the use of water from construction wells. The upgrades to the Caliente-Las Vegas route would require about 54,000 cubic meters (44 acre-feet) of water (LeFever 1998b, all) that the analysis assumed would come from seven wells.

The average amount of water withdrawn from each well would be about 7,700 cubic meters (6 acre-feet). Chapter 3, Section 3.2.2.2.3, identifies the hydrographic areas over which the Caliente-Las Vegas route would pass, their perennial yields, and whether the State considers each a Designated Groundwater Basin. Table 6-67 summarizes the status of the hydrographic areas associated with the Caliente-Las Vegas route and identifies the approximate portion of the route that would pass over Designated Groundwater Basins.

Table 6-67. Hydrographic areas along Caliente-Las Vegas route.

	Designated Groundwater Basins	
Hydrographic areas crossed	Number	Percent corridor length represented
13	5	50

The withdrawal of 7,700 cubic meters (6 acre-feet) a year from a well would have little impact on the hydrographic areas associated with the Caliente-Las Vegas route based on their perennial yields (Chapter 3, Section 3.2.2.2.3), even if multiple wells were placed in the same hydrographic area. As indicated in Table 6-67, about 50 percent of the route's length would be in areas with Designated Groundwater Basins, where the potential for groundwater depletion is watched carefully by the Nevada State Engineer's office. This does not mean that a contractor could not obtain water appropriations in these areas; the State Engineer would have the authority to approve such appropriations. The fact that requests for water appropriations under this action would be for minor amounts and for a short-term construction action should provide the State Engineer even more discretion. Other options would be to lease temporary water rights from individuals along the route, ship water from other permitted resources by truck (about 3,000 truckloads) to construction sites, or use a combination of these two actions. Obtaining a water appropriation from the State Engineer for a short-term construction use or using an approved allocation should ensure that groundwater resources would not be adversely affected.

Operations. Section 6.3.3.1 discusses impacts to groundwater from the operation of an intermodal transfer station, highway maintenance, and heavy-haul truck operations.

Biological Resources and Soils

Section 6.3.3.1 discusses impacts to biological resources from the construction and operation of an intermodal transfer station and upgrades to highways that would be common to all intermodal transfer stations and routes. This section discusses construction- and operations-related impacts that would be unique to the Caliente intermodal station and Caliente-Las Vegas route.

Construction. Section 6.3.3.2.1 discusses potential Caliente intermodal transfer station siting locations and impacts to biological resources from construction of the station.

The predominant land cover types along the Caliente-Las Vegas route are creosote-bursage and Mojave mixed scrub (TRW 1999k, page 3-32). The regional area for each vegetation type is extensive (Utah State University 1996, GAP data). Because areas disturbed by upgrade activities would be in or adjacent to the existing rights-of-way and the areas have been previously degraded by human activities, impacts would be small.

Three threatened or endangered species occur along the route (TRW 1999k, page 3-33). The desert tortoise occurs along the southern part of the route from near Alamo to Yucca Mountain (Bury and Germano 1984, pages 57 to 72). An approximately 100-kilometer (62-mile) section of U.S. 93 from Maynard Lake to the junction with I-15 is critical habitat for the desert tortoise (50 CFR 17.95). Slight alterations of habitat immediately adjacent to existing roads would have only small impacts on desert tortoises because work would occur in the existing right-of-way. Tortoise populations are depleted for more than 1 kilometer (0.6 mile) on either side of roads with average daily traffic greater than 180 vehicles (Bury and Germano 1984, pages 57 to 72). Two endangered species—the Pahranagat roundtail chub and the White River springfish—occur in Ash Springs or its outflow. The route crosses the outflow of Ash Springs, which is designated critical habitat for the White River springfish (50 CFR 17.95). Because improvements would occur on the existing roadway and the Nevada Department of Transportation would use standard practices to reduce erosion and runoff, road improvements would not adversely affect the species living there. Nine other special status species occur within 100 meters (330 feet) of this route (TRW 1999k, page 3-33). Four of these species occur at Ash Springs or its outflow, and would not be affected for the reasons stated above for this site. The other five species would not be affected because construction activities would be restricted to the existing right-of-way, so occupied habitat would not be destroyed.

This route would cross eight areas designated as game habitat (TRW 1999k, page 3-33). Habitat in these areas would be reduced slightly due to construction activities along existing roads. Game animals could be disrupted if they were in these areas during construction.

Seven springs, riparian areas, or other wet areas occur near this route (TRW 1999k, page 3-33). These areas may be jurisdictional wetlands or other waters of the United States. However, no formal delineation has occurred. Construction could increase sedimentation in these areas. The corridor crosses a number of ephemeral streams that may be classified as waters of the United States. DOE will work with the State of Nevada and the U.S. Army Corps of Engineers to minimize impacts to these areas and would obtain individual or regional permits, as appropriate.

Impacts to soils would be transitory and small and would occur only along the shoulders of existing roads.

Operations. Impacts from operations would include periodic disturbances of wildlife by the additional truck traffic along this route. Trucks probably would kill individuals of some species but losses would be few and unlikely to affect regional populations of any species. No additional habitat loss would occur during operations. Impacts to soils would be small.

Cultural Resources

Section 6.3.3.1 discusses impacts to cultural resources that would be common to all the heavy-haul truck implementing alternatives.

There are four archaeological sites near the Caliente intermodal station locations, none of which has been evaluated for eligibility for the *National Register of Historic Places* (TRW 1999m, pages 2-19 to 2-47). Because no systematic ethnographic field studies have been completed for the Caliente-Las Vegas routes and the intermodal transfer station in Caliente, specific impacts to culturally important sites, areas, or resources cannot be determined at this time. The Caliente-Las Vegas route follows a portion of U.S. 95 that passes through approximately 1.6 kilometers (1 mile) of the Las Vegas Paiute Indian Reservation, and the U.S. 93 segment passes near the Moapa Indian Reservation.

Occupational and Public Health and Safety

This section addresses potential impacts to occupational and public health and safety from upgrading highways and heavy-haul truck operations on the Caliente-Las Vegas route. Impacts from the associated intermodal transfer station in Caliente would be the same as those discussed in Section 6.3.3.2.1.

Construction. Industrial safety impacts on workers from upgrading highways for the Caliente-Las Vegas route would be small (Table 6-68). The analysis evaluated the potential for impacts in terms of total reportable cases of injury, lost workday cases, fatality risks for workers, and traffic-related fatalities from commuting workers and the movement of construction materials and equipment. Table 6-69 lists the estimated fatalities from construction and commuter vehicle traffic.

Table 6-68. Impacts to workers from industrial hazards from upgrading highways along the Caliente-Las Vegas route.

Group and industrial hazard category	Construction[a]	Operations[b]
Involved workers		
Total recordable cases[c]	18	270
Lost workday cases	8	140
Fatalities	0.1	0.5
Noninvolved workers[d]		
Total recordable cases	4	12
Lost workday cases	2	6
Fatalities	0.01	0.01
Totals[e]		
Total recordable cases	22	280
Lost workday cases	10	150
Fatalities	0.1	0.5

a. Impacts are totals over about 2 years.
b. Includes impacts from periodic maintenance and resurfacing activities. Impacts are totals over 24 years.
c. Total recordable cases includes injury and illness.
d. The noninvolved worker impacts are based on 25 percent of the involved worker level of effort.
e. Totals might differ from sums due to rounding.

Operations. Incident-free radiological impacts listed in Table 6-70 would occur during the routine transportation of spent nuclear fuel and high-level radioactive waste on the Caliente-Las Vegas route. These impacts would include those from transportation along the route and along railways in Nevada leading to the Caliente intermodal transfer station. The table includes the impacts of 2,600 legal-weight truck shipments from commercial sites that do not have the capability to load rail casks.

Socioeconomics

This section describes socioeconomic impacts that would occur from upgrading and using highways on the Caliente-Las Vegas route. It includes impacts from constructing and operating an intermodal transfer station in Caliente.

Construction. Socioeconomic impacts from upgrading highways for the Caliente-Las Vegas route and building an intermodal transfer station would be transient, occurring over short periods and be spread among the communities and counties along the route. Employment for route upgrades and intermodal transfer station construction would be about 290 workers. The highway upgrades would cost about $93

Table 6-69. Estimated number of fatalities from construction material delivery vehicles and construction and operations worker commuting traffic for the Caliente-Las Vegas route for heavy-haul trucks.

Activity	Kilometers[a]	Traffic fatalities	Vehicle emissions fatalities
Construction[b]			
Material delivery vehicles	61,000,000	1.1	0.0044
Commuting workers	37,000,000	0.4	0.0026
Subtotals	*98,000,000*	*1.5*	*0.007*
Operations[c]			
Commuting workers	200,000,000	2.0	0.014
Totals	***300,000,000***	***3.5***	***0.021***

a. To convert kilometers to miles, multiply by 0.62137.
b. Impacts are totals over about 2 years.
c. Impacts are totals over about 24 years.

