Final
Environmental Impact Statement

for
the Nevada Test Site and Off-Site Locations
in the State of Nevada

Volume 1

Appendix I

U.S. Department of Energy
Nevada Operations Office
Las Vegas, Nevada

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ACRONYMS

AT/SST	Armored Tractor/Safe-Secure Trailer
ac	acres
ADROIT	Potential risk associated with Defense Programs Transportation Activities
ANL-E	Argonne National Laboratory - East
BAPL	Bettis Atomic Power Laboratory
Bq	Becquerel
CGTO	Consolidated Group of Tribes and Organizations
dBa	a weighted decibel
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
EIS	Environmental Impact Statement
EM	Emergency Materials
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FORTRAN	A computer programming language for problems that can be addressed in algebraic terms
g	gram
Hz	hertz
HIGHWAY	A computer program used for evaluating routes for transporting hazardous materials in the United States
hours/yr	hours per year
INEL	Idaho National Engineering Laboratory
KAPL	Knolls Atomic Power Laboratory
km	kilometer
LANL	Los Alamos National Laboratory
LCF	Latent cancer fatality
LLNL	Lawrence Livermore National Laboratory
LLW	Low-Level Waste
m^2	square meters
m^3	cubic meters
ERPG	Emergency response planning guidelines
m	meter
mi	mile
yd	yard
NAFR Complex	Nellis Air Force Range

ACRONYMS (continued)

nCi	nanocurie
NTS	Nevada Test Site
PSC	Public Service Commission
ORNL	Oak Ridge National Laboratory
PEIS	Programmatic Environmental Impact Statement
PORTS	Portsmouth Gaseous Diffusion Plant
RFETS	Rocky Flats Environmental Technology Site
SLAC	Stanford Linear Accelerator
Spaghetti Bowl	U.S. 15/95 Interchange in Las Vegas
SRS	Savannah River Site
RADTRAN	A computer code combining user-determined meteorological, demographic, transportation, packaging, and material factors with health physics data to calculate the expected radiological consequences and accident risk of transporting radioactive materials
VOC	Volatile Organic Compound

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SUMMARY

This report has been prepared to address local transportation issues concerning current and potential operations at the Nevada Test Site (NTS), to document the results of the NTS transportation risk analysis, and to provide information and supporting documentation for the Environmental Impact Statement (EIS) for the NTS and Off-Site Locations in the State of Nevada. Four alternatives are evaluated in the NTS EIS: Alternative 1, Continue Current Operations, (No Action); Alternative 2, Discontinue Operations; Alternative 3, Expanded Use; and Alternative 4, Alternate Use of Withdrawn Lands. The transportation risk analysis estimated the health risk from highway transportation of DOE-generated low-level waste, mixed waste, and defense-related nuclear materials for each of the four alternatives.

Stakeholders have identified transportation, health, and safety issues as their paramount concern. In response to these concerns, the U.S. Department of Energy, Nevada Operations Office (DOE/NV) solicited and received input from the public through public meetings and in meetings with federal, state, and local organizations; and commissioned a transportation study. The stakeholders and U. S. Department of Energy (DOE) established the Transportation Protocol Working Group and Big Group to further discuss issues associated with NTS transportation activities. The Transportation Protocol Working Group submitted over 20 recommendations to the DOE concerning the transportation of low-level waste to the NTS. These recommendations covered areas such as information gathering and dissemination; emergency response communications, equipment, and training; operating procedures; and route selection. The recommendations of the Transportation Protocol Working Group are discussed in Chapter 2.

The DOE/NV has also begun a comprehensive study to assess the potential social and cultural effects on American Indian people from the transportation of low-level waste and mixed waste. The study will focus on the American Indian people who reside along three of the primary routes previously evaluated for risk in the NTS EIS. The DOE is committed to having the study reflect the full range of American Indian options.

As part of its mission related to Defense Program, the DOE maintains and operates a special fleet of trucks and trailers used to transport Category II or higher nuclear material between Department of Defense (DoD) and DOE sites in a safe and secure manner. The DOE/Albuquerque Operations Office, Transportation Safeguards Division is responsible for the operation and maintenance of these safe-secure trailers and support vehicles. Since the establishment of this program in 1974, the DOE/Transportation Safeguards Division has accumulated more than 120 million kilometers (km) (75 million miles) of over-the-road experience transporting DOE-owned nuclear materials without an accident that resulted in a release of radioactive material.

Another significant program managed by the DOE that includes transportation activities is the Environmental Restoration/Waste Management Program. Two low-level waste management sites for the DOE complex are presently located at the NTS. Two additional missions which would expand operations at the NTS are under consideration: the addition of the disposal of low-level mixed waste from off-site generators, and the expansion of current disposal facilities to receive significantly more waste. Expansion of these programs would result in an increased need for support services in the areas of shipping, handling, and disposal of hazardous materials. Interstate transportation of low-level waste is also an integral part of these expanded missions.

This study used two different models to calculate risk: (1) potential risk associated with Defense Programs Transportation Activities (ADROIT), and (2) a computer code combining user-determined meteorological, demographic, transportation, packaging, and material factors with health physics data. This second model

(RADTRAN-like) was used to calculate the expected radiological consequences and accident risk of transporting radioactive material for waste management activities. Because of national security concerns associated with special nuclear material, the DOE developed ADROIT to define the potential risk associated with Defense Program transportation activities. A RADTRAN-like model was used to calculate the risk associated with the Waste Management and Environmental Restoration Program. This model was used based on the stakeholder request to see each step in the process. This model is comprised of a combination of spreadsheet, and a computer programming language for problems that can be addressed in algebraic terms (FORTRAN) numbers. A detailed discussion of the model is contained in the *Summary of the Transportation Risk Assessment Results for the Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/NV, 1996).

The results of the transportation risk analysis show that the human health risks from transportation operations are low under any alternative, and are not significant contributors to the total risk from all operations under these alternatives. The expected number of occurrences of cargo-related health effects were calculated for both incident-free and accident scenarios for radioactive and hazardous cargo. Vehicle-related health effects of traffic fatalities and injuries were also calculated. The maximum reasonably foreseeable accidents for low-level waste and mixed waste transportation were assessed. There are no maximum reasonably foreseeable Defense Program accidents that would result in a radioactive release. The total human health risk is dominated by vehicle-related deaths, injuries, and illness and even those numbers are low. Radiation-induced fatalities and illnesses result predominantly from incident-free exposures; however, the expected number of latent cancer fatalities is extremely small in either case.

Of particular interest locally were the in-state risks of low-level and mixed waste transportation. As far as in-state routes are concerned, vehicle-related fatalities and injuries dominate the risk, followed by incident-free radiation-induced fatalities. The risks along all in-state routes are very low, and, are within the uncertainty bands of the analysis. These risks are so similar, that it is not meaningful to rank routes solely on the basis of risk. The results indicate that routing decisions need not rely solely on the health risks as they are all similar, and all are low; however, certain routes do exhibit small risk reductions over others and could be used as a risk management tool. Reduction of total risk can be achieved mainly by selecting the route from a given generator site with the lowest vehicle-related risks.

Risk is not the only concern in the transportation of radioactive and hazardous waste to the NTS. Consequently, the DOE will continue to interact with the stakeholders to ensure that local concerns are brought to the attention of carriers selecting routes; will ensure that full government-to-government consultation with American Indian tribal governments occurs; and will continue to conduct all operations, including shipping, in a safe manner.

1.0 INTRODUCTION

1.1 Purpose and Scope

The NTS is a multiple-facility site that supports a diverse range of DOE mission objectives. Although the principal mission of the NTS has been to conduct nuclear tests, and more recently, to maintain a readiness to conduct nuclear tests, the NTS has also supported other DOE activities in the waste management, environmental restoration, non-defense research and development, and work for others program. This report was written to address the local issues concerning these and potential future operations and to provide information and supporting documentation to the NTS EIS, particularly by summarizing the transportation risk analysis.

Four alternatives have been identified for evaluation in the NTS EIS:

- Alternative 1, Continue Current Operations (No Action)
- Alternative 2, Discontinue Operations
- Alternative 3, Expanded Use
- Alternative 4, Alternate Use of Withdrawn Lands.

Alternative 1 is defined as the continuation of ongoing DOE and interagency programs, activities, and operations at NTS. It also includes the provision for continuing past operations such as; maintaining and conducting nuclear weapons tests, and disposal of waste generated from some outside sources.

Alternative 2 represents one end of the spectrum of options considered in the EIS. This alternative would result in site closure, with the exception of required activities in support of site security and environmental monitoring. All current programs, including waste receipt and disposal activities, would be discontinued.

Under Alternative 3, use of the NTS and its resources would be expanded to support national programs of both a defense and nondefense nature. This would mean a significant increase in opportunities for use of the NTS and its capabilities and resources in support of ongoing and new Defense, Nondefense Research and Development and Work for Others Programs activities. The increase in activities would result in increased highway transport of hazardous materials and waste to and from the NTS.

Alternative 4 places new environmental and economic-based activities at the NTS. Under this alternative, potential new programs and activities would depend on future mission requirements, land-use designations, and withdrawal status at the NTS. One key feature of this alternative, as defined in the NTS EIS, is that the DOE would stop all defense-related activities, including most of those under the Work for Others Program. Waste management operations would continue in support of ongoing DOE/NV operations and activities.

The current mission of the NTS is to maintain readiness to test nuclear weapons. Under Alternative 3, Expanded Use, the mission of the NTS would increase to include many stockpile stewardship responsibilities, such as weapons assembly and disassembly, and storage of plutonium pits and other highly enriched nuclear material. This mission requires the transport of special nuclear material to the NTS. Transportation scenarios have been developed for these activities and modeled to define the risk associated with the transportation of special nuclear material. The type of weapons, specified routes, and other associated information is classified for reasons of national security.

As part of its Defense Program mission, the DOE maintains and operates a special fleet of trucks and trailers used to transport Category II or higher nuclear material between DoD and DOE sites in a safe and secure manner. The DOE Albuquerque

Operations Office, Transportation Safeguards Division is responsible for the operation and maintenance of these safe-secure trailers and supporting vehicles. Since the establishment of this program in 1974, the DOE Transportation Safeguards Division has accumulated more than 120 million km (75 million miles) of over-the-road experience in transporting DOE-owned nuclear materials without any accident that resulted in a release of radioactive material.

The DOE is responsible for managing and operating complex-wide radioactive Waste Management and Environmental Restoration Program activities. These programs provide for the comprehensive management of all DOE-generated radioactive waste, as well as some non-DOE defense-related wastes. As part of these programs, two low-level management sites are located at the NTS. In accordance with the provisions established in the Atomic Energy Act of 1954, the NTS has received radioactive waste for disposal from the DOE and the DoD generators since 1976.

This current mission of managing DOE and DoD low-level waste is under consideration for expansion within the DOE complex. Two potential expansions of the DOE/NV mission are; the addition of the disposal of low-level mixed waste from off-site generators on the NTS, and expansion of the current disposal facilities to receive significantly more low-level waste. Generator sites are shown on the map of the United States in Figure 1-1. Future defense mission activities at the NTS could also include storage and/or production of special nuclear materials. Expansion of these programs would result in an increased need for support services in the areas of shipping, management, and disposal of hazardous material.

During the scoping period for the NTS EIS and in subsequent meetings with the DOE, some members of the public, elected officials, and private issue advocacy groups expressed concern about the DOE's ongoing and expanding radioactive waste and nuclear materials management activities at NTS. These stakeholders asked the DOE to provide them with more information about the potential risks to human health associated with transporting radioactive waste and nuclear materials. Stakeholders were particularly interested in local transportation issues, such as the routing of radioactive shipments in and around southern Nevada metropolitan areas, and the potential for using rail systems as an option to highway transport. A map depicting the NTS, nearby states, and the regional highway system is given in Figure 1-2.

The transportation risk analysis in this study estimated the health risk in terms of both vehicle-related death and injuries and cargo-related deaths and illness such as; latent cancer fatalities from highway transportation of DOE-generated low-level waste, mixed waste, defense-related nuclear materials, and bulk shipments of hazardous chemicals for each of the four alternatives. The study also assesses the nonradiological risk (vehicle emissions) of health effects associated with all DOE transportation activities. Rail and intermodal transportation options were not evaluated in the risk analysis, but have been included in Attachment E. The environmental consequences of highway transportation and on-site operations are discussed in Chapter 5 of the Final NTS EIS.

The remainder of this chapter provides background information, and a summary of the results, and conclusions of the transportation risk analysis. Chapter 2 contains a discussion of stakeholders concerns and recommendations issues. Chapter 3 summarizes the transportation risk analysis for Defense, Waste Management, and Environmental Restoration Program. References are provided in Chapter 4. Six attachments provide additional details and supporting information for this study.

Several changes have occurred between publication of the Transportation Study in the NTS Draft EIS and publication in the Final EIS. The Transportation Protocol Working Group's recommendations have been added to Chapter 2. This chapter has also been revised to remove any implication that full government-to-government consultation with American Indian tribes has occurred. A discussion of past and planned

Figure 1-1. NTS EIS Transportation Study Waste Generator Locations

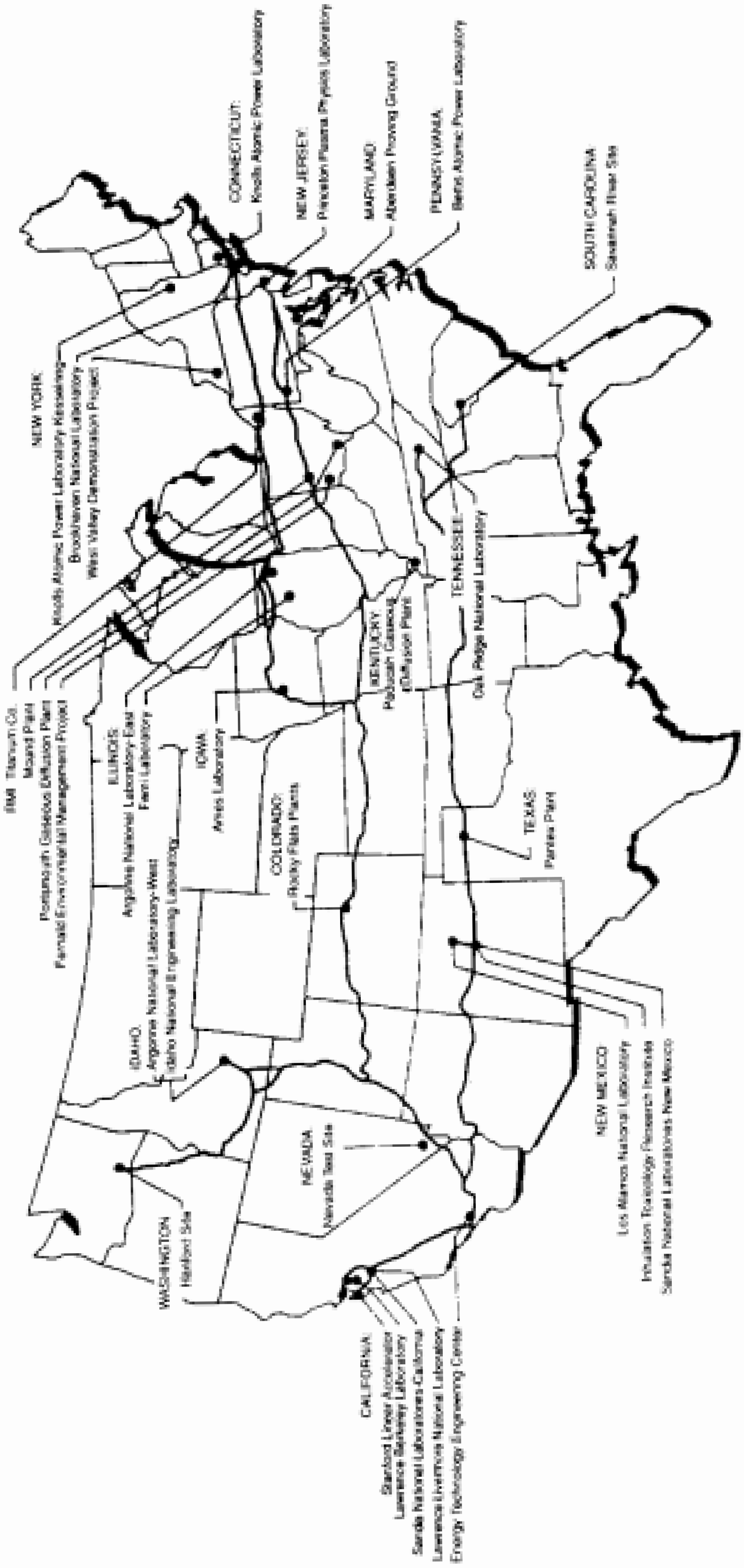
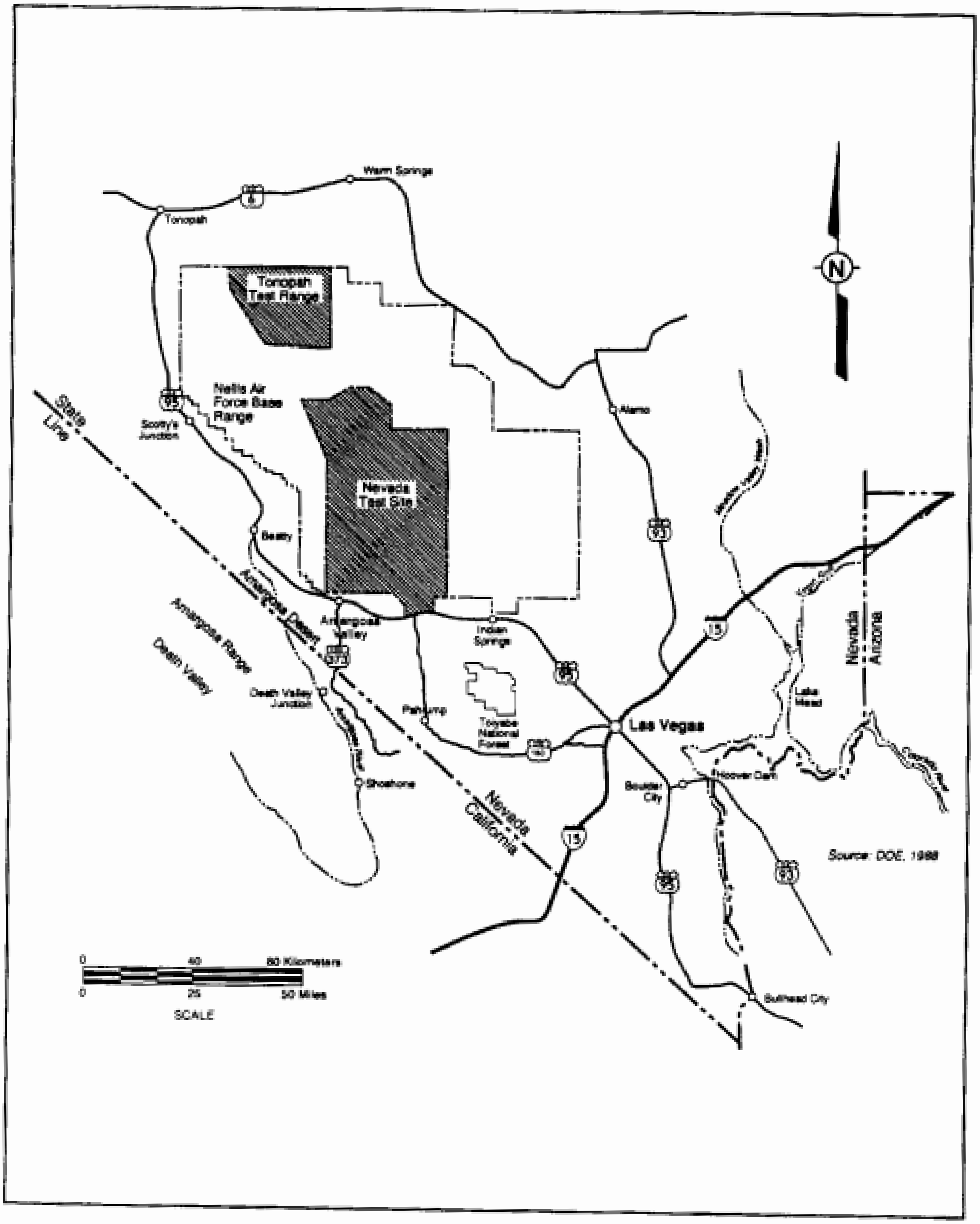


Figure 1-2. NTS Map



American Indian involvement in low-level waste transportation issues has been added.

In response to concerns that the transportation risk code, RADTRAN, was not used in this analysis to calculate the transportation risk, a study (IT Corp, 1995a) was conducted to compare the results generated by RADTRAN to those generated by the model used in this analysis. The results of that comparison are summarized in Section 3.3.1 of this study.

Chapter 3 includes sites specific Defense Program analyses, hazardous material and waste (radioactive low-level, mixed and hazardous) analysis, and maximum foreseeable accidents. An NTS-specific analysis of the risk of the transportation of defense-related nuclear materials has been conducted and the results of that analysis have been added in Section 3.2. Several waste management transportation activity scenarios have also been added (Section 3.3): incident-free nonradiological health effects, incident-free maximum individual doses, the maximum reasonably foreseeable accident, and the risk from transportation of low-level waste (contaminated soil) from the Tonopah Test Range to the NTS for disposal. A hazardous chemicals shipment transportation risk analysis has also been added.

In addition, a number of minor mathematical errors have been corrected. These corrections do not significantly increase the risk results, or do they affect any of the conclusions.

1.2 Background Information

A sitewide EIS is required by the DOE's implementing regulations for the National Environmental Policy Act, to evaluate the environmental impact associated with DOE activities and programs, including current proposed activities. The NTS EIS provides a means to evaluate the potential effects of changes in operations and changes in the site's missions, as well as an opportunity to consider the total effects of reasonably foreseeable activities. An EIS is also required for any federal actions that have the potential for significant environmental impact. Through the Record of Decision, the DOE will make important decisions regarding the mission of the NTS.

Stakeholders identified transportation, health, and safety issues as a paramount concern during the NTS EIS scoping process. The DOE conducts transportation operations in accordance with the requirements of the U.S. Department of Transportation and applicable U.S. Nuclear Regulatory Commission regulations (Attachment A), in accordance with their own orders, and it holds an excellent transportation record, DOE, (1993a). Under Alternatives 1 and 3, the Defense Program activities continue interstate transportation of special nuclear materials to the NTS. Much of the waste identified in Chapter 4 of the NTS Final EIS is generated by DOE and DoD facilities outside the State of Nevada. Therefore, interstate transportation of low-level radioactive waste is an integral part of the Waste Management Program, and those associated activities have the potential to increase under Alternative 3.

In response to similar concerns throughout the DOE complex, the DOE is funding several studies designed to provide additional information on transportation risks and alternative modes of transporting various types of waste. The DOE's Idaho National Engineering Laboratory is evaluating the costs and risks associated with alternative modes of spent nuclear fuel transportation, including intermodal and rail options.

The proposed action of formulating and implementing an integrated Waste Management Program is evaluated in the *Draft Waste Management Programmatic EIS (DOE, 1995c)* that would include consolidating existing waste management operations, and establishing a waste transportation network. This Programmatic EIS contains a transportation risk assessment which identifies human health effects in terms of the expected number of fatalities and injuries. However, it would not be appropriate to compare these results to the NTS transportation risk results because different assumptions were used. For example, the Waste Management EIS assesses effects over 20 years, and the NTS study assesses effects for only 10 years. Furthermore, the assumptions used to develop the alternatives in each EIS are different, including assumptions about volumes of waste, and different models were used to calculate the risk. However, the results of both studies indicate that transportation risks are very low.

The DOE/NV has also solicited and received input from the public through public meetings and meetings with federal, state, local governments, and other organizations. The transportation risk analysis draft outline and preliminary draft input were provided to participants of the general transportation meetings. Comments were received during these meetings and incorporated, as appropriate. From this, a group of concerned stakeholders, called the "Big Group", was identified to meet on a regular basis to focus on general transportation issues. Additionally, a Transportation Protocol Working Group was created to focus on technical issues.

The DOE met with the Consolidated Group of Tribes and Organizations (CGTO), and gave a brief presentation on transportation issues. The DOE/NV officials later visited three tribal governments and gave presentations on transportation issues that could affect tribal lands or interests. No further studies or any consultations were conducted. A comprehensive study has been initiated to assess the potential social and cultural effects on American Indian people from the transportation of low-level and mixed waste.

1.3 Summary of Results

The DOE has over four decades of experience in the safe transportation of hazardous materials and waste. Although accidents involving vehicles containing radioactive material have occurred, no significant releases, exposures, or radiation fatalities have ever occurred. The expected number of occurrences of cargo-related health effects were calculated for both incident-free and accident scenarios for radioactive and hazardous cargo. Vehicle-related health effects of traffic fatalities and injuries were also calculated. Results of the transportation risk analysis are discussed in Sections 3.2.3 and 3.3.4.

1.3.1 Defense Program

The DOE has evaluated and reported the risks (consequences and probabilities) associated with transporting Defense Program nuclear material in the *Defense Programs Transportation Risk Assessment: Probabilities and Consequences of Accidental Disposal of Radioactive Material Arising from Off-Site Transportation of Defense Program Material*, (SNL/NM, 1994). The annual risk for shipping various cargos was evaluated based on many factors including, but not limited to; the transportation mode, how often and how far each cargo must be shipped, the specific route, and the population density along specific routes.

Under Alternative 1 the risk of a single latent cancer fatality (LCF) due to incident-free transportation of Defense Program nuclear materials has been calculated as 4×10^{-5}; and the nonradiological risk due to vehicle emissions is 1.85×10^{-4}. The expected number of traffic fatalities is 6×10^{-4}. The risk of a single accident-initiated LCF is 8×10^{-11}.

Defense Program activities described in Alternative 3 could include certain stockpile stewardship responsibilities (storage of plutonium pits and assembly and disassembly of components and weapons) and management of Defense Program surplus materials. This is in addition to the activities described in Alternative 1. The risk of a single LCF due to incident-free transportation is 2.14×10^{-3}, and the risk of nonradiological health effects from vehicle emissions is 4.01×10^{-3}. The expected number of traffic fatalities is 1.06×10^{-2}. The risk of a single accident-initiated LCF is 1×10^{-6}. The transportation risks for these additional activities are also being evaluated in programmatic environmental impact statements being prepared by the DOE.

1.3.2 Waste Management Program

The total human health risk associated with hazardous materials and waste transportation for the waste management activities is dominated by vehicle-related deaths and injuries, and even those numbers are low: 2 fatalities and 27 injuries in 10 years (0.2 fatalities and 2.7 injuries per year), and a 0.003 risk of nonradiological health effects due to incident-free transportation under Alternative 1; and 8 fatalities and 103 injuries in 10 years (0.7 fatalities and 10.3 injuries per year), and an 0.012 risk of nonradiological health effects due to incident-free transportation under Alternative 3. Typically, 50,000 traffic fatalities occur each year. It is evident that the 0.2 or 0.7 fatalities due to transportation operations under Alternatives 1 and 3 represent minimal increases in the national number of traffic statistics.

Radiation-induced fatalities and illnesses result predominantly from incident-free exposures; however, the expected number of latent cancer fatalities is extremely small in any case. For instance, under Alternative 1, the total number of expected LCF is 2.5×10^{-3} in 10 years, which would be 2.5×10^{-4} annually (2.5×10^{-3} equals 0.0025, or about two and one-half fatalities every 1,000 years). Of the total LCFs, 0.0025 are attributable to incident-free transportation, and only 1.1×10^{-6} to accident scenarios. Approximately 2,500 people die of cancer each year in Nevada, and transportation of radioactive waste to the NTS under Alternative 1 adds 0.00025 to that total. The results for Alternative 3 are slightly higher than those for Alternative 1, although they are still low: 0.077 (7.7×10^{-2}) LCFs in 10 years. This is primarily because of the greater quantities of waste being shipped to the NTS under the Expanded Use Alternative.

The maximum reasonably foreseeable low-level waste and mixed waste transportation accidents have a probability of occurrence of 8.08×10^{-3} (for low-level waste) and 3.23×10^{-3} (for mixed waste) under Alterative 3 for the most severe consequences of latent cancer-fatality and detriment. There are no maximum reasonably foreseeable Defense Program accidents which would cause a release of radioactive material.

1.4 Conclusions

The results of this transportation risk analysis show that the human health risks from transportation operations are low under any alternative, and are not significant contributors to the total risk from all operations under these alternatives. Along the in-state routes, vehicle-related fatalities and injuries dominate the risk because they are similarly followed by incident-free radiation-induced fatalities. The risks along all in-state routes are low, and within the uncertainty bands of the analysis; therefore, it is not meaningful to rank routes solely on the basis of risk.

Risk of course, is not the only issue of concern in the transportation of radioactive and hazardous waste to the NTS. The DOE will continue its policy of interacting with the stakeholders, ensuring that local concerns are brought to the attention of carriers selecting routes, and conducting all operations, including shipping, in a safe manner. The DOE will also begin full government-to-government consultation with the affected American Indian tribes.

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2.0 PUBLIC ISSUES

2.1 Public Involvement

Public involvement has played a significant role in the development of this study. During the NTS EIS public scoping meetings, transportation was identified as a major concern ranking second behind issues associated with the alternatives. At the same time, local communities expressed concern over the routes used to ship low-level waste, as well as the route selection process. They also made it clear that they felt the DOE could do a better job of communicating with local governments on transportation issues.

The DOE solicited and received comments from the public during a series of transportation meetings held with federal agencies, state, and local government organizations. Specific concerns expressed included:

- Health and safety issues
- On- and off-site transportation risks
- Railroad options
- Local highway segments
- Carrier and route selection
- Applicable laws and regulations
- Emergency response and procedures
- Identification and analysis of alternative routes, monitoring shipments, packaging, and handling requirements.

These issues were repeatedly identified at various transportation meetings during the scoping period, and in comments provided on the Draft Implementation Plan for the NTS EIS. To the extent possible, the DOE intends to address these concerns in this report.

The DOE/NV has accepted responsibility for improving communications with state and local governments, as well as the public. In response to issues raised by city officials from North Las Vegas, Nevada, concerning low-level waste shipments along Craig Road, the DOE/NV met with North Las Vegas representatives in July 1994 to discuss their concerns. The news about this meeting was not well-received by other local communities, and received an unfavorable report in the media. Following this, the DOE/NV again sought to better identify and address the wide range of local concerns.

During the formal NTS EIS scoping period (August 10, 1994, through November 10, 1994), it became clear that transportation was an issue that required attention. Therefore, a separate transportation meeting "Big Group" was held on November 15, 1994, as a follow-up to an August meeting, to elicit further local government comments on specific issues and concerns to be included in this Transportation Study. An advance notice of the meeting was announced in the press so interested citizens could also attend. The meeting was attended primarily by representatives of the state, surrounding counties, and cities located near the NTS. A draft outline for the study was provided to participants at the meeting, and time was provided at the end of the meeting for public comment.

During the November meeting, several "one-on-one" meetings with the DOE/NV transportation team were requested by local representatives. These meetings (Table 2-1) offered an opportunity for the specific concerns to be heard, as well as for DOE/NV technical experts to answer questions in an informal setting. It was suggested during the first of these meetings, and supported during others, that working groups be established to focus on the technical details of the risk assessment and transportation protocol. Comments and responses from the "Big Group" meeting held April 20, 1995, are provided in Attachment C, Public Participation In The Transportation Study.