Table 6-70. Health impacts from incident-free Nevada transportation for the Caliente-Las Vegas route heavy-haul truck implementing alternative.[a]

Category	Legal-weight truck shipments	Rail and heavy-haul truck shipments	Totals[b]
Involved workers			
Collective dose (person-rem)	220	520	740
Estimated latent cancer fatality	0.09	0.21	0.30
Public			
Collective dose (person-rem)	270	1,300	1,600
Estimated latent cancer fatality	0.13	0.64	0.77
Estimated vehicle emission-related fatalities	0.00014	0.0040	0.0041

a. Impacts are totals for 24 years (2010 to 2033).
b. Totals might differ from sums of values due to rounding.

million (1998 dollars) and would require 25 months to complete. Constructing an intermodal transfer station would cost $24 million and require 1.5 years.

At its peak, increased employment for both construction workers (direct workers) and other workers who would be employed either because of highway upgrade and intermodal transfer station construction projects or as a result of the economic activity generated by the projects (indirect workers) would be about 810. The change in employment for Clark, Nye, and other Nevada counties except Lincoln County would be less than 1 percent of the counties employment base. For Lincoln County, the increase in employment would be as much as 2 percent. This increase would be a moderate impact. However, it would be within historic short-term changes in employment for the county.

As a result of increased employment, population would be affected. The projected increases in population would reach a peak in 2009. During that year, the cumulative increase in population would be about 540. Population changes for Clark, Lincoln, and Nye Counties from increased employment would be less than 1 percent above the baseline. Thus, employment and population impacts from highway improvement and intermodal transfer station construction projects would be small in comparison to existing employment and populations in the affected counties.

The increased real disposable income in the affected counties would reach a peak in 2008 at $20.1 million. Gross Regional Product would peak in 2008 at $35.3 million. Increased State and local government expenditures from highway improvement and intermodal transfer station construction projects would reach their peak in 2009 at $1.5 million.

Changes to real disposable income, Gross Regional Product, and government expenditures would be small—less than 1 percent for Clark, Lincoln, Nye, and the other Nevada counties.

Operations. Operations at an intermodal transfer station and the use of heavy-haul trucks would begin in 2010 and last until 2033. An operations workforce of 26 would be required for the intermodal transfer station. For the national mostly rail transportation scenario, the station would operate throughout the year. The analysis assumed that operations workers would reside in Lincoln County. The workforce for heavy-haul truck operations, including escorts, would be 120 workers.

Employment would be likely to remain relatively level throughout operations. Operations employment (direct and indirect) would average about 250 workers. The analysis assumed that about 100 of these workers would be employed in Lincoln County. The impact on population would be about 460 additional residents, about 130 in Lincoln County. Employment and population increases for Lincoln County, which would experience the largest changes as a fraction of the baseline, would be about 3.5 percent. These employment and population impacts would be moderate in comparison to the existing employment and population levels for the county and would be within the range of historic changes in the county.

Real disposable income in the region of influence (Clark, Lincoln, and Nye Counties, and the remainder of Nevada) from operating an intermodal transfer station in Caliente and operating heavy-haul trucks based in Caliente would rise throughout operations, starting at $2.7 million in 2010 and increasing to $11.3 million in 2033. Gross Regional Product would also rise during operations, starting at $4.7 million in 2010 and increasing to $13.8 million in 2033. Annual State and local government expenditures would increase from $340,000 in 2010 to about $2.5 million in 2033. Increases to real disposable income, Gross Regional Product, and government expenditures would be moderate in Lincoln County for the Caliente-Las Vegas route. Changes in real disposable income and government expenditures for the county would be about 2.5 and 1.8 percent, respectively. The projected change in gross regional product for the county would be 4.3 percent. This change would be within historic short-term changes for Lincoln County.

Because of the periodic need to resurface highways used by the heavy-haul trucks, employment would increase in the years these projects occurred. During those years, employment (direct and indirect) in the region would increase by 190 for a Caliente-Las Vegas route. Overall, employment changes from periodic (every 8 years) highway-resurfacing projects would be less than 1 percent in Clark, Nye, and Lincoln counties for the route. The impacts of the increases would be small.

Population increases would follow the increases in employment for highway resurfacing projects. Overall, the short-term increase in population in Nevada would be about 100 for a Caliente-Las Vegas route. As a consequence, impacts to employment and population in affected counties in Nevada would be small and transient for highway resurfacing projects.

Noise

Section 6.3.3.1 discusses noise impacts common to all the heavy-haul truck implementing alternatives. This section focuses on the noise impacts that would be unique to the Caliente-Las Vegas heavy-haul truck implementing alternative.

Noise impacts of the Caliente intermodal transfer station would be the same as those discussed in Section 6.3.3.2.1.

Construction activities for upgrading highways along the Caliente-Las Vegas route would occur on all sections with the exception of the section of I-15 between its intersection with U.S. 93 and the planned Northern Las Vegas Beltway. Northern Las Vegas, the Towns of Caliente and Indian Springs, and the small rural communities of Crystal Springs and Alamo would fall within the 2000-meter (6,560-foot) region of influence for construction noise. The potential number of inhabitants would be highest for the route near the greater Las Vegas area. There are also small rural communities and towns along the route.

Because the shipments would pass through a large population area, there would be a potential for noise impacts along the route.

Utilities, Energy, and Materials

Section 6.3.3.1 discusses utilities, energy, and materials impacts that would be common to the heavy-haul truck implementing alternatives. This section focuses on the utilities, energy, and materials impacts that would be unique to the Caliente-Las Vegas heavy-haul truck implementing alternative.

Construction. The construction of the Caliente intermodal transfer station would produce the same utilities, energy, and materials impacts as those discussed in Section 6.3.3.1.

Table 6-71 lists the estimated quantities of primary materials for the upgrade of Nevada highways for the Caliente-Las Vegas route. These quantities would be unlikely to be large in relation to the southern Nevada regional supply capacity (see Section 6.3.3.1).

Table 6-71. Utilities, energy, and materials required for upgrades along the Caliente-Las Vegas route.

Route	Length (kilometers)[a]	Diesel fuel (million liters)[b]	Gasoline (thousand liters)	Asphalt (million metric tons)[c]	Concrete (thousand metric tons)	Steel[d] (metric tons)
Caliente-Las Vegas	377	5.5	110	0.55	0.80	21

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. To convert metric tons to tons, multiply by 1.1023.
d. Steel includes rebar only.

Operations. Section 6.3.3.1 discusses the utilities, energy, and materials needs for the operation of an intermodal transfer station.

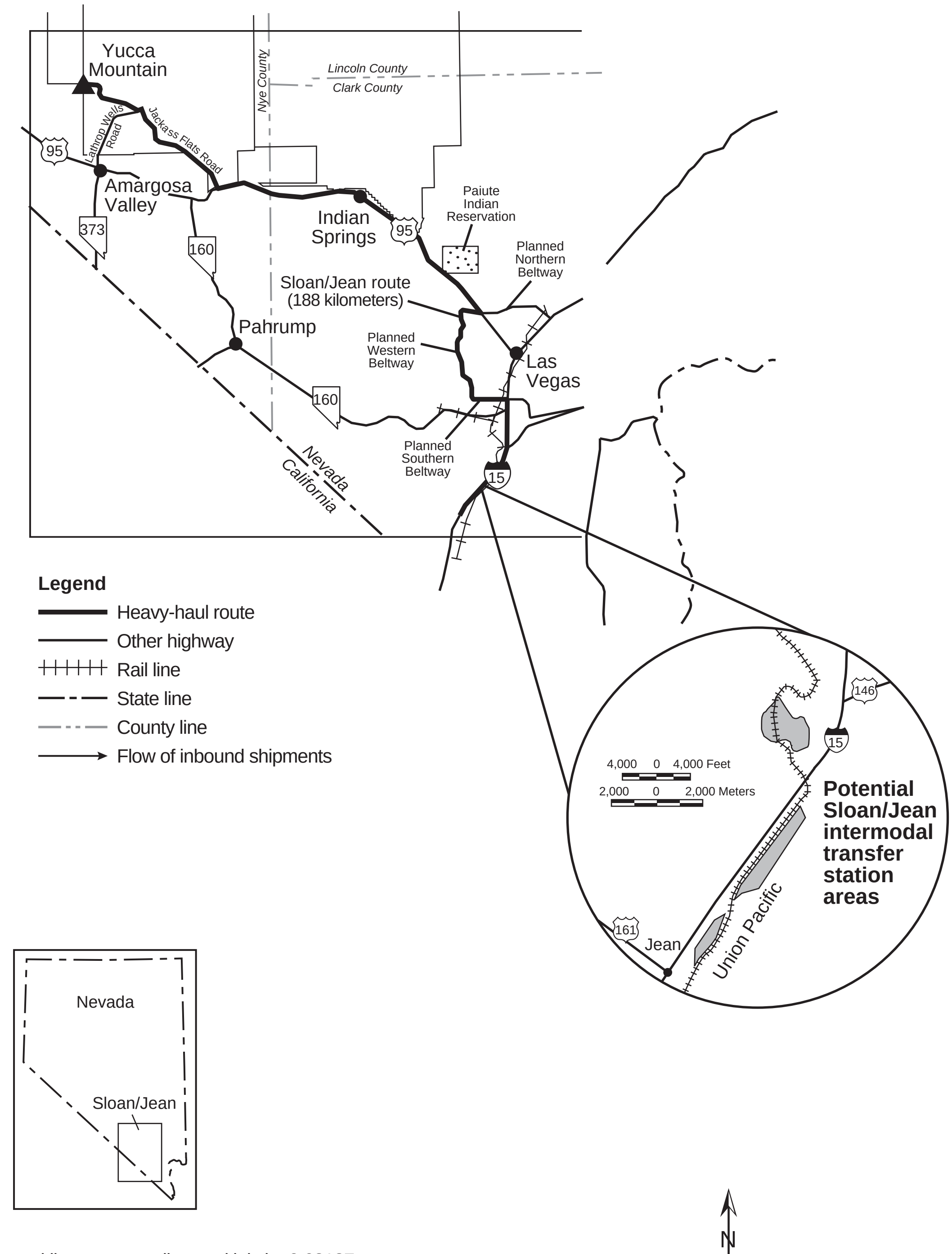
Fossil fuel that would be consumed by heavy-haul trucks during operations is discussed in Chapter 10, which addresses irreversible commitments of resources.

6.3.3.2.4 *Sloan/Jean Route Implementing Alternative*

The Sloan/Jean route (Figure 6-21) is about 188 kilometers (117 miles) long. Heavy-haul trucks and escorts leaving a Sloan/Jean intermodal transfer station would enter I-15 at the Sloan interchange. The trucks would travel on I-15 to the exit to the southern portion of the proposed Las Vegas Beltway, and then travel northwest on the beltway. They would leave the beltway at U.S. 95, and travel north on U.S. 95 to the Mercury entrance to the Nevada Test Site. The trucks would travel on Jackass Flats Road on the Nevada Test Site to the Yucca Mountain site.

The three potential areas for an intermodal transfer station southwest of Las Vegas are between the existing Union Pacific sidings at Sloan and Jean. One area is on the east side of I-15, south of the Union Pacific rail underpass at I-15, and has an area of 3.3 square kilometers (811 acres). The second, which has an area of 3.1 square kilometers (758 acres), is south of the Sloan rail siding along the east side of the rail line. A third area is south of the second, directly north of the Jean interchange on I-15, and has an area of 1.0 square kilometer (257 acres).

The following sections address impacts that would occur to land use; air quality; biological resources and soils; hydrology including surface water and groundwater; cultural resources; occupational and public health and safety; socioeconomics; noise; and utilities, energy, and materials. Impacts that would occur to aesthetics and waste management would be the same as those discussed in Section 6.3.3.1 and are,



To convert kilometers to miles, multiply by 0.62137.

Potential heavy-haul routes in Nevada are highways identified by the Nevada Department of Transportation for shipments of overweight and overdimensional loads. The Nevada Department of Transportation would issue permits that specified approved routing for heavy-haul truck shipments on Nevada highways. The State of Nevada could designate alternative routes as specified in 49 CFR 397.103.

Source: Modified from DOE (1998g, all).

Figure 6-21. Sloan/Jean heavy-haul truck route.

therefore, not repeated here. Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

Land Use and Ownership

This section describes anticipated land-use impacts that could occur from the construction and operation of the Sloan/Jean intermodal transfer station, upgrades of highways, and heavy-haul truck operations over the Sloan/Jean route. Chapter 3, Section 3.2.2.2.1, describes the Sloan/Jean intermodal transfer station site and the associated truck route.

Construction. At the Sloan/Jean intermodal station area there could be potential impacts related to the current use of the land. All three Sloan/Jean candidate sites are on land administered by the Bureau of Land Management. The northernmost area is in the Spring Mountain grazing allotment and the Ivanpah Valley desert tortoise area of critical environmental concern. The Bureau of Land Management has designated land east of the railroad as a gravel pit (community pit), but that land has not been worked; the area is open to fluid mineral leasing but closed to mining claims. The two southern areas are in the Jean Lake grazing allotment, a special recreation management area, and an area designated as available for sale or transfer. Both southern areas are open to fluid mineral leasing and mining claims (TRW 1999f, page 21).

The Sloan/Jean route would require considerable improvements at the interchange with I-15. These disturbed areas probably would be subject to increased erosion for at least some of the construction phase. Water would be applied during construction to suppress dust and compact the soil; this would reduce the potential for erosion. Drainage control along the route probably would remain as it is now. These combined measures would minimize the potential for adverse impacts to soils. Section 6.3.3.1 discusses other impacts on land use from upgrading Nevada highways for use by heavy-haul trucks.

Operations. There would be no direct land-use impacts associated with the operation of the Sloan/Jean intermodal transfer station or the Sloan/Jean route other than those described in Section 6.3.3.1.

Air Quality

This section describes anticipated nonradiological air quality impacts from the construction and operation of an intermodal transfer station and heavy-haul truck operation along the Sloan/Jean upgraded route. Such impacts would result from releases of criteria pollutants, including nitrogen dioxide, sulfur dioxide, carbon monoxide, and particulate matter (PM_{10} and $PM_{2.5}$).

Construction. Section 6.3.3.1 discusses air quality impacts for the construction of the Sloan/Jean intermodal transfer station. These impacts would be a result of emissions from construction equipment and fugitive dust from earth excavation and construction vehicle traffic. The Sloan/Jean intermodal transfer station locations are near or in the Las Vegas air basin, which is in nonattainment with national Ambient Air Quality Standards for carbon monoxide and PM_{10} (FHWA 1996, pages 3-53 and 3-54). Because the station could affect the air basin, DOE compared its estimated annual emission rates to the General Conformity Rule annual emission threshold levels for carbon monoxide and particulate matter. Based on the predicted annual rates, the construction of the Sloan/Jean intermodal transfer station would emit about 2 percent of the emission threshold level for carbon monoxide and 48 percent for PM_{10}. Based on this evaluation, a general conformity analysis would not be required for construction of the intermodal transfer station.

Section 6.3.3.1 also discusses the air quality impacts from upgrades of the Sloan/Jean route for heavy-haul truck transport. These impacts would be a result of emissions from construction equipment and fugitive dust from earth excavation and construction vehicle traffic. Construction equipment design and controls would ensure that emissions did not exceed ambient air quality standards. Most of the road upgrades would occur in areas that are in attainment for criteria pollutants. However, portions of the upgrades would occur in the Las Vegas Valley airshed, which is in nonattainment for carbon monoxide and PM_{10}.

Operations. Section 6.3.3.1 discusses the air quality impacts associated with the operation of the Sloan/Jean intermodal transfer station and from emissions of heavy-haul trucks. The potential station locations are near or in the Las Vegas air basin, which is in nonattainment for carbon monoxide and PM_{10}. Because the operation of a station could affect the air basin, DOE compared the estimated annual emission rates to the General Conformity Rule annual emission threshold levels for carbon monoxide and particulate matter. Based on the predicted annual emission rates, the operation of the Sloan/Jean intermodal transfer station would emit about 9 percent and 2 percent of the emission threshold levels for carbon monoxide and PM_{10}, respectively. Therefore, a general conformity analysis would not be required for operation of the intermodal transfer station.

The Sloan/Jean route would involve heavy-haul trucks passing through the Las Vegas Valley airshed, which is in nonattainment for carbon monoxide and PM_{10}. The air quality impacts to this airshed from the operation of four or five trucks a day would be very small in comparison to the amount of pollutants emitted from automobile travel and other commercial vehicles in the basin.

Hydrology

DOE anticipates limited impacts to surface water and groundwater during upgrades to Nevada highways so they could accommodate daily use by heavy-haul trucks. This section discusses these impacts as well as those from the construction and operation of an intermodal transfer station and operation of trucks on the Sloan/Jean route. Section 6.3.3.1 discusses the hydrology impacts that would be common to all of the heavy-haul truck implementing alternatives. This section focuses on the hydrology impacts that would be unique to the Sloan/Jean heavy-haul truck implementing alternative.

Surface Water

Section 6.3.3.1 discusses the impacts to surface water from the construction and operation of an intermodal transfer station and upgrades to highways. The common impacts discussed in that section apply to surface water along the Sloan/Jean route.

Groundwater

Construction. Section 6.3.3.1 discusses the impacts to groundwater from the construction of an intermodal transfer station. Upgrades to the Sloan/Jean route would not require any water wells. The road upgrades would require an estimated total of about 9,200 cubic meters (8 acre-feet) of water (LeFever 1998b, all). Options for obtaining this water would be to lease temporary water rights from individuals along the route, ship water from other permitted resources by truck (about 500 truckloads) to construction sites, or use a combination of these two actions.

Operations. Section 6.3.3.1 discusses impacts to groundwater from the operation of an intermodal transfer station, highway maintenance, and heavy-haul routes.

Biological Resources and Soils

Section 6.3.3.1 discusses impacts to biological resources from the construction and operation of an intermodal transfer station and upgrades to highways that would be common to all intermodal transfer stations and routes. This section discusses the construction- and operations-related impacts that would be unique to the Sloan/Jean intermodal station and route.