At the April 20, 1995 meeting, in addition to providing a transportation study status update, a session without DOE representatives was held and stakeholders identified the positives and negatives associated with the development and content of DOE/NV's Draft Transportation Study. When the DOE participants were invited to rejoin the

Table 2-1. Transportation meetings held on the NTS EIS Transportation Study

(Page 1 of 5)

EIS Transportation Study Meetings		
Host Organization	**Date**	**Location**
Local & County Government	August 22, 1994	DOE/NV Auditorium 2753 S. Highland Las Vegas, Nevada 89109
University of Nevada, Las Vegas Harry Reid Center	November 15, 1994	University of Nevada, Las Vegas Harry Reid Center Las Vegas, Nevada 89154
Clark County	December 6, 1994	301 E. Clark Avenue Suite 570 Las Vegas, Nevada 89101
City of Henderson	December 7, 1994	223 Lead Street Henderson, Nevada 89015
City of Las Vegas	December 12, 1994	1785 E. Sahara Avenue Suite 440 Las Vegas, Nevada 89104
City of North Las Vegas	December 13, 1994	2200 Civic Center Drive Las Vegas, Nevada 89030
Boulder City	January 5, 1995	1005 Arizona Street Boulder City, Nevada 89005
Lincoln County	January 18, 1995	Howard Hughes College of Engineering University of Nevada, Las Vegas Las Vegas, Nevada 89154
Nye County	January 26, 1995	Nuclear Repository Office Pahrump, Nevada 89041
White Pine County	February 10, 1995	Ely, Nevada 89301
Community Advisory Board for the NTS Programs	March 1, 1995	Holiday Inn Crowne Plaza Las Vegas, Nevada 89109
Esmeralda County	March 13, 1995	Esmeralda County Courthouse Goldfield, Nevada 89013
City of Laughlin	March 14, 1995	Bilbray Industries 3650 Southpoint Circle Laughlin, Nevada 89029
Southern Paiute Tribal Association	March 22, 1995	Southern Paiute Field Station St. George, Utah 84770
University of Nevada, Las Vegas Harry Reid Center	April 20, 1995	University of Nevada, Las Vegas Harry Reid Center Las Vegas, Nevada 89154

Table 2-1. Transportation meetings held on the NTS EIS Transportation Study

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Big Group Working Meetings		
Host Organization	**Date**	**Location**
DOE/NV	July 1994	U. S. Department of Energy Nevada Operations Office 2765 S. Highland Drive Las Vegas, Nevada 89109
DOE/NV	November 1994	University of Nevada, Las Vegas Harry Reid Center Las Vegas, Nevada 89154
DOE/NV	April 1995	University of Nevada, Las Vegas Harry Reid Center Las Vegas, Nevada 89154
DOE/NV	April 1996	U.S. Department of Energy 2621 Losee Road Bldg. C-1 Auditorium North Las Vegas, Nevada 89030
Transportation Protocol Working Group Meetings		
Host Organization	**Date**	**Location**
DOE/NV	April 6, 1995	Desert Research Institute 788 E. Flamingo Road Las Vegas, Nevada 89109
DOE/NV	April 27, 1995	Clark County Offices 301 E. Clark Avenue, #570 Las Vegas, Nevada 89101
DOE/NV	May 22, 1995	Clark County Offices 301 E. Clark Avenue, #570 Las Vegas, Nevada 89101
DOE/NV	January 11, 1996	Desert Research Institute 788 E. Flamingo Road Las Vegas, Nevada 89109
DOE/NV	February 1, 1996	U.S. Department of Energy 2621 Losee Road Bldg. C-1 Auditorium North Las Vegas, Nevada 89030
DOE/NV	March 18, 1996	Conference Call
DOE/NV	April 10, 1996	Conference Call

Table 2-1. Transportation meetings held on the NTS EIS Transportation Study

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Transportation Risk Working Group Meetings		
Host Organization	**Date**	**Location**
DOE/NV	May 16, 1995	U.S. Department of Energy Nevada Operations Office 2765 S. Highland Las Vegas, Nevada 89109
DOE/NV	June 15, 1995	IT Corporation 4330 S. Valley View, #114 Las Vegas, Nevada 89103
Draft Implementation Plan Meetings		
Community Advisory Board for the NTS Programs	February 1, 1995	Holiday Inn Crowne Plaza Las Vegas, Nevada 89109
DOE/NV	February 7, 1995	University of Nevada, Las Vegas Las Vegas Campus Classroom Building Complex Las Vegas, Nevada 89154
DOE/NV	February 9, 1995	University of Nevada Reno Campus Classroom Student Union Building Reno, Nevada 89557
DOE/NV	March 7, 1995	DOE/NV Auditorium 2753 S. Highland Las Vegas, Nevada 89109
DOE/NV	March 9, 1995	Reno Sparks Convention Visitors Center 4590 S. Virginia Street Reno, Nevada 89501

Scoping Period Meetings	
Date of Meeting	**Location**
September 7, 1994	Fallon Convention Center 100 Campus Way Fallon, Nevada 89046
September 8, 1994	Carson City Community Center 851 E. Williams Street Carson City, Nevada 89701
September 13, 1994	Dixie Center convention Facilities 425 South 700 East St. George, Utah 84770
September 15, 1994	Tonopah Convention Center 301 Brougher Tonopah, Nevada 89049

Table 2-1. Transportation meetings held on the NTS EIS Transportation Study

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Scoping Period Meetings	
Date of Meeting	**Location**
September 20, 1994	Cashman Field Convention Center 850 Las Vegas Boulevard, North Las Vegas, Nevada 89101
September 21, 1994	Bob Ruud Community Center Highway 93 Caliente, Nevada 89008
October 4, 1994	Henderson Convention Center 200 S. Water Street Henderson, Nevada 89015

Other Information Meetings		
Sponsor	**Date**	**Location**
State of Nevada Clearinghouse	August 30, 1994	State Clearinghouse II Capitol Complex Carson City, Nevada 89710
Environmental Management Community Advisory Board	October 5, 1994	Holiday Inn Crowne Plaza 4225 Paradise Road Las Vegas, Nevada 89101
Affected Units of Government	October 21, 1994	White Pine County Convention Center 150 6th Street Ely, Nevada 89301
South-Central Nevada Federal Complex Advisory Board	October 28, 1994	Tonopah Convention Center 301 Brougher Tonopah, Nevada 89049
Air & Waste Management Association	December 14, 1994	Palace Station Hotel & Casino 2411 West Sahara Las Vegas, Nevada 89102
State of Nevada Clearinghouse	December 19, 1994	Nevada State Library Capitol Complex Carson City, Nevada 89710
State, Local, Tribal, Government	February 24, 1995	Tonopah, Nevada 89049
Southern Nevada Federal Facility Community Advisory Board	February 28, 1995	Tonopah, Nevada 89049

Table 2-1. Transportation meetings held on the NTS EIS Transportation Study

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Other Information Meetings		
Sponsor	**Date**	**Location**
Consolidated Group of Tribal and Organizations	March 17 - 19, 1995	NTS Mercury, Nevada 89023
Paiute Tribe of Southern Utah	September 9, 1995	Tribal Headquarters 600 North 100 East Cedar City, Utah 84720
Moapa Band of Paiutes	September 14, 1995	Tribal Headquarters P.O. Box 340 Moapa, Nevada 89025
Las Vegas Paiute Tribe	September 19, 1995	Tribal Headquarters #1 Paiute Drive Las Vegas, Nevada 89109
DOE/NV	March 6, 1996	Community Advisory Board Durango High School Las Vegas, Nevada 89109
DOE/NV	March 13, 1996	Air and Waste Management Luncheon Palace State Station Hotel Las Vegas, Nevada 89101
Public Hearings		
DOE/NV	March 5, 1996	Dixie Center Convention Facilities 425 South 700 East St. George, Utah 84770
DOE/NV	March 13, 1996	Nuclear Repository Office Pahrump, Nevada 89041
DOE/NV	March 19, 1996	University of Nevada Reno Campus Classroom Student Union Building Reno, Nevada 89557
DOE/NV	March 26, 1996	Cashman Field Convention Center 850 Las Vegas Boulevard, North Las Vegas, Nevada 89101
Public Workshops		
UNLV CORE	April 8, 1996	City Hall Boulder City, Nevada 89005
UNLV CORE	April 16, 1996	Train Depot Caliente, Nevada 89008
UNLV CORE	April 23, 1996	Commissioner's Chamber Courthouse Tonopah, Nevada 89049
UNLV CORE	April 25, 1996	West Las Vegas Art Center North Las Vegas, Nevada 89030

stakeholders, the facilitator reported the results of the session. It was at this meeting that the stakeholders requested that a risk working group be formally established to review the risk assessment. The DOE/NV then formalized the Transportation Risk Working Group. This group is comprised of representatives from state and local governments and from the Community Advisory Board who expressed an interest in reviewing and understanding the technical details of transportation risk analysis.

The stakeholder Transportation Protocol Working Group met to identify, prioritize, and understand local issues and concerns associated with the transportation of low-level waste to the NTS, resulting in the Transportation Protocol Working Group's recommendations. The working group will continue to meet with DOE at a minimum of three times a year to discuss issues. This "teaming" approach has been well-accepted by community members, and has already resulted in the acquisition of more current demographic data. Suggestions have also been offered regarding how to present the information to the public in a more straight-forward and understandable manner.

In March 1995, the DOE met with the CGTO at the NTS to discuss tribal involvement in the NTS EIS. At that time a brief presentation of transportation issues was presented and it was apparent that these issues were very important to the CGTO representatives. In June, a letter was sent to the tribes and organizations of the CGTO formally announcing the intention to begin consultation to address specific transportation concerns of tribal governments. Following this, DOE/NV officials visited three tribal governments and gave a brief presentation of transportation issues that could affect tribal lands or interests.

These actions do not constitute full government-to-government consultation. Consequently, the DOE/NV will begin a comprehensive study to assess the potential social and cultural impacts to American Indian people that could occur from the transportation of low-level radioactive waste. The American Indian people who currently reside near the routes identified in the NTS EIS Transportation Risk Analysis will be the focus of this study. The proposed study provides an opportunity for a full government-to-government relationship between potentially involved tribes and the DOE/NV, and outlines DOE's ongoing commitment to make every effort to have this study reflect the full range of the American Indian perspective.

2.2 Stakeholder Issues

The DOE/NV worked with state and local governments through the Transportation Protocol Working Group to identify local issues. Five issues were identified by the group as major concerns:

- Transportation management operations (applicable laws, regulations, packaging, and handling requirements, and emergency preparedness) associated with hazardous materials and waste
- Local route segments of concern, primarily Craig Road, Hoover Dam, and Interstate 15/U.S. Highway 95 Interchange
- Routing of hazardous materials and waste
- Rail options for the NTS
- Health risk associated with transportation

An inclusive list of the issues identified and ranked by the Transportation Protocol Working Group is shown in Table 2-2. The Transportation Protocol Working Group continued to meet and submitted over 20 recommendations as comments on the NTS Draft EIS (Subsection 2.2.6).

2.2.1 Transportation Management Operations

All DOE activities are governed by DOE orders, which for transportation operations, adopt the standards of Department of Transportation regulations in *Title 49 of the Code of Federal Regulations*. Compliance with these regulations protects workers, the public, and the environment from exposure to radioactive or hazardous materials. Cargo-related incident-free risks along the Hoover Dam route are higher than those for the alternate routes because of the low speed and higher population density. Cargo-related accident risks along the Hoover Dam route are similar to those of the alternate routes because of relatively small differences in distances, and large uncertainties associated with accident risks.

One scenario of concern is the likelihood of a vehicle accident over Hoover Dam, and the possibility of a release of radioactive or hazardous material into the Colorado River, contaminating the water. The consequences of such an accident are minor. Radioactive or hazardous material present in these shipments is not present in concentrations high enough to contaminate the food chain or affect the ecosystem. Of the material spilled, some could be suspended in the water and carried downstream, but the material would be highly diluted. The remainder would likely settle to the bottom quickly. In addition, the likelihood of a release actually reaching the river is also very low. Since the likelihood of an accident is very low and related consequences are extremely minimal, the associated risk is very low.

The DOE also complies with applicable state and local regulations. Stakeholders have expressed concern about their knowledge and under standing of applicable laws and regulations, the division of responsibility, how radioactive and hazardous materials are packaged and shipped, and emergency preparedness.

The laws and regulations which apply to DOE transportation operations to, from, and on the NTS are listed in Attachment A. Packaging requirements, carrier selection criteria, driver training, liability, and on-site waste acceptance and tracking procedures are described in Attachment B.

The stakeholders also identified concerns about local rural emergency preparedness. Emergency response training and procedures are described further in Attachment D. First responder training is available to all jurisdictions within Nevada and has been taught in several Nevada counties. First-on-scene training has been made available by the DOE to fire, law enforcement, and emergency medical responders in Nevada since 1983. Because of the nature of this training, the basic courses have been presented at other locations in both southern (Las Vegas and Henderson) and northern (Reno-Sparks and Elko) Nevada. The Emergency Medical Personnel Radiological Seminar has been given in both Tonopah and Ely. The DOE is working with rural response forces to schedule training that volunteers can attend in their local areas.

2.2.2 Local Segments of Concern

Several route segments in and around the NTS present concerns regarding accident rates and the consequences of a release: Craig Road, Hoover Dam, and the Interstate 15/U.S. Highway 95 interchange (referred to locally by the name, the "Spaghetti Bowl"). The segments were included in the in-state routes in the transportation risk analysis.

Craig Road

Craig Road was suggested as a possible alternate route to avoid the Interstate 15/U.S. Highway 95 interchange. North Las Vegas provided an updated population density of 0.00045 persons per square meter for this segment of the route. However, to be conservative in calculating the cargo-related risks along this route, a value of 0.00082 persons per square meter was used. Risks due to vehicle-related traffic injuries and fatalities are slightly higher for Craig Road than for the routes which include the Interstate 15/U.S. Highway 95 interchange, primarily because of the higher accident rate for Craig Road. However, the cargo-related risk due to incident-free transportation along Craig Road is slightly lower.

Hoover Dam

A study was commissioned by the U.S. Department of the Interior (CH2M Hill, 1993) to predict truck accident rates and hazardous materials shipment accident rates for different road segments leading to, over, and from Hoover Dam. The key findings of this study indicate that while approximately 50 truck overturns are expected

Table 2-2. Results of Transportation Protocol Working Group Issue Ranking

(Page 1 of 2)

Rank	Issue	Votes to rank issues (1 = highest priority)									Total
		1	2	3	4	5	6	7	8	9	
1	Criteria that will be used to weigh issues in final recommendations for routing	30	3	10	3	2	5	30		40	123
2	Transportation safety	20	7	7	10	10	20	30	15		119
3	Training for local first responders	20	5	10	10	5	10	10		20	90
4	Potential rail access to NTS	30	10	8	3	20	15				86
5	Will the DOE ever recommend routes for low-level waste in Nevada?		8	4	3	5	1	20			41
6	Perceived risk vs. calculated risk		5	7	3	5	10				30
7	Which State of Nevada statues apply to routing and training required?		4	4	3	2	10			5	28
8	Lines and mechanisms of communication between the DOE, Transportation Protocol Working Group, state and local governments		3	3	7	2	2			10	27
9	Entire regulatory structure within state, local, federal, and tribal governments, and how they interact		4	5	1	3	2			10	25
10	Risk analysis methodology - communication - public perception of risk		9	7	3	3	2				24
11	Cost benefit analysis between rail and truck for low-level waste for total systems life cycle, based on what comes out of the EM Programmatic EIS		2	5	7	5	2				21
12	Total impacts of truck shipments (low-level waste to NTS)		6	5	3	3	2				19
13	Procedures for inspection		3	2	3	5	5				18
14	Discussion and description of existing routes as they currently exist		3	3	7	3	1				17
15	Potential safe havens (time of day, day of week)		2	2	1	5	1			5	16
16	Shipment of transuranic waste		1	7	3	2	2				15
16	Emergency routes within southern Nevada		3	2	3	5	2				15

Table 2-2. Results of Transportation Protocol Working Group Issue Ranking

(Page 2 of 2)

Rank	Issue	Votes to rank issues (1 = highest priority)									Total
		1	2	3	4	5	6	7	8	9	
16	DOE/NV current authority in managing transportation issues and limits (where should they be?)		2	2	3	2	1			5	15
16	Possible time of day limitations and restrictions on interchange areas		3	0	1	5	1			5	15
17	Relationship between the DOE/NV Transportation Study and the requirements in Section 180C National Environmental Protection Agency		1	5	7	0	1				14
18	First responder equipment		1					10			11
19	Colorado River crossing		1	0	3	5	0				9
20	Types of waste, materials, and containers		1	2	1	3	1				8
21	American Indian Resource Issues		1	0	3	0	2				6
22	Notification and exportation of commodities		1	0	1	0	2				4
23	Agency regulatory interaction		2								2
23	Vehicle operator training/license		2								2
23	Shipments, numbers, points of origin, schedule		2								2
23	Data, data sources - level of accuracy		2								2
24	Funding for roadway and staff improvements		1								1
25	Definition and detailed description of low-level waste										0

during the 10-year time frame of the NTS EIS, only 5 of those are expected to be hazardous materials shipments. Of those five hazardous materials shipments, less than one is expected to result in a spill.

Currently, approximately 825 hazardous materials shipments cross the Hoover Dam per week. The study (CH2M Hill, 1993) indicates that two spills are estimated to occur over the next 20 years on the basis of historical accident rates at the Hoover Dam. Class 7 (radioactive substances) shipments over the Hoover Dam represent only a small fraction of the total hazardous materials shipments. The volume of hazardous material shipped under Alternative 3 represents less than 3 percent of the total hazardous material shipped across Hoover Dam; therefore, using CH2M Hill predictions, no spills involving radioactive materials are expected during the next 20 years.

The study also indicated that only a small fraction of the total accidents are severe enough to cause injury or death because of the exceedingly low speed around and over the Hoover Dam. Vehicle-related injury and fatality risks along the Hoover Dam route are comparatively lower than the alternate routes to the Hoover Dam because of the lower speeds along the dam route. Cargo-related incident-free risks along the Hoover Dam route are higher than those for the alternate routes because of the low speed and higher population density. Cargo-related accident risks along the Hoover Dam route are similar to those of the alternate routes because of relatively small differences in distances, and large uncertainties associated with accident risks.

Another concern raised about this route involves trucks stopping in or near Boulder City. The proximity of Boulder City to the NTS is such that a lengthy stop would occur infrequently.

Interstate 15/U.S. Highway 95 Interchange

The Interstate 15/U.S. Highway 95 interchange is a primary route that would avoid Craig Road. Risks due to vehicle-related traffic injuries and fatalities are slightly lower for the interchange than for the alternate routes primarily became of lower accident rates due to lower speed. Cargo-related risks due to incident-free transportation are slightly higher than those of the alternate routes, because the interchange has a higher population density than the alternate routes, and because of the low rates of speed assumed for urban travel through the interchange. Cargo-related accident risk along the interchange route is similar to that of alternate routes and is subject to large uncertainties.

2.2.3 Routing

Routing has been identified as a is a major concern of the stakeholders. Routes are selected in accordance with the U.S. Department of Transportation regulations. The shipper selects the carrier, and it is the carrier's responsibility to select a route between the shipper's location and the destination that is in compliance with all applicable Department of Transportation regulations. The same regulations apply whether the carrier is a common carrier, contract carrier, or if the shipper operates its own transport vehicle. No individual, entity, organization, or jurisdiction may select or require routing that is not in compliance with these regulations. When evaluating routing options and the radiological risk of transport, the carrier must consider:

1. Known accident rates along potential routes
2. Transit time
3. Population density and activities
4. Time of day and day of the week that transport will occur

Two contracting mechanisms exist for shipping: contract carriers, who carry under a special contract; and common carriers, who carry under a bill of lading. Because of deregulation, industry and government preference is to use common carriers unless specific, tangible benefits can be realized by using contract carriers. A more detailed discussion of these contracting mechanisms is provided in Attachment B.

2.2.4 Rail Option

Although no generators currently ship, or plan to ship, material to NTS by rail, a rail access study (Attachment E) that discusses the option of using rail to transport radioactive and hazardous materials to the NTS is included for information. This NTS Rail Access Study was prepared to provide existing data to stakeholders interested in the NTS Transportation Study. This attachment was prepared without involving American Indian people, and can not be considered complete until American Indian assessments are performed and incorporated into the text of this attachment.

The primary benefit of developing the capability to transport waste to the NTS by rail or by using truck/rail intermodal systems is to reduce the number of legal-weight truck shipments of material, particularly radioactive material. The radiological and nonradiological risk to the public and the environment during transport of the materials is roughly proportional to the number of shipments. The only alternative for which rail transport would be viable to the NTS is one in which the NTS would be the sole disposal site for low-level waste for the entire DOE complex (Alternative 3). Under this alternative, the NTS would receive a projected one million cubic meters (m^3) of low-level waste over the next 10 years.

The study summarizes past rail access studies, and identified potential rail routes using the three major railroad lines that pass through Nevada: the Union Pacific (Caliente to Stateline) line, the Southern Pacific (Ogden to Reno) line, and a second Union Pacific line that runs from Salt Lake City, Utah to Winnemucca, Nevada. Rail transport is also being considered by the Yucca Mountain Site Characterization Project Office. According to DOE (1995b), four rail routes constitute the most reasonable route alternatives and they are: Caliente, Carlin, Jean, and Valley Modified . They are considered reasonable based on minimum land use conflicts, maximum use of favorable topography and federal land, avoidance of land federally withdrawn from public use, direct access to a major regional carrier, and conditions allowing design in accordance with accepted rail engineering practices.

In addition to the four potential rail routes, two concepts were discussed in the NTS rail access study, one in which NTS would be supported by truck or rail/truck intermodal shipments, and the other in which a rail spur to NTS would be constructed and used to supplement truck transportation. The effects of these alternatives on the environment and area resources were then discussed. The costs of shipping by truck, rail, and intermodal modes were also compared. No recommendations or decisions were made in the report; rather the comparison is presented to stimulate discussion of the issue.

2.2.5 Health Risks

Closely related to routing is the concern about the human health risk from exposure to ionizing radiation as a result of the transportation of hazardous materials and waste. Exposure to radiation occurs during incident-free transportation, and as a result of a vehicle accident-induced release. A transportation risk analysis was conducted to estimate the human health risks from transporting low-level waste, mixed waste, nuclear material, and bulk shipments of hazardous materials to the NTS. Risks were calculated over the entire generator-to-NTS route, for in-state routes, and for on-site transportation of the low-level waste. The national routes chosen for evaluation are described in Attachment F. The consequences evaluated were vehicle-related fatalities, injuries, and illness; and cargo-related fatalities, injuries, and illness. Cargo-related fatalities include latent cancer fatalities, and deaths from chemically induced cancers. Radiation-induced health effects, other than latent cancer fatalities, could be illness or genetic effects. Chemically induced noncancer ailments could also be possible.

Results and conclusions are summarized in Section 1.3 of this report, and described in more detail in Chapter 3.0. The results show that the greatest risk under any alternative is that of traffic-related injuries (estimated to be about 100 injuries in 10 years), followed by vehicle-related fatalities (2 and 8 in 10 years for Alternatives 1 and 3, respectively). Along the routes inside Nevada, these risks fall to less than 5 injuries and less than 1 fatality in 10 years. One human health risk of concern is radiation-induced death and injury. To put this risk in perspective, consider that while the expected number of latent cancer fatalities in the State of Nevada due to low-level waste transportation under Alternative 1 is 7.5×10^{-5}, in 1 year, an annual average of close to 2,500 cancer deaths from all causes occurred in Nevada between 1982 and 1990 (National Cancer Institute, 1990). In other words, an individual in the State of Nevada is more than 30 million times more likely ($2{,}500/7.5 \times 10^{-5}$) to die of cancer from any cause than to die of radiation-induced cancer from transportation of radioactive waste.

2.2.6 Transportation Protocol Working Group Recommendations

The Transportation Protocol Working Group has officially submitted, as comments on the NTS Draft EIS, recommendations that the DOE should take to respond to local concerns. The text of their submittal follows:

> These recommendations are the result of a series of discussions (by telephone, conference, and in person) among members of the Protocol Working Group, a subcommittee of the NTS Advisory Group (a.k.a., the Big Group). Representatives of the DOE/Nevada Operations Office were present all such discussions and are cognizant of the proposed action items presented in this document.
>
> These recommendations do not reflect the official positions of any local government, participating group, or individual. They are being put forth to: (1) help the participants see the areas of most concern to Protocol Working Group members, and (2) assist staff of governmental and private agencies preparing comments on the Draft EIS for the Nevada Test and Off-Site Locations in the State of Nevada. With this information, reviewers may incorporate specific recommendations into their own comments, or indicate where they disagree. This will assist the DOE/NV in understanding the importance of each recommendation to each individual commentor. In addition, we feel that DOE's perception of the importance of any recommendation will be enhanced by repetition of that recommendation in individual comment submissions. It is important to note that these recommendations may become part of the official record of the EIS only when they are submitted as comments.
>
> Protocol Working Group members expect the DOE/NV to evaluate each of these recommendations explicitly in the EIS. Further, we would like any recommendation that is accepted by the DOE/NV to be addressed in the Record of Decision as a specific, rather than a planned or to-be-developed, mitigation measure.

For the reader's convenience, the following recommended action items are grouped into three major areas that include: (1) institutional interaction/communication, (2) mitigation, and (3) route selection and selection of parking areas. The mitigation group is further subdivided into sub areas of communication, equipment, planning and training, and procedures and operations. No consensus was reached regarding route selection, with some persons opting for the specification of certain routes, others calling for development of a route-selection methodology, others calling for the development of a route-selection methodology, and still others suggesting compromise measures.

Therefore, the section on routing and parking area selection contains a brief summary of the discussions rather than specific recommendations.

Institutional Interaction/Communication

1. The DOE must specify shipment notification procedures, including: (1) state, tribal and local jurisdiction, (2) estimates of materials and volumes to be shipped, and (3) designations of points of contact for corridor jurisdictions.

2. There should be regular meetings among representatives of the DOE, corridor jurisdictions, and other stakeholders and interested entities. These meetings should be used to:

   a. Provide updates regarding ongoing and planned shipment campaigns, and reports and evaluations on past shipments (based on DOE monitoring program);

   b. Address issues that may arise when significant changes have occurred or are planned for the transportation system, and in materials and/or volumes being shipped;

c. Identify and mitigate additional impacts or concerns of local communities should transportation problems occur.

3. Interim information can be made available through postings to an internet home page, or through other electronic, hard copy, or oral communication.

In addition, the DOE should also provide:

a. A mechanism for receiving and addressing concerns that may arise between meetings; and,

b. Annual reports to include, at the minimum; identification of carriers, sources and destinations of each shipment, the number and volume of shipments of each substance, highway and rail evaluations of each shipment campaign.

Mitigations

1. Communications

The DOE must ensure that local emergency response agencies are able to identify low-level waste shipments and provide immediate notification to federal and state agencies responsible for responding to or supporting the handling of accidents.

2. Equipment

a. The DOE/NV should provide responding jurisdictions/agencies with at least two new detection instruments per jurisdiction, and ongoing calibration services in conjunction with local training in corridor communities in emergency response for incidents involving radioactive materials.

b. The DOE/NV should provide or facilitate the provision of in-vehicle radio repeater, binoculars, cellular telephones, and other equipment to corridor jurisdictions.

c. The DOE should provide preference to local public safety and emergency response agencies for the free distribution of federal surplus emergency response equipment.

3. Planning and Training

a. DOE/NV should work with corridor communities to make training opportunities as effective as possible. Consideration should be given to direct funding of training programs to the corridor communities, providing training opportunities on weekends to accommodate volunteer responders, and providing stipends to participants (See, Item 1 under Equipment).

b. The DOE should provide financial and technical assistance as necessary to ensure that corridor communities have up-to-date emergency management and evacuation plans in place.

4. Procedures and Operations

a. Transported loads should be covered or contained to prevent possible aerosol disbursement.

b. All shipments of low-level waste arriving at the NTS during off-hours should be directed to temporarily park their loads in a secure area inside the NTS gates.

c. Each truck transporting Class 7 materials should have two drivers present at all times.

d. Carriers should respond to all driver advisories and notifications of delays and make appropriate adjustments to primary routes.

e. All vehicles should be required to undergo quarterly CVSA inspections (based on enhanced Northern American standard), and should display appropriate safety inspection stickers.

Route Selection and Selection of Parking Areas

1. Members of the group were unable to reach consensus on recommended action terms regarding transportation. However, there were a number of discussions that brought out three definite positions. These were:

   a. The DOE should select specific primary routes, usually interstates, U.S. and state highways, and direct carriers to use these routes through contracts or other means. Any exception to their use would occur when drivers may make adjustments to routes based upon official advisories and notifications of delays (see Group II, Mitigation; Item 4 Procedures and Operations).

   b. The DOE should avoid the use of certain routes, segments of routes, and shipping at specific times. In this case, the DOE/NV and affected parties would agree on routes and segments of routes that cannot be used for Low-Level Waste (LLW) shipments. It was also suggested that the DOE institute policies to avoid transporting materials during holidays, peak tourist travel periods, or during special events. Examples of areas to avoid are Hoover Dam and the Spaghetti Bowl. Carriers would be prohibited by contract or other means from using certain routes, route segments, or shipping at certain times.

   c. The DOE and stakeholders should agree on a methodology for route selection. Under this option the DOE must commit in the Record of Decision to a clearly articulated process for routing LLW shipments, and to a mechanism that binds the shipper to adhering to the identified routing alternative. Two members suggested specific language for a recommendation on route selection methodology and direction to carriers.

   This suggested language and other discussion brought out the point that the DOE and stakeholders should enter into a process to establish methodologies for selecting the safest and most acceptable routes. Some working group members recommended that the U.S. Department of Transportation guidelines for routing of hazardous and radioactive materials be used to provide direction in this effort. Within this context, it was also suggested that the DOE should provide state and local jurisdictions with copies of the route and risk analyses for each carrier transporting Class 7 materials, as defined in *Radioactive Material* 49 CFR 172.403.

   d. As a compromise between Options b and c above, some working group representatives thought that option b might be put into effect and used until a methodology is agreed upon.

2. Parking Areas

   The DOE/NV should work with the state and corridor jurisdictions to develop criteria for selection of safe parking areas to be used by carrier vehicles. This is related to the recommendation in Group II, Mitigation, Procedures and Operations item b, that all shipments of low-level waste arriving at NTS during off-hours be required to temporarily park loads in a secure area inside the NTS gates.

Detailed responses to specific recommendations can be found in Volume 3 of the NTS final EIS.

2.3 American Indian Issues

The study will focus on the American Indian people who reside along three of the primary routes previously evaluated for risk in this EIS.

Several comments were also received from Sovereign Nations. Responses to those specific comments can be found in Volume 3 of the final EIS.

American Indian tribes are concerned that the promised full government-to-government consultation has not taken place, and that their concerns have not been recognized. American Indian people, especially elders, express a fear of radiation as an "angry rock" which can affect people as it travels, even when safely packaged. American Indian people also express the concern that places of spiritual power are being, and could be further harmed by the transportation of radioactive and hazardous waste.

In response, the DOE has begun a comprehensive study of the potential social and cultural effects of low-level waste transportation on affected American Indian tribes.

2.4 Conclusions

During public meetings with the DOE, the stakeholders established transportation working groups to consider issues and review DOE transportation activities. Many of these issues first appeared in the transportation study of the Draft EIS. After working for several months, the Transportation Protocol Working Group developed a set of recommendations. These recommendations have been reviewed by DOE/NV management, and as a result, the DOE has begun to make decisions about what mitigating actions are required, and what actions can be taken as part of normal program activity. The DOE/NV will continue to meet with the Transportation protocol Working Group, the "Big Group," and state and local government representatives on a regular basis to address their concerns.

The DOE/NV is also beginning full government-to-government consultation on transportation issues with the affected American Indian tribes. The DOE is committed to having this study reflect the full range of American Indian options.

3.0 Transportation Risk

3.1 General Information

One of the primary concerns of the public regarding the transportation of radioactive material is the human health risk associated with exposure to ionizing radiation. To respond to these concerns, the health risks of transporting low-level waste, low-level mixed waste, nuclear material and bulk shipments of hazardous materials to and on the NTS were calculated for a transportation risk analysis.

To evaluate risk, three components must be defined. The first component is the scenario. Scenarios are made up of either one basic failure event or an initial failure event followed by subsequent failures that lead to some undesirable outcome. The second component is likelihood. Likelihood describes how often the scenario is expected to occur. Likelihood may be expressed as a probability, which is a subjective expression of the belief that something will, or will not, occur. (For example, there is a 70 percent chance of showers tomorrow.) Probability is a unit-less number and is always between zero and one. Likelihood may also be expressed as a frequency, such as a rate, e.g., 5×10^{-5} accidents per mile (mi). The third component of risk is consequence, the undesired results of the scenario. To evaluate consequences, the source term (what is released, how much, what form it takes) must be defined and then its dispersion predicted. From the exposure caused by a release, a dose is calculated, and that dose is related to a health effects. This commonly used definition of risk (the product of probability and consequence) allows the risk for a given accident scenario, i.e., to be expressed in general terms (Equation 3.1) as defined in Rhyne (1988).

Risk is expressed numerically as a combination of the likelihood and the consequences of the scenario. It may be in the form of the percentage probability of a given consequence (e.g., 0.02 percent), or the expected number of failures (which can be a whole number).

Results of a risk analysis can be used to make decisions concerning the best ways to manage the risk. To reduce risk, either the scenario frequency must be reduced by preventive measures or the consequences must be controlled by mitigating features. In transportation risk analysis, the release frequency is reduced by using safer roads with lower accident rates; taking shorter routes, which reduces the opportunity for an accident; and using strict packaging criteria and strict operating procedures, to reduce the probability of a release. Consequences, particularly radiological doses, are mitigated by using more robust packaging, reducing the exposed population, and by emergency response.

Equation 3.1 - Mathematical Definition of Transportation Risk

$$R_i = P_{1j} \times M_j \times P_{2jk} \times P_{4jm} \times P_{3jn} \times A_{jkl} \times X_{jn} \times N_{jm}$$

where:

R_i	=	Risk for a given accident scenario.
P_{1j}	=	Accident frequency, in accidents per mile on transport link j based on highway type and conditions, vehicle type, and traffic conditions.
M_j	=	Number of miles in link j.
P_{2jk}	=	Probability that the accident in link j results in accident forces of type k,e.,g., mechanical forces or thermal forces are generated.
P_{4jm}	=	Probability that release class ℓ occurs, based on the accident force type, force magnitude,and the package capability.
P_{3jn}	=	Probability that meteorological class n occurs on link j.
$A_{jk}\ell$	=	Release amount for release class ℓ.
X_{jn}	=	Health effect on the hazardous material for meteorological class n.
N_{jm}	=	Number of persons in population class m.

3.2 Defense Programs Transportation Risk Analysis

This section describes the risk assessment of transporting Defense Program nuclear material (test devices, nuclear explosives, and pits) to the NTS. The consequences of interest are incident-free radiation-induced cancer, traffic fatality and accident-initiated radiation-induced cancer and detriment in *U.S. DOE, Transportation Risk Assessment From Sandia National Laboratories to D. Howard, U.S. DOE, Nevada Test Site EIS,* (Clauss 1996). Incident-free non-radiological risk was also calculated for Defense Programs (SAIC, 1996a). The consequences of terrorist attacks are not specifically analyzed, but the radiological consequences are not believed to be greater than the maximum release scenario presented.

3.2.1 Defense Programs Transportation Risk Methodology and Data

The DOE maintains and operates a special fleet of trucks and trailers used to transport Category II or higher nuclear material between DoD sites and DOE production sites, laboratories, and test sites in a safe and secure manner. Because the DOE exclusively operates and maintains the safe-secure trailer network, the DOE is responsible for evaluating and approving the use of this network. One method of evaluation is to perform a transportation risk assessment; the model used for safe-secure trailer activities is ADROIT. This code was developed and is operated by Sandia National Laboratories.

Three different consequences are considered in the risk evaluation: intrinsic radiation; blunt trauma, burns, or both associated with transportation accidents; and dispersal of radioactive material associated with extremely severe transportation accidents.

'Intrinsic radiation' exposes members of the public along the roadway, on the roadway, and at rest stops to extremely low levels of ionizing radiation during routine travel. Although the levels are well below those at which there is any immediate or observable health effect, and are below regulatory concern, there is a small probability that an exposed individual may develop a latent cancer which may be fatal. The risk associated with intrinsic radiation is referred to as 'incident-free risk'.

In a severe transportation accident, 'blunt trauma, burns, or both' may result in fatalities to vehicle occupants, pedestrians, and bystanders. This consequence is independent of the cargo carried in the trailer. The risk associated with fatalities and injuries caused by blunt trauma and/or burns is referred to as the 'vehicle-related risk'.

Given a very severe transportation accident, radioactive materials could be dispersed into the atmosphere, which could subsequently expose members of the public in the vicinity of the accident to ionizing radiation. Although the exposure levels can be higher than those associated with intrinsic radiation (due to direct contact by inhalation), the levels are still below those that result in an immediate or observable health effect. Just as for intrinsic radiation, the primary health effect is a possible increase in latent cancer fatalities in the exposed population. The risk associated with dispersal is referred to as 'cargo-related risk'.

1. <u>Incident-Free Risk</u>

   a. Transportation of radioactive materials will result in some radiological dose to the general public along the route even under normal conditions. The incident-free risk calculation in the ADROIT code is patterned after the one used as a basis for the RADTRAN computer code *RADTRAN 4 Volume II: Technical Manual,* (Neuhauser and Kanipe, 1993) with modifications to specialize it for safe-secure trailer shipments. A simple radiation transport model is used to calculate the radiation flux intensity as a function of distance from the source. The people absorbing the dose are divided into three groups: people adjacent to the roadway on which the shipment is traveling, people traveling on the roadway in other vehicles, and people exposed during rest stops. The total dose to the public is the sum of the doses for each of these three groups.

b. For calculational purposes, each trailer is modeled as a point radiation source located at the geometric center of the trailer. The source strength of the radiation is usually given in terms of the Transportation Index (TI), which is a measure of the source strength one meter from the "package" surface. Both gamma rays and neutrons contribute to the TI, but for weapons shipments the gamma component is usually dominant. While the mechanisms that govern the transport of neutrons in air are quite different from those that govern gamma rays, the rate of absorption in air for both types of radiation is similar. For this reason, as well as to simplify the calculations, the source is modeled as 100 percent gamma radiation. This approximation leads to a conservative (overestimate) result for radiation dose (Neuhauser and Kanipe, 1993). A large fraction of the people exposed to the radiation will be protected by some environmental shielding such as automobile bodies, building walls, and shrubbery. However, the effect of this shielding is ignored in the calculations, which is also conservative.

c. Incident-free nonradiological risk was also calculated in SAIC (1996a), and nonradiological health effects are those associated with vehicle exhaust emissions.

2. Vehicle-Related Risk

a. The probability of fatalities due to direct effects of the accident environment (i.e., blunt trauma, burns, or both to vehicle occupants, pedestrians and bystanders) is calculated in ADROIT based on a simple event tree.

b. The annual probability of tow-aways is based on the distribution for the Armored Tractor/Safe-Secure Trailer (AT/SST) overall tow-away rate per mile, the influence factors for different operating environments, and the annual mileage in each operating environment; which is determined from the shipment projections, and the route segmentation data files. The probability of a fatal accident given a tow-away accident is sampled from a binomial distribution based on Determination of Influence Factors and Accident Rates for the Armored Tractor/Safe-Secure Trailer (Phillips et al., 1994). Given a fatal accident the number of fatalities is sampled from the multinomial distribution based on the 1980 to 1988 trucks involved in fatal accidents data (Variable 45) for tractor semitrailer accidents, (Blower, 1991; Sullivan and Massie, 1993).

There are three basic elements of the accidental dispersal risk assessment. Probabilities of release by the three mechanisms that can produce respirable-sized aerosols and specific consequence scenarios were developed based on an event tree analysis. Consequences are evaluated for each end event in the tree through an assessment which integrates dispersal calculations, route characterization, population data, and dose-health effects models to provide an estimate of excess LCFs and contaminated area. Uncertainties are evaluated by incorporating Latin hybercube sampling into the caluclations for probabilities and consequences.

3. Cargo-Related Risk

a. Radioactive materials transported to support Defense Program include, but are not limited to, isotopes of plutonium, uranium, thorium, and hydrogen. Other than relatively low levels of intrinsic radiation (which are considered in the incident-free risk calculation), plutonium and uranium isotopes do not pose a significant health hazard in the form in which they are transported; they must first be converted to an aerosol with respirable-size particles. Three mechanisms by which aerosol may be generated and released are considered in ADROIT: violent reaction of high explosive, oxidation in a fire, and spalling and break-up of the surface oxide layer by mechanical forces.

b. There are three basic elements of the accidental dispersal risk assessment. Probabilities of release by the three mechanisms that can produce respirable-sized aerosols, and specific consequence scenarios are developed based on an event tree analysis. Consequences are evaluated for each end event in the tree through an assessment which integrates dispersal calculations, route characterization, population data, and dose-health effects models to provide an estimate of excess latent cancer fatalities and contaminated area. Uncertainties are evaluated by incorporating Latin hybercube sampling into the calculations for probabilities and consequences.

For this analysis, ADROIT was used to calculate the probability of each accident scenario leading to a release. The operating history with the AT/SST is sufficient to define an overall tow-away accident rate. The mean estimate for the rate of tow-away accidents involving an AT/SST is 0.066 per million miles. However, the number of accidents experienced with the AT/SST is not sufficient to quantify the accident rate in the operating environments of interest, or the types and severities of accidents. Thus, general commerce data for heavy truck transportation is used as a surrogate for AT/SST data to quantify the relative accident rates in different operating environments, and the types and severities of accidents.

Human health effects are estimated in the consequence assessment. Health consequences are expressed in terms of the expected number of excess LCF produced in the exposed population. The exposed population is defined as those members of the public subject a maximum individual risk of contracting an excess latent cancer resulting in fatality (given a dispersal) greater than 1 in 10 thousand.

3.2.2 Defense Programs Transportation Risk System Description

Under Alternative 1, nuclear test devices would be transported to the NTS Nuclear test devices, high explosives, and pits would be transported to NTS under Alternative 3.

The only Defense Program shipments to and from the NTS under Alternative 1 are 10 per year from Pantex; two per year from Los Alamos National Laboratory (LANL); and two per year from Lawrence Livermore National Laboratory (LLNL), for a total of 140 shipments over the 10 year period in question. The radiological hazard from these shipments is bounded by assuming not more than 10 kg of weapons grade plutonium per container, and only one container for each AT/SST trip.

Under Alternative 3, the NTS would receive not only the test device shipments (as in Alternative 1), but also nuclear explosives. The projected number of shipments of nuclear explosives over the 10 year period is 1,587.

Under this Alternative, the NTS would be the sole location for interim storage of pits as well as being used for assembly/disassembly operations. Under this scenario, pits already stored at the Pantex Plant would be transported from Pantex to the NTS. In addition, pits would be transported between the NTS and LANL for the purpose of quality assurance and testing. The projected number of shipments over the next 10 years under this scenario is 366.

Details concerning routes are classified.

3.2.3 Defense Program Transportation Risk Results

Health effects for the transportation of Defense Program nuclear materials to the NTS were calculated for incident-free radiological effects and nonradiological effects, vehicle-related traffic fatalities and accident-initiated radiological effects (LCF). The risks were calculated for the transportation of test devices, nuclear explosives, and pits. The results of this analysis for Alternative 1 are shown in Table 3-1, in Table 3-2 for Alternative 3, and are compared in Table 3-3.

3.2.4 Defense Program Transportation Risk Conclusions

For all scenarios, between 60 and 65 percent of the collective exposure (and health risk) is received by people on the roadway. Between 30 and 35 percent is received by members of the public at rest stops. The balance of the collective exposure is received by people off the roadway. By contrast, the maximum individual dose (and risk) is received by an individual off the roadway. This is because an individual living near the roadway in Las Vegas or another town common to all the routes is assumed to be exposed to the intrinsic radiation from all the shipments, whereas the people sharing the roadway or at rest stops are not likely to include the same individuals for all (or even most) shipments.

No reasonably foreseeable (release probability greater than 10^{-7} per year) consequence (greater than 1) scenarios that would result in a release exist in the transportation of Defense Program nuclear materials to the NTS. Therefore, there are no maximum reasonably foreseeable accidents.

3.3 Waste Management Activities Transportation Risk

Waste management transportation is the risk associated with transportation of waste generated by environmental restoration and waste management programs at the NTS. This section describes the risk analysis of the transportation of low-level waste and mixed waste to the NTS. The analysis calculated both incident-free and accident-initiated risks of radiation-induced cancer and detriment; and chemical-induced cancer and noncancer health effects, as well as the expected number of traffic fatalities and injuries. Risks were calculated for the entire national route from each generator, and for 10 representative in-state routes. All results represent the risk for the entire 10 year campaign. The maximum reasonably foreseeable accident was also assessed.

3.3.1 Methodology

The risk assessment approach includes system definition, accident scenario description, frequency analysis, consequence analysis, risk evaluation, and documentation. Following this approach, the first step in the transportation risk analysis for the Waste Management Program was to identify the current and potential types of waste that would be transported to the NTS under each alternative. Representative national routes from each generator to the NTS as well as in-state routes, were selected for evaluation. The in-state routes were chosen to reflect local concerns regarding route segments. The routes chosen are not necessarily the exact routes that will be chosen by actual carriers, but represent the most likely routes on the basis of distance, accessibility, and economics. On-site transportation risk was also calculated. The maximum reasonably foreseeable accident was assessed, as were maximum individual doses.

In this transportation risk analysis, the scenarios are either incident-free transportation, which has the consequence of exposure to ionizing radiation from the contents or exposure to vehicle-exhaust emissions, or accident-initiated releases. In accident-initiated releases, a vehicle accident is the initiating event and must be followed by failure of the packaging in order to result in an actual release of the radioactive or hazardous contents. A complete list of the NTS transportation risk analysis accident scenarios can be found in DOE/NV (1996).

Table 3-1. Defense Programs Transportation Risk for Alternative 1

Consequences	Risk
Incident-free radiological effects	4×10^{-5}
Incident-free nonradiological effects	1.85×10^{-4}
Traffic fatalities	6×10^{-4}
Accident-initiated radiological effects	8×10^{-11}
Maximum exposed individual	7×10^{-8}

Table 3-2. Defense Programs Transportation Risk for Alternative 3

Consequences	Test Devices	Nuclear Explosives	Pits	Total
Incident-free radiological effects	4×10^{-5}	2×10^{-3}	1×10^{-4}	2.14×10^{-3}
Incident-free nonradiological effects	a	a	a	4.01×10^{-3}
Traffic fatalities	6×10^{-4}	8×10^{-3}	2×10^{-3}	10.6×10^{-3}
Accident-initiated radiological effects	8×10^{-11}	9×10^{-7}	1×10^{-7}	1×10^{-6}
Maximum exposed individual	7×10^{-8}	3×10^{-6}	2×10^{-7}	3.3×10^{-6}

a. Not calculated individually

Table 3-3. Comparison of Defense Programds Transportation Risks Between Alternative 1 and Alternative 3

Consequences	Alternative 1	Alternative 3
Incident-free radiological effects	4×10^{-5}	2.14×10^{-3}
Incident-free nonradiological effects	1.85×10^{-4}	4.01×10^{-3}
Traffic fatalities	6×10^{-4}	1.06×10^{-2}
Accident-initiated radiological effects	8×10^{-11}	1×10^{-6}
Maximum exposed individual	7×10^{-8}	3.3×10^{-6}

The consequences of interest in this study are vehicle-related and cargo-related. Vehicle-related consequences include traffic fatalities, traffic injuries, and incident-free nonradiological consequences. Cargo-related consequences are divided into four types:

1. Radiation-induced latent cancer fatality, i.e., a cancer occurring 20 or so years (chronic) after exposure, resulting in a fatality.

2. Radiation-induced detriment, i.e., other chronic health effects including non-fatal cancer occurring after 20 years or so, such as genetic damage or birth defect.

3. Cancer incidence 20 years or more in the future (chronic) resulting from exposure

to hazardous volatile organic compounds due to accident conditions.

4. Noncancer health effects (chronic) due to exposures to hazardous volatile organic compounds due to accident conditions (i.e., nausea, genetic effects, and central nervous system damage).

Although accident-initiated exposure levels may be higher than those associated with incident-free transportation, the levels would still be below those that result in an immediate or observable health effect; therefore, the risk of early (acute) fatality or illness is not reported. Radiological consequences for the transportation of radioactive waste were estimated for members of the public and transport crew under both normal operating conditions and accident conditions. Members of the public are considered to be persons who are within 800 meters (m) (875 yards [yd]) of the transportation corridor, persons sharing the transport corridor with the transport, and persons at rest stops. For the accident scenarios, the radiological doses were estimated for individuals located near the scene of the accident and for the population within a 61 km (50-mi) radius of the accident. Risk associated with waste handling activities are discussed in detail in Appendix H, Human Health Risks and Safety Impacts Study.

Radiological consequences are expressed in terms of person-rem (Roentgen equivalent man). The collective dose to an exposed population is calculated by summing individual doses in that population. For example, if 100 people are exposed to 300 millirem per year (mrem/yr), the collective dose would be:

(100 people x 0.3 rem) = 30 person-rem due to background radiation in a population of 100.

Assuming a linear dose-response relationship, a population dose of 30 person-rem is equivalent to 50 people receiving a dose of 600 mrem/yr.

The most significant health effects due to radiation exposure are latent cancer fatalities (LCF) and detriment (illness or injury), as defined by International Commission on Radiation Protection (ICRP 1991). In cases where the individual dose is more than 20 rem and the dose rate is greater than 10 rem in a 1-hour period, prompt effects, in addition to latent effects, may be of concern. None of the exposures resulting from the transportation of low-level waste and mixed waste to the NTS would exceed this level. For example, the dose-to-risk conversion factor for workers is 0.0004 LCF per person-rem. If a population of 100 workers received a collective dose of 30 person-rem, the estimated number of LCFs among all 100 workers would be:

(30 person - rem x 0.0004 LCF/Person - rem) = 0.012LCF

This means that there would be about 1 chance in 83 (1/0.012) that a single LCF would occur among the 100 workers as a result of the radiation exposure. Latent cancer fatalities caused by radiation exposure are cancers that take many years to develop, and may not be the actual cause of death. In addition to LCFs, other health effects, including nonfatal cancer and genetic effects, could occur.

The DOE guidance for preparing environmental impact statements recommend using a transportation risk model which is a defensible estimation method, such as the most current version of RADTRAN. The stakeholders requested that a more open modeling process be used, so they could actively review the assumptions, input data, and formulas.

The model used to perform the NTS EIS Transportation Study is a RADTRAN-like model that is more flexible and easier for the stakeholder to review and use. The model is composed of a combination of spreadsheets and FORTRAN number to assist in the evaluation of routes for the transportation of low-level waste. Being easier to review, the analysis allows stakeholders to review input data and assumptions, and contributes to the acceptance of risk values.

The NTS transportation risk model was compared to RADTRAN 4 (IT Corp., 1995a). Three sites within the DOE complex were chosen, and up to four routes were modeled for each site. The routes used were identified as those most frequently traveled. The sites used for this comparison are Lawrence Livermore National Laboratory, Pantex Plant, and Savannah River Site. Similar source terms (based on shipment inventory) were used in both models.

The primary differences between the models are in the development of the external dose rate, and in assumptions concerning shielding of the low-level waste. If a radioisotope which was present at the identified site was not present in the RADTRAN library, that radioisotope was eliminated from the radioactive source term in order to maintain compatibility of the models. Instead of the actual external dose rate based on historical data from the DOE, the Transportation Index (TI) was used in RADTRAN 4 to calculate external exposure during routine transportation. The TI is defined as the exposure rate at a distant of 1 meter from the container.

The other difference between the models is in the shielding factors used. No shielding was used in the RADTRAN calculation, resulting in a very conservative potential exposure rate. The NTS model takes into account shielding, based on real time data that has been obtained from DOE low-level waste shipments. The assumptions associated with the shielding result in NTS-model dose results that are attenuated by a factor of 10^{-2} to 10^{-4} relative to the corresponding RADTRAN 4 calculated doses.

This comparison indicates that the results are comparable given the standard assumptions. The radiation doses calculated by the two models are in general agreement. This was expected, since the equations used in the NTS model are based on RADTRAN 4 equations. As indicated, the reason for the primary difference in the dose results is the assumptions associated with shielding in the NTS model. Another factor that may account for some of the differences in the results is the difference in long-term treatment of dispersion of radioactive material from a container after an accident.

The results of a separate study calculating the risk from transporting low-level waste from Tonopah to the NTS, (IT Corp., 1995b) were incorporated into the results reported here. In addition, corrections were made to some of the results from the Draft Transportation Risk Assessment; the calculation of new results is documented in *Risk Assessment for the NTS EIS Alternatives 1 & 3 and the TTR* (SAIC, 1996d).

3.3.2 System Description

The system being evaluated consists of shipments of radioactive and hazardous materials (including wastes) to the NTS. The type and amount of waste varies under each alternative. Historically, the primary radioactive waste type accepted for disposal at the NTS has been low-level waste. Under Alternative 1, Continue Current Operations (No Action), and Alternative 3, Expanded Use, the disposal sites at the NTS would continue to accept low-level waste from both on-site and off-site generators. Mixed waste from on-site generators would also be managed under both alternatives. Definitions of other radioactive waste types are provided below for comparison and clarity.

Waste Definitions

- **Hazardous Waste** — Wastes that are designated as hazardous by the Environmental Protection Agency (EPA) or State of Nevada regulations. Hazardous waste, defined under the Resource Conservation and Recovery Act, is waste from production or operation activities that poses a potential hazard to human health or the environment when improperly treated, stored, or disposed. Hazardous wastes that appear on special EPA lists possess at least one of the following characteristics: ignitability, corrosivity, reactivity, or toxicity.

- **Mixed Waste** — Waste containing both radioactive and hazardous components, as defined by the Atomic Energy and the Resource Conservation and Recovery Act, respectively. Mixed waste intended for disposal must meet the Land Disposal

Restrictions as listed in *Land Disposal Restrictions* 40 CFR 268. Mixed waste is a generic term for specific types of mixed waste such as low-level mixed waste, and transuranic mixed waste.

- **Low-Level Mixed Waste** — Low-level waste that also includes hazardous components, as identified in, *Identification and Listing of Hazardous Waste*, 40 CFR 261, Subparts C and D.

- **Transuranic Waste** — Radioactive waste containing alpha-emitting radionuclides having an atomic number greater than 92, half-lives greater than 20 years, and in concentrations greater than 100 nanocuries (nCi) per gram.

- **Low-Level Waste** — Radioactive waste not classified as high-level waste, transuranic waste, spent nuclear fuel, or the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic elements is less than 100 nCi per gram.

- **High-Level Waste** — The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing of and any solid waste derived from the liquid, that contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation.

- **Classified Waste** — Weapons components and assemblies designated by the U.S. Government, pursuant to Executive Order, statute, or regulation, that require protection against unauthorized information or material disclosure for reasons of national security. Additional security and safeguards management activities are required in the handling of these materials.

Under Alternative 1, the NTS would continue to accept waste from 15 off-site generators (currently approved) and from ongoing DOE/NV environmental restoration activities. Future waste shipments would consist of both low-level waste and mixed waste. If Alternative 3 is selected, it is anticipated that waste shipments to the NTS would come from approximately 28 off-site waste generators (DOE, 1995c). Future waste received at the NTS for disposal would generally consist of low-level waste and mixed waste, the type being dependent upon the specific waste-generator site. Alternative 2, would result in closure of the NTS; therefore, no waste operations would occur. Alternative 4, Alternate Use of Withdrawn Land, would allow for only NTS-generated waste to be managed, and no off-site transport would occur. Since Alternatives 2 and 4 would eliminate the receipt and disposal of wastes generated outside the NTS, they are not considered further in this analysis. The waste generators, primary waste types, and waste shipment information associated with alternatives 1 and 3 are shown in Tables 3-4, 3-5, and 3-6.

Another aspect of a transportation system is routing. Routes evaluated in the waste management analysis were selected using the routing program *Highway 3.2–An Enhanced Highway Routing Model: Program Description, Methodology, and Revised User's Manual*, (Johnson et al., 1993). The routes evaluated may not be the actual routes used for transportation.

The HIGHWAY 3.2 program is a flexible tool for evaluating highway routes for transporting hazardous materials in the United States. The HIGHWAY database contains a computerized road atlas that describes over 240,000 miles of highways including complete description of the entire interstate system and other highways except those that parallel a nearby interstate. Many state highways and a number of local and county highways are also identified. The database also includes locations of nuclear facilities and major airports.

Table 3-4. Low-Level Waste and Mixed Waste Volumes[a] and Shipments for Alternative 1

Generator	Volume (m^3)[b]	Number of Shipments [c,d]
Aberdeen Proving Ground	790	21
Energy Technology Engineering	614	16
Environmental Management Project	84,177	2,213
Lawrence Livermore National Laboratory	1,928	51
Inhalation Toxicology Research Institute	344	9
Mound	60,027	1,578
Nevada Test Site	150,500	11,615[e]
Oak Ridge National Laboratory	26,607	699
Pantex Plant	769	20
RMI Extrusion Plant	5,528	146
Rocky Flats Environmental Technology Site	14,000	2,000
Sandia National Laboratories - California	219	6
Sandia National Laboratories - New Mexico	351	9

[a] All volumes derived from the 1994 Integrated Data Base, the Baseline Environmental Management Report (DOE, 1995a) and the Draft Waste Management Programmatic EIS (DOE, 1995c)

[b] Cubic Meter

[c] Assume containers are 4' x 4' x 7' boxes

[d] Assume 12 containers per shipment

[e] Bulk shipment; assume 13 m^3 per shipment

Table 3-5. Low-Level Waste Volumes[a] and Shipments for Alternative 1

Generator Site	10-year Volume Projection (m^3)[b]	Number of Shipments[b,c]
Aberdeen Proving Ground	790	21
Ames Laboratory	1,232	32
Argonne National Laboratory - East	11,265	296
Bettis Atomic Power Laboratory	9,775	257
Brookhaven National Laboratory	3,264	86
Energy Technology Engineering Center	614	16
Fermi Laboratory	2,165	57
Fernald Environmental Management Project	84,177	2,213
Hanford	170,891	4,492
Idaho National Engineering Laboratory and	106,934	2,811
Knolls Atomic Power Laboratory - Kesselring	15,554	409
Lawrence Berkeley Laboratory	5,099	134
Lawrence Livermore National Laboratory	1,928	51
Los Alamos National Laboratory	41,773	1,098
Inhalation Toxicology Research Institute	344	9
Mound	60,027	1,578
Nevada Test Site	150,000	11,600
Oak Ridge National Laboratory	26,607	699
Paducah Gaseous Diffusion Plant	16,996	447
Pantex Plant	769	20
Portsmouth Gaseous Diffusion Plant	63,512	1,670
Princeton Plasma Physics Laboratory	187	5
RMI Extrusion Plant	5,528	146
Rocky Flats Environmental Technology Site	14,000	2,000
Sandia National Laboratories/CA	219	6
Savannah River Site	243,901	6,411
West Valley Demonstration Project	67	2
Stanford Linear Accelerator	3,694	97
Sandia National Laboratories/NM	351	9

[a] All volumes derived from the 1994 Integrated Data Base, the Baseline Environmental Management Report (DOE, 1995a) and the Draft Waste Management Programmatic EIS (DOE, 1995c)
[b] Assumes containers are 4' x 4' x 7'
[c] Assumes 12 containers per shipment

Table 3-6. Mixed Waste Volume and Shipments for Alternative 3

Generator	Volume (m^3)[b]	Number of Shipments[c,d]
Ames Laboratory	1	1
Argonne National Laboratory - East	6,700	181
Bettis Laboratory	40	1
Hanford	120,000	3,243
Idaho National Engineering Laboratory	47,390	1,281
Knolls Laboratory	150	4
Lawrence Berkeley Laboratory	4,300	116
Los Alamos National Laboratory	2,700	73
Nevada Test site (ER)[a]	500	15
Paducah Plant	600	16
Portsmouth Plant	33,754	912
RMI Extrusion Plant	25	1
Rocky Flats	63,000	9,000
Savannah River	21,300	576
West Valley	40	1

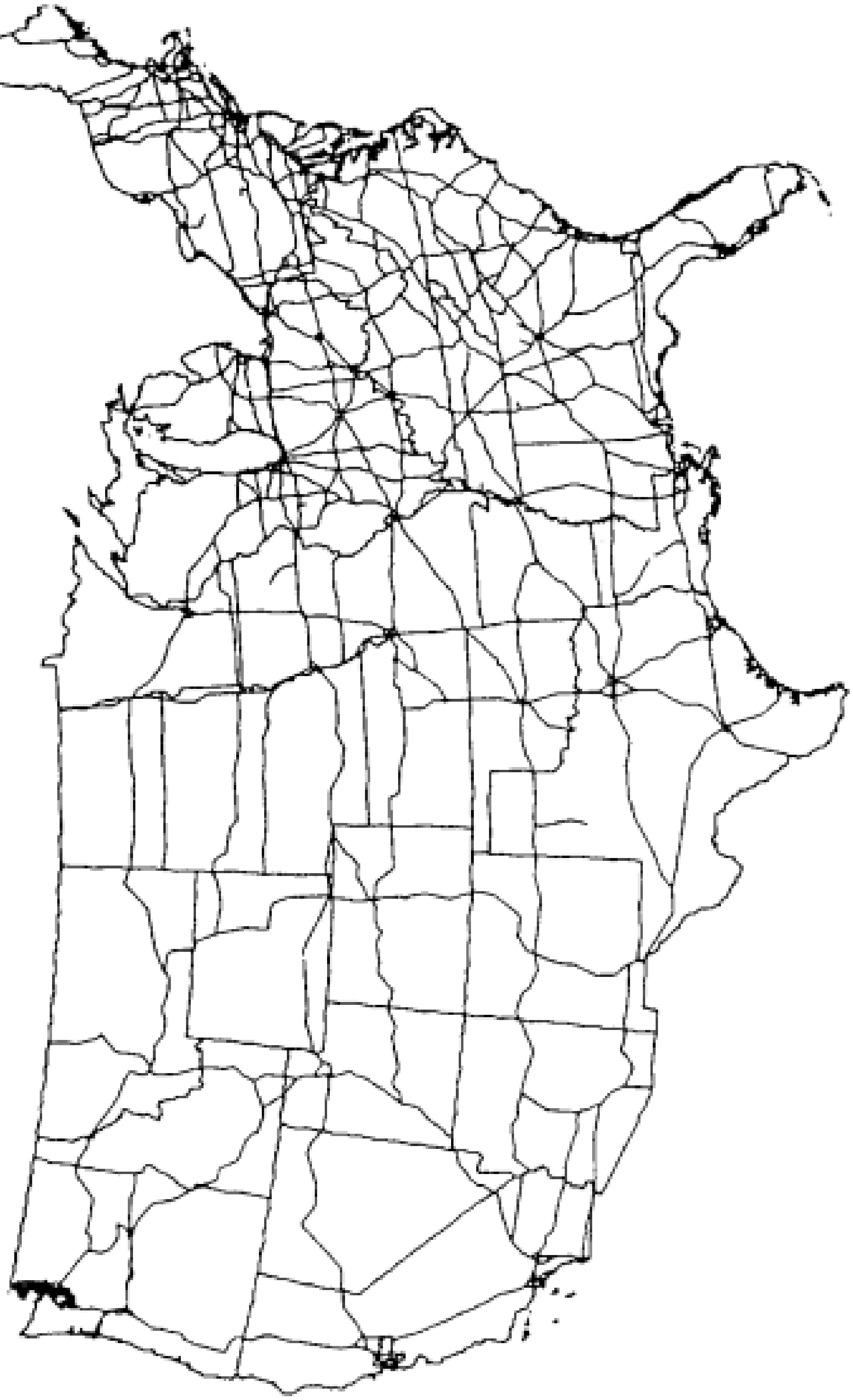
[a] Generated by the Environmental Restoration Program
[b] Cubic Meter
[c] Assume containers are 4' x 4' x 7' boxes
[d] Assume 12 containers per shipment

Several different types of transport routes may be calculated by the HIGHWAY Program, depending on a set of user- supplied constraints. HIGHWAY calculates routes by minimizing the total distance and driving time along a particular highway segment. Several user-supplied routing constraints can be imposed during the selection process. Special features of the model HIGHWAY is the ability to calculate routes that maximize the use of the interstate highway system, and the ability to select routes that bypass a specific state, city, town, or highway segment.

The HIGHWAY 3.2 Program has the capability to automatically identify alternative routes. Most routing models will produce only a single route, although different routes between the generator site and the NTS often vary only slightly in distance and estimated driving time. With the alternative routing feature, the HIGHWAY Program offers a selection between different routes of nearly equal length. It also has the capability to report route-specific population density data. The population density distribution is calculated for each highway segment in the route and is reported on a state-by-state basis. The population data used by the program are based on the 1990 U.S. Bureau of the Census block group data. A United States map showing the national interstate system is given in Figure 3-1. Specific descriptions of the generator truck routes were taken from the HIGHWAY 3.2 routing code, and are described in detail in Attachment F.

Ten in-state routes within Nevada, generated by the HIGHWAY 3.2 computer program, were identified for evaluation to allow more detailed analysis of the Nevada routes. This effort was crucial to comparing geographic areas of concern. The selection of routes within Nevada had the same

Figure 3-1. National Interstate System



parameters as the national routes, that is, interstate and state highways were used instead of local roads wherever possible. However, rather than the most direct routes being selected, alternative routes were identified specifically to avoid three geographical areas of concern: Craig Road, the Interstate 15/U.S. Highway 95 interchange, and Hoover Dam (Boulder City).

Within Nevada, the routes selected are based on the direction of approach to the NTS. Local concerns focused their analysis on specific areas such as the Hoover Dam; highway segments that had congested or seemingly higher accident probabilities, (Interstate 15/U.S. Highway 95 interchange), and segments with rapid growth, (Craig Road). In particular, one alternative route was proposed to avoid passage through Boulder City and Hoover Dam. Interstate 40 to Interstate 15 would allow shipments to approach the NTS from the south without passing through Boulder City and Hoover Dam. This alternative would allow shipments to proceed to the NTS through Pahrump, Nevada or on the U.S. Highway 95 through the Interstate 15/U.S. Highway 95 interchange. The routes are described in the following paragraphs.

NV-1, Eastern Route 7 (Figure 3-2). (Note: "Eastern Route 7" identified that the route is approached from the east, and the number relates to the specific unique designation the route was given earlier.) South on Interstate 15 (from Arizona) to Las Vegas, through the Interstate 15/U.S. Highway 95 interchange, and north on U.S. Highway 95. The length of this route is 238 (km) (148 miles [mi]). The interstate 15/U.S. Highway 95 interchange is referred to locally as the "Spaghetti Bowl". It is a location at which numerous merging vehicles routinely create congestion, traffic delays, and accidents. None of the Nevada route descriptions include a local road approximately 3.2 km (2 mi), that connects U.S. Highway 95 to the NTS entrance gate at Mercury, because it is common to all of the Nevada route alternatives; however, this local connector road was included in the risk analysis calculation.

NV-2, Eastern Route 8 (Figure 3-3). South on Interstate 15 (from Arizona) to Craig Road (SR-573), west to Rancho Drive, north on U.S. Highway 95. The length of this route is 227 km (141 mi). Craig Road is another road segment of concern to local officials. The residential growth in the adjacent areas has created congestion as well as concern for the effect of hazardous material transport to the residential population.

NV-3, Northern Route 5 (Figure 3-4). South on U.S. Highway 93 (from Idaho) to Ely, south on U.S. Highway 6 to Tonopah, south on U.S. Highway 95. The length of this route is 846 km (526 mi) the longest Nevada alternate route. It is the only Nevada route which goes through Ely and Tonopah, as well as other areas with relatively low population densities.

NV-4, Eastern Route 9 (Figure 3-5). North on U.S. Highway 93 (from Arizona) via Hoover Dam, to Las Vegas, through the Interstate 15/U.S. Highway 95 interchange, continuing north on U.S. Highway 95. The length of this route is 161 km (100 mi). Routing through the Hoover Dam/Boulder City area is also a local concern. Traffic in the area is congested by the slowdown of vehicles because of the curves and grade of the road as well as visitors entering and leaving the parking areas for the Hoover Dam.

NV-5, Eastern Route 10 (Figure 3-6). North on U.S. Highway 93 (from Arizona) via Hoover Dam, to U.S. Highway 93/U.S. Highway 95, north to State Route-146, west to Interstate 15, and north to State Route-160 to U.S. Highway 95. The length of this route is 211 km (131 mi).

NV-6, Southern Route 6 (Figure 3-7). North on U.S. Highway 95 (from California) through the Interstate 15/U.S. Highway 95 Interchange and, north on U.S. Highway 95. The length of this route is 233 km (145 mi).

NV-7, Southern Route 8 (Figure 3-8). North on U.S. Highway 95 (from California) north on State Route-146, west to Interstate 15, to State Route 160 to U.S. Highway 95. The length of this route is 283 km (176 mi).