Construction. Potential Sloan/Jean intermodal transfer station site locations are between the existing Union Pacific rail sidings at Sloan and Jean. The dominant land cover type in these areas is creosote-bursage (TRW 1999k, page 3-36). The land cover type at the site is extensive in the region (Utah State University 1996, GAP data).

The three sites that DOE is considering for a Sloan/Jean intermodal transfer station are in the range of the desert tortoise, but none of the areas are critical habitat for the tortoise (50 CFR 17.95). The construction site would disturb approximately 0.2 square kilometer (50 acres) of tortoise habitat. The likelihood of tortoise death or injury due to construction activities would be small if DOE moved tortoises in the immediate area to a safe habitat. The pinto beardtongue (classed as sensitive by the Bureau of Land Management) occurs in two of the proposed locations of the Sloan/Jean intermodal transfer station (TRW 1999k, page 3-36). If one of these sites was selected, DOE would conduct pre-activity surveys for this plant species and would avoid disturbance of occupied areas if possible. There are no designated game habitats at the proposed location for the intermodal transfer station, and there are no springs or other areas that could be classified as wetlands (TRW 1999k, page 3-36).

Predominant land cover types in nonurban areas along the route are creosote-bursage and Mojave mixed scrub (TRW 1999k, page 3-36). The regional area for each vegetation type is extensive. Because areas disturbed by upgrade activities would be in or adjacent to existing rights-of-way and the areas have been previously degraded by human activities, impacts would be small.

The only threatened or endangered species that occurs along the route is the desert tortoise. Desert tortoise habitat occurs throughout the length of the route (Bury and Germano 1984, pages 57 to 72; 50 CFR 17.95). Construction activities could kill or injure desert tortoises; however, losses would be few because construction would occur only on the right-of-way and desert tortoises are uncommon along heavily traveled roads (Bury and Germano 1984, Appendix D, page D12). Four other special status species occur along this route (TRW 1999k, page 3-36), but construction activities would be limited to the road and adjacent areas; occupied habitat would not be destroyed and these species should not be affected.

This route would not cross any areas designated as game habitat and there are no springs or wetlands near the route. The corridor crosses a number of ephemeral streams that may be classified as waters of the United States. DOE would work with the State of Nevada and the U.S. Army Corps of Engineers to minimize impacts to these areas, and obtain individual or regional permits, as appropriate (TRW 1999k, page 3-36). Impacts to soils would be transitory and small and would occur only along the shoulders of existing roads.

Operations. Impacts from operations would include periodic disturbances of wildlife from activities at the intermodal transfer station and additional truck traffic along this route. Trucks probably would kill individuals of some species but losses would be few and unlikely to affect regional populations of any species. No additional habitat loss would occur during operations. Impacts to soils would be small.

Cultural Resources

Section 6.3.3.1 discusses the impacts to cultural resources that would be common to all the heavy-haul truck implementing alternatives.

There are seven archaeological sites near the Sloan/Jean intermodal transfer station locations, none of which has been evaluated for potential eligibility for the *National Register of Historical Places*.

The Sloan/Jean route follows a portion of U.S. 95 that passes through approximately 1.6 kilometers (1 mile) of the Las Vegas Paiute Indian Reservation. However, no field studies have been completed for the route. Therefore, specific impacts to culturally important sites, areas, or resources cannot be determined at this time.

Occupational and Public Health and Safety

This section addresses potential impacts to occupational and public health and safety from upgrading highways and heavy-haul truck operations on the Sloan/Jean route. Impacts from the associated intermodal transfer station in the Sloan/Jean area would be the same as those discussed in Section 6.3.3.1.

Construction. Industrial safety impacts on workers from upgrading highways for the Sloan/Jean route would be small (Table 6-72). The analysis evaluated the potential for impacts in terms of total reportable cases of injury, lost workday cases, fatality risks for workers, and traffic fatalities related to commuting workers and the movement of construction materials and equipment. Table 6-73 lists the estimated fatalities from construction and commuter vehicle traffic.

Table 6-72. Health impacts to workers from industrial hazards from upgrading highways along the Sloan/Jean route.

Group and industrial impact category	Construction[a]	Operations[b]
Involved workers		
Total recordable cases[c]	10	160
Lost workday cases	4	90
Fatalities	0.07	0.3
Noninvolved workers[d]		
Total recordable cases	2	7
Lost workday cases	1	4
Fatalities	0	0.007
Totals[e]		
Total recordable cases	12	170
Lost workday cases	5	94
Fatalities	0.07	0.3

a. Impacts are totals over about 6 months.
b. Includes impacts for periodic maintenance and resurfacing. Impacts are totals over about 24 years.
c. Total recordable cases includes injury and illness.
d. The noninvolved worker impacts are based on 25 percent of the involved worker level of effort.
e. Totals might differ from sums due to rounding.

Operations. The incident-free radiological impacts listed in Table 6-74 would occur during the routine transportation of spent nuclear fuel and high-level radioactive waste on the Sloan/Jean route. These impacts would include transportation along the Sloan/Jean route as well as transportation along railways in Nevada leading to the Sloan/Jean intermodal transfer station. The table includes the impacts of 2,600 legal-weight truck shipments from commercial sites that do not have the capability to load rail casks.

Socioeconomics

This section describes socioeconomic impacts that would occur from upgrading and using highways along the Sloan/Jean route and building an intermodal transfer station for heavy-haul truck transportation. It includes the impacts of operating an intermodal transfer station near Sloan/Jean in southern Nevada.

Table 6-73. Estimated number of fatalities from construction material delivery vehicles and construction and operations worker commuting traffic for the Sloan/Jean route for heavy-haul trucks.

Activity	Kilometers[a]	Traffic fatalities	Vehicle emissions fatalities
Construction[b]			
Material delivery vehicles	32,000,000	0.6	0.0023
Commuting workers	21,000,000	0.2	0.0015
Subtotals	*53,000,000*	*0.8*	*0.0038*
Operations[c]			
Commuting workers	120,000,000	1.2	0.0089
Totals	***170,000,000***	***2.0***	***0.013***

a. To convert kilometers to miles, multiply by 0.62137.
b. Impacts are totals over about 6 months.
c. Impacts are totals over 24 years.

Construction. Socioeconomic impacts from upgrading highways for a Sloan/Jean route and building an intermodal transfer station would be transient, occur over short periods, and be spread among the communities and counties along the route. Employment for route upgrades and intermodal transfer station construction would be about 230 workers. Upgrading highways for the route would cost about

Table 6-74. Health impacts from incident-free Nevada transportation for the Sloan/Jean heavy-haul truck implementing alternative.[a]

Category	Legal-weight truck shipments	Rail and heavy-haul truck shipments[b]	Totals[c]
Involved workers			
Collective dose (person-rem)	220	490	710
Estimated latent cancer fatalities	0.09	0.2	0.29
Public			
Collective dose (person-rem)	270	750	1,000
Estimated latent cancer fatalities	0.13	0.38	0.51
Estimated vehicle emission-related fatalities	0.00014	0.015	0.015

a. Impacts are totals for 24 years (2010 to 2033).
b. Includes impacts to workers at an intermodal transfer station.
c. Totals might differ from sums of values due to rounding.

$20 million (1998 dollars) and would require 6 months to complete. Constructing an intermodal transfer station would cost $24 million (1998 dollars) and require 1.5 years.

Employment for both construction workers (direct workers) and other workers who would be employed either because of highway upgrade and intermodal transfer station projects or as a result of the economic activity generated by the project (indirect workers) would be about 720. The change in employment for Clark, Nye, and Lincoln Counties, and the remainder of Nevada would be much less than 1 percent of their employment bases.

Increased employment would affect population. The projected increases in population would reach a peak of about 560 in 2009. Population changes for Clark, Nye, and Lincoln Counties, and the remainder of Nevada that would arise from increased employment would be much less than 1 percent above the baseline. Thus, employment and population impacts would be small in comparison to existing employment and populations in the affected counties.

Increased real disposable income in Clark, Nye, and Lincoln Counties, and the remainder of Nevada for highway improvements and intermodal transfer station construction would peak in 2009 at $19.9 million. Gross Regional Product would peak in 2009 at $33.6 million. Increased State and local government expenditures resulting from highway upgrade and intermodal transfer station construction projects would reach their peak in 2009 at $1.5 million. Changes to real disposable income, Gross Regional Product, and government expenditures would be small—much less than 1 percent for Clark, Nye, and Lincoln Counties, and the remainder of Nevada. (All dollar values reported in this section are in 1992 constant dollars unless otherwise stated.)

Operations. Operations at an intermodal transfer station and the use of heavy-haul trucks would begin in 2010 and last until 2033. An operations workforce of about 26 would be required for the intermodal transfer station. For the national mostly rail transportation scenario, the station would operate throughout the year. The workforce for heavy-haul truck operations over a Sloan/Jean route, including shipment escorts, would be about 66 workers. The analysis assumed that operations workers would reside in Clark County.

Employment would be likely to remain relatively level throughout operations. Operations employment (direct and indirect) would be about 120 workers. The impact on population would be about 200 additional residents. Employment and population increases for Clark, Nye, and Lincoln Counties, and the remainder of Nevada would be small in comparison to existing employment and population levels.

Real disposable income from operating an intermodal transfer station in Sloan/Jean and operating heavy-haul trucks based at Sloan/Jean would rise throughout operations, starting at $1.6 million in 2010 and increasing to $5.4 million in 2033. Gross Regional Product would also rise during operations, starting at $2.3 million in 2010 and increasing to $4.7 million in 2033. Annual State and local government expenditures would increase from $240,000 in 2010 to $840,000 in 2033. Increases to real disposable income, Gross Regional Product, and government expenditures would be small—much less than 1 percent in Clark, Nye, and Lincoln Counties, and the remainder of Nevada for the Sloan/Jean route.

Because of the periodic need to resurface highways used by the heavy-haul trucks, employment would increase in the years these projects occurred. During those years, employment (direct and indirect) in the region would increase by about 100 for a Sloan/Jean route. Overall, employment changes from periodic (every 8 years) highway resurfacing projects would be small in Clark, Nye, and Lincoln Counties, and the remainder of Nevada for the route. As a consequence, impacts to employment and population in affected counties in Nevada would be small and transient for highway resurfacing projects.

Noise

Section 6.3.3.1 discusses noise impacts common to all the heavy-haul truck implementing alternatives. This section focuses on the noise impacts that would be unique to the Sloan/Jean heavy-haul truck implementing alternative.

Construction. There are residences and commercial businesses near the three potential sites for an intermodal transfer station in the Sloan/Jean area. Construction noise would occur during daylight hours and would be a temporary source of elevated noise in the area. Nighttime noise impacts would be unlikely because construction activities would not occur at night.

For the Sloan/Jean route, southern and western Las Vegas, the Town of Indian Springs, and the small rural community of Jean would be within the 2,000-meter (6,560-foot) region of influence for construction noise. Construction activities would occur on all sections of the route with the exception of I-15 between its interchange at Sloan and the planned Southern Las Vegas Beltway. Because the number of inhabitants of the region of influence would be high because the route passes around the greater Las Vegas area and includes other small rural communities and towns, there is a potential for construction noise impacts.

Operations. The presence of residences and commercial businesses near the Sloan/Jean location would make an intermodal transfer station a potential source of more noise complaints than the more remote locations. However, because operational noise in the vicinity of Sloan/Jean would not be much higher than the levels associated with most other light industrial areas, noise impacts would be unlikely. Railcar switching would be the greatest source of noise.

However, there would be a potential for noise impacts from heavy-haul truck operations along the Sloan/Jean route, based on community size and the number of affected communities. The route passes the City of Las Vegas, one established town, and one rural area on its way to the Yucca Mountain site.

Utilities, Energy, and Materials

Section 6.3.3.1 discusses utilities, energy, and materials impacts that would be common to all the heavy-haul truck implementing alternatives. This section focuses on the utilities, energy, and materials impacts that would be unique to the Sloan/Jean heavy-haul truck implementing alternative.

Construction. The construction of the Sloan/Jean intermodal transfer station would have the same utilities, energy and materials impacts as those discussed in Section 6.3.3.1.

Table 6-75 lists the estimated quantities of primary materials for the upgrade of Nevada highways for the Sloan/Jean route. These quantities are not likely to be very large in relation to the southern Nevada regional supply capacity (see Section 6.3.3.1).

Table 6-75. Utilities, energy, and materials required for upgrades along the Sloan/Jean route.

Route	Length (kilometers)[a]	Diesel fuel (million liters)[b]	Gasoline (thousand liters)	Asphalt (million metric tons)[c]	Concrete (thousand metric tons)	Steel[d] (metric tons)
Sloan/Jean	188	1.7	29	0.24	0.1	2.3

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. To convert metric tons to tons, multiply by 1.1023.
d. Steel includes rebar only.

Operations. Section 6.3.3.1 discusses utilities, energy, and materials needs for operation of an intermodal transfer station.

Fossil fuel that would be consumed by heavy-haul trucks during operations is discussed in Chapter 10, which addresses irreversible commitments of resources.

6.3.3.2.5 *Apex/Dry Lake Route Implementing Alternative*

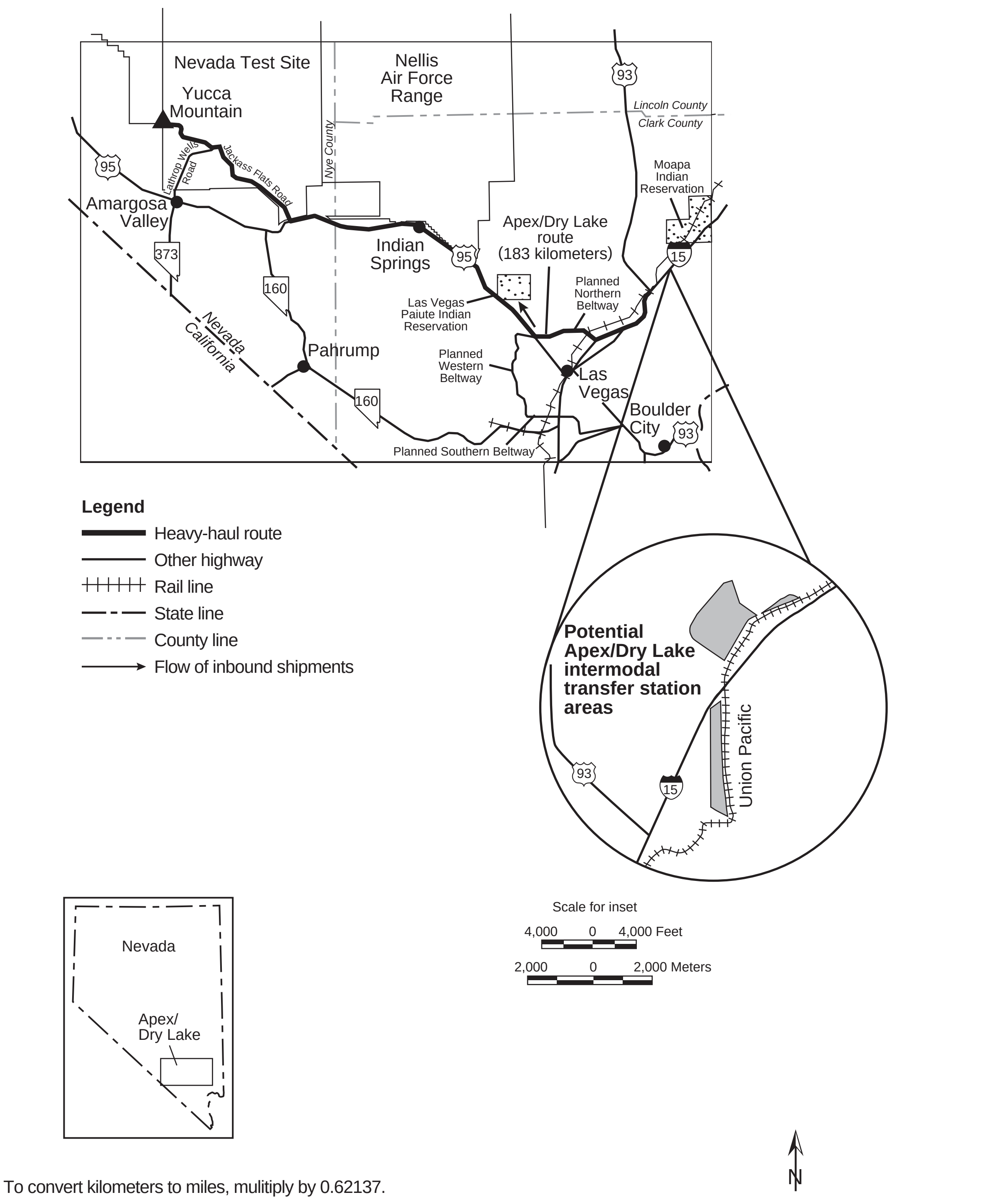
The Apex/Dry Lake route (Figure 6-22) is about 183 kilometers (114 miles) long. Heavy-haul trucks and escorts would leave the intermodal transfer station at the Apex/Dry Lake location and enter I-15 at the Apex interchange. The trucks would travel south on I-15 to the exit to the proposed northern Las Vegas Beltway and travel west on the beltway. They would leave the beltway at U.S. 95, and travel north on U.S. 95 to the Mercury entrance to the Nevada Test Site. The trucks would travel on Jackass Flats Road on the Nevada Test Site to the Yucca Mountain site.

The potential sites for the Apex/Dry Lake intermodal transfer station are in areas northeast of Las Vegas between the Union Pacific rail sidings at Dry Lake and at Apex. Two large contiguous areas are available for station siting. The first area is directly adjacent to the Dry Lake siding. The Dry Lake area is large [3.5 square kilometers (877 acres)] and has flat topography along the west side of the Union Pacific line. It is bounded by hills to the north and by a wash and private land to the south. The second area, which is on the east side of I-15 adjacent to the Union Pacific line and south of where the main Union Pacific line crosses I-15, has an area of 0.96 square kilometers (237 acres). Because this area is between the Dry Lake and Apex sidings, the construction of an additional rail siding would be necessary.