Figure 3-2. NV-1, Eastern Route 7

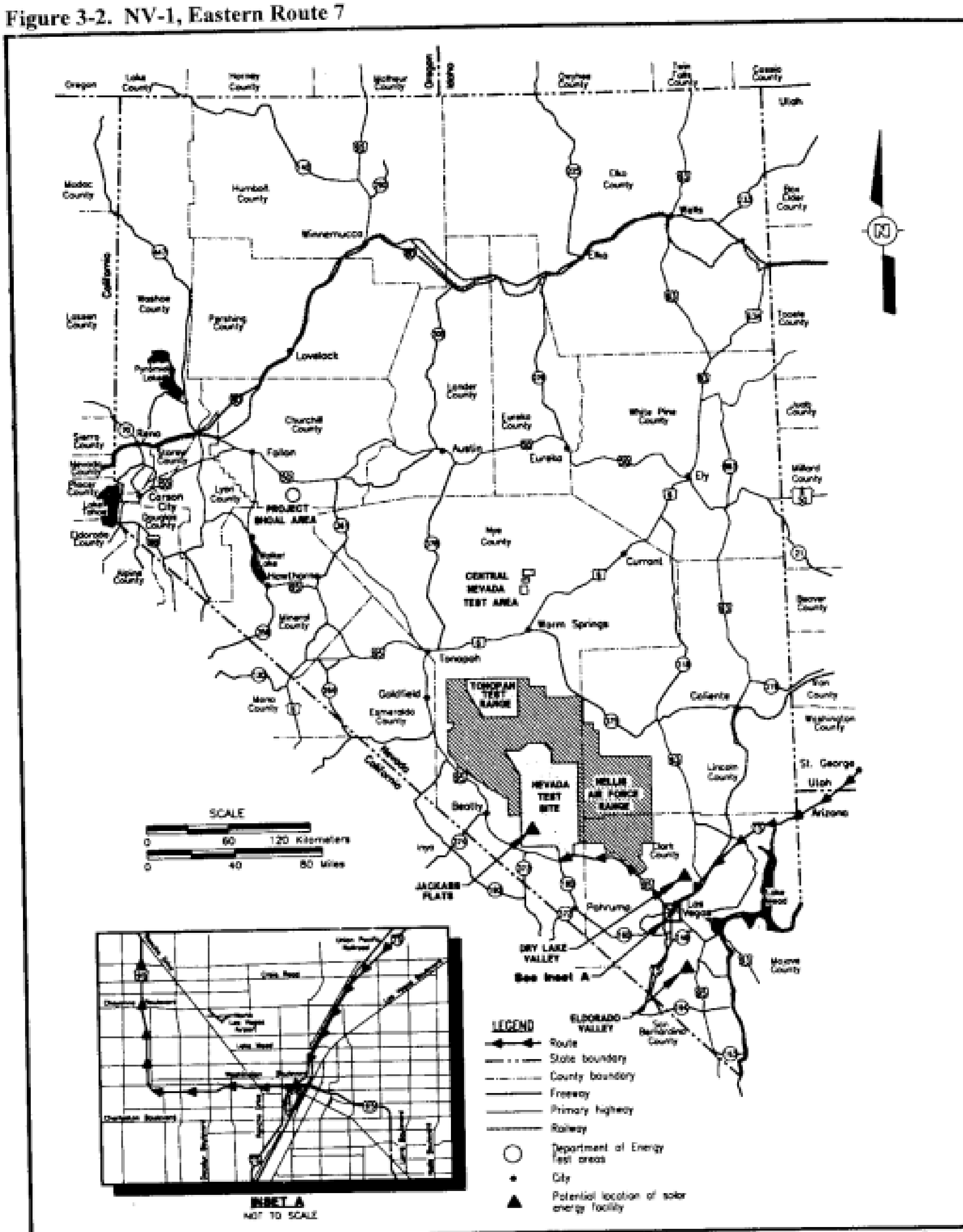


Figure 3-3. NV-2, Eastern Route 8

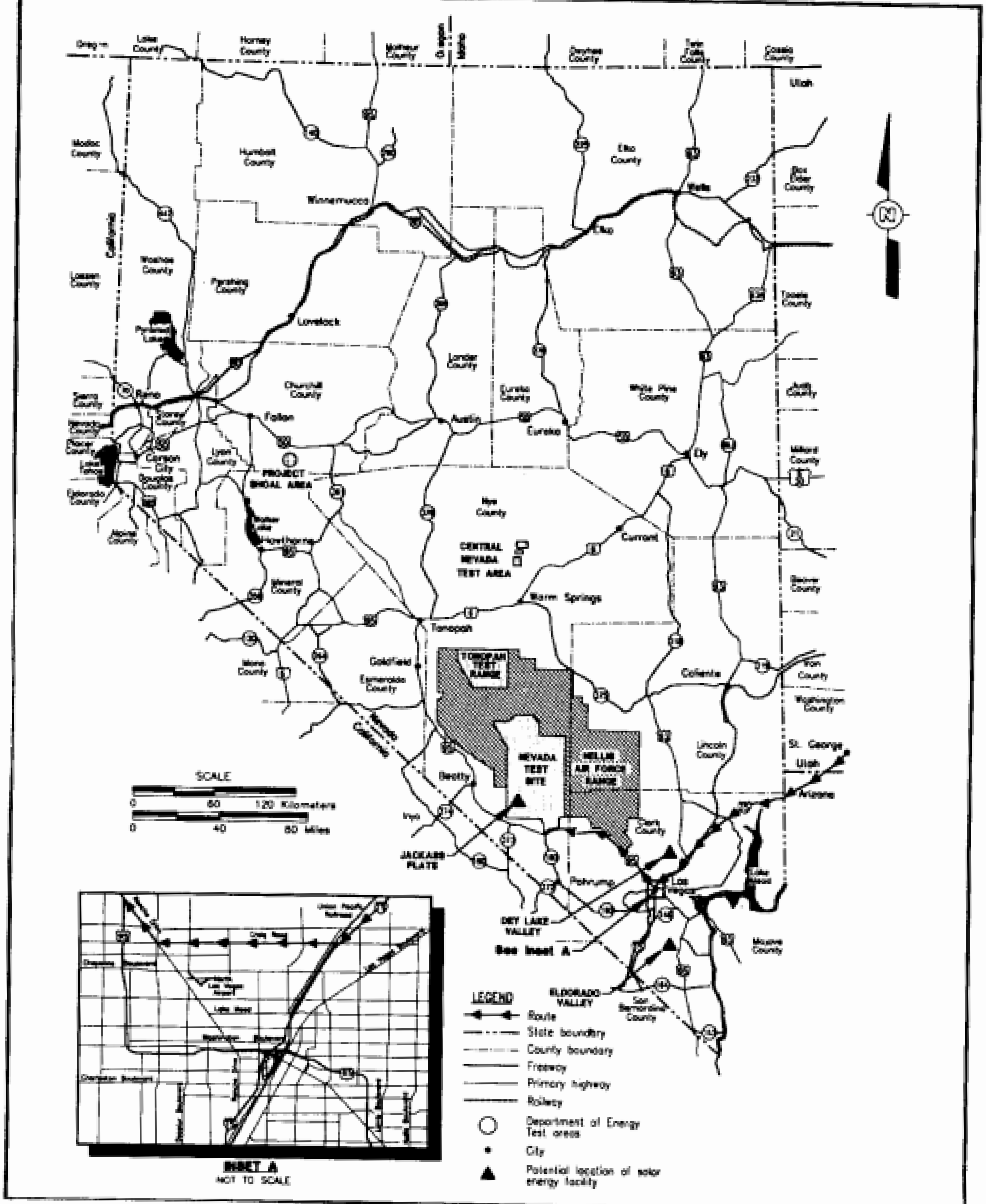


Figure 3-4. NV-3, Northern Route 5

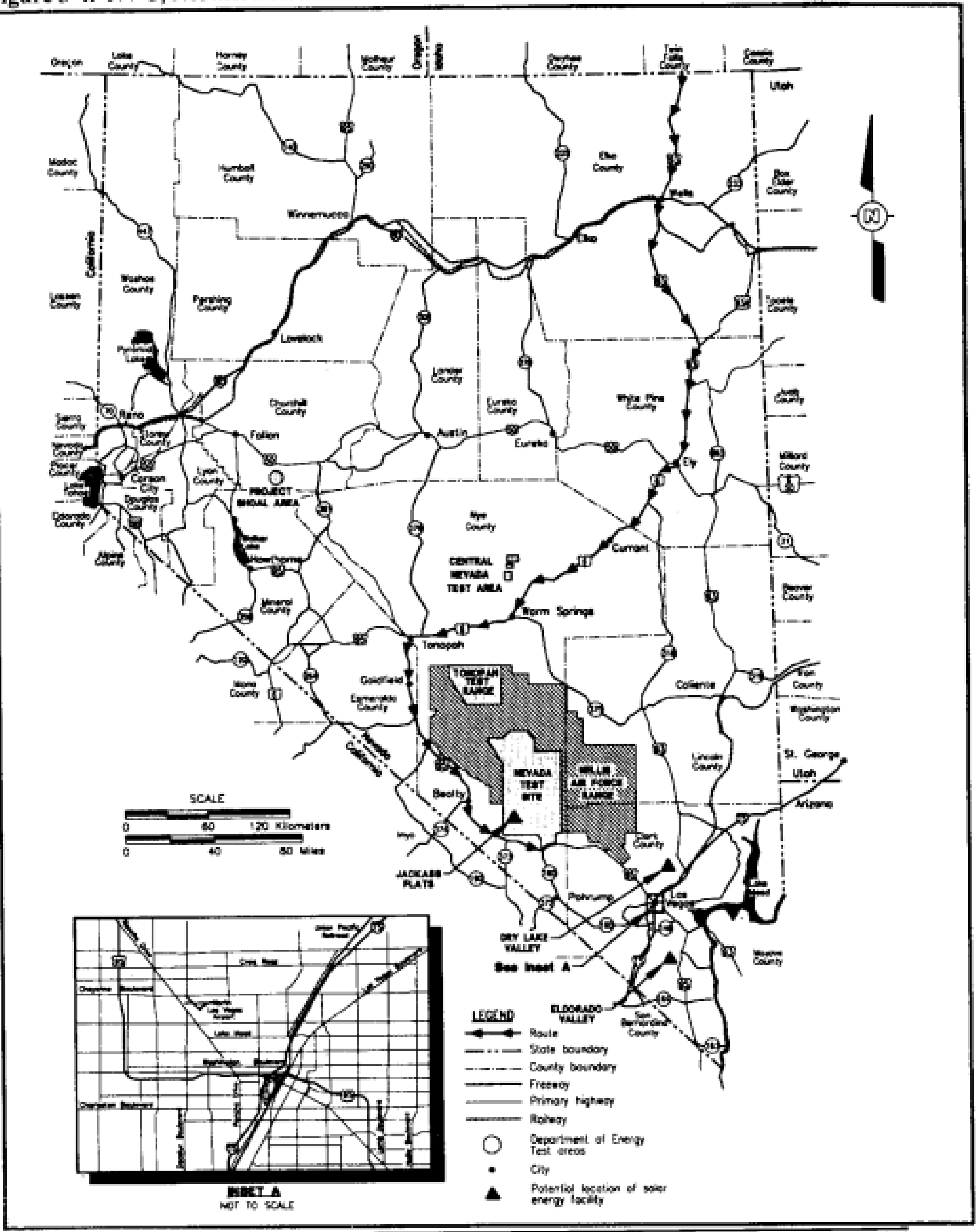


Figure 3-5. NV-4, Eastern Route 9

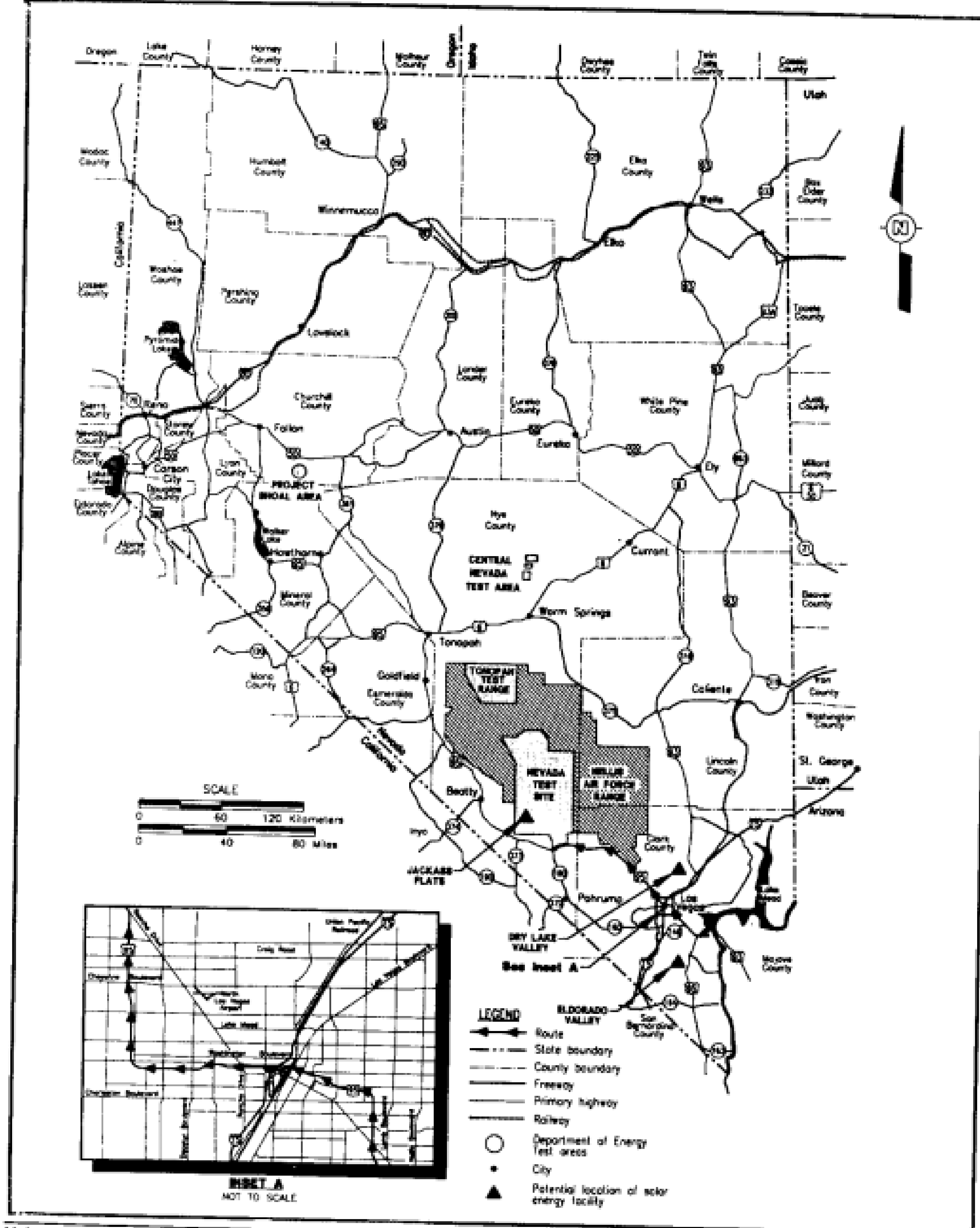


Figure 3-6. NV-5, Eastern Route 10

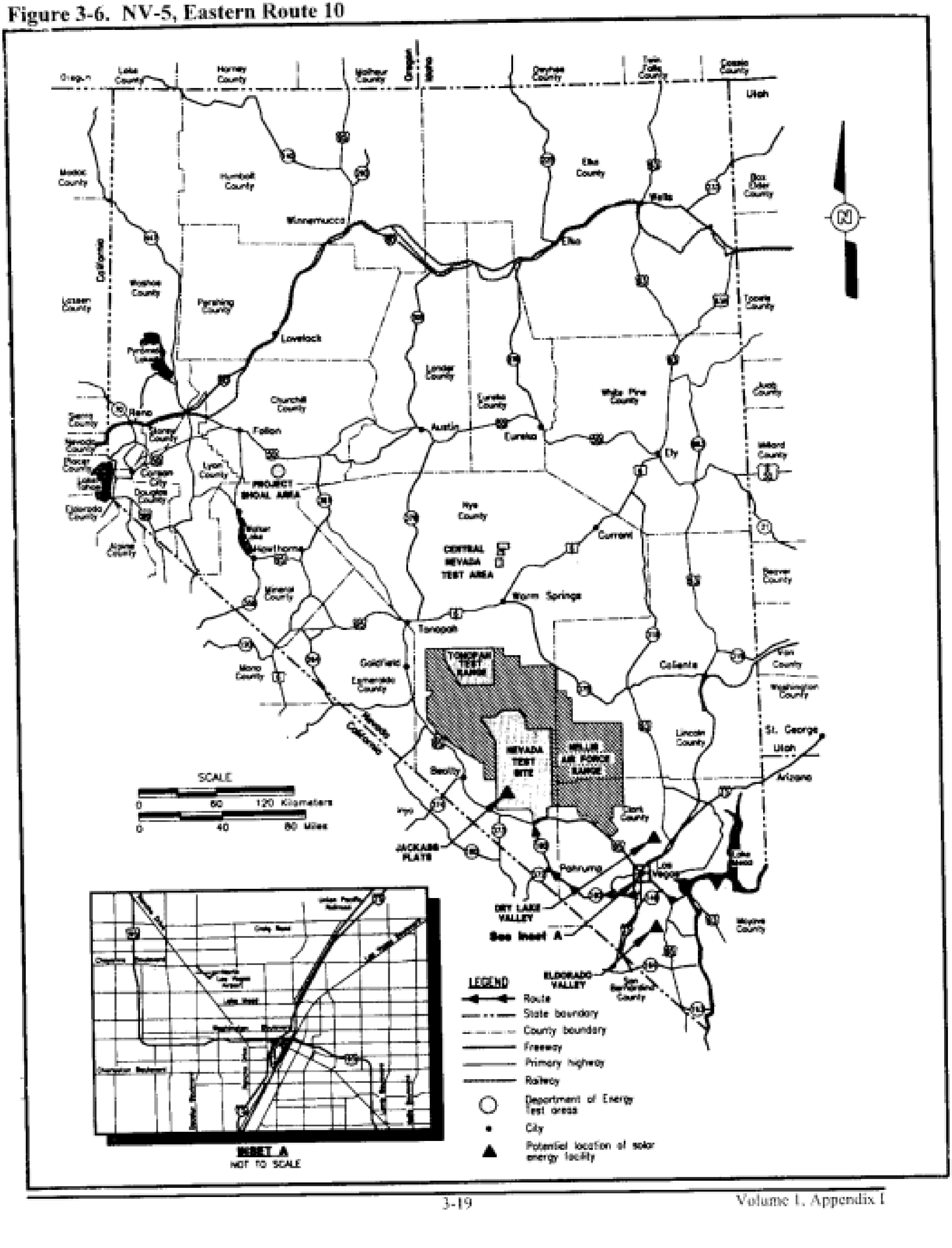


Figure 3-7. NV-6, Southern Route 6

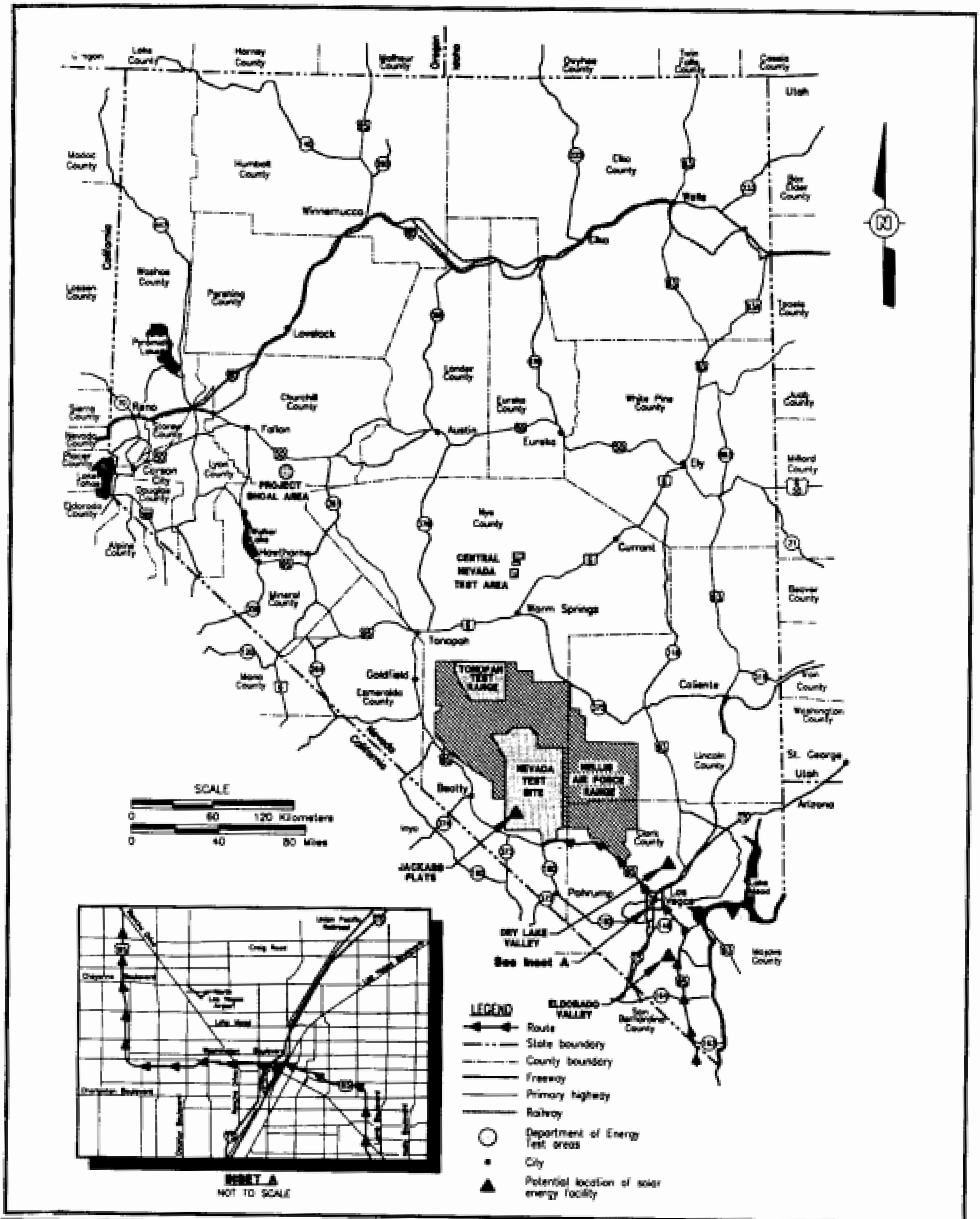
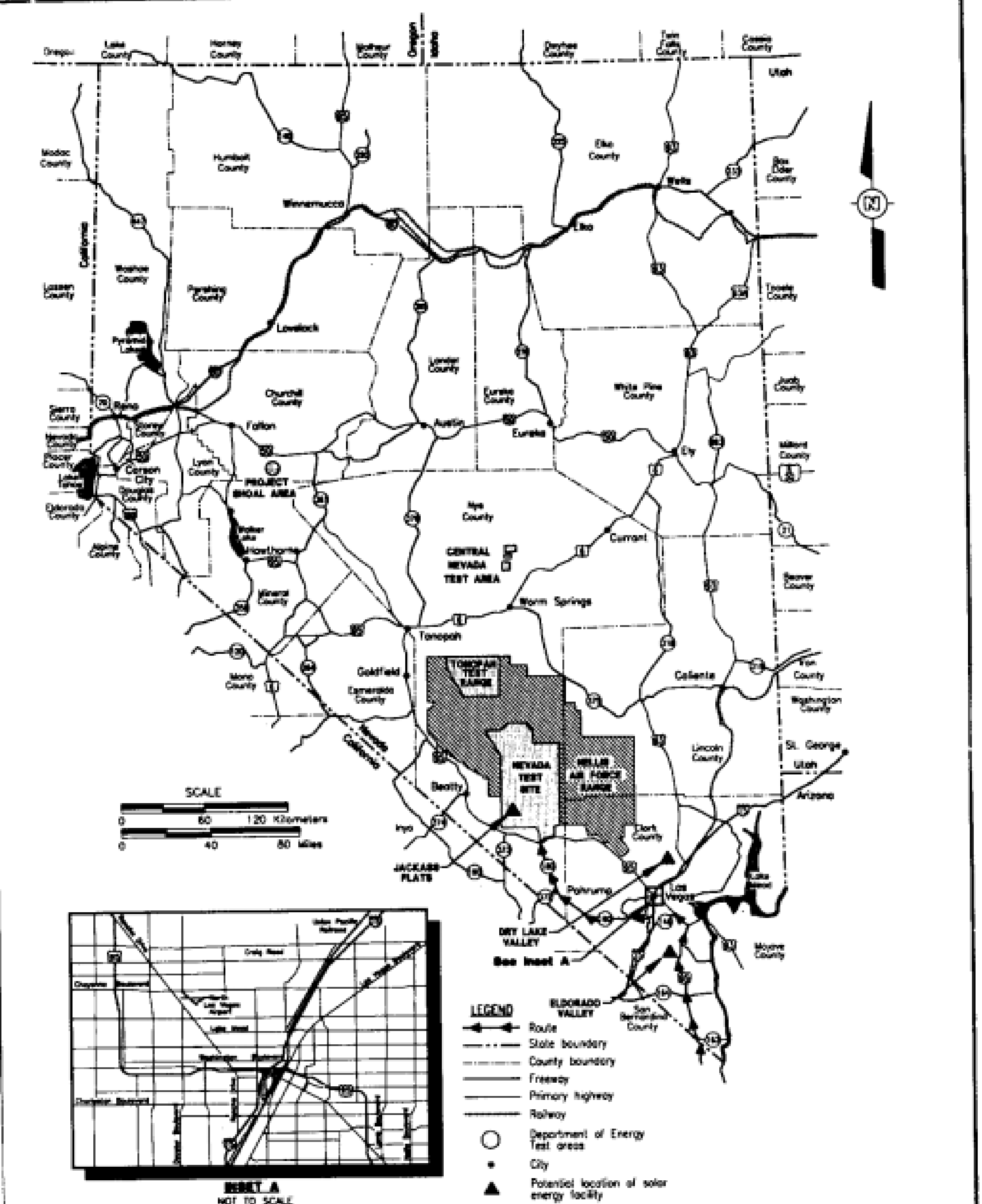


Figure 3-8. NV-7, Southern Route 8



NV-8, Southern Route 1 (Figure 3-9). North on Interstate 15 (from California), to Las Vegas through the Interstate 15/U.S. Highway 95 Interchange, north on U.S. Highway 95. The length of this route is 175 km (109 mi).

NV-9, Southern Route 2 (Figure 3-10). North on Interstate 15 (from California), west on State Road-160 to U.S. Highway 95. The length of this route is 208 km (129 mi).

NV-10, Southern Route 5 (Figure 3-11). North on State Road-373 (from California), east on U.S. Highway 95. The length of this route is 74 km (46 mi).

3.3.3 Data Values

The types of data used, their sources, assumptions, and related uncertainties for the waste management activities evaluation are discussed below. Specific values of all data are provided in DOE/NV (1996). Low-level and mixed waste characterization data was derived from the DOE Integrated Data Base, the Draft Waste Management Programmatic EIS (DOE, 1995c), and NTS waste management estimates. Representative physical and radiological characteristics were assumed for each waste type because detailed consideration of every possible shipment would be impractical. Contact-handled low-level waste, mixed waste, and transuranic waste were each assigned a dose rate of 0.05 mrem/hr at 1 m from the shipping container.

Accident severity categories for radioactive waste transportation accidents are taken from *Final on the Transportation of Radioactive Material by Air and Other Modes*, NUREG-0170 (NRC, 1977). Accident severity is assigned on the basis of impact force and the potential for fire. Each accident severity category is assigned a probability of occurrence. Potential radioactive releases from transportation accidents were estimated using release fractions (IT Corp., 1996) for each accident severity category.

Radioactive material released to the atmosphere is dispersed by the wind. Two Pasquill stability categories were selected; one to represent the average dispersion, and another to represent a worst-case dispersion.

Population dose estimates are based on the unit risk factor approach. The unit risk factor proves an estimate of the dose to either crew members or specified members of the public from transporting a single shipment, on a single route, with a specified population density. Unit risk factors, in units of person-rem per kilometer, are multiplied by shipping distances in various population zones (as determined by the HIGHWAY 3.2 code) to calculate the total population dose for one shipment.

The population dose estimates are then converted to excess latent cancer fatalities using the dose conversion factors of 5×10^{-4} (0.0005) excess fatal cancers per person-rem for members of the public and 4×10^{-4} (0.0004) fatal cancers per person-rem for the crew (ICRP, 1991).

Radiation detriment the dose conversion factors are 1.6×10^{-4} for the worker and 2.3×10^{-4} for the general public. The dose conversion factor for the public is slightly higher because of the inclusion of more sensitive individuals (e.g., children).

The chemical-induced noncancer risk is reported as a hazard index. The hazard index is the ratio between daily intake of a noncarcinogenic toxic chemical and acceptable reference level. If the hazard index is less than one, then no consequences would be expected.