The following sections address impacts that would occur to land use; biological resources and soils; occupational and public health and safety; socioeconomics; and utilities, energy, and materials. Impacts to air quality, noise, and hydrology from the construction and operation of an intermodal transfer station, upgrading of highways, and operation of heavy-haul trucks on an Apex/Dry Lake route would be the same as those discussed in Section 6.3.3.2.4 for a Sloan/Jean route. Impacts to cultural resources, aesthetics, and waste management would be the same as those discussed in Section 6.3.3.1 and are, therefore, not repeated here. Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

Land Use and Ownership

This section describes estimated land-use impacts that could occur from the construction and operation of the Apex/Dry Lake intermodal transfer station, upgrades of highways, and heavy-haul truck operations on the Apex/Dry Lake route. Chapter 3, Section 3.2.2.2.1, describes the Apex/Dry Lake intermodal transfer station site and associated truck route.



To convert kilometers to miles, mulitiply by 0.62137.

Potential heavy-haul routes in Nevada are highways identified by the Nevada Department of Transportation for shipments of overweight and overdimensional loads. The Nevada Department of Transportation would issue permits that specified approved routing for heavy-haul truck shipments on Nevada highways. The State of Nevada could designate alternative routes as specified in 49 CFR 397.103.

10 0 10 20 30 Miles
10 0 10 20 30 Kilometers

Source: Modified from DOE (1998g, all).

Figure 6-22. Apex/Dry Lake heavy-haul truck route.

Construction. The Apex/Dry Lake intermodal transfer station site could have potential impacts related to the current use of the land. Both potential Apex/Dry Lake site areas are on land administered by the Bureau of Land Management. The northern area has several infrastructure corridors (power line, telephone, and road rights-of-way). It is in the Dry Lake grazing allotment and a planned utility corridor. It is also open to mineral leasing and mining claims. One area has been designated as available for sale or transfer.

The Apex/Dry Lake route would require considerable improvements at the interchange at I-15. These disturbed areas probably would be subject to increased erosion for at least some of the construction phase. Water would be applied during construction to suppress dust and compact the soil; this would reduce the potential for erosion. Drainage control along the route probably would remain as it is now. These combined measures would minimize the potential for adverse impacts to soils. Section 6.3.3.1 discusses impacts on land use from upgrading Nevada highways for use by heavy-haul trucks.

Operations. There would be no direct land-use impacts associated with the operation of the Apex/Dry Lake intermodal transfer station or the Apex/Dry Lake route other than those described in Section 6.3.3.1.

Biological Resources and Soils

Section 6.3.3.1 discusses impacts to biological resources from the construction and operation of an intermodal transfer station and upgrades to highways that would be common to all intermodal transfer stations and routes. This section discusses the construction- and operations-related impacts that would be unique to the Apex/Dry Lake intermodal station and route.

Construction. DOE has identified three areas for the construction of an Apex/Dry Lake intermodal transfer station. The predominant land cover type at these sites (creosote-bursage) is extensively distributed in the region (TRW 1999k, page 3-36; Utah State University 1996, GAP data). Considerable industrial development has occurred near the potential sites. The three sites are in the range of the threatened desert tortoise, although none is in an area considered to be critical habitat for the tortoise (50 CFR 17.95). The construction site would disturb approximately 0.2 square kilometer (50 acres) of desert tortoise habitat. The likelihood of death or injury to tortoises due to construction activities would be small if DOE conducted surveys for tortoises in areas to be disturbed and moved tortoises in the immediate area out of harm's way. Geyer's milk vetch (BLM sensitive) occurs on the southern edge of one of the proposed locations of the Apex/Dry Lake intermodal transfer station (TRW 1999k, page 3-37). If this location for an intermodal transfer station was selected, DOE would conduct pre-activity surveys for this plant's species and would avoid occupied habitat if possible. There are no designated game habitats at the proposed locations for the intermodal transfer station, or any springs or other areas that could be classified as wetlands (TRW 1999k, page 3-37).

The predominant land cover types along the Apex/Dry Lake heavy-haul route are creosote-bursage and Mojave mixed scrub, which are common throughout this region (TRW 1999k, page 3-34; Utah State University 1996, GAP data). Because areas disturbed by upgrade activities would be in or adjacent to the existing rights-of-way and the areas have been previously degraded by human activities, impacts would be small.

The only resident threatened or endangered species that occurs along the Apex/Dry Lake route is the desert tortoise. Desert tortoise habitat occurs along the entire length of the route (Bury and Germano 1984, pages 57 to 72; 50 CFR 17.95). Construction activities could kill or injure desert tortoises; however, losses would be few because construction would occur only on the right-of-way and desert tortoises are uncommon adjacent to heavily traveled roads (Bury and Germano 1984, Appendix D, page D12). Three other special status species occur along this route (TRW 1999k, page 3-35) but because construction activities would be limited to the road and adjacent areas, occupied habitat would not be destroyed and these species should not be affected.

This route would not cross any areas designated as game habitat or springs or possible wetlands (TRW 1999k, page 3-35). The corridor crosses a number of ephemeral streams that may be classified as waters of the United States. DOE would work with the State of Nevada and the U.S. Army Corps of Engineers to minimize impacts to these areas, and obtain individual, regional, or nationwide permits, as appropriate. Impacts to soils would be transitory and small and would occur only along the shoulders of existing roads.

Operations. Impacts from operations would include periodic disturbances of wildlife from activities at the intermodal transfer station and additional truck traffic along this route. Trucks probably would kill individuals of some species but losses would be few and unlikely to affect regional populations of any species. No additional habitat loss would occur during operations. Impact to soils would be small.

Occupational and Public Health and Safety

This section addresses potential impacts to occupational and public health and safety from upgrading highways and heavy-haul truck operations on the Apex/Dry Lake route. The impacts of the Apex/Dry Lake intermodal transfer station would be the same as those discussed in Section 6.3.3.1.

Construction. Industrial safety impacts on workers from upgrading highways for the Apex/Dry Lake route would be small (see Table 6-76). The analysis evaluated the potential for impacts in terms of total reportable cases of injury, lost workday cases, fatalities for workers, and traffic fatalities related to commuting workers and the movement of construction materials and equipment. Table 6-77 lists the estimated fatalities from construction and commuter vehicle traffic.

Table 6-76. Impacts to workers from industrial hazards from upgrading highways along the Apex/Dry Lake route.

Group and trauma category	Construction[a]	Operations[b]
Involved workers		
Total recordable cases[c]	9	160
Lost workday cases	4	90
Fatalities	0.06	0.3
Noninvolved workers[d]		
Total recordable cases	2	7
Lost workday cases	1	4
Fatalities	0.004	0.007
Totals[e]		
Total recordable cases	11	170
Lost workday cases	5	94
Fatalities	0.06	0.3

a. Impacts are totals over about 6 months.
b. Includes periodic maintenance and resurfacing. Impacts are totals over about 24 years.
c. Total recordable cases includes injury and illness.
d. The noninvolved worker impacts are based on 25 percent of the involved worker level of effort.
e. Totals might differ from sums due to rounding.

Operations. Incident-free radiological impacts listed in Table 6-78 would occur during the routine transportation of spent nuclear fuel and high-level radioactive waste on the route. These impacts would include transportation along the route as well as transportation along railways in Nevada leading to an Apex/Dry Lake intermodal transfer station. The table includes the impacts of 2,600 legal-weight truck shipments from commercial sites that do not have the capability to load rail casks.

Socioeconomics

This section describes socioeconomic impacts that would occur from upgrading and using highways along the Apex/Dry Lake route and building an intermodal transfer station for heavy-haul truck transportation. It includes impacts from the operation of an intermodal transfer station at the Apex/Dry Lake site in Clark County.

Construction. Socioeconomic impacts from upgrading highways for an Apex/Dry Lake route and building an intermodal transfer station would be transient, occur over short periods, and be spread among

Table 6-77. Estimated number of fatalities from construction material delivery vehicles and construction and operations worker commuting traffic for the Apex/Dry Lake route for heavy-haul trucks.

Activity	Kilometers[a]	Traffic fatalities	Vehicle emissions fatalities
Construction[b]			
Material delivery vehicles	32,000,000	0.6	0.0023
Commuting workers	20,000,000	0.2	0.0014
Subtotals	*52,000,000*	*0.8*	*0.0037*
Operations[c]			
Commuting workers	120,000,000	1.2	0.0089
Totals	***170,000,000***	***2.0***	***0.013***

a. To convert kilometers to miles, multiply by 0.62137.
b. Impacts are totals over about 6 months.
c. Impacts are totals over 24 years.

Table 6-78. Health impacts[a] from incident-free Nevada transportation for the Apex/Dry Lake heavy-haul truck implementing alternative.

Category	Legal-weight truck shipments	Rail and heavy-haul truck shipments[b]	Totals[c]
Involved workers			
Collective dose (person-rem)	220	470	690
Estimated latent cancer fatalities	0.09	0.19	0.28
Public			
Collective dose (person-rem)	270	670	940
Estimated latent cancer fatalities	0.13	0.34	0.47
Estimated vehicle emission-related fatalities	0.00014	0.0029	0.0030

a. Impacts are totals for 24 years (2010 to 2033).
b. Includes impacts to workers at an intermodal transfer station.
c. Totals might differ from sums of values due to rounding.

the communities and counties along the route. Employment for route upgrades and intermodal transfer station construction would be about 230 workers.

Upgrading highways for the Apex/Dry Lake route would cost $20 million (1998 dollars) and would require 6 months to complete. Constructing an intermodal transfer station would cost $24 million (1998 dollars) and require 1.5 years.

At its peak, increased employment for both construction workers (direct workers) and other workers who would be employed either because of highway upgrade and intermodal transfer station projects or as a result of the economic activity generated by the projects (indirect workers) would reach about 540. The change in employment for Clark, Lincoln, and Nye Counties, and the remainder of Nevada would be much less than 1 percent of the counties' employment bases.

Increased employment would also affect population. The projected increases in population would reach a peak of about 360 in 2009. Population changes for Clark, Lincoln, and Nye Counties, and the remainder of Nevada from increased employment would be much less than 1 percent above the baseline. Thus, employment and population impacts from highway upgrade and intermodal transfer station construction projects would be small in comparison to the existing employment and populations in the affected counties.

The increased real disposable income of people in the affected counties would reach a peak in 2009 at less than $14.6 million. Gross Regional Product would peak in 2009 at less than $26 million. Increased State and local government expenditures resulting from highway upgrade projects would reach their peak in

2009 at less than $1 million. (All dollar values reported in this section are in 1992 constant dollars unless otherwise stated.)

Changes to real disposable income, Gross Regional Product, and government expenditures would be small—much less than 1 percent for Clark, Lincoln, and Nye Counties, and the remainder of Nevada.

Operations. Operations at an intermodal transfer station and the use of heavy-haul trucks would begin in 2010 and last until 2033. An operations workforce of about 26 would be required for the intermodal transfer station. For the national mostly rail transportation scenario, the station would operate throughout the year. The workforce for heavy-haul truck operations over an Apex/Dry Lake route, including shipment escorts, would be about 66 workers. The analysis assumed that operations workers would reside in Clark County.

Employment would be likely to remain relatively level throughout operations. Operations employment (direct and indirect) would be about 120 workers. The impact on population would be about 190 additional residents. Employment and population increases for Clark, Lincoln, and Nye Counties, and the remainder of Nevada would be small in comparison to existing employment and population levels.

Real disposable income from operating an intermodal transfer station at Apex/Dry Lake and operating heavy-haul trucks would rise throughout operations, starting at $1.6 million in 2010 and increasing to $5.4 million in 2033. Gross Regional Product would also rise during operations, starting at $2.3 million in 2010 and increasing to $4.7 million in 2033. Annual State and local government expenditures would increase from about $240,000 in 2010 to $840,000 in 2033. Increases to real disposable income, Gross Regional Product, and government expenditures would be small—much less than 1 percent in Clark, Lincoln, and Nye Counties, and the remainder of Nevada for the Apex/Dry Lake route.

Because of the periodic need to resurface highways used by the heavy-haul trucks, employment would increase in the years these projects occurred. During those years, employment (direct and indirect) in the region would increase by about 100 for an Apex/Dry Lake route. Overall, employment changes from periodic (every 8 years) highway resurfacing projects would be small in Clark, Lincoln, and Nye Counties, and the remainder of Nevada for the route.

Population increases would follow the increases in employment for highway resurfacing projects. Overall, the short-term increase in population would be about 100. As a consequence, impacts to employment and population in affected counties in Nevada would be small and transient for highway resurfacing projects.

Utilities, Energy, and Materials

Section 6.3.3.1 discusses the utilities, energy, and materials impacts that would be common to all the heavy-haul truck implementing alternatives. This section focuses on the utilities, energy and materials impacts that would be unique to the Apex/Dry Lake heavy-haul truck implementing alternative.

Construction. The construction of the Apex/Dry Lake intermodal transfer station would have the same utilities, energy, and materials impacts as those discussed in Section 6.3.3.1.

Table 6-79 lists the estimated quantities of primary materials for the upgrade of Nevada highways for the Apex/Dry Lake route. These quantities are not likely to be very large in relation to the southern Nevada regional supply capacity (see Section 6.3.3.1).

Operations. Section 6.3.3.1 discusses the utilities, energy, and materials needs for the operation of an intermodal transfer station.

Table 6-79. Utilities, energy, and materials required for upgrades along the Apex/Dry Lake route.

Route	Length (kilometers)[a]	Diesel fuel (million liters)[b]	Gasoline (thousand liters)	Asphalt (million metric tons)[c]	Concrete (thousand metric tons)	Steel[d] (metric tons)
Apex/Dry Lake	183	1.6	28	0.23	0.1	2.3

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. To convert metric tons to tons, multiply by 1.1023.
d. Steel includes rebar only.

Fossil fuel that would be consumed by heavy-haul trucks during operations is discussed in Chapter 10, which addresses irreversible commitments of resources.

6.3.4 Environmental Justice Impacts in Nevada

The analysis considered existing highways and railroads that DOE would use in Nevada—I-15, the proposed Las Vegas Beltway; U.S. 95; five possible highway routes for heavy-haul trucks; the Union Pacific Railroad's mainlines in northern and southern Nevada; and alignments for a possible branch rail line in five rail corridors in the State. If DOE constructed and operated the repository, it would use combinations of these routes for shipments of spent nuclear fuel and high-level radioactive waste. DOE would use alternative preferred routes designated by the State of Nevada for highway shipments to the repository.

In general, the consequences of using a transportation route would occur close to the route. Thus, for transportation on a highway or railroad to affect a census block group for which environmental justice concerns could exist, the route would have to cross or be adjacent to the block group. Figure 3-23 shows the census block groups with minority percentages in Nevada. Figure 3-24 shows the census block groups with low-income percentages in Nevada. Figures 6-23 and 6-24 show the minority and low-income block groups, respectively, in the Las Vegas metropolitan area.

Portions of some routes would cross or be adjacent to Native American tribal lands. Highway routes avoid census block groups with high fractions of minority, low-income, or Native American populations with the exception of sections of I-15 that pass through the center of the Moapa Indian Reservation northeast of Las Vegas, Nevada; a 1.6-kilometer (1-mile) section of U.S. 95 across the southwest corner of the Las Vegas Paiute Indian Reservation; and sparsely populated areas of census block groups in the northern parts of Clark County. The Union Pacific Railroad's mainline tracks pass through the center of the Moapa Indian Reservation and through the center of Las Vegas, Nevada, crossing census block groups with high fractions of minority and low-income populations. Also, a branch rail line in the Valley Modified rail corridor would pass near the Las Vegas Paiute Indian Reservation, and the Caliente-Las Vegas and Apex/Dry Lake routes for heavy-haul trucks would pass near the Moapa Indian Reservation. None of the potential intermodal transfer station sites that DOE could use would be near a census block group with high minority or low-income populations, but an intermodal transfer station in the Apex/Dry Lake area could be as close as about 3 kilometers (2 miles) to the Moapa Indian Reservation.

Impacts along Nevada highways and railroads from the transportation of spent nuclear fuel and high-level radioactive waste would be small. The number of shipments in the mostly legal-weight truck and mostly rail scenarios would be small in comparison to the number of all other commercial shipments in southern Nevada. For comparison, under the mostly legal-weight truck scenario as many as five trucks carrying spent nuclear fuel would pass through the Moapa Indian Reservation on I-15 each day compared to daily traffic of more than 3,000 commercial trucks that use this section of highway (NDOT 1997, page 6; Cerocke 1998, all). Under the mostly rail scenario as many as 11 railcars per week carrying spent nuclear fuel could travel into southern Nevada compared to about 1,000 railcars each day for other