Uncertainty is introduced with each step of the analysis. Conservative assumptions and values (those which lead to overestimating the risk) are used whenever assumptions are made, and when the data values are not well known. The most uncertain parameter was the contents of each shipment, e.g., the radiological characteristics, the chemical characteristics, and the physical form. It was conservatively assumed that the waste forms were resuspendable and combustible under accident conditions. The high end of allowable concentration values used for the chemicals were taken from (DOE, 1995c). Other uncertainties include the health effect models used for

Figure 3-9. NV-8, Southern Route 1

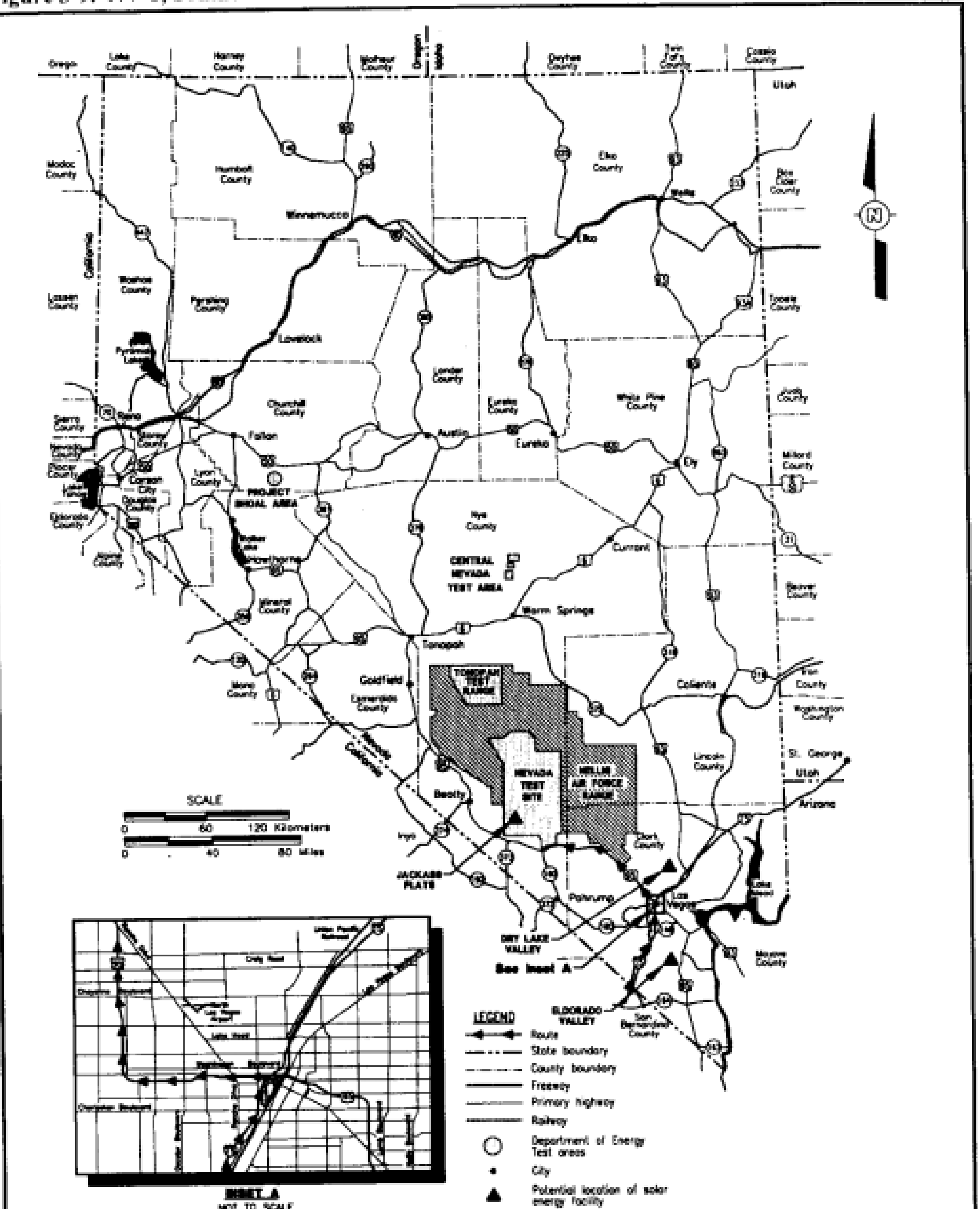


Figure 3-10. NV-9, Southern Route 2

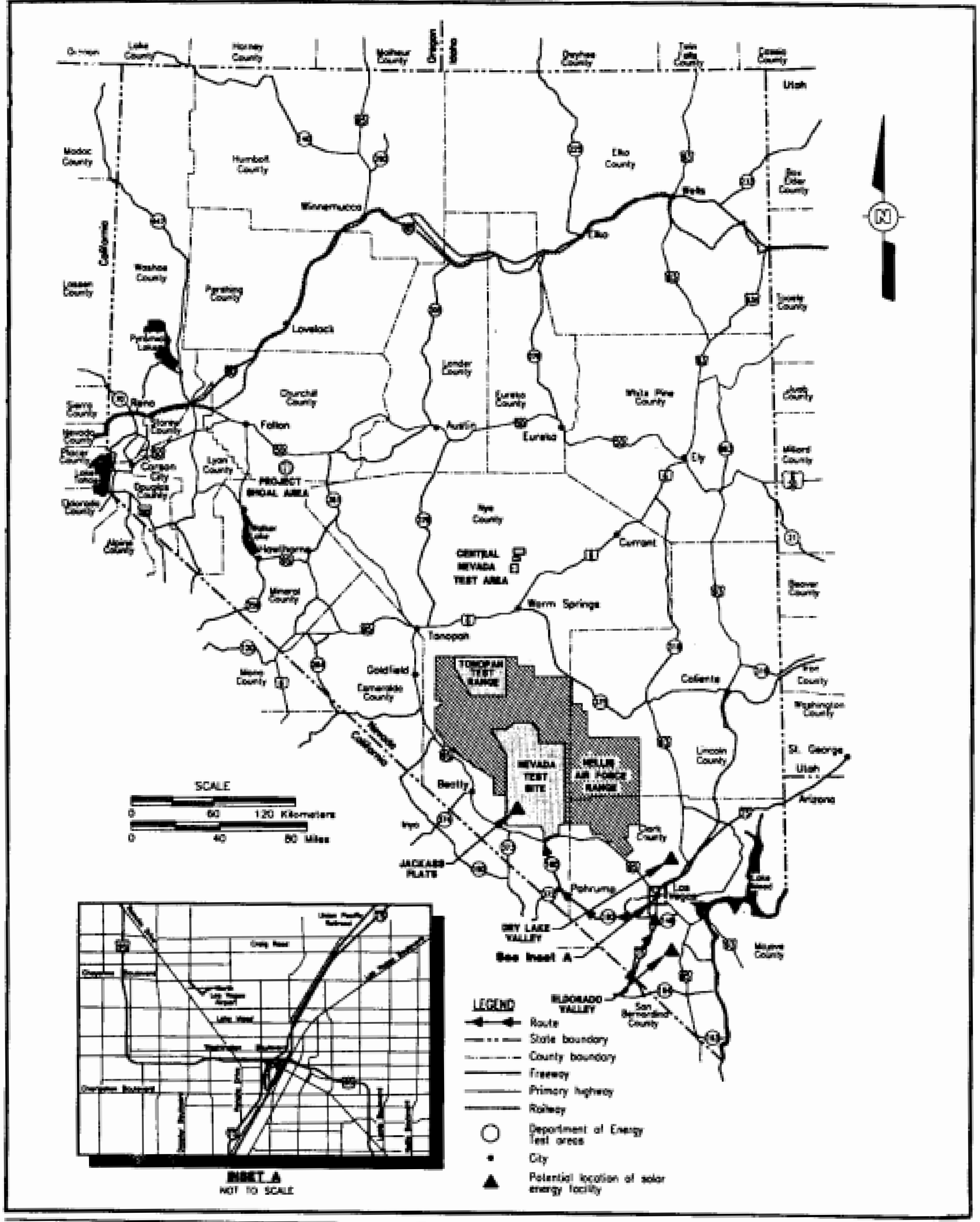
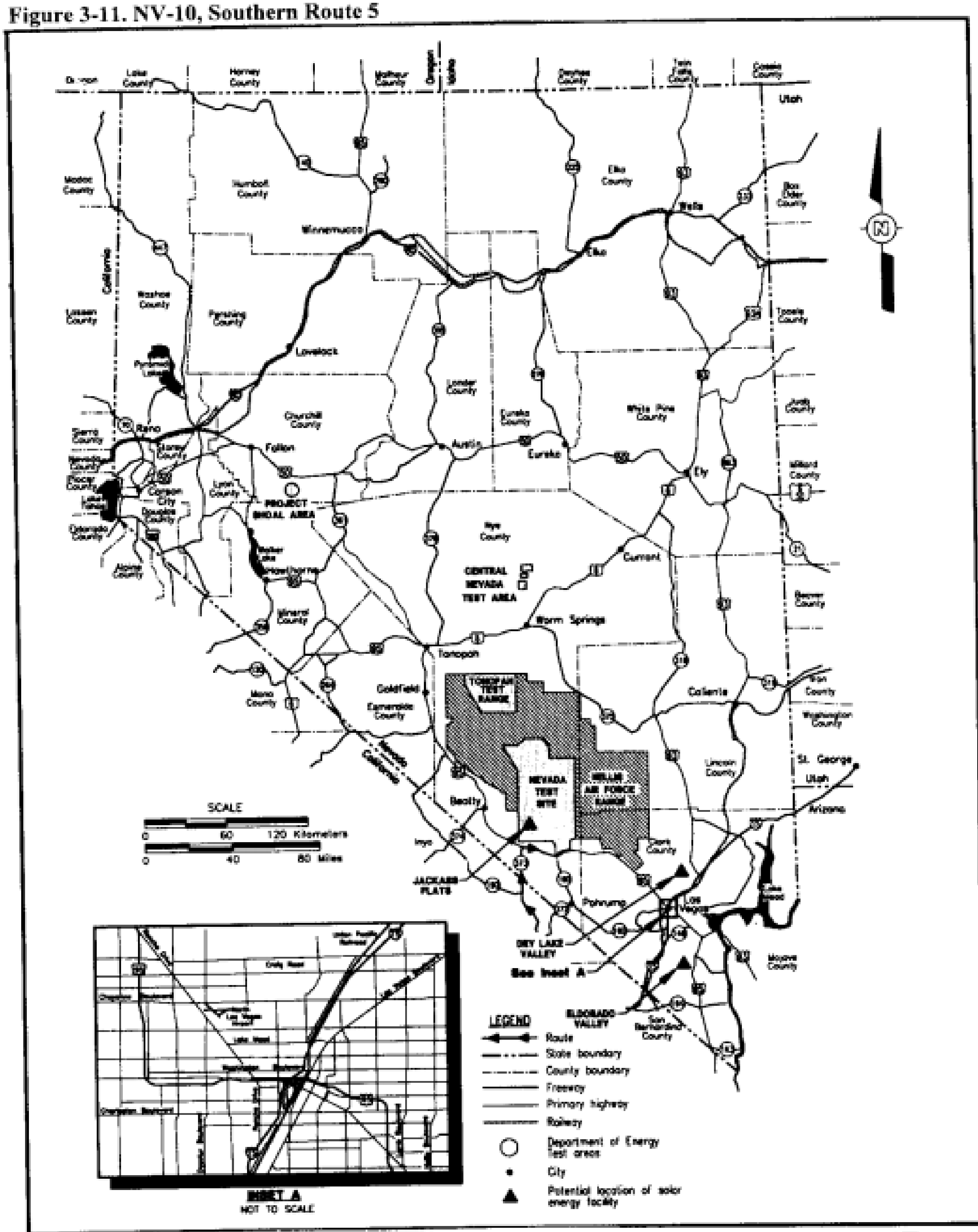


Figure 3-11. NV-10, Southern Route 5



chemicals, radionuclides, and dose assessment assumptions. The data required to apply the methodology are subject to sampling errors, variability, measurement errors, and assumptions. The cargo-related risks are low but they also have the largest uncertainties because the input parameters for their calculations are the least known. The uncertainties for the higher vehicle-related risks are the smallest, allowing differentiation for each route on the basis of distance, which is subject only to a small measurement error.

3.3.4 Waste Management Transportation Risk Results and Conclusions

The following sections discuss national, in-state, and on-site risks from the transportation low-level and mixed waste to the NTS.

National Routes Risk

The estimated number of vehicle fatalities along the national routes during the 10-year period for Alternative 1 is 2, 27 vehicle injuries are estimated. The risk of a single radiation-induced cancer fatality in the general population is 0.0025 (about 1 in 400). The risks calculated for the other consequence types is significantly smaller than these. Results are shown in Table 3-7.

Along the national routes within Nevada, less than one (0.02) vehicle death is estimated, and only one vehicle-related injury. The risk of a single radiation-induced cancer fatality is 0.00075 about 1 in 1,300 (Table 3-8).

Under Alternative 3, the number of vehicle fatalities is estimated as eight. One hundred and three vehicle-related injuries are estimated to occur. The risk of a single radiation-induced LCF is 0.077 (about 1 in 3). These results are shown in Table 3-7. Within Nevada, only four vehicle-related injuries are expected, and less than one (0.08) fatality. Cargo-related fatalities are 0.016 (Table 3-8).

Maximum Exposed Individual Risk

The maximum individual dose and health effects risk were calculated for members of the public: a person caught in traffic, a resident living along the highway, and a service station worker. These results are reported for a single event in *Maximum Individual Doses for Incident-Free Transportation*, (SAIC, 1996b). The maximum exposed individual was a person caught in traffic with an expected dose of 4.1 mrem/event, resulting in a risk of latent cancer fatality of 2×10^{-6} (about 1 in 500,000).

Incident-free nonradiological risk

Incident-free nonradiological risks for transportation of low-level waste and mixed waste were calculated in SAIC (1996a). These health effects resulted from exposure to vehicle exhaust emissions.

Under Alternative 1, these incident-free nonradiological risks are 3.02×10^{-3} (about 1 in 300), and they are 1.20×10^{-2} (about 1 in 75) under Alternative 3.

Maximum reasonably foreseeable accident

The maximum reasonably foreseeable accident is defined as the accident of highest consequences with a probability of occurrence that is greater than or equal to 1.0×10^{-7} per year. These accidents for low-level and mixed waste transportation under Alternatives 1 and 3 were analyzed in an assessment of NTS shipments (SAIC 1996c). The maximum reasonably foreseeable accidents were evaluated for urban, suburban, and rural populations under both neutral and stable atmospheric conditions. The maximum consequences under Alternative 1 occur in an urban zone under stable atmospheric conditions; they are radiation-induced fatal cancers (2.25×10^{-3}), and detriment (1.04×10^{-3}). The highest annual maximum severity accident frequency was 2.25×10^{-5} for travel through rural population zones.

Under Alternative 3, the most severe expected consequences from low-level waste transportation is also radiation-induced cancer (2.25×10^{-3}). The maximum severity accident frequency with these consequences is 8.08×10^{-3} for travel through rural population zones. The radiation-induced health effects consequences and probabilities for mixed waste transportation are the same as those for low-level waste transportation. The chemical-induced consequences are cancer (1.1×10^{-6}) and the chemical noncancer hazard index is 0.38. The hazard index represents the ratios of the daily exposure to a referenced acceptable limit; if the ratio is less than one, no adverse effects would be expected. The maximum probability of an accident with these consequences is 3.23×10^{-3}, also for travel through rural population zones.

The maximum reasonably foreseeable accident was not analyzed for Alternative 2 and 4 due to no off-site transportation.

In-State Route Risk Results

The expected number of consequences per shipment along the Nevada routes NV-1 through NV-10 are shown in Figures 3-12 through 3-19. The largest number of vehicle fatalities 1.8×10^{-5},is along NV-3 while NV-4 (Hoover Dam and through the *Interstate 15/U.S. Highway 95* Interchange) poses the lowest risk (around 1×10^{-6}). The other routes have approximately the same traffic-related fatality rate (2×10^{-6}).

These risk estimates have very low uncertainties associated with them.

Vehicle-related injury estimates per shipment were the highest for NV-1, NV-2, NV-3, and NV-6 (around 2×10^{-4}). Injury rates (per shipment) for all other routes were approximately the same (around 1×10^{-4}) with the exception of NV-10 which is low due to the short distance traveled.

Risks due to incident-free shipment are the largest for routes with the longest distance, highest population, and low rates of speed through urban zones. Routes NV-1, NV-4, and NV-6 had the highest risk (approximately 7.5×10^{-7}); while all other routes had lower, but similar, risks (around 1.25×10^{-7}).

Radiation-induced cancer death estimates due to accidents are primarily sensitive to distance traveled and population density along the route. NV-3, the longest route, has the highest risk (8.75×10^{-12}). The difference between the highest risk and the lowest is exceedingly small.

Chemical cancer deaths and hazards due to accidents would be the result of acute exposure to members of the crew or the public during a release of volatile organic compounds when an accident caused the breach of a container. These risks are dependent on distance and population density; therefore, the risks for NV-1, NV-4, and NV-6 are the greatest. The risks for all remaining routes are by risks due to incident-free transportation. Incident-free transportation risks are conservative because the estimate of the population at risk is high, and because no credit is taken for the shielding properties of surrounding structures. Uncertainties were not calculated for these risks, as they are small compared to the off-site risks, and no alternate routing is considered.

Risks associated with the noncarcinogenic effect of volatile organic compounds are represented by a hazard index. If the hazard index is less than one; approximately the same because of large *uncertainties in the calculation.*

These results indicate that the greatest risk is from vehicle-related injuries, followed by vehicle-related fatalities, and finally, incident-free radiation exposures (fatalities and injuries).

On-Site Transportation Risk Results

Detailed results of the on-site transportation risk analysis are provided in DOE/NV (1996). The on-site transportation risk analysis includes; NTS-generated low-level waste from 17 points of origin on the NTS to the disposal site, plus contaminated soil from environmental restoration activities at Tonopah. A summary of results is shown on Table 3-9. No on-site transportation is associated with Alternative 2. As with off-site transportation, the risks from traffic fatalities are the largest, followed as it is for the national routes in-state routes, and on-site transportation, no adverse effects are expected.

Figure 3-12. Nevada In-State Traffic Fatality Risk

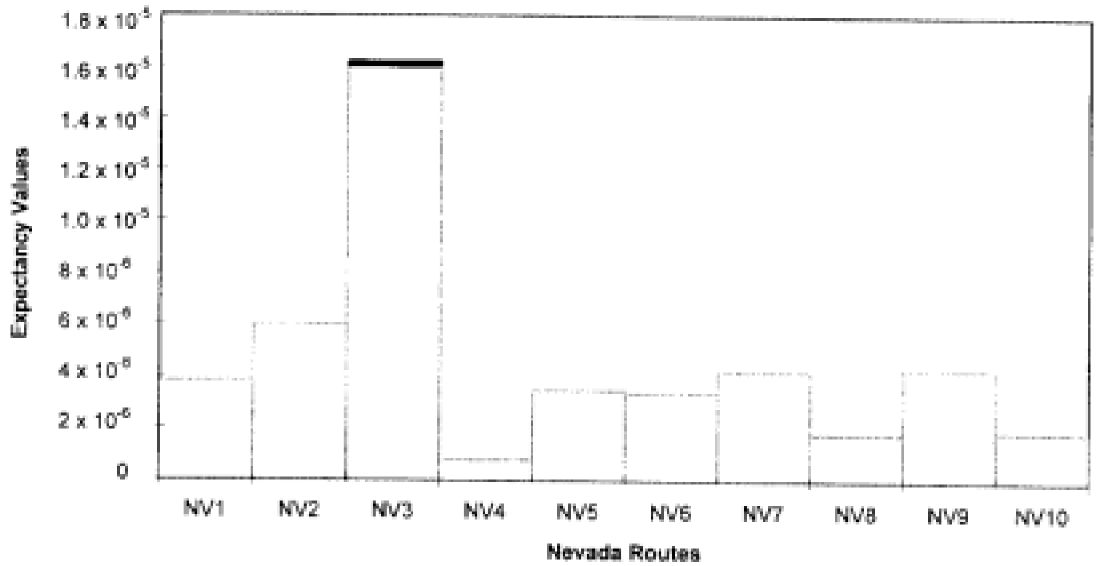


Figure 3-13. Nevada In-State Traffic Injury Risk

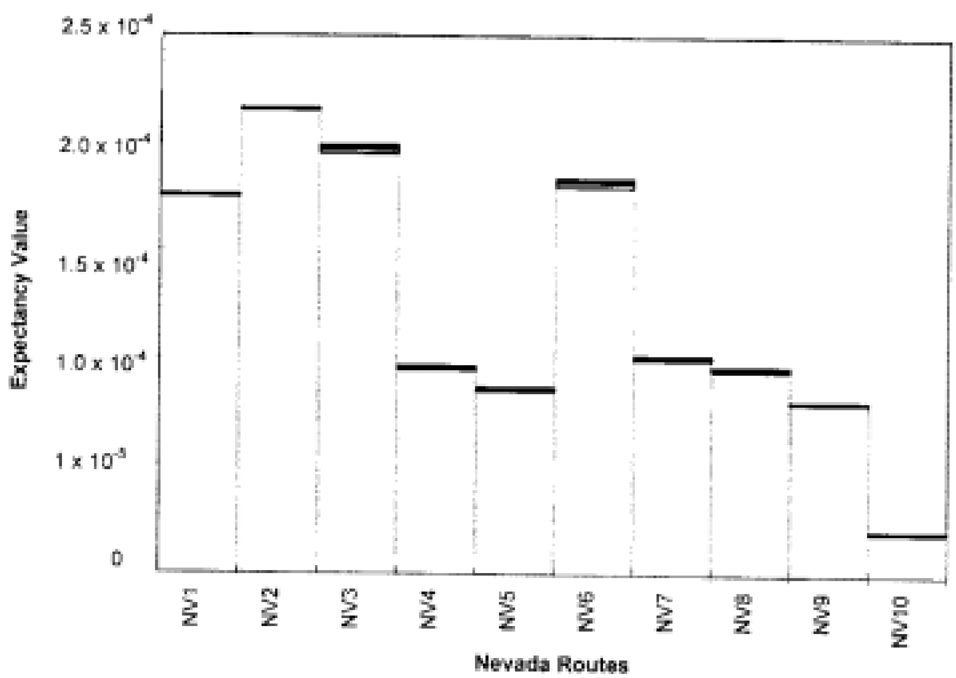


Figure 3-14. Nevada In-State Incident-Free Radiation-Induced Cancer Fatality Risk

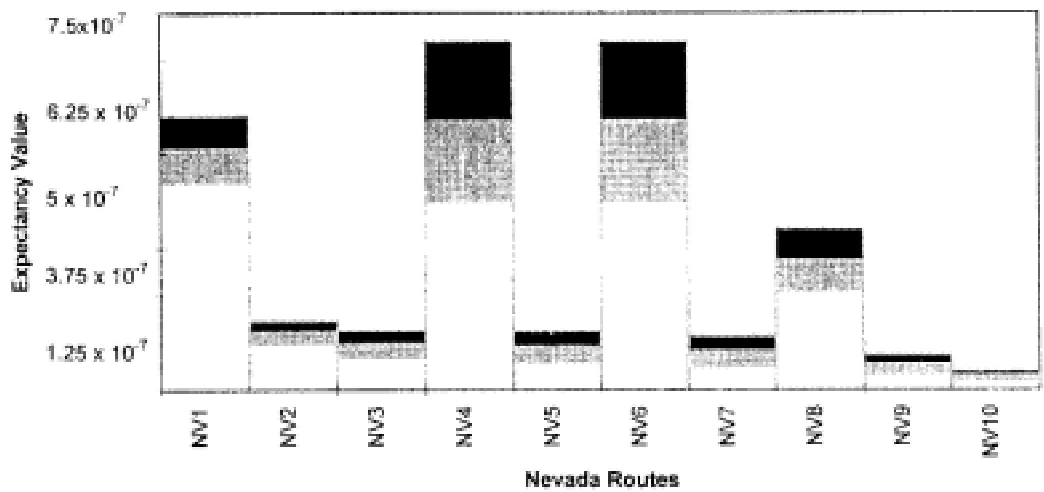


Figure 3-15. Nevada In-State Radiation-Induced Cancer Fatality Risk Due to Accidents

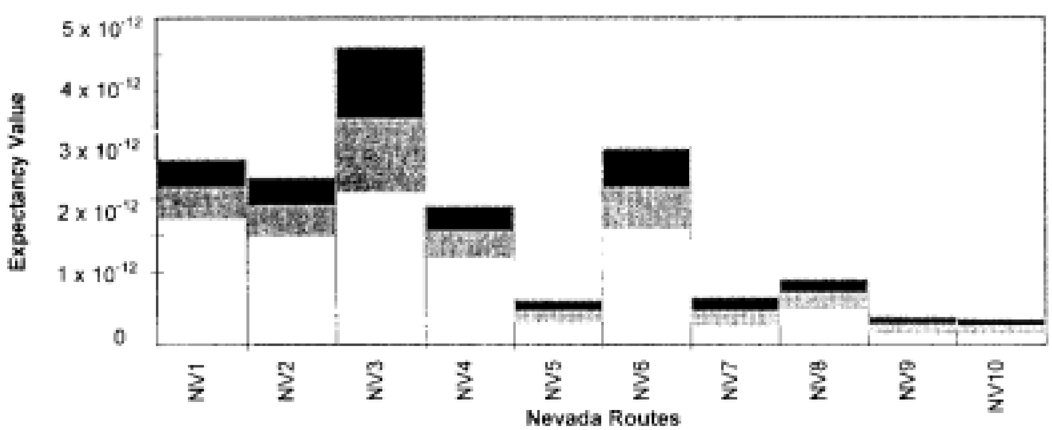


Figure 3-16. Nevada In-State Incident-Free Radiation Induced Detriment Risk

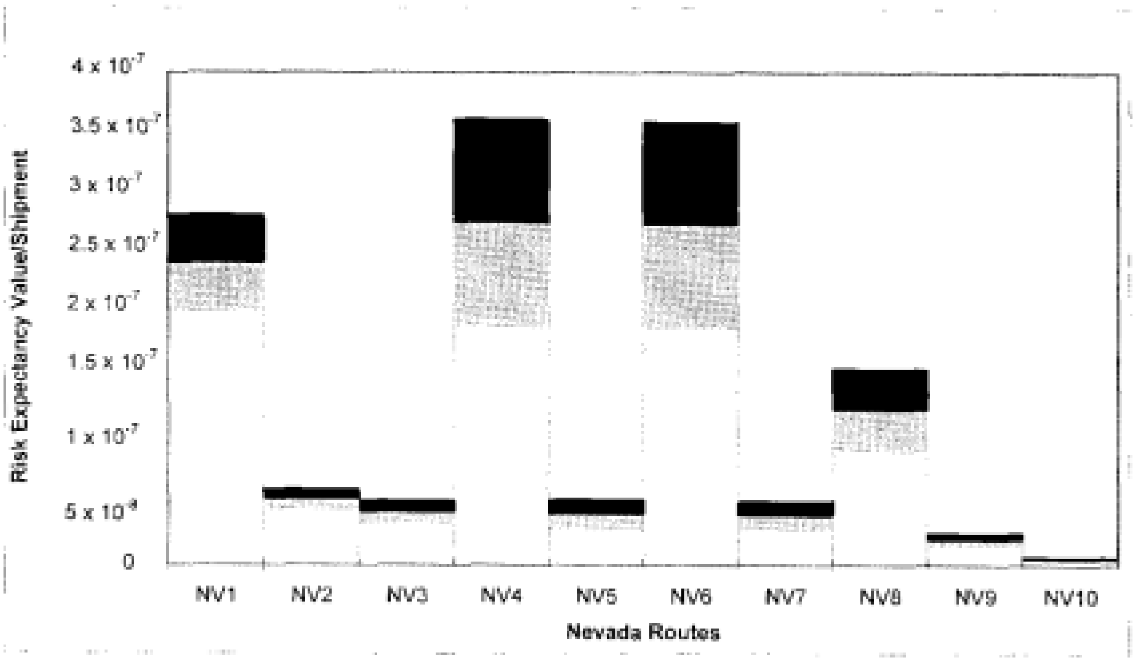


Figure 3-17. Nevada In-State Radiation-Induced Detriment Risk Due to Accidents

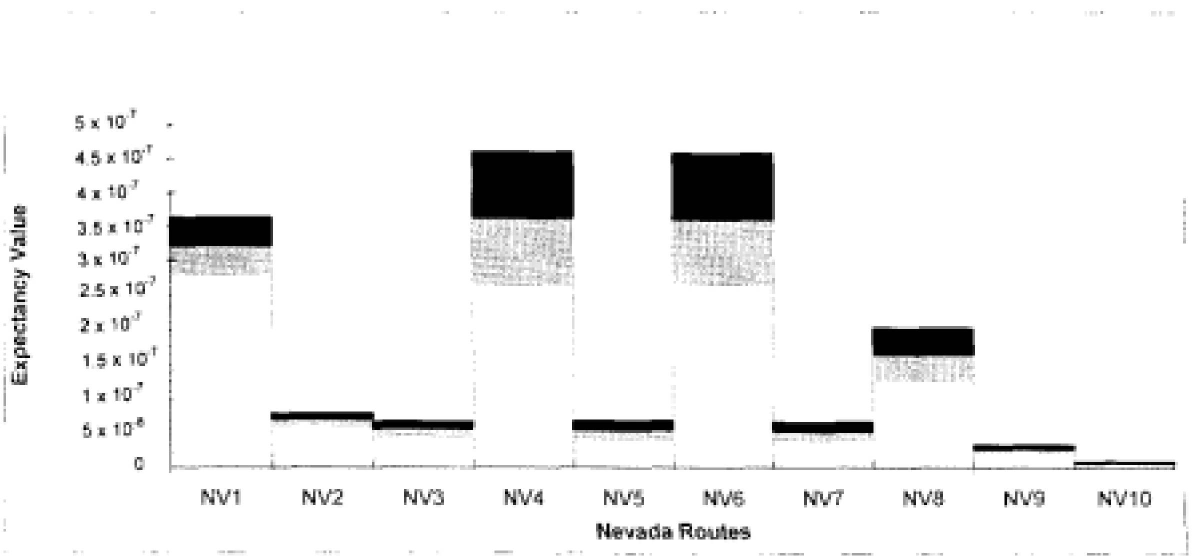


Figure 3-18. Nevada In-State Chemical-Induced Cancer Risk

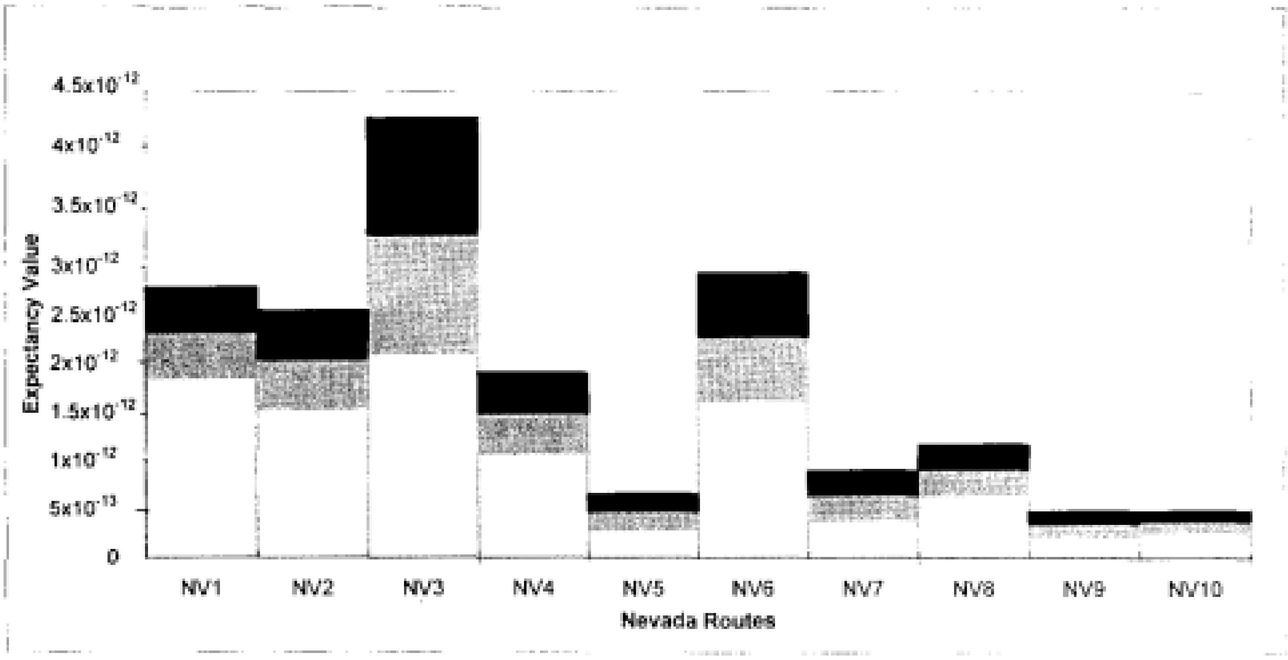


Figure 3-19. Nevada In-State Chemical-Induced Noncancer Hazard Index

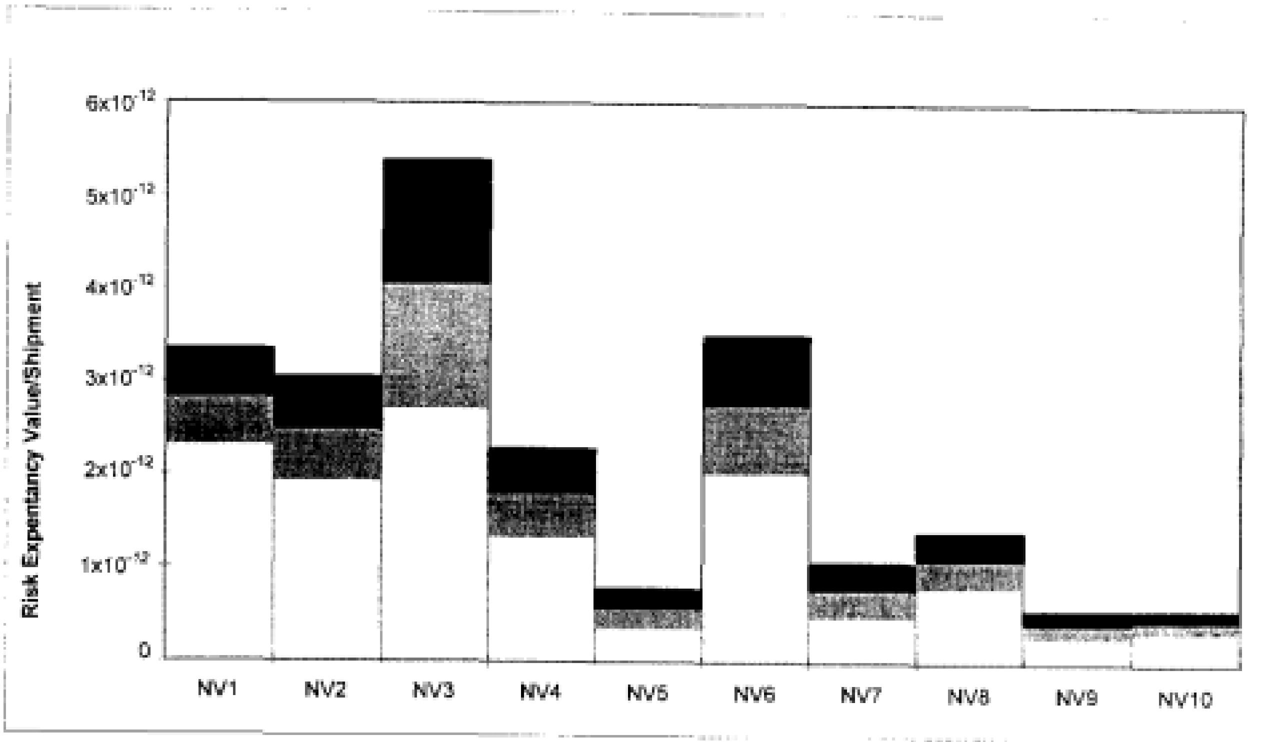


Table 3-7. Expected Number of Occurrences in 10 years (National Route)

Consequence	Risk	
	Alternative 1	Alternative 3
Vehicle-related fatalities	2	8
Vehicle-related injuries	27	1.3
Incident-free nonradiological health effects	3.02×10^{-3}	1.20×10^{-2}
Radiation-induced cancer fatalities	2.5×10^{-3}	7.7×10^{-2}
Radiation-induced detriment	1.4×10^{-3}	3.9×10^{-2}
Chemical-induced cancer	9×10^{-6}	7.5×10^{-5}

Table 3-8. Expected number of Occurrences in 10 years (within Nevada)

Consequence	Risk	
	Alternative 1	Alternative 3
Vehicle-related fatalities	2.3×10^{-2}	7×10^{-2}
Vehicle-related injuries	1	4
Incident-free nonradiological health effects	7.84×10^{-4}	1.61×10^{-3}
Radiation-induced cancer fatalities (LCFs)	7.5×10^{-4}	1.6×10^{-3}
Radiation-induced detriment	3.54×10^{-4}	7.9×10^{-5}
Chemical-induced cancer	2.4×10^{-6}	9.8×10^{-6}

3.3.5 Waste Management Transportation Risk Conclusions

The primary goal of the waste management analysis study was to estimate the health effects of the transportation of low-level and mixed waste along various routes from generators to the NTS. The results indicate that routing decisions need not rely solely upon the health risks, as they are all similar, and all are low. However, certain routes do exhibit small risk reductions over others, and their use could be a risk management tool. Reduction of total risk can be achieved mainly by selecting the route from a given generator site with the lowest traffic-related risks.

On the basis of the evaluation of in-state routes alone, routes NV-4, or NV-5 would have the lowest number of traffic related injuries or NV-10 if entering from the west. To reduce incident-free radiation cancer risks, NV-5 is preferable to NV-4; however, it should be noted that these risks are highly uncertain, and the estimates are very conservative. To reduce the risk due to accidents involving hazardous materials, NV-5 the most desirable route because it is the shortest distance, and has the lowest population density. However, when selecting national routes, risks outside the state would also have to be considered.

On-site transportation risks are common to all alternatives that involve transportation, and do not contribute significantly to the total risk of any alternative.

3.4 Hazardous Materials Shipments Transportation Risk

A separate analysis was performed for this EIS to assess impacts from transportation accidents involving nonradioactive hazardous materials SAIC (1996e). Hazardous chemicals are routinely shipped to the NTS from chemical manufacturers in various parts of the United States. In addition, the NTS routinely ships hazardous wastes to off-site hazardous waste treatment, storage, and disposal facilities. All shipments of hazardous chemicals and hazardous waste are made by truck.

To assess human health risks from transportation accidents involving hazardous chemicals, the shipment of chemicals in bulk quantities represents the bounding case because of the large quantities per shipment. A review of NTS hazardous material shipment records identified the top six chemicals that are routinely shipped to the NTS in bulk quantities. These chemicals were screened for relative toxicity to humans based on the Reference Concentration assigned to each chemical by the U.S. Environmental Protection Agency. (The reference concentration is the concentration in air below which it is unlikely for sensitive populations to experience adverse health effects.) Of the six chemicals reviewed, ammonia was found to have the highest relative toxicity. Approximately two shipments of ammonia per year are made from Las Vegas, NV to the NTS. Each shipment contains about 1,000 pounds of ammonia.

The bounding case for shipments of hazardous waste was determined by review of NTS hazardous waste shipment records. Each NTS hazardous waste stream was evaluated and ranked based on the following properties: potential for accidental dispersion, quantity, chemical concentration, material form (liquid, gas, or solid), and the frequency of shipment. Based on this screening methodology, Lab Pack waste was identified as the most important waste stream on the basis of types and quantities of hazardous wastes. Lab Pack wastes consist of a wide assortment of individual chemicals which were subsequently screened for relative toxicity based on their reference concentrations. The results of this screening process identified mercury, barium, chromium, arsenic, and cadmium as the Lab Pack chemicals that present the greatest health risks to humans. The average Lab Pack weight per shipment is about 460 kilograms. Under Alternatives 1 and 4, it was assumed that annual hazardous waste shipments would be similar to recent experience, about 20 shipments per year. The number of shipments is assumed to double to 40 shipments per year under Alternative 3. Alternative 2 was assumed to have a single shipment to remove any wastes stored in the Area 5 Hazardous Waste Storage Unit at the time that the NTS program operations were discontinued.

The postulated accident scenario is a truck accident leading to a breach of shipping containers (drums or tank) and a release of hazardous materials to the environment. The spilled chemicals either evaporate (liquid spill) or are aerosolized by the accident impact and wind (solid release). Accident probabilities were calculated for urban, suburban, and rural population zones based on: truck, accident rates per highway kilometer, the conditional probability that an accident will result in a release of hazardous material, the length (kilometers) of the shipment route, and the number of shipments per year.

Airborne concentrations of released chemicals were calculated using the EPI number code computer program for both neutral and stable atmospheric dispersion conditions. Consequences to people located downwind of the release are expressed in terms of Emergency Response Planning Guidelines (ERPGs). ERPG values are estimates of airborne concentration thresholds above which one can reasonably anticipate observing adverse effects based on an exposure time of one hour.

- *ERPG-1:* The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects, or perceiving a clearly defined objectionable odor.

- ERPG-2: The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or

Table 3-9. On-site Transportation Risk for NTS-Generated Waste

Consequence	Alternative 1	Alternative 3	Alternative 4
Traffic fatalities	0.11	0.11	0.11
Traffic injuries	1.1	1.1	1.1
Radiation-induced cancer fatalities	1×10^{-7}	3×10^{-7}	9×10^{-8}
Radiation-induced detriment	1×10^{-7}	2×10^{-7}	8×10^{-8}
Chemical-induced cancers	NA[a]	NA	NA

[a] Not applicable

developing irreversible or other serious health effects, or symptoms than could impair their abilities to take protective action.

- ERPG-3: The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

For a severe transportation accident involving a tanker shipment of ammonia, the probability of the accident occurring in an urban population zone is estimated to be about 2.3×10^{-7} per year and could result in 5 to 39 people being exposed to ammonia in excess of ERPG-3 concentrations. The probability of the accident in a suburban population zone increases to 1.4×10^{-6} per year and 1 to 7 people could be exposed to ammonia in excess of ERPG-3 concentrations. The accident probability increases to 4.3×10^{-6} for rural population zones where no people would be exposed to ERPG-3 concentrations, but 0 to 3 people could be exposed to ammonia in excess of ERPG-1 concentrations. These probabilities and consequences are assumed to be the same for Alternatives 1, 3, and 4. No bulk chemical shipments are expected under Alternative 2.

For a severe transportation accident involving a shipment of lab packed hazardous wastes, the probability of the accident occurring in an urban population zone is estimated to be about 2.5×10^{-5} per year. No people would be exposed to chemicals in excess of ERPG-3 concentrations, but 1 to 6 people could be exposed to chemicals in excess of ERPG-2 concentrations. The probability of the accident in a suburban population zone increased to 7.6×10^{-5} per year; one person could be exposed to chemicals in excess of ERPG-2 concentrations, and 92 to 183 people could be exposed in excess of ERPG-1 concentrations. The accident probability increases to 1.7×10^{-4} for rural population zones where no people would be exposed to ERPG-3 or ERPG-2 concentrations, but 1 to 2 people could be exposed to chemicals in excess of ERPG-1 concentrations. The probabilities given for these accidents are based on the estimated annual hazardous waste shipments for Alternatives 1 and 4. For Alternative 3, the accident probabilities double, but he consequences remain the same. For Alternative 2, the accident probabilities are lower by a factor of 20.

The consequences presented for hazardous material transportation accidents establish the upper bound of reasonably foreseeable consequences. In other words, if the postulated accidents actually occurred, the consequences would be expected to be less than those presented in this EIS. The accident analyses performed for the EIS did not consider mitigative actions, such as individuals taking cover, escaping to an area of lower or safe concentrations, or wearing protective equipment, which would lower the consequences of the postulated accidents.

3.5 Summary

A transportation risk analysis was performed in response to stakeholder concerns about the alternatives in the NTS EIS. The transportation of low-level waste, mixed waste, nuclear materials, and hazardous chemicals was analyzed. Both vehicle-related and cargo-related consequences were assessed for incident-free radiological and nonradiological health effects, vehicle fatalities and injuries, accident-initiated radiological fatalities and detriment, and chemical-induced cancers. A hazard index was calculated as a measure of the chemical-induced noncancer health effect. In addition, the maximum individual exposure (dose and health risk) for low-level waste transportation was calculated.

The maximum reasonably foreseeable accidents associated with low-level waste and mixed waste transportation were identified.

The results of the transportation risk analyses for Defense Program nuclear material and waste management of low-level and mixed waste show that the human health risks from transportation are low under any alternative, and are not significant contributors to the total risk from all operations under any alternative. Since transportation decisions do not need to be made on the basis of risk (because all the risks are low, and, are similar within the uncertainty bounds), other factors can be given greater consideration.

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Attachment A to Appendix I

APPLICABLE FEDERAL, STATE, AND LOCAL LAWS AND REGULATIONS

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Attachment A. Applicable Federal, State, and Local Laws and Regulations

All shipments of hazardous materials, including radioactive, whether from industry or government, must be packaged and transported according to strict federal, state, and local regulations. Handling, storage, and disposal of these wastes must also be performed in accordance with specific regulations. These regulations are intended to protect the public, transportation and other workers, and the environment from potential exposure to hazardous materials or radiation.

This appendix lists those federal, state, and local laws and regulations, including U.S. Department of Energy (DOE) orders, that the DOE believes are applicable to the safe transportation of materials to and from the Nevada Test Site (NTS). The NTS transportation activities must comply with federal, state, and local environmental protection regulations, waste management regulations, occupational health and safety standards, and transportation regulations.

In Tables A-1 through A-6, regulatory citations and requirements, including the implementing authority, are summarized. The summary column in each table lists a brief description of the regulation's possible relation to the NTS transportation activities. The tables are organized by implementation authority.

Table A-1. Applicable State and local laws and regulations. (Page 1 of 2)

Title	Authority	Citation	Summary
Committee on Transportation	Department of Motor Vehicles and Public Safety	AB748 (1993)	This legislation makes an appropriation to the Nevada Highway Patrol of the Department of Motor Vehicles and Public Safety for the pilot program of the Alliance of Uniform Hazardous Material (HAZMAT) Transportation Procedures and provides for other related matters. The pilot program will test uniform registration and permitting of hazardous materials motor carriers.
Rocky Mountain Low-Level Radioactive Waste Compact Statute	Compact Members, Rocky Mountain Low-Level Radioactive Waste Board	Nev. Rev. Stat. Ann. §§459.007 through 459.0083	Ratifies the Rocky Mountain Low-Level Radioactive Waste Compact, and approves Nevada's entry into same, for the cooperative management of low-level radioactive waste. The compact board is required to make suggestions to appropriate officials in the party states to ensure that adequate emergency response programs are available to deal with any exigency that might arise with respect to low-level waste transportation or management. Additionally, requires party states to adopt and enforce procedures for shipments to conform to packaging and transportation requirements. Authorizes the Department of Health to administer compact responsibilities.
License to Use Area for Disposal Required	Health Division	Nev. Rev. Stat. Ann. §§459.221	A shipper, producer or broker of radioactive waste must obtain a license from the Health Division in order to dispose of the waste. Unlicensed shippers will have the waste returned to them. The license is issued when the shipper or broker demonstrates that waste will be labeled and packaged in accordance with the regulations of the State Board of Health. Penalties are prescribed for violations.
Requirements for Transporting Radioactive Waste	Motor Vehicle Division, Public Service Commission	Nev. Rev. Stat. Ann. §§459.707 through 708	The approval of the Public Service Commission (PSC) is required for the Division to issue a permit to carriers that seek to transport radioactive waste. The PSC also must determine that carriers will comply with all applicable laws and regulations of the state and the federal government. Grounds for revocation of a permit are specified. Section 459.708 states that motor carriers shall reject packages for transport if they are leaking, do not bear the required shipping label, or are not accompanied by the prescribed shipping documents. Carriers are liable for packages in their custody that are deficient as noted above.

Table A-1. Applicable State and local laws and regulations. (Page 2 of 2)

Title	Authority	Citation	Summary
Nevada Hazardous Materials Laws	State Board of Health, State Department of Transportation, Department of Motor Vehicles and Public Safety, Highway Patrol Division, State Environmental Commission, Department of Conservation and Natural Resources	Nev. Rev. Stat. Ann. §§459.001 et seq.	A Nevada hazardous materials statute establishes requirements for hazardous and nuclear materials waste management, transportation, and emergency response.
Western Interstate Nuclear Compact	Western Interstate Nuclear Board	Nev. Rev. Stat. Ann. §§459.001 through 459.005	Nevada is a party to the Western Interstate Nuclear Compact which, in relevant part, obligates party states to provide mutual aid in coping with nuclear incidents. This may or may not extend to nuclear transportation incidents.
Hazardous Materials Regulations (February 1992 edition)	Board of Health	Nev. Admin. Code §§459.010 through 459.950	The Nevada Board of Health has promulgated radiation control regulations which concern hazardous materials licensing, transportation, and radiation protection.
Transportation of Hazardous Materials	Fire Chief	Ordinance No. 960	Clark County, Nevada, has an ordinance regarding transportation of hazardous materials. The ordinance includes requirements for reporting, certification, fees, routing, and liability issues as they relate to the transportation of hazardous materials through Clark County, Nevada.
Transportation of Hazardous Materials	Department of Fire Services	Ordinance No. 3190	The City of Las Vegas, Nevada, has an ordinance that regulates the transportation of hazardous (including radioactive) materials in the city. The ordinance includes requirements for reporting, permitting, fees, routing, and liability issues as they relate to the transportation of hazardous materials through Las Vegas, Nevada.
Transportation of Hazardous Materials	Fire Department	Ordinance No. 821	The City of North Las Vegas, Nevada, has an ordinance concerning hazardous materials transportation by various modes in and through the city. The ordinance includes requirements for adoption of federal regulations, liability, notification, and reporting issues as they relate to the transportation of hazardous materials through North Las Vegas, Nevada.

Table A-2. Applicable U.S. Department of Transportation regulations

Title	Authority	Citation	Summary
Transportation Title 49 CFR	U.S. Department of Transportation	Subtitle A (parts 1 - 99)	Office of the Secretary of Transportation
		Subtitle B	Other Regulations Relating to Transportation
		I (parts 100 - 199)	Research and Special Programs Administration, Department of Transportation
		II (parts 200 - 299)	Federal Railroad Administration, Department of Transportation
		III (parts 300 - 399)	Federal Highway Administration, Department of Transportation
		IV (parts 400 - 499)	Coast Guard, Department of Transportation
		V (parts 500 - 599)	National Highway Traffic Safety Administration, Department of Transportation
		VI (parts 600 - 699)	Federal Transit Administration, Department of Transportation
		VII (parts 700 - 799)	National Railroad Passenger Corporation
		VIII (parts 800 - 899)	National Transportation Safety Board
		X (parts 1,000 - 1,399)	Interstate Commerce Commission

Table A-3. Applicable Nuclear Regulatory Commission regulations

Title	Authority	Citation	Summary
Notices, Instructions and Reports to Workers; Inspections	U.S. Nuclear Regulatory Commission (NRC)	10 CFR 19	Each licensee shall post Form NRC-3 "Notice to Employees," the regulations in Title 10 CFR 20, and the applicable operating procedures. Each worker shall be advised annually of their exposure to radiation or radioactive material.
Standards for Protection Against Radiation	NRC	10 CFR 20	Establishes standards for protection against ionizing radiation resulting from activities conducted under licenses from the U.S. Nuclear Regulatory Commission.
Disposal of High-Level Radioactive Wastes in Geologic Repositories	NRC	10 CFR 60	Prescribes rules governing the licensing of the DOE to receive and possess radioactive material at a geologic repository.
Disposal of Low-Level Radioactive Waste	NRC	10 CFR 61	Provides standards for near-surface land disposal of radioactive waste.
Packaging and Transportation of Radioactive Material	NRC	10 CFR 71	Provides requirements for packaging, preparation for shipment, and transportation of licensed material; and states procedures and standards for U.S. Nuclear Regulatory Commission approval of packaging and shipping procedures for radioactive material.
Fees for facilities and materials licenses and other regulatory services under the Atomic Energy Act of 1954, as amended	NRC	10 CFR 170	Sets out fees charged for licensing services rendered by the U.S. Nuclear Regulatory Commission.

Table A-4. Applicable EPA regulations

Title	Authority	Citation	Summary
Resource Conservation and Recovery Act Standards Applicable to Generators of Hazardous Wastes	EPA Environmental Protection Agency	40 CFR 262	Part 262 describes the regulatory requirements imposed on generators of hazardous wastes. An EPA identification number is required prior to offering any hazardous waste for transport. Part 262 also deals with the preparation of hazardous wastes for shipment and preparing a uniform hazardous waste manifest.
Resource Conservation and Recovery Act —Standards Applicable to Transporters of Hazardous Waste	EPA	40 CFR 263	Part 263 deals with standards for hazardous waste transporters. A transporter of hazardous wastes must obtain an EPA identification number, comply with the hazardous waste manifest system, and notify the proper authorities if any discharges (spills) occur during transportation. In addition, Part 263 contains some provisions for permitting.
Designation, Reportable Quantities, and Notification	EPA	40 CFR 302	Identifies reportable quantities of listed hazardous substances and sets forth notification requirements for any releases of these substances that exceed reportable quantities.
Hazardous Chemical Reporting: Community Right-to-Know	EPA	40 CFR 370	Reporting requirements to provide the public with information on hazardous chemicals in their communities, and to facilitate emergency response plans are established.
National Environmental Policy Act of 1969	EPA	40 CFR 1500–1508	Establishes procedures to ensure that environmental information is available to the public before environmental decisions are made and taken.

Table A-5. Applicable Occupational Safety and Health Administration regulations

Title	Authority	Citation	Summary
Occupational Safety and Health Standards	U.S. Department of Labor	29 CFR Part 1910	Establishes provisions for workplace health and safety procedures.

Table A-6. Applicable DOE requirements

Title	Authority	Citation	Summary
National Environmental Policy Act Compliance Program	U. S. Department of Energy (DOE)	DOE Order 491 (Draft)	Implements the Environment, Safety, and Health Strategic Plan; and substantively revises DOE 5440.1E to incorporate provisions of the Secretary of Energy's National Environmental Policy Act Policy of June 1994. It reflects the secretary's charge to control the cost and time for document preparation and review while maintaining quality, implements effective National Environmental Policy Act planning and teamwork, enhances public involvement, and strives for continuous improvement of the National Environmental Policy Act process.
Materials Transportation and Traffic Management	DOE	DOE Order 460.2	Transportation management.
General Environmental Protection Program	DOE	DOE Order 5400.1	Establishes environmental protection program requirements, authorities, and responsibilities for DOE operations to ensure compliance with applicable federal, state, and local environmental protection laws and regulations, executive orders, and internal DOE policies.
Radiation Protection of the Public and the Environment	DOE	DOE Order 5400.5	Establishes standards and requirements for the operations of DoD and DOE contractors with respect to protection of members of the public and the environment against undue risk from radiation.
Radioactive Waste Management	DOE	DOE Order 5820.2A	Contains packaging requirements for various materials.
Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Waste	DOE	DOE Order 460.1	Each package offered for transport to a carrier must comply with this order, U.S. Department of Transportation regulations, and the applicable standards of Title 10 CFR Part 71.
Radiological Assistance Program	DOE	DOE Order 5530.3	DOE to provide support and emergency response.
Quality Assurance	DOE	DOE Order 5700.6C	Establishes quality assurance requirements for the DOE.
Nevada Test Site DOE Approved Waste Acceptance Criteria, Certification, and Transfer Requirements	DOE	NV-325 (Rev. 1)	Establishes procedures, requirements, and criteria for the safe transfer and disposal of low-level and mixed waste, and storage of transuranic and transuranic mixed waste at the NTS.

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Attachment B to Appendix I

PROCEDURES AND REGULATIONS RELATING TO TRANSPORTATION OF HAZARDOUS MATERIALS

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Attachment B. Procedures and Regulations Relating to Transportation of Hazardous Materials

B.1 General Transportation Procedures and Regulations

B.1.1 Containerization, Packaging, and Labeling Regulations

The containerization and packaging of hazardous materials must comply with detailed U.S. Department of Transportation (DOT) and the U.S. Nuclear Regulatory Commission regulations. The form, quantity, and concentration of the radioactive materials determine the type of packaging used. All radioactive materials must be packaged to ensure that the radiation level at the package surface does not exceed the DOT regulations 49 CFR 173. The requirements of Title 49 CFR 173, Subpart I, ensure that package handlers, transporters, and the public are advised of package contents; and do not receive dose rates in excess of recognized safe limits established by the U.S. Nuclear Regulatory Commission. After radioactive materials are put in the proper packaging, they are sealed, they are surveyed with special instruments to ensure radiation is within regulatory limits, and checked for external contamination. The package is then marked and labeled to provide information about its contents.

The radioactive waste type that would be shipped to the Nevada Test Site (NTS) under Alternatives 1 and 3 would likely be low-level waste or mixed waste. The type of packaging for a great majority of low-level and mixed waste will be industrial (strong, tight packages). However, to provide additional information and comparisons of the three basic types of packaging used to transport radioactive wastes and/or materials, information on all three basic types of packages are provided in the following paragraphs (49 CFR 173, Subpart I). It should be noted that packaging regulations apply to both rail and truck transport.

- **Industrial Packages**. This type of package is used for materials that present little hazard from radiation exposure, due to their low-level of radioactivity. They are shipped in "strong, tight" packages (49 CFR 173.421). Slightly contaminated clothing, laboratory samples, and smoke detectors are examples of materials that may be shipped in strong, tight packages. These packages are generally constructed of cardboard, wood, or metal. The DOT has proposed that strong, tight packages be replaced by "industrial packaging," which is a standard international package for low-level radioactive materials. Industrial packaging conforms to international design and construction requirements. This type of container will retain and protect the contents during normal transportation activities.

- **Type A Packages**. This type of container is used for radioactive materials with higher specific activity levels (radioactivity) These packages must demonstrate their ability to withstand a series of tests without release of their contents. Test requirements are established by the U.S. Nuclear Regulatory Commission. Regulations require that the package protect its contents and maintain sufficient shielding under conditions normally encountered during transportation. These packages are generally 55-gallon steel drums, steel boxes, or specially designed shielded boxes. Typically, Type A packages are used to transport radiopharmaceuticals (radioactive materials for medical use) and certain regulatory-qualified industrial products.

- **Type B Packages**. This type of container is used for radioactive materials that exceed the limits of Type A package requirements must be shipped in Type B packages. Shippers use this type of package to transport materials that would present a radiation hazard to the public or the environment if there was a major release. For that reason, a Type B package design must not only demonstrate its ability to withstand tests simulating normal shipping conditions, but it must also withstand credible accident conditions without releasing its contents. Type B packages are used to transport materials with high levels of radioactivity, such as spent fuel from nuclear power plants. The size of Type B packages can range from small containers to those weighing over 100 tons.

The packaging of waste is completed by the shipper. (In all cases, radioactive waste received at the NTS under Alternatives 1 and 3 would be from a DOE-approved waste generator.) The shipper marks and labels the container, and ensures that vehicle placarding is in place. The three types of waste packages are shown in Figure B-1.

Federal regulations *Radioactive Material* 49 CFR 172 requires that shippers follow specific required guidelines in marking and labeling all packages containing radioactive materials. At a minimum, markings must provide the proper shipping name, identification number, the shipper's name and address, as well as other information. Labels must identify the contents and radioactivity level (indicated in curies [Ci]), a unit of measurement that specifies the number of atoms undergoing radioactive decay per second), and provide a hazard index to ensure proper handling. Shippers of radioactive materials use one of three different shipping labels in accordance with Title 49 CFR Part 172.403 (c): Radioactive White I (lowest category), Yellow II, or Yellow III (highest category. The appropriate label corresponds to the type of material shipped, and the measured radiation level of the package's contents. Radioactive White I is designated for materials with a package surface radiation level of less than 0.5 mrem/hr. Radiation Yellow II is used for materials with a radiation level greater than 0.5 mrem/hr. But less than 50 mrem/hr. Yellow III is designated for waste with a radiation level greater than 50 mrem/hr. (See Table B-1). Any waste package containing a highway-route controlled quantity of radioactive material must be labeled Radioactive Yellow-III. This requirement does not generally relate to low-level or mixed waste. Each package requiring radioactive labels must have two labels, one affixed to opposite sides of the package. The package contents (name of radionuclides) and the activity of the contents (e.g., Ci and microcurie [μCi]) must be written on the radioactive label in the spaces provided.

The shipment of certain types of radioactive materials requires that the vehicle be clearly marked with placards on all four sides. Most shipments received at the NTS have the Radioactive White-I placard. Materials that meet highway route-controlled parameters, such as commercial radioactive spent nuclear fuel, require a white square to be displayed behind each radioactive placard. The correct use of markings, labels, and placards is the responsibility of the shipper. Markings, labels, and placards identify the hazardous contents to emergency responders and guide them in the selection of appropriate safety procedures in the event of an accident.

Radioactive material shipments must be accompanied by accurate shipping papers (49 CFR 172.200). These papers contain detailed information on the materials being transported, and they reference the appropriate emergency response procedures to follow should the need arise. In addition, these documents include certification that the materials are properly described, classified, packaged, marked, and labeled and are in proper condition, according to Department of Transportation regulations. Drivers must keep shipping papers in the vehicle and make them available at all times for inspection by responsible officials.

Figure B-1. Examples of container types

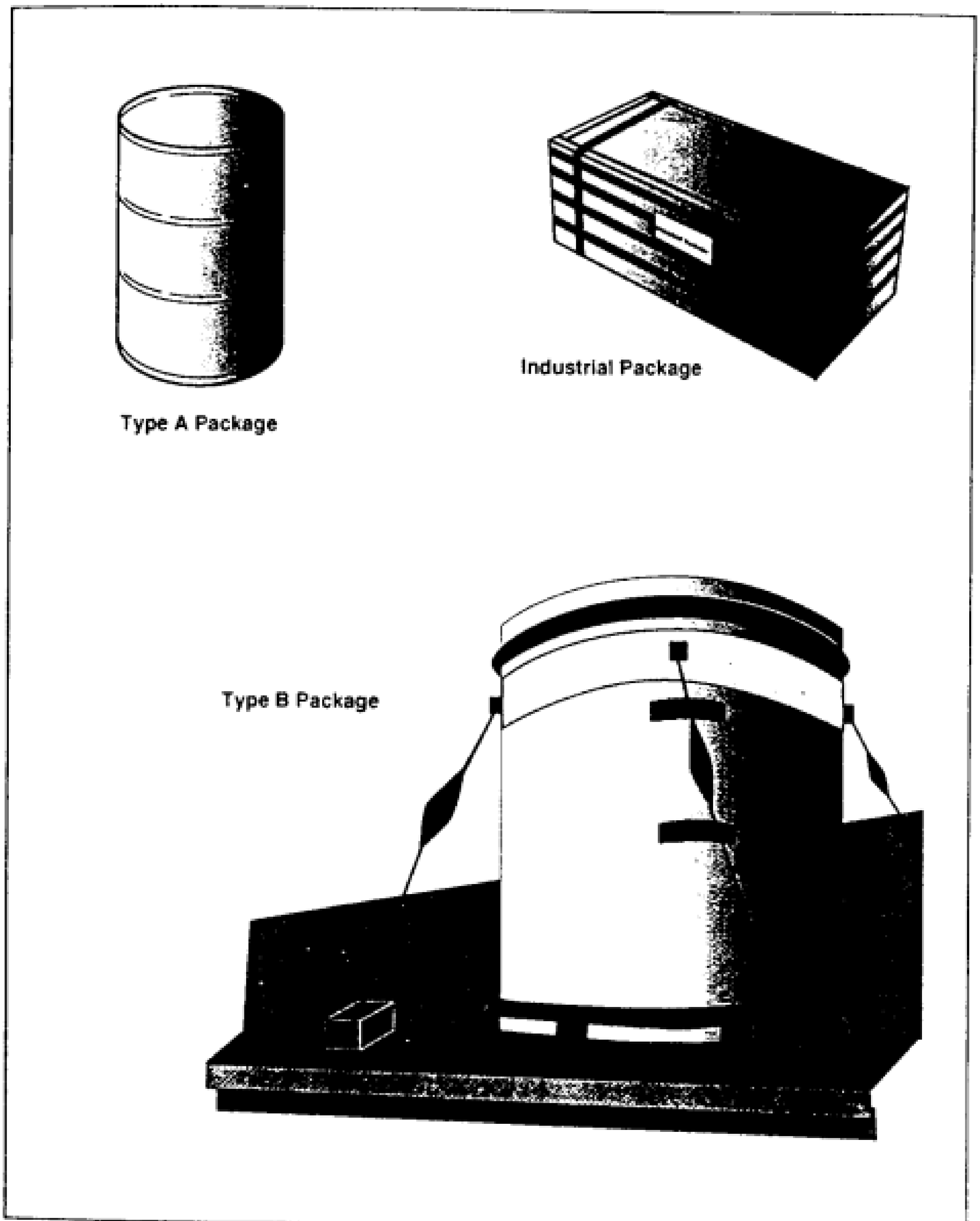

Table B-1. Category of label to be applied to radioactive materials packages

Transport Index (T.I.)	Radiation Level (RL) at Package Surface	Fissile Criteria	Label Category[a]
NA[b]	≤0.5 mrem/hr (mrem/hr)	Fissile class I only, no fissile class II or III	White-I
T.I. ≤ 1.0	0.5 mrem/h <RL ≤50 mrem/hr	Fissile class I, fissile class II, with T.I. ≤ 1.0, no fissile class III	Yellow-II
T.I. > 1.0	50 mrem/hr <RL	Fissile class II with 11.0 < T.I., fissile class III	Yellow-III

[a] Any package containing a "highway route controlled quantity" (49 CFR 173.403) must be labeled as Radioactive Yellow-III

[b] Not Applicable

B.1.2 DOE Procedure for the Selection of Carriers

The DOE, through its Transportation Management Division at DOE Headquarters in Washington, DC, make every effort to ensure the quality of the carriers, drivers, and equipment used to transport DOE material. The DOE has a Motor Carrier Evaluation Program to assist DOE field offices and contractor transportation personnel in selecting carriers to transport radioactive and hazardous materials.

Carriers are also subject to Federal Highway Administration inspections that provide information on driver qualifications, maintenance, and operating policies. The Department of Transportation issues a safety fitness rating for the carrier. DOE evaluates for its use only those carriers with a satisfactory rating from the Department of Transportation.

The DOT funds the Motor Carrier Safety Assistance Program, which provides information on accident statistics, roadside inspection results, and compliance reviews at the carrier's principal place of business. The DOE contractor's transportation specialists receive copies of this data, and use the information contained therein to select carriers for further consideration.

The DOE and its contractor transportation specialists visit carriers' corporate offices and maintenance facilities to determine whether they are eligible to transport radioactive and hazardous materials for the DOE.

The specialists review the following information on the carriers:

- Experience with hazardous and radioactive cargo
- Safety and regulatory compliance record
- Driver employment policies
- Equipment maintenance programs and procedures
- Emergency response capabilities
- Driver training program, including documentation
- Financial stability and insurance records.

The DOE scores each motor carrier on how well they comply with DOT standards, meet essential DOT-prescribed requirements, and possess desirable attributes. Any carrier not meeting DOT standards is declared ineligible. Carriers are typically re-evaluated on a scheduled basis related to their level of DOE activity.

Two contracting mechanisms exist for shipping materials: the special contract negotiated for individual shipments, or for a series of shipments; and the bill of lading which acts as the contract between carriers and shippers. Carriers performing under special contract are called contract carriers, while carriers performing under a bill of lading are called common carriers.

The Act to Regulate Commerce was signed into law on February 4, 1887, and created the Interstate Commerce Commission. Several additional acts were passed during the first half of the twentieth century that imposed restrictions on all modes of transportation. During this time, there was a major distinction between the two types of carriers, and shippers with "specialized" commodities normally chose contract carriers rather than common carriers because there was greater regulation of the contract carrier. During the late 1970s, deregulation was started and, the authority of the Interstate Commerce Commission has diminished significantly, in fact it may soon cease to exist. Much of what has become law has been tested in the courts and will be in the court system for years to come, but it is clear that industry and government are moving away from regulation. Deregulation has made the choice between contract and common carriers almost moot; however, shippers may elect to do comparison studies before selecting a carrier. In selecting a carrier, the DOE generator/shipper gives careful consideration to cost, performance history, and condition and availability of equipment. Inspections and evaluations of the carrier, and the ability to work closely with available carriers are also carefully deliberated.

The following paragraphs and tables show some of the differences between contract and common carriers. Primarily due to deregulation, industry and government preference is to use common carriers unless there are very specific, tangible benefits to be gained by using contract carriers.

Contract carriers are obligated to supply only what is negotiated and contained in the provisions of the specific contract. Additional needs identified by the shipper require further negotiation and incur additional cost. Delays are also a common result of this process. The responsibilities of both the carrier and the shipper must be carefully defined and documented; for example, responsibility for damage, delay, and terms of custody. (These responsibilities are inherent in the bill of lading and bind the common carrier without additional documentation.) Contractual timeframes and total tonnage to be moved are identified. The shipper must pay for the total identified tonnage even if the tonnage is less than the contractual amount. Each shipment is treated individually and is paid for through standard billing procedures. Payment is not made unless full service is rendered. The shipper has no control over who bids on the contract, which could result in an award to an owner-operated carrier that uses owner-operator drivers and equipment. In this situation, little or no control can be exercised over the operators or the equipment.

Some common carriers do have authority to bid on and operate as contract carriers, but there is no guarantee that a company in this status would be awarded the contract. Common carriers have control over their operators (employed by the company) and operate under established rules of operation such as those governing dispatcher-operator interactions, global positioning systems on equipment, and maintenance support agreements throughout the country. A comparison of carrier contractual issues is provided in Table B-2. In summary, public perception (based on comments received) is that DOE will have more control over their shipments, that the shipment will somehow be safer, and the government will be able to make all routing decisions if a contract carrier is selected (see Table B-3). This is not necessarily true. There are pros and cons to the type of carrier selected for any given shipment or series of shipments. In order to make a decision that provides the best, safest transportation for any commodity, a variety of subjects must be reviewed. All criteria such as type of shipment (truck load versus less than a truck load); single shipment or on-going campaign; single or multiple origins or destinations; specific routing requirements; general cargo versus hazardous materials; transit times, special handling, equipment, and packaging; services available in the geographic location of the shipper; willingness of carriers to work closely with DOE transportation managers and their contractors; and

Table B-2. Comparison of carrier contractual issues

CARRIER TYPE	PROS	CONS
Contract	Carrier must comply with Title 49 CFR Federal Motor Carrier Safety Regulations	Shipper will incur extra costs if item(s) not originally negotiated are requested
	Carrier will provide dedicated equipment and drivers	Obligated to adhere to contract requirements, procurement rules and regulations in addition to transportation regulations
		Potential for contractor financial instability
		Case law is not binding, only what is contained in the contract is binding
Common	No contract negotiation needed	
	Carrier must comply with Title 49 CFR Federal Motor Carrier Safety Regulations	
	Agree on routes to be used under certain conditions	
	Shipper pays for services received, with no stipulation to pay for more	
	Normally have more and better equipment, which is more readily available	
	Legally bound by case law	

Table B-3. Public perception of carrier issues

CARRIER TYPE	PROS	CONS
Contract	DOE in control of shipments DOE has control of routes used Contract carriers use best equipment, drivers, and communication devices available	
Common		DOE not in control of carrier operations. No oversight of carrier's selection of routes

the effect of deregulation as discussed above will be examined before any decision to use common or contract carriers is made.

B.1.3 Route Selection Process

Carriers or private trucking companies are responsible for selecting routes for low-level waste shipments in accordance with *Federal Highway Administration: Requirements For Motor Carriers and Drivers Code of Federal Regulations* (49 CFR Part 397.101 (a). However, the DOE works closely with carriers in this area. The carriers are required to ensure that the motor vehicle is operated on routes that minimize radiological risk. They must consider available information on accident rates, transit time, population density and activities, and the time of day and day of week during which transport will occur.

For shipments containing a highway route-controlled quantity of radioactive material, the carrier must adhere to the requirements in Title 49 CFR Part 397.101(b) through (g)(3). These shipments occur on state-designated routes, (49 CFR 397.103), or preferred routes, as defined in Title 49 CFR Part 397.101(b).

B.1.4 Liability

Carriers of hazardous materials must carry liability insurance to cover damages in case of an accident. The carrier retains liability for accidents in which it is at fault. The carrier is also responsible for the costs to clean up the site of an accident. The DOE is responsible, however, for legitimate health and safety claims after an accident has occurred. Decreased land values or loss of business are not DOE's responsibility, because carriers are responsible for selecting routes of travel and must carry insurance in accordance with Department of Transportation requirements.

The required amount of coverage for carriers of radioactive materials varies according to the mode of transport (water, air, road, or rail). Minimum coverage requirements are contained in (49 CFR Part 387). If damages caused by an accident exceed the liability coverage held by the carrier, umbrella coverage is provided by the Price-Anderson Act. The Price-Anderson Act was added in 1957 as an amendment to the Atomic Energy Act of 1954 to help establish financial protection for persons injured and persons liable for those injured by a nuclear incident or a precautionary evacuation. The Act provides coverage for public liability arising from: (1) the slow release of radioactive material, if the release resulted from an action that occurred during contract activity, even if the damage occurred after the termination of the contract; and (2) the release of the nuclear material component of mixed waste. The Act also covers damages resulting from terrorism, sabotage, and other illegal acts which might occur during transport. Funding for this coverage comes from both private insurance and government indemnity.

B.1.5 Driver Training and Education

Drivers of vehicles that transport hazardous materials (which includes radioactive materials) must first receive special training and certification in accordance with Department of Transportation Regulations, which include the Federal Motor Carrier Safety regulations (49 CFR 350-399).

Drivers must have in their immediate possession a document certifying that training has been completed, and a copy placed in their qualification file (required by *Driver Qualification Files* 49 CFR 291.51) showing the following:

- The driver's name and operator's license number
- The dates that training was provided
- The name and address of the person providing the training
- That the driver has been trained in the hazards and characteristics of highway route-controlled quantity of Class 7 (radioactive) materials
- A statement by the person providing the training that information on the certificate is accurate.

Lastly, drivers must have in their immediate possession the route plan required by Title 49 CFR Part 391.57, and be operating the vehicle in accordance with the plan.

Transportation of hazardous waste also requires the specialized training of drivers. Title 49 CFR Parts 172.700-172.704 discusses the importance and responsibility for training and testing of employees who handle hazardous materials. As defined in *Definitions and Aggravations* (49 CFR Part 171.8), this would be a person who is employed by a hazardous materials employer, and who in the course of employment, directly affects hazardous materials transportation safety. Hazardous materials employers must ensure that every employee who handles hazardous materials is trained and tested in accordance with Title 49

CFR Parts 172.700-172.704 prior to performing any function subject to Department of Transportation's hazardous materials regulations. The training may be provided by the employers or other public or private sources and must include the following:

- **General Awareness Familiarization Training**

  Training designed to provide familiarity with the requirements of the hazardous materials regulations in Title 49 CFR, and to enable the employee to recognize and identify hazardous materials consistent with the hazard communication standards of the hazardous materials regulations in Title 49 CFR.

- **Function-Specific Training**

  Training concerning the requirements in Title 49 CFR as they apply to the employee's specific job function.

- **Safety Training**

  Training concerning emergency response, employee protection measures against work-place hazards, and methods and procedures for avoiding accidents.Training conducted by employers must comply with hazard communication programs required by the Occupational Safety and Health Administration of the Department of Labor or the Environmental Protection Agency (EPA). This training may be used to satisfy the training requirements of the preceding paragraph to avoid unnecessary duplication of training, to the extent that such training addresses the requirements.

The training for hazardous materials employees employed on or before July 2, 1993, shall be completed by October 1, 1993. Training for hazardous materials employees employed after July 2, 1993, or who change hazardous materials job functions, shall be completed within 90 days after employment or job change. The required training shall be received by the employee every 2 years.

Records of current training for the preceding 2 years must be created and maintained by the employer for as long as the employee is employed, and for 90 days after that. The records must include the following information:

- Employee's name
- Most recent training completion dates
- Description, copy, or location of the training materials
- Name and address of the person providing the training, and
- Certification that the hazardous material employee has been trained and tested.

B.1.6 Inspection and Enforcement System

State, tribal, and local law enforcement personnel may conduct vehicle inspections in terminals and along road sides, and are responsible for enforcement of all applicable state and local laws and regulations. For all radioactive material shipments, the Nevada Department of Human Resources, Health Division, is notified of the shipment prior to its entering Nevada. State officials make all other notifications within Nevada. In accordance with U.S. Nuclear Regulatory Commission directives, the general public is not specifically informed of a given shipment.

B.1.6.1 NTS Procedures. The DOE is committed to ensuring that waste accepted for disposal at the NTS is properly characterized, certified, packaged, and transported according to all safety, environmental, and transportation requirements. Transportation on the NTS is accomplished in accordance with the *Hazardous Material Onsite Transportation Safety Manual, Nevada Test Site* (DOE, 1994). The DOE/NV requirements are revised as necessary to reflect any changes in regulatory requirements. Waste that does not meet these requirements is not accepted for disposal on the NTS. In order to help in implementing the Radioactive Waste Acceptance Program, NTS personnel provide assistance through education and site visits for waste generators.

At the NTS, DOE/NV accepts and disposes of low-level waste. The waste is from approved DOE and DoD facilities across the United States. Approval to ship waste to the NTS is granted only after the waste generator certifies that all waste meets the DOE/NV's strict acceptance criteria. Personnel with expertise in waste management, quality assurance, and applicable state and federal regulations assure compliance with the program's inspection criteria. The requirements, terms, and conditions for accepting waste for disposal are briefly described in the following section.

All waste streams are characterized according to strict waste acceptance criteria prior to their being approved for shipment to the NTS or other DOE sites. A computerized database for DOE waste was established in 1987. This database includes information regarding the generator, number of shipments, weight, volume, radionuclides, and their concentrations. At the disposal site, the location of each waste package in the disposal facility is mapped according to a grid system.

DOE Order 5820.2A requires the disposal facility to develop and implement waste acceptance criteria. The NTS specific program for waste acceptance, at its radioactive waste disposal facilities, is accomplished by the rigorous approval process detailed in the *Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements* (NV-325, Revision 1) (DOE, 1992). The NV-325 details the acceptance criteria that on- and off-site generators must meet to dispose or store radioactive waste at the NTS. The NV-325 requirements specify criteria for acceptable waste content and form, characterization, packaging, labeling, certification, and transport. All waste must meet these strict criteria to ensure that all safety, health, environmental, and transportation requirements are met.

In order to evaluate the acceptability of the site's overall waste certification program and each individual waste stream, the DOE/NV conducts comprehensive reviews of programmatic and waste-related documentation and performs a thorough facility audit. Each site sending waste to the NTS will continue to be reevaluated on a regularly scheduled basis. Although NV-325 provides waste acceptance criteria for four radioactive waste types, the NTS has only received low-level waste from off-site generators since May, 1990. Criteria for the three waste types not currently being received at the NTS will remain in NV-325. This establishes a documented acceptance program for such waste types if and/or when the NTS is capable of receiving these waste types.

The most accurate waste volume projections available are based on 3-year forecasts that are provided to the NTS by the waste generators. Generators are required to submit 3-year forecasts every 6 months. Information from the 3-year forecasts is broken down by fiscal year quarters (fiscal years run from October 1 through September 30), and is provided to the Nevada Division of Environmental Protection on a quarterly basis.

Typically, the 3-year forecasts include both approved generators and those generators who are not approved, but are actively in the NV-325 approval process cycle. Generators who are not approved and not actively involved in the approval process sometimes submit 3-year forecasts but it is not a requirement.

There are strict requirements for waste acceptance at the NTS. The acceptance process begins with an application. Each site designated by the DOE Headquarters to ship low-level waste to the NTS must submit an application to the DOE/NV. Applications are reviewed to ensure that the waste and the generator's waste management program are fully described. Applications for low-level waste must also state that the waste does not contain any nonradioactive hazardous materials as defined by the Resource Conservation and Recovery Act. These requirements include the identification, transportation, treatment, storage, and disposal of waste.

Once the application review is completed and accepted, personnel from the DOE/NV travel to the waste generator's facility to inspect all stages of waste production. This review is necessary to ensure that the information in the generator's application is complete and accurate; methods of waste generation, characterization, handling, and shipping are evaluated and certified.

After the inspection is complete, an audit report is issued. If problems are identified, the generator must complete corrective actions, and DOE personnel must return to the site to verify that the problems have been corrected. When all requirements are met, the manager of the DOE/NV permits the generator to send waste to the NTS for disposal. Sites that are approved to dispose of low-level waste are inspected periodically to assure that all waste acceptance criteria continue to be met.

Each generator shipping waste to the NTS must designate a waste certification official who is independent from budget concerns to schedule waste handing and shipping. The waste certification official is a key person responsible for certifying that the waste shipped to the NTS meets DOE/NV requirements. In addition, the generator must have an independent quality assurance organization that reviews all phases of the waste management program, including inspections and waste certification.

To determine the ability of the generator to meet waste acceptance criteria, generator quality assurance personnel inspect the following key points, at a minimum, during the independent examination:

- Empty shipping containers are inspected to assure that they are free from dents, rust, corrosion, or other conditions that could compromise strength and integrity.
- Waste is certified as meeting DOE/NV requirements. For example, low-level waste cannot contain nonradioactive hazardous waste, free liquids, gas containers under pressure, disease-causing or infectious agents, corrosive material, or explosives. If necessary, the waste must be stabilized so it does not give off harmful vapors, gases, or liquids. The generator must demonstrate that its personnel are qualified to properly document and certify that these conditions are met.
- Waste packaging must meet strength, size, and weight requirements. This is necessary to ensure that the integrity of all packages is maintained after they are stacked in landfills at the NTS waste management site. In addition, marking and labeling each waste package must meet Department of Transportation, federal, and environmental safety requirements.

Radioactive cargo is the most closely inspected of all hazardous material shipments, and must be accompanied by shipping papers. These papers contain accurate, detailed information on the materials being transported, and they reference the appropriate emergency response procedures to follow, should the need arise. In addition, these documents include certification that the materials are properly described, classified, packaged, marked, labeled, and are in proper condition according to Department of Transportation regulations. Drivers must keep shipping papers in the vehicle and make them available at all times for inspection by responsible officials.

B.1.7 Monitoring and Tracking System

The waste disposal sites are presently open Monday through Thursday (during daylight hours only). Waste shipments are scheduled so that they arrive in time to be off-loaded during business hours. In the event that a nonclassified shipment arrives and cannot be off-loaded during business hours, the driver reports to the Mercury guard gate to check in. The driver is directed to a secure staging area where the trailer may be detached from the tractor. The trailer remains at the staging area until normal business hours when it is reattached to the tractor and sent through the normal receiving process. There are established procedures regulating radioactive waste entering the NTS waste disposal areas (Areas 3 and 5) (NV-

325). The procedures for receiving hazardous materials (including radioactive materials) for other programs and activities on the site follow the basic steps described in the following paragraphs:

A more detailed description of the NTS transportation requirements is available in DOE/NV Hazardous Material On-Site Transportation Manual, Nevada Test Site, the DOE-356, Rev. 3, October 1994.

The load-bearing truck checks in at the receiving office for the NTS at Mercury, Nevada, to present the shipping orders and manifest to the security officer. The trucks are monitored to make sure external radiation levels are below established limits before they are permitted on the NTS. Each truck trailer is also inspected to ensure the security seal is intact. The attending officer reviews the shipping papers and contacts the disposal area to verify the truck's entry and load. Upon showing proper identification to the NTS security officer, the driver is given a badge with a dosimeter (a device for measuring doses of radiation), which must be worn while at the NTS. Information about the truck's forthcoming entrance, its contents, and its destination is entered into the on-site tracking system for hazardous materials.

The truck is then permitted to enter through the Mercury gate and proceed to the disposal site. At the waste site office, the shipping papers are again reviewed and verified. The shipment is monitored again for external radiation levels, and the security seal is rechecked. The truck then enters a gate to the disposal area, and the trailer is carefully opened (the seal removed) and monitored for radioactive contamination. Each package is inspected as it is unloaded to make sure that it is undamaged and properly labeled. The packages are customarily unloaded into the disposal pit by forklift or crane. Later, the entire container is placed in a specific location within the disposal pit for permanent disposal and covering. When these materials are taken to specific locations on the NTS, the on-site tracking system is again used to show the route taken by vehicles carrying the hazardous materials within the NTS. Finally, the empty trailer is monitored for radioactive contamination before it is released from the waste management site. The truck is again inspected for radioactive contamination within the Mercury camp area and before exiting the Mercury gate. The driver returns to the receiving office to check out and return the badge and dosimeter. The truck's departure is noted on the tracking system.

In Nevada, a monitoring/tracking system based at the NTS is used. This tracking system, called the NTS Traffic System, is a database. Waste generator sites provide information on the shipment location, volume, and time that the shipment would be expected at the NTS. The routing from the generator sites is known by the agencies using the database. The information can be revised if the driver is delayed, for example, due to mechanical failure. County and local governments may request access to this tracking system.

B.2 Transportation of Defense Materials

The DOE maintains and operates the Transportation Safeguards System. This system is comprised of a fleet of specialized equipment used to transport, in a safe and secure manner, Category II or higher nuclear material between DoD and DOE production sites, laboratories, and test sites. The materials transported support DOE and DoD activities for production, testing, surveillance, limited-life component replacements, and dismantlement and disposal of nuclear weapons. Materials are transported throughout the United States either by air or over-the-road operations. For the purpose of this study, only over-the road operations are germane.

The DOE, Albuquerque Operations Office, Transportation Safeguards Division is responsible for the operation and maintenance of the Transportation Safeguards System. In terms of over-the-road operations, the specialized equipment includes a fleet of highly modified highway tractors, safe-secure trailers, and support escort vehicles. Since the DOE exclusively operates and maintains the Transportation Safeguards System, it is responsible for evaluating and approving these transportation operations throughout the continental United States.

The safe-secure trailer is a modified, standard closed van. The dry-freight-type semi-trailer includes necessary cargo tie-down equipment and temperature monitoring, fire alarm, and access denial systems. It is essentially a mobile vault that is highly resistant to unauthorized entry and provides a high degree of cargo protection under accident conditions. The safe-secure trailers are pulled by an armored, penetration-resistant highway tractor. Many special features are also added to these tractors to make them safe for the drivers and passengers, *Highway Transportation Technical analysis Report* (Crowder et al, 1993). The safe-secure trailers are accompanied by armed couriers in escort vehicles equipped with communications and electronics systems, radiological monitoring equipment, and other equipment to enhance safety and security.

The DOE operates the Transportation Safeguards System under full compliance with DOT requirements, except for regulations that would tend to conflict with security imperatives, the DOE complies with, and often exceeds, the requirements of the DOT regulations during over-the-road operations, even though the DOE is exempted from compliance with *U.S. Government Material* (49 CFR Part 173.7[b]).

Since its establishment in 1975, the Transportation Safeguards Division has accumulated more than 120 million km (75 million mi) of over-the-road experience in transporting DOE Defense Program-owned cargo without any accidents that resulted in a release of radioactive material.

B.3 References

REGULATION, ORDER, LAW

49 CFR 171-397 — U.S. Department of Transportation, "Transportation," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, 1994.

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Crowder et al., 1993 — Crowder, G.W., B.D. Boughten, J.K. Deuel, and L.J. Branstetter, *Highway Transportation Technical Analysis Report (CHITTAR)*, Draft SAND93-2501, Secret National Security Information, Sandia National Laboratories, Albuquerque, NM, 1993.

DOE, 1992 — U.S. Department of Energy (DOE), Nevada Operations Office, *Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements*, NV-325, Rev. 1, Las Vegas, NV, 1992.

DOE/NV, 1994 — DOE, *Hazardous Material Onsite Transportation Safety Manual, Nevada Test Site*, DOE/NV 356, Rev. 3, 1994.

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Attachment C to Appendix I

PUBLIC PARTICIPATION IN THE TRANSPORTATION STUDY

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Attachment C. Public Participation in the Transportation Study

C.1 Summary of Public Involvement

The Transportation Study is one of the technical reports being prepared in support of the Nevada Test Site (NTS) Environmental Impact Statement (EIS). It identifies and addresses the potential environmental impacts related to the transportation of hazardous materials to and from the NTS under the alternatives being considered in the NTS EIS. The following discussion generally describes the public participation in the Transportation Study.

Following the formal NTS EIS scoping period, a general transportation meeting was held in Las Vegas on November 15, 1994. Those in attendance included representatives of surrounding counties and cities near the NTS. Presentations by the U.S. Department of Energy, Nevada Operations Office (DOE/NV) representatives included a description of existing transportation conditions, DOE procedures, emergency response capabilities, and the proposed draft outline of the Transportation Study. Comments, issues, and questions regarding transportation were raised by those in attendance (Section C.2). In addition, one-on-one meetings between the DOE/NV transportation group and county and city officials were requested. These one-on-one meetings, which were held at each requested location (e.g., cities of North Las Vegas and Henderson), were conducted to offer an opportunity for governmental and American Indian representatives to voice their concerns. Additionally, the DOE/NV transportation group was able to present and respond to requests for additional information on a timely basis. Two committees, the Protocol Working Group and Risk Assessment Working Group, were also established during the one-on-one meetings.

The Protocol and Risk Assessment Working Groups were formed to provide forums for communication on specific transportation concerns. The Protocol Working Group was established to discuss the protocol for handling routing decisions that may have the potential to affect local communities. The Risk Assessment Working Group was established to provide local data and ad hoc studies to help ensure that the most current information available is used in the Transportation Study.

A second meeting with representatives of various surrounding counties, cities, and other interested organizations was held on April 20, 1995. During this meeting, preliminary results were issued through the Draft Preliminary Transportation Study. Information on concerns and issues raised during the first meeting, during the one-on-ones, through the mail, and by telephone calls was provided at this meeting. In addition, comments on the preliminary results of the transportation impacts were discussed.

The meetings of the Protocol and Risk Assessment Working Groups will continue on an as-needed basis. One-on-one meetings with the representatives from American Indian tribes and organizations will continue. A list of the scoping meetings, as of the fall of 1995 is shown in Table C-1.

C.2 General Responses to the April 20, 1995, Transportation Meeting Comments

These responses were prepared following the April 20, 1995, transportation meeting and sent to everyone on the "Big Group" mailing list. Subsequent to this mailing, additional discussions were held internally that altered the response to comment number 2. A short discussion follows the original response that provides DOE/NV's most current thinking.

General Response

The comments provided during the transportation closed session meeting on April 20, 1995, are valued for several reasons. The public comments demonstrate sincere interest in the study, provide indicate recognition that the DOE is taking the public's concerns seriously.

Table C-1. EIS Meetings as of October 13, 1995 (Page 1 of 2)

Location	Date
Scoping Meetings	
State of Nevada	August 20, 1994
Fallon, Nevada	September 7, 1994
Carson City, Nevada	September 8, 1994
St. George, Utah	September 13, 1994
Tonopah, Nevada	September 15, 1995
Las Vegas (Cashman Field), Nevada	September 20, 1994
Pahrump, Nevada	September 21, 1994
Caliente, Nevada	September 22, 1994
Henderson, Nevada	October 4, 1994
State of Nevada Clearinghouse (Carson City), Nevada	August 30, 1994
EM Community Advisory Board, Nevada	October 5, 1994
Affected Units of Governments (White Pine County, state, tribal, local governments)	October 21, 1994
South-Central Nevada Federal Complex Advisory Board	October 28, 1994
Transportation Study Meetings	
Local/County Governments (Las Vegas, Nevada)	August 22,1994
Local/County Governments (Harry Reid Center, Las Vegas, Nevada)	November 15, 1994
Local/County Governments (Harry Reid Center, Las Vegas, Nevada)	April 20, 1995
Transportation Study One-on-One Meetings	
Clark County, Las Vegas, Nevada	December 6, 1994
City of Henderson, Nevada	December 7, 1994
City of Las Vegas, Nevada	December 12, 1994
City of North Las Vegas, Nevada	December 13, 1994
Boulder City, Nevada	January 5, 1995
Lincoln County, Nevada	January 18, 1995
Nye County, Nevada	January 16, 1995
Goldfield, Nevada	March 13, 1995
Laughlin, Nevada	March 14, 1995

Table C-1. EIS Meetings as of October 13, 1995 (Page 2 of 2)

American Indian	March 22, 1995
Ely, Nevada	February 10, 1995
EM Community Advisory Board	March 1, 1995
Implementation Plan Meetings	
EM Community Advisory Board	February 1, 1995
Las Vegas, Nevada	February 7, 1995
Reno, Nevada	February 9, 1995
Las Vegas, Nevada	March 7, 1995
Reno, Nevada	March 9, 1995
Other Meetings	
Air & Waste Management	December 14, 1994
State, Tribal, Local Government Coordinating in Tonopah	February 14, 1995
Southern Nevada Federal Facilities Community Advisory Board	February 28, 1995
American Indian Consultation	March 17-19, 1995
State Clearinghouse Meeting - Carson City, Nevada	April 19, 1995
Paiute Tribe of Southern Utah	September 9, 1995
Moapa Band of Paiutes	September 14, 1995
Las Vegas Paiute Tribe, Nevada	September 19, 1995

Before providing item-by-item responses to comments, we note that the comments were provided in response to ongoing dialogue, as well as in the April 10, 1995, Preliminary Draft Transportation Study. This draft was not complete, it was a work-in-progress document.

Item by Item Response to Comments

1. No analysis of data, generators, commodities, and radiation waste type.

Response: The analysis was not included in the April 10, 1995, Preliminary Draft Transportation Study because the model had not yet been run. This information will be included in the next draft.

2. Not integrated yet with Yucca Mountain.

Response: Although the DOE has stated that only the Yucca Mountain site characterization activities will be included in the NTS EIS, the DOE/NV staff is currently working with their Yucca Mountain counterparts to determine an approach to effect integration of transportation issues. This will be possible because Yucca Mountain is beginning preparation of their own EIS. The planned EIS for a potential repository at Yucca Mountain will evaluate the environmental impacts of construction, operation, and closure of a repository at Yucca Mountain. The Yucca Mountain EIS will consider the cumulative impact of transporting nuclear waste with the radioactive materials/waste shipments expected by the NTS.

Following the preparation of this response, a meeting was held with representatives of Yucca Mountain Site Characterization Projects Office and a decision was made not to commit Yucca Mountain to consider cumulative impacts associated with NTS waste shipments. The DOE will consider cumulative impacts; however, Yucca Mountain may not be the organization that does this work.

3. Heavy haul route refers to Craig Road and the "Spaghetti Bowl," contrary to previous agreements.

Response: As agreed in a meeting with North Las Vegas officials in July 1994, the DOE/NV is committed to not using Craig Road for shipments of low-level waste. We are currently telling the carriers they are not to use the Craig Road route. To the best of our knowledge, no agreement has been reached regarding the "Spaghetti Bowl"; however, we are committed to exploring all options for avoiding this interchange.

As responsible decision makers, we want to make sure we have the data required to support our decisions. Therefore, both Craig Road and the "Spaghetti Bowl" will be included in the study. Inclusion of a route in the study does not imply that route will be used.

4. Inadequate risk assessment factors.

Response: Risk assessment factors were not identified in the Preliminary Draft Transportation Study, but will be part of the final document. In addition, a risk working group has been formed to address this issue in detail.

5. Page 1.3 (Preliminary Draft Transportation Study): Today's meeting is already written.

Response: A place was set aside in the study for "today's meeting." Since the meeting was set, we felt it appropriate to include an up-to-date summary of public involvement activities. The outcome of the April 20, 1995, meeting was not included, only its date and purpose.

6. Mistake on 1.2.2 (Preliminary Transportation Study): Conflict with National Environmental Policy Act *Code of Federal Regulations*, Cost/Benefit Analysis 40 CFR 1502.23.

Response: It is our understanding that this comment refers to the fact that the National Environmental Policy Act 40 CFR 1502.23 states that alternatives cannot be eliminated based solely on cost. We recognize this constraint and are now including a description of both the northern and southern rail routes for comparison to highway routes. Please see Item 19 for further discussion of how rail routes will be addressed in the completed Transportation Study.

7. Sources of information are weak, inaccurate, and untimely.

Response: We are making every effort to ensure accurate and timely information is used in the study. One step toward this is our request to local, state, and tribal governments to provide their most current demographic and traffic data for incorporating into the risk models. We will be working with the Risk Assessment Working Group to obtain the most current official data.

8. Unfair in training, rural versus urban.

Response: First responder training is available to all jurisdictions within the state of Nevada, and has been given in several Nevada counties.

First-On-Scene Training has been made available by the DOE to fire, law enforcement, and emergency medical responders throughout Nevada since 1983 (at no cost other than travel to the presentation site). Because of the nature of this training, the basic courses have been presented at specialized training facilities at the NTS. Refresher training sessions have been presented for many people at locations in both southern (Las Vegas and Henderson) and northern (Reno-Sparks and Elko) Nevada. The Emergency Medical Personnel Radiological Seminar will be presented this August in both Tonopah and Ely. Understanding that the volunteer nature of the rural response force may make it difficult for them to attend, the DOE will work with them to schedule training.

9. Future and current choke points are ignored "Spaghetti Bowl".

Response: Analysis of choke points, such as Hoover Dam and the "Spaghetti Bowl," will be provided in the final study. This issue will also be addressed by the Transportation Protocol Working Group. In addition, the "Spaghetti Bowl" is scheduled for reconstruction over the next few years to alleviate congestion problems.

10. Guiding assumptions for risk analyses were not presented.

Response: The assumptions had not yet been incorporated into the study. They will be provided in the next version of the Transportation Study. These will also be discussed by the Risk Assessment Working Group. In addition, the technical appendices addressing the risk analyses will be available to interested parties in early June, prior to release of the next version of the study.

11. Rail spur implications for waste volume are not addressed.

Response: Over the next several weeks, the DOE/NV must decide on what assumptions to make regarding the volume of low-level radioactive waste to be transported to the NTS. Once these assumptions are made, the DOE/NV can complete its evaluations and draft report.

The scope of the rail evaluations includes a cost and risk comparison of moving the same volume of materials by both truck and rail. The potential competitive advantages to the NTS of having rail access, to support the development of new missions, could lead to the movement of additional materials not considered in this evaluation. For the development of major new facilities, a separate impact assessment could be required.

12. No impact analysis.

Response: The April 10, 1995, version of the Preliminary Draft Transportation Study does not include impact analyses, because the model for the risk assessment had not yet been completed.

13. Section 2.5.1 (Preliminary Draft Transportation Study): has no provision for funding personnel training in rural counties.

Response: First responder training is free to the counties. As stated in Item 8, the DOE will work with the counties and the Transportation Protocol Working Group to identify needs and develop a strategy to meet those needs.

14. What about compensation for rural (county training) volunteers, i.e., lost wages, vacation (time), and equipment?

Response: Please see Items 8 and 13.

15. Section 1.4 (Preliminary Draft Transportation Study): Please include your definition of high-activity low-level waste.

Response: The next version of the Transportation Study will include a definition of high-activity low-level waste, as well as other waste types. It is important to remember that the definitions of high-level and low-level waste are rooted in the way the waste was generated, rather than the level of radioactivity in the waste. Keeping that in mind, the following definitions are presented:

High-level waste: Radioactive material which results from chemical reprocessing of spent fuel, contains fission products, traces of uranium and plutonium, and other transuranic elements.

Low-level waste: Radioactive waste not classified as high-level waste, transuranic waste, spent fuel, or by-product material. In genera,l most low-level waste has low specific activity. However, low-level waste can have high specific activity and still be considered low-level waste because it is not high-level waste, transuranic waste, or spent nuclear fuel.

Transuranic waste: Waste material contaminated with U-233 (and its daughter products), certain isotopes of plutonium, and nuclides with atomic numbers greater than 92 (uranium). It is produced primarily from reprocessing spent fuel and from the use of plutonium in the fabrication of nuclear weapons.

16. Tribes should not have to go to the DOE; DOE should go to the tribes.

Response: For many years, the DOE has transported radioactive and non-radioactive materials and waste on state and federal highways across American Indian lands. Although the DOE has complied with all national and state transportation laws and regulations, we have not made a concentrated effort, to date, to coordinate our transportation needs with the various tribal governments. Now, recognizing and understanding our responsibility, we are working to establish relationships and coordinating our transportation needs with tribal governments prior to shipping materials and waste. A letter was sent to each Tribal Council Chair inviting him or her to meet with the DOE on a government-to-government basis to discuss the topic of transportation.

In addition, the DOE has had several meetings with American Indian representatives specifically to discuss the NTS EIS. To fully incorporate the comments from the American Indian tribes, the DOE has provided funding for a Resource Document to be prepared by a team of American Indian writers representing various local tribes. This Resource Document is expected to reflect a unified position and/or comments on the NTS EIS. This is an innovative outreach approach that is consistent with the DOE's resolve to incorporate and encourage the full participation of the American Indian People.

17. The document does not consider reality of local conditions, policy, or sentiment.

Response: The DOE has met one-on-one, and in larger groups, to gain a better understanding of local concerns. The study was modified to address and clarify questions raised about the regulatory arena the DOE operates in with regards to transportation, carrier selection, oversight of carriers, and emergency management and training. As the study is finalized, our goal is to reflect local conditions, policy, and sentiment in the draft study report as long as they do not conflict with U.S. Department of Transportation laws and regulations.

18. There is no discussion of liability (insurance).

Response: The information on liability had not been fully compiled; therefore, was not included in the April 10, 1995, version of the preliminary draft study. It will be provided in the completed draft version of the Transportation Study.

Liability is the responsibility of the commercial carrier. Most commercial carriers are insured by private insurance companies. Carriers are aware of liability and insurance requirements. The DOE traffic managers inform their traffic officer that copies of carrier insurance coverage must be available prior to using a carrier.

19. Figure 1.1 (Preliminary Draft Transportation Rail Study) needed work, particularly to clarify "main" versus "alternate."

Response: The April 10, 1995, preliminary study identified two rail routes; the Modified Valley route, and the Stateline route as feasible alternatives for rail access to the NTS. Since that time, in response to comments received, we have decided that the final study will include descriptions of the four routes as identified and recommended for detailed evaluation in the Yucca Mountain document, "Nevada Potential Repository Preliminary Transportation Strategy Study 1." These routes will be discussed for comparison purposes only (with highway routing). No rail decision will be made as a result of this study or the NTS EIS.

The only scenario where rail access to the NTS might be required, because of the large volumes of projected low-level waste, is where the NTS would be the sole low-level waste disposal site for the

DOE complex. This is one of the alternatives included in the Draft Waste Management Programmatic EIS and is included in Alternative 3 of the NTS EIS. Although the NTS EIS and this transportation study are addressing this option, the final decision will be made in association with the Draft Waste Management Programmatic EIS and its transportation study. Therefore, detailed risk analysis, as would be performed for decisional purposes, will not be done for the NTS EIS.

20. Page 1.2.1 (Preliminary Draft Transportation Rail Study): regarding the No-Build Alternative: trucks go through Las Vegas, contrary to promises made at one-on-one county meetings.

Response: Please see Item 3.

21. Clarify issues about responsibility, accountability, liability.

Response: The April 10, 1995, draft report did not offer a clear discussion of responsibilities, accountability, and liability. Our goal is to provide this discussion as it pertains to the DOE, carriers, and local jurisdictions in the completed draft study report.

22. Other routes are omitted, e.g., Tonopah Test Range, Tonopah Test Site, Nellis Air Force Base.

Response: The Transportation Study focuses on activities at the NTS and Tonopah Test Range, as well as off-site locations within Nevada. While there are no waste disposal areas within the other DOE Nevada-operated sites, Environmental Restoration Program Projects are expected at these sites under Alternatives 1, 3, and 4 of the NTS EIS. Transportation of materials associated with these activities will be along the same Nevada public highways as identified in the existing and or potential highway routes. This point will be clarified in the Transportation Study.

23. Previous statements and agreements are missing, time and time again.

Response: The final Transportation Study will summarize comments and concerns raised by the local jurisdictions. However, although all input will be considered, it is possible that not all will be adapted or used. In addition, many of the suggestions received during the one-on-one meetings have been formulated into issues that will be further addressed by the Transportation Protocol Working Group. (Also, see response to Item 17).

24. Environmental risk is not considered under scenarios.

Response: The Transportation Study will include possible human impacts associated with various scenarios corresponding to the four alternatives identified in the NTS EIS. As stated, the Preliminary Draft Transportation Study was not completed and subsequently, the risk information was not included in the April 10, 1995, version.

25. No new alignment for heavy haul.

Response: Please see Item 3.

26. Heavy haul analysis and discussion is not realistic.

Response: Please see Item 3.

27. Legislation is in process to create a rail spur - fait accompli - not a recommendation.

Response: Our goal is to include a short summary of the events associated with the legislation in the completed draft study report. However, this legislation affects Yucca Mountain, and not the NTS EIS. Proposed language, as introduced, would require a separate National Environmental Policy Act process to evaluate the impacts of using this route for the movement of spent nuclear fuel and high-level waste. The Modified Valley Route, as well as other potential rail corridors, will be evaluated in the planned EIS for a Potential Repository at Yucca Mountain. Movement of these materials is not part of the scope of the transportation study, or a mission under consideration in the four EIS alternatives.

28. Page 1.2.2 (Preliminary Draft Transportation Study): No presentation of northern routes and no reason.

Response: Please see Item 19.

29. Page 2.1.1 (Preliminary Transportation Rail Study): The authority to designate routes, truck (economy) company, DOE, Nevada Department of Transportation.

Response: Low-level and mixed waste are not considered highway route controlled quantities; however, the following discussion is provided should there by some materials of this nature sent to the NTS.

Movement of highway route controlled quantities takes place on preferred highway routes identified by individual states with the intent to minimize time in transit. Interstate highway routes and alternatives designated by a state routing agency are preferred routes. Because Nevada has no designated routes, the preferred routes to the NTS presently include Interstate 15 and U.S. Highway 95. Nevada is considering the designation of alternative preferred routes. The DOE would be obliged to use these routes for highway route controlled quantities shipments. However, few projected shipments in this study would contain highway route controlled quantities of radioactive material. The Transportation Study, when completed, will provide the Nevada Department of Transportation information relating to all possible state-designated shipping routes.

Subsection 2.2.3 presently provides information on state routing agencies having the authority to designate routes for highway route controlled quantities shipments. Carriers planning highway route controlled quantity shipments are responsible for obtaining information about existing state-designated routes. States report these routes to the DOE, as required. The Department of Transportation maintains this information in a database for carriers to access and use.

30. Trucks' minimum requirements not stated.

Response: Please see Item 3.

31. No relationship between this study and the other 26 DOE EISs, especially the study of transportation issues.

Response: Consistent with Alternative 3 of the NTS EIS, the Transportation Study will address all materials that are identified in the other DOE EISs for possible shipment to the NTS. However, our study is focused primarily on intra-Nevada issues, and therefore, is relying on the EISs to provide the National Environmental Policy Act coverage for the activities they address.

In addition, while the Preliminary Transportation Study does not address this issue explicitly, the NTS EIS will contain a section entitled "Cumulative Effects." The Council on Environmental Quality (CEQ) defines *Protection of Environment: Cumulative Impact* 40 CFR Part 1508.7 cumulative impact as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." Subsequently, the NTS EIS is the appropriate report to identify and analyze impacts of other EISs regarding cumulative impacts.

32. It is not apparent that a review has been made of comprehensive laws and regulations (local, state, tribal, special districts, etc.).

Response: It is our goal to provide available information on various laws and regulations in the completed draft Transportation Study.

33. Rail options don't consider inter-modal transfer.

Response: Please see Item 3. Intermodal transfers will be included in the completed draft Transportation Study.

34. The DOE is abdicating routing authority to carriers.

Response: The DOE does not have routing authority for any shipments. It strictly adheres to Department of Transportation regulations for all hazardous materials (both radioactive and non-radioactive) shipments. However, the DOE will explore all avenues to ensure selected carriers of hazardous materials adhere to all transportation direction. These avenues include alternate contracting mechanisms, which would provide the DOE with some control over route selection.

35. Take each issue presented here and give written comment and response to concerns and rationale.

Response: The DOE/NV will adopt this practice for the remainder of the Transportation Study.

36. Be more clear of ongoing process and how we will be meaningfully involved in it.

Response: Since the summer of 1994, the DOE/NV has been involved in an ongoing dialogue with state, tribal, and local governments in an effort to understand our stakeholders concerns and response to these concerns. We are using a multi-tiered approach that offers several methods for participation in the Transportation Study:

(a) Traditional public participation associated with development and finalization of an EIS

(b) Periodic "Big Group" meetings with state, county, city, and tribal leaders, as well as interested members of the public

(c) One-on-one meetings with interested communities

(d) Transportation Protocol Working Group

(e) Transportation Risk Assessment Working Group.

Comments and suggestions received during any of these activities will be considered and incorporated into the Transportation Study, as appropriate. In all cases, the DOE/NV will respond to the comments explaining how they were incorporated, or why they were not incorporated.

The Transportation Protocol Working Group, composed of representatives from city, county, tribal, state and federal governments, as well as from the NTS Community Advisory Board, will develop recommendations on transportation issues, which it will present to the "Big Group." The goal is for participants in the "Big Group" to take these recommendations back to their respective organizations for review, and provide individual official comments and recommendations to the DOE/NV.

To maintain the dialogue established through these various venues, the Transportation Protocol Working Group will continue to meet after completion of the Transportation Study. It is anticipated that the Transportation Risk Assessment Working Group will disband upon completion of the Transportation Study, since their work will be completed.

In addition, the DOE/NV is committed to establishing a working relationship with American Indian councils to identify if and how the American Indians want to participate in this process.

Furthermore, in those areas directly related to local concerns, we invite state, local, and tribal governments, to provide explicit wording for sections they are concerned about. This will assist us in reflecting local conditions, policies, and sentiments accurately.

37. Include a list or map that shows all generators.

Response: This information will be provided (as indicated above) in the completed Transportation Study.

38. Give all assumptions and data sources used for risk analysis.

Response: This information will be provided (as indicated above) in the completed Transportation Study.

39. Discuss rail transportation from any direction, not just Las Vegas and areas from the south.

Response: Please see Item 19.

40. Rail routes are not as available to generators as are road routes.

Response: Please see Item 19.

41. It is unclear how to incorporate comments that have been made before - no-show on nontribal participation.

Response: Please see Item 16.

42. Address alternate routes to Hoover Dam.

Response: The completed Transportation Study will include risk analyses for alternate routes to Hoover Dam.

43. Include a broad discussion of the U.S. Air Force Acts and DOE/U.S. Nuclear Regulatory Commission implementation.

Response: At this time, we do not believe that a discussion of U.S. Air Force Acts and DOE/U.S. Nuclear Regulatory Commission is relevant to the Transportation Study.

44. Clarify parameters on route selection.

Response: The principal objective of the Transportation Study is to determine the probable impacts of the NTS EIS proposed alternatives on the existing and potential highway routes, and consider a rail spur alternative as appropriate. The "Big Group" may, on considering the results of the probable impact analysis, decide to make recommendations for the DOE/NV to consider in the routes selected for transporting hazardous materials to the NTS EIS. Also, see Item 34.

C.3 References

REGULATION, ORDER, LAW

40 CFR 1502.23 — Environmental Protection Agency (EPA), *Code of Federal Regulations, Protection of Environment: Cost-Benefit Analysis*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, 1993.

40 CFR 1508.7 — EPA, *Code of Federal Regulations, Protection of Environment: Cumulative Impact*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, 1993.

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Attachment D to Appendix I

EMERGENCY RESPONSE PROCEDURES AND TRAINING

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Attachment D. Emergency Response Procedures and Training

Radioactive materials are among the many kinds of hazardous materials that emergency responders might have to deal with in a transportation accident. The more potentially harmful the levels of radioactive materials, the stricter the packaging, safeguards, and other requirements designed to prevent their release must be. Although rare, accidents involving radioactive materials do happen, and an emergency preparedness system is in place to respond.

Ultimately, state, tribal, and local government officials in the region where an accident occurs have the prime responsibility for initial emergency response to any accident, including those involving radioactive materials. A highway patrol officer, or fireman, is usually the first person on the scene. The first responder will typically relay the information about the accident to a State Command Center that will contact the hazardous materials response team, the carrier, and the U.S. Department of Energy (DOE). These first responders also typically administer first aid, isolate the area, extinguish fires, and identify the hazard by the vehicle placards and shipping papers. They may also contact CHEMTREC, a company that provides help on how to respond to hazardous material emergencies, if hazardous materials or mixed waste are involved. The first responder can refer to the U.S. Department of Energy (DOT) Emergency Response Guidebook to determine immediate steps to be taken. Upon request, state and federal agencies will supply trained personnel to conduct radiological tests at the site to determine whether any radioactive material releases have occurred. Most local and state governments have emergency response plans and training programs in place to prepare first responders for transportation accidents involving radioactive materials. States also conduct radiological response training on behalf of the Federal Emergency Management Agency, which also supplies radiological monitoring instruments to the states. The Federal Emergency Management Agency also provides the Radiological Emergency Response Training for the state, tribal, and non-DOE response team members.

D.1 Federal Response

Federal agencies do not become involved in responding to an emergency unless specifically requested to do so by state, tribal, or local government officials (Figure D-1). However, if a federal agency's support is needed, it is available as described in the Federal Radiological Emergency Response Plan, which outlines each agency's responsibility. The DOE will provide support in accordance with the Atomic Energy Act of 1954 and DOE Order 5530.3, *Radiological Assistance Program.* The DOE is the primary agency for providing radiological monitoring and assessment assistance. The Nuclear Regulatory Commission, The Environmental Protection Agency, the Federal Emergency Management Agency, and other agencies also provide assistance as part of this plan. The DOE's support ranges from giving technical advice over the telephone, to sending highly trained personnel and state-of-the-art equipment to the accident site (on request by authorized state officials) to help identify and minimize any radiological hazards, and perform radiological monitoring.

Any state, tribal, local, or private sector organization needing radiological assistance can call the nearest DOE Regional Coordinating Offices to obtain information, advice, or assistance through the Federal Radiological Monitoring and Assessment Plan (Figure D-2). The DOE maintains Regional Coordinating Offices in eight regions across the country. The Regional Coordinating Offices receive calls for assistance 24-hours a day, and are prepared to send trained personnel and equipment to an accident site. The DOE Regional Coordinator decides what action is needed based on the request. The DOE Regional Coordinating Office also ensures that appropriate state or tribal personnel are contacted in order to ensure appropriate involvement of them and their resources. If necessary, the coordinator sends a

Figure D-1. Typical notifications made following a radiological transportation emergency

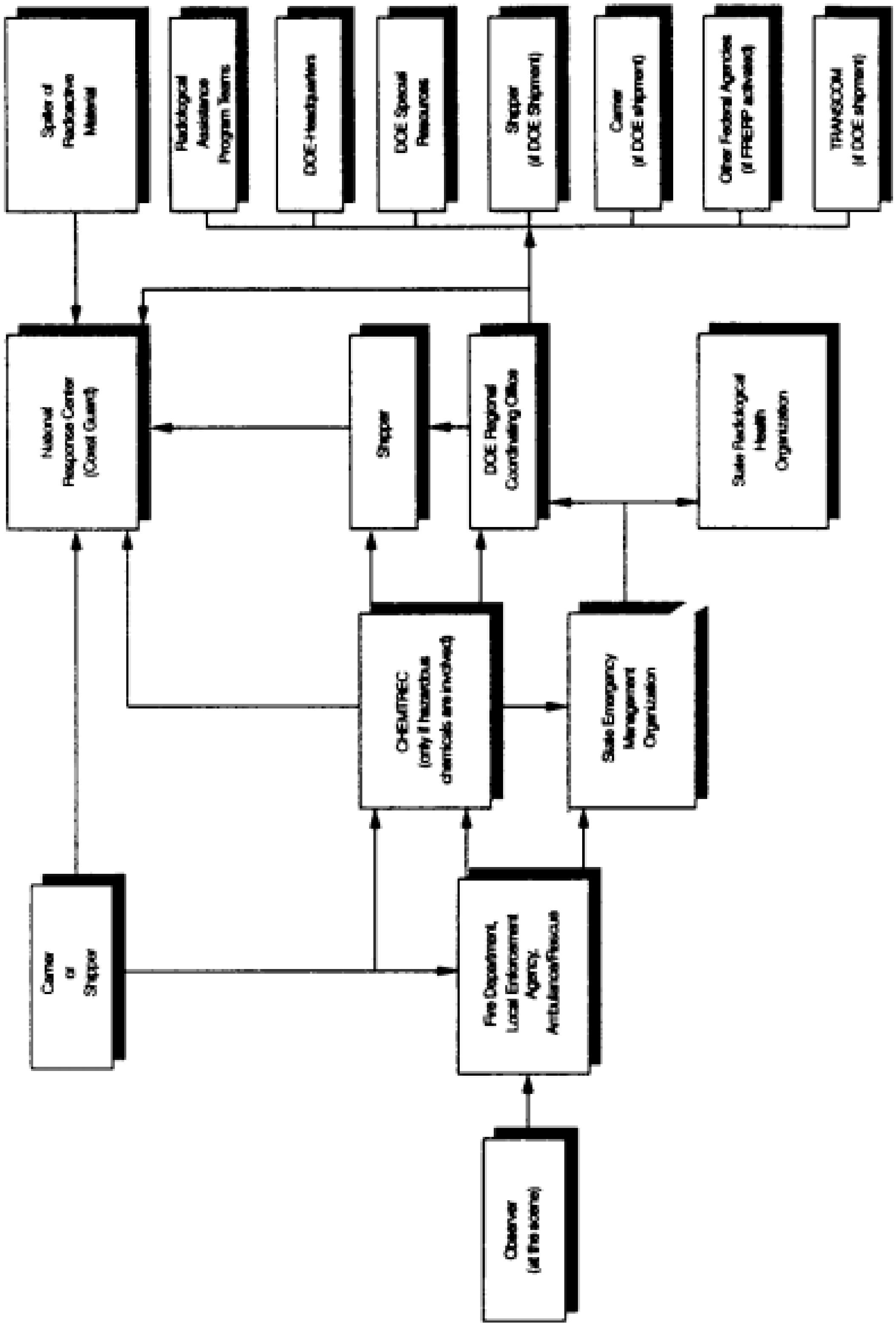
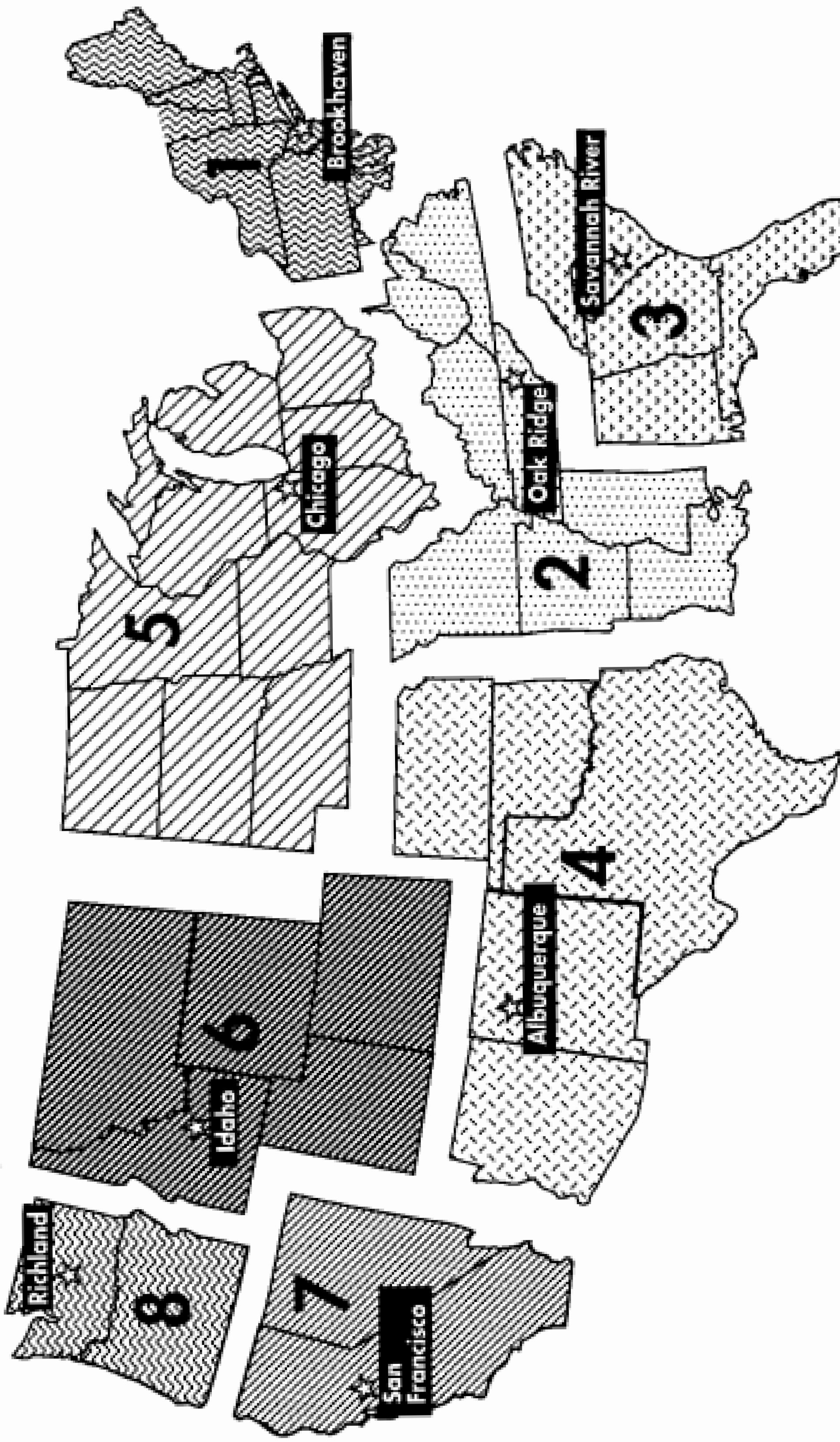


Figure D-2. U.S. Department of Energy regional coordinating offices



federal team to the accident site to assist the authorities in charge. If personnel, equipment, or both are needed at the accident scene, the Regional Coordinating Office coordinates the activation of a DOE Radiological Assistance Program Team. The Radiological Assistance Program team's capabilities include field monitoring, spectrometry, sampling, decontamination, dedicated response vehicles, mobile laboratories, generators, communications equipment, and aerial surveys. Personnel include health physicists, industrial hygienists, and public information staff. Should the emergency require monitoring and assessment resources exceeding those of the Radiological Assistance Program team, a federal monitoring and assessment center will be established, where all federal agencies provide support.

After the immediate threat from the accident has passed, the lead federal radiological monitoring and assessment role is transferred from the DOE to the Environmental Protection Agency. It is the responsibility of the carrier to repackage and dispose of any primary radioactive material spilled, plus any contaminated material.

Although the DOE only ships about 11,000 radioactive material shipments per year (compared to a national total of 2 million such shipments), the DOE actively ensures the safety of its shipments, including assisting state and local emergency responders, as requested, should an accident occur.

The DOE follows all DOT (49 CFR 170-178, 383, 387, and 390 through 399), Nuclear Regulatory Commission; *Energy: Packaging and Transportation of Radioactive Material* (10 CFR 71), and other regulations and operating procedures to help ensure safe transport, and to assist emergency response personnel. This compliance includes proper packaging, marking and labeling the packages, providing the correct emergency response information on shipping papers, placarding the vehicle, stowing and securing the packages, complying with driver training and routing requirements, and following vehicle safety requirements. Local, state, tribal, and federal emergency response systems are in place to respond in the event of a transportation accident. This response network, along with other preventive safety measures, such as package design and testing, and adherence to stringent regulations, support the continued safe shipping of DOE-owned radioactive materials.

D.2 Training Programs

The DOE, other government agencies, and private industry all offer emergency response training for personnel responding to accidents involving hazardous and radioactive materials. The DOE also provides training to state and local emergency personnel that covers basic procedures for dealing with transportation accidents. The first-on-scene training program has been made available by the DOE, to fire, law enforcement, and emergency medical responders in Nevada since 1983 (at no cost other than travel expenses to the presentation site). These courses are available to all jurisdictions within the State of Nevada and have been given in several Nevada counties. Emergency Medical Personnel Radiological seminars will be presented in the near future in Tonopah and Ely, Nevada. The DOE is committed to working with rural emergency and volunteer response forces to make it easier to attend training by arranging training schedules and locations that are easily accessible.

The Transportation Emergency Preparedness Program establishes consistent response policies and procedures among the DOE's various programs. A controlled, coordinated emergency preparedness program ensures a constant capability to respond to accidents involving radioactive materials. The Transportation Emergency Preparedness Program also supports the Transportation Emergency Training for Response Assistance Program, which provides radiological response training for both DOE and civil responders. Civil-oriented Transportation Emergency Training for Response Assistance Program training sessions include the Radiological Emergency Training for Local Responders course, intended primarily for local emergency personnel; and Radiological Emergency Operations, for state, tribal, and regional radiological response team members. Radiological Emergency Operations is a revision of the Radiological Emergency Response Operations course formerly taught by the DOE. It is now more oriented toward response to transportation incidents involving radiological materials. Civil personnel, in limited numbers, have also attended the Rail Radiological Response and Transportation Public Information courses, which are part of the Transportation Emergency Training for the Response Assistance program.

The Transportation Emergency Training for Response Assistance Program is managed by DOE/NV for the DOE Headquarters Offices of Environmental Management, Nonproliferation, and National Security.

The Transportation Emergency Preparedness Program initiatives focus on planning and training, exercises, and technical assistance to DOE elements, as well as state, tribal, and local governments. An important Transportation Emergency Preparedness Program initiative is a series of training exercises known as TRANSAX which is emergency preparedness simulation. The DOE, in conjunction with states and tribes, conducts these training exercises to evaluate response systems and support services.

TRANSAX '90, the first such exercise, was a joint effort between the DOE, state, and local agencies in Colorado.

TRANSAX '92, involved agencies of the state of Idaho, Shoshone-Bannock Tribes, and local organizations for response and accident command.

TRANSAX '94, involved agencies of the states of Idaho and Oregon, local governments, and the Umatilla Tribe.

The TRANSAX exercises helped participants improve their emergency response planning and procedures. The series is ongoing and will involve other states, tribes, and local organizations in the future.

The DOE-sponsored training programs are available to all local and state agencies that may have the need to respond to emergency situations involving transportation of radioactive materials.

D.3 References

REGULATION, ORDER, LAW

10 CFR 71	U.S. Nuclear Regulatory Commission (NRC), *Energy: Packaging and Transportation of Radioactive Material*, *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, 1988.
49 CFR 171-399	U.S. Department of Transportation (DOT), *"Transportation," Office of the Federal Register,* Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC.
DOE Order 5530.3	Department of Energy (DOE), *Radiological Assistance Program*, Washington, DC, 1992.

Attachment E to Appendix I

NTS RAIL ACCESS STUDY

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Attachment E. Nevada Test Site Rail Access Study

Transportation of low-level waste to the Nevada Test Site NTS by truck could also be accomplished by developing rail access from one of the existing mainline railroads or by intermodal transfer to a legal weight truck. This section provides a summary of considerations related to rail spur development, use of truck/rail intermodal systems, and comparisons to the continued use of truck transportation systems.

This discussion serves as an introduction to alternative radioactive material transportation opportunities that could benefit both the community and the federal government. This section does not support any specific decision in this Environmental Impact Statement (EIS), since rail transportation is not part of any specified operating alternative. Rather, this section is a basis for starting a future discussion of this issue.

The primary outcome of developing the capability of transporting low level waste to the NTS by rail or by using truck/rail intermodal systems, would be the reduction of the number of legal-weight truck shipments of material in particular, radioactive material. The radiological and nonradiological risk to the public and the environment during transport of these materials by truck is roughly proportional to the number of shipments. According to the Association of American Railroads, *Competitive Policy Reporter* (AAR, 1993), rail transport is five times safer than truck transport in terms of accidents per ton-mi when carrying hazardous materials. Railroads also ensure that shipments are better separated from other traffic and the public.

E.1 Railroad Access

Three major railroad lines pass through Nevada, which could be used as a starting point in developing a rail spur to the NTS. One of these routes is the Union Pacific line that runs from Salt Lake City, Utah south into Nevada at Caliente, then south through Las Vegas and into California near Stateline, Nevada. The second carrier is the Southern Pacific Railroad that operates a route from Ogden, Utah, to Reno, Nevada. This line has two branch lines, one running south from the vicinity of Cobre, Nevada, to Ely, Nevada, and the other running south from the vicinity of Hazen, Nevada, to Thorne, Nevada. The Union Pacific operates a second northern route that runs from Salt Lake City, Utah, to Winnemucca, Nevada, and then west into California. The Southern Pacific line and the Union Pacific line run parallel between Wells and Winnemucca, Nevada. All rail shipments going west use the Southern Pacific line, and those going east use the Union Pacific line between those two points.

E.1.1 Site Rail Access History

Several studies have been done over the last several years to evaluate rail access options from an existing mainline railroad to the NTS. The following sections present a general description of these studies.

E.1.1.1 Feasibility Study for Transportation Facilities to NTS. In March 1962, Holmes & Narver prepared a report for the Atomic Energy Commission entitled *"Feasibility Study for Transportation Facilities to the Nevada Test Site,"* (AEC, 1962). The study was a preliminary determination of the technical and economic feasibility of constructing and operating a railroad short-line from the vicinity of Las Vegas (Wann) to Mercury and then on to Jackass Flats in Area 25. The result of that study indicated that the short-line railroad concept was technically and economically feasible. The cost of the rail line was estimated to be $12,323,000, and could be amortized in about 6⅓ years. The end result of this activity was that the U. S. Department of Energy (DOE) supported Clark County in upgrading U.S. Highway 95 into a four-lane highway from Las Vegas to the entrance to Mercury to provide a safer highway for the NTS workers.

E.1.1.2 Lincoln County Study. In 1989, ETS Pacific prepared a report for the City of Caliente evaluating three alternative rail corridor routes through Lincoln County, Nevada to Yucca Mountain, Nevada. These routes could also service the NTS.

The first route started in Caliente and then went north to Pioche on the abandoned Union Pacific railroad right-of-way. The alignment continued up Lake Valley to Bristol Wells and then westerly down through Dry Lake Valley, south of Burnt Peak, to cross State Route 318. The line continued to Timber Gap, into Garden Valley, and then into Sand Spring Valley. The line then ran southwest to Chalk Mountain, crossing State Route 375, and then into the Nellis Air Force Range Complex (NAFR). The line continued down Emigrant Valley around Rhyolite Hills to Groom Pass. From Groom Pass, the line descended to Yucca Flat onto the NTS and then to Yucca Mountain. As reported in the study; *Evaluate Alternative Rail Corridor Routes through Lincoln County* (ETS Pacific, 1989a), This alignment was 331 km (206 mi) long, and was estimated to cost $215 million to construct.

The second route was essentially the same, except that it started at Crestline (about 32 km [20 mi] northeast of Caliente on the Union Pacific mainline), went to Sheep Springs Draw, then descended just east of Panaca Hills, and connected to the first route just north of Condor Canyon. As reported in the study, this alignment was 327 km (203 mi) long, and in 1988 ETS Pacific estimated its cost would have been about $210 million.

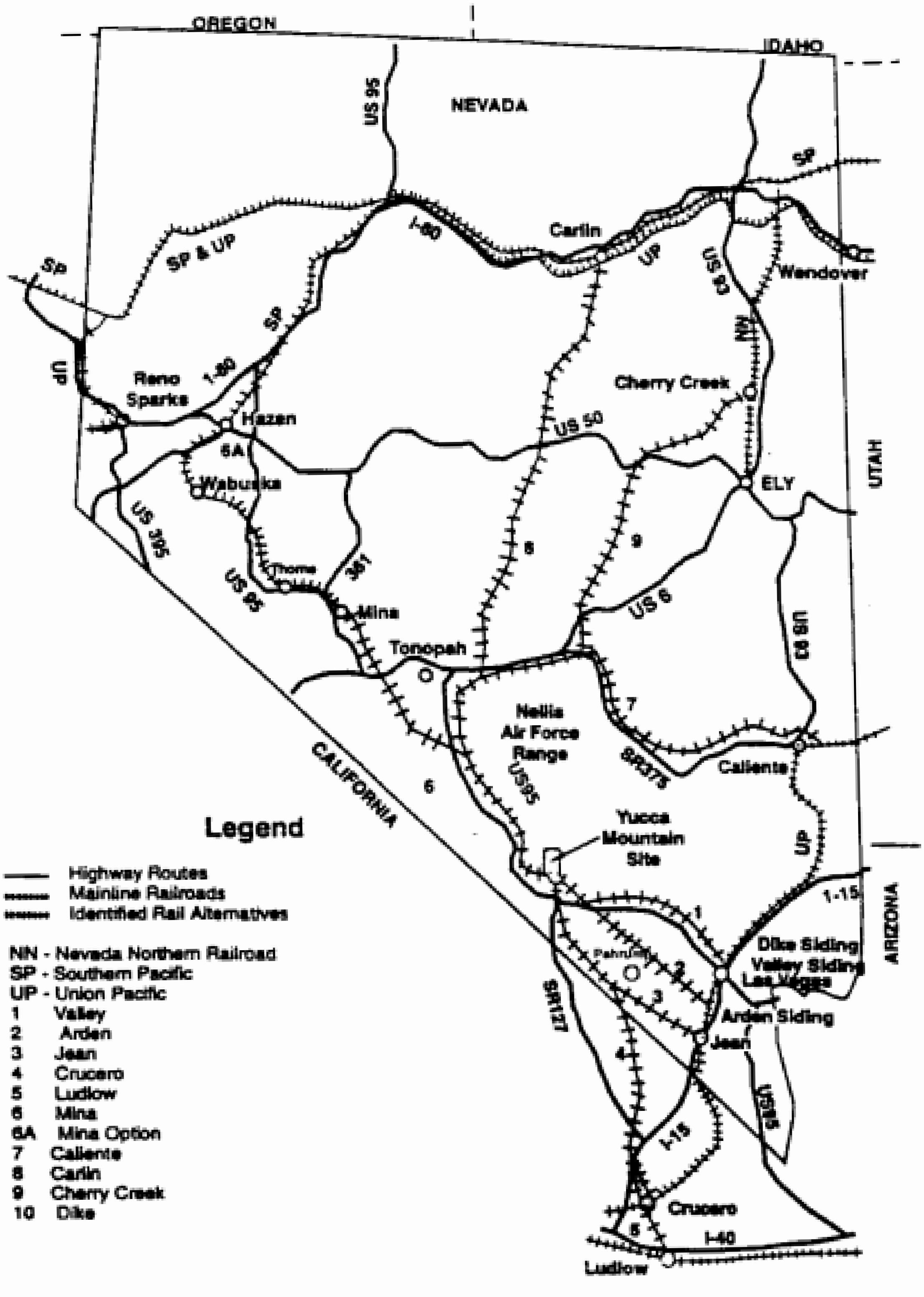
The third route started south of Caliente in Elgin, Nevada, followed Kane Springs Valley to U.S. Highway 93, then went parallel to U.S. Highway 93 north to Lower Pahranagat Lake. The line then went southwest into the Desert National Wildlife Range passing Desert Lake, into Clark County, and ended near U.S. Highway 95. This route would require an intermodal transfer station along U.S. Highway 95 to transfer the waste from railcar to truck for the remaining 161 km (100 mi) of the route. As reported in the study, this alignment was 187 km (116 mi) long, and 1988 cost estimates were about $171 million. Subsequent to the study that developed the route from Elgin to U.S. Highway 95, ETS Pacific issued a study (ETS Pacific, 1989b) that added a rail alignment from the location at the end of the previous alignment at U.S. Highway 95 that went north along U.S. Highway 95 to the vicinity of Yucca Mountain. The additional rail alignment of 121 km (75 mi) in length would have added about $86 million to the total cost of building the rail line from Elgin to Yucca Mountain.

Based on the data developed in the study, ETS Pacific ranked the three routes from most desirable to least desirable in the order of the second route, the first route, and the third route. ETS Pacific determined the third route is the least desirable because it passes through the Desert National Wildlife Range and does not end up at Yucca Mountain. This report did not consider going through the NAFR Complex and the NTS in the area of the underground nuclear testing to be problematic.

E.1.1.3 Preliminary Rail Access Study. In 1990, the DOE issued a *Preliminary Rail Access Study* (DOE, 1990) that identified 10 rail options (Figure E-1) from the currently existing mainline railroads in Nevada to Yucca Mountain. Lincoln County and Caliente identified three additional alignments that were addressed in the study. Each of the options was reviewed to identify land-use compatibility issues. They were categorized as either having existing conflicts that are not likely to change prior to DOE needing access, potential conflicts, or no identified conflicts. Of the 13 alignments (including 3 from the Lincoln County study), the Caliente and Jean alignments were found to have no significant land-use conflicts, and the Carlin alignment was judged to have the least potential for serious conflicts of all the routes connecting to the Southern Pacific line, based on a detailed review of current ownership patterns and development criteria.

The three routes identified with the least land-use conflicts were recommended for further engineering evaluation with the objective of not excluding access to any of the three regional rail

Figure E-1 U.S. Department of Energy identified railroad options and Nevada state rail network, 1989



carriers. The remaining 10 alignments were recommended for continued monitoring, should any of the identified land access conflicts be removed. As identified in the rail access study, the final routes selected for consideration as potential rail access alignments to the Yucca Mountain site will be identified and discussed as part of the Yucca Mountain Project EIS scoping process.

A major result of this study is a table of the lengths of each alignment and the costs, both capital and operating, and maintenance costs. Line lengths and costs ranged from a low of 159 km (99 mi), $142 million (1988 dollars) capital cost, and $740,000 annual operations and maintenance costs for the Valley option; to a maximum of 721 km (448 mi), $735 million capital cost, and $3.3 million annual operations and maintenance costs for the longest of the Caliente alignments. The capital costs included the cost of $500,000 per mile for track work, $500,000 per mile for grading