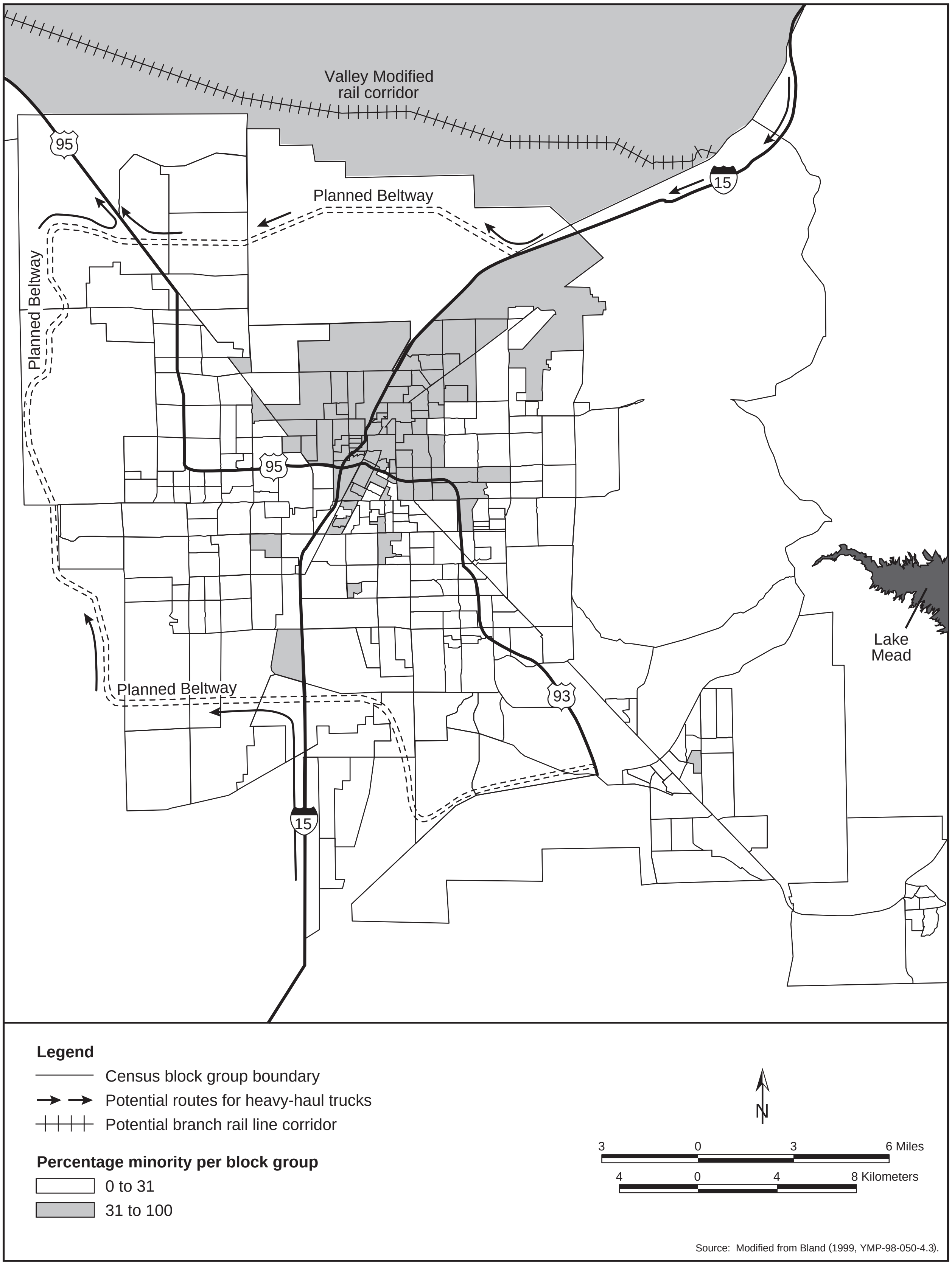


Figure 6-23. Minority census block groups in the Las Vegas metropolitan area.

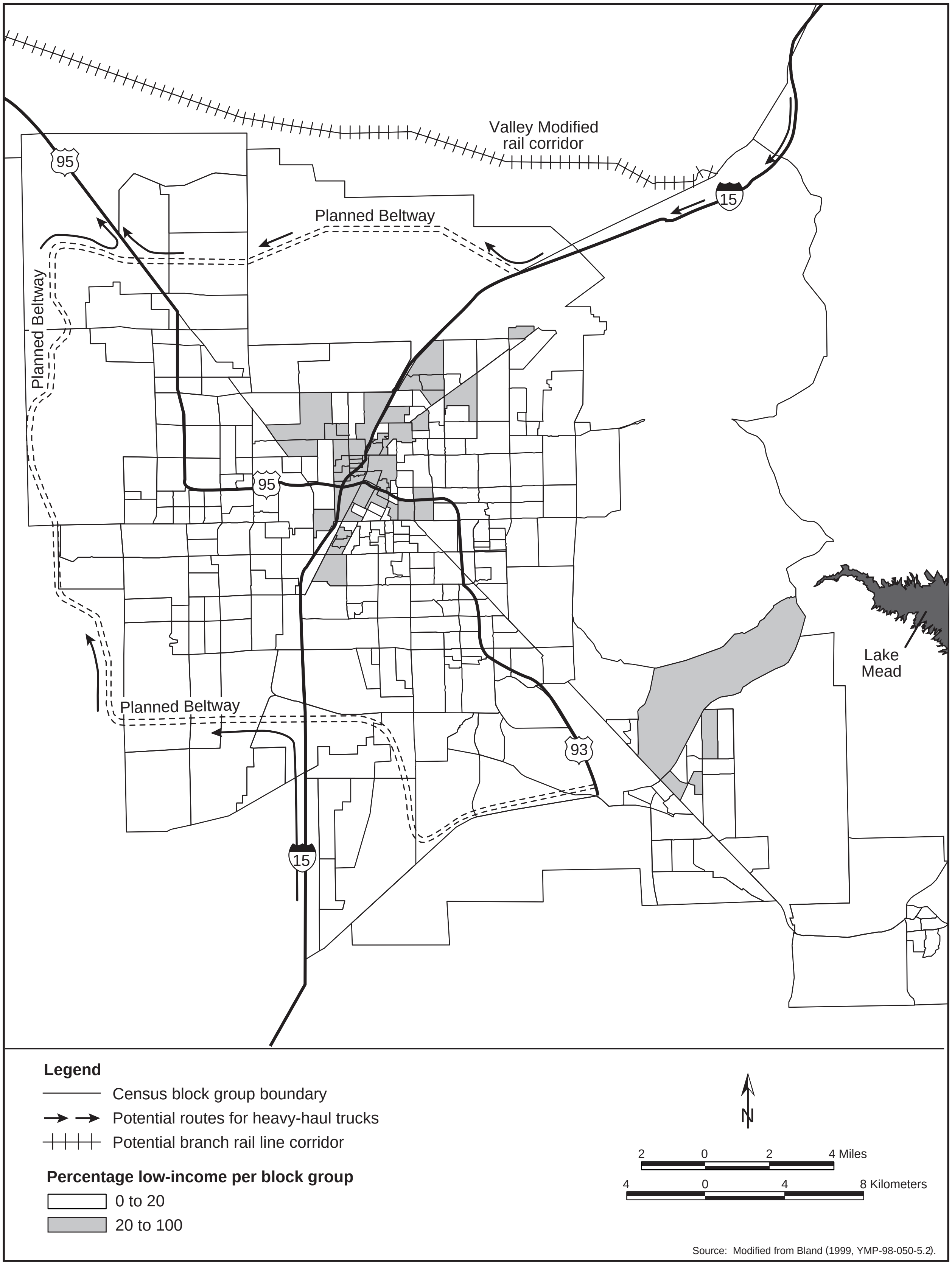


Figure 6-24. Low-income census block groups in the Las Vegas metropolitan area.

commodities. Thus, impacts from truck and rail traffic and emissions would be small for these shipments. The potential for accidents that could result in injuries or fatalities involving the shipments would also be small in comparison to the overall risk of accidents that would occur from other commercial traffic.

Up to about 10 percent of travel in southern Nevada by legal-weight trucks or railcars carrying spent nuclear fuel would be through Native American reservations and census block groups with high fractions of minorities or low-income populations. Because public health and safety impacts to all populations in Nevada would be small (less than 1 latent cancer fatality for incident-free transportation and 0.0005 latent cancer fatality for accidents over 24 years), the impacts to populations along 10 percent of the routes of travel would also be small. Because the probability would be small at any single location, the risk of an accident at a specific location would also be small. Thus, impacts to minority or low-income populations or to Native Americans in small communities along the routes would also be small and, therefore, unlikely to be disproportionately high and adverse.

In addition, for existing highways and mainline railroads, the added traffic would be minimal and shipments of spent nuclear fuel and high-level radioactive waste would be unlikely to affect land use, air quality, hydrology, biological resources and soils, cultural resources, socioeconomics, noise, or aesthetics. The analyses discussed in the preceding sections also determined that impacts to these resource areas from construction and operation of a branch rail line in any of the five potential rail corridors or construction of an intermodal transfer station and upgrading of highways in Nevada would be low.

Because the analyses did not identify large impacts for railroad and highway transportation of spent nuclear fuel and high-level radioactive waste in Nevada that would constitute credible adverse impacts on populations, workers, or individuals, adverse effects would be unlikely for any specific segment of the population, including minorities, low-income groups, and Native American tribes. Thus, there would be no environmental justice impacts in Nevada unique to shipment by legal-weight truck, by rail using one of the branch rail line implementing alternatives, or by heavy-haul truck using an intermodal transfer station and one of the five highway routes evaluated. In addition, environmental justice impacts would be unlikely for the construction of an intermodal transfer station and upgrading of highways for one of the possible heavy-haul truck routes. Chapter 4, Section 4.1.13.4, contains an environmental justice discussion of a Native American perspective on the Proposed Action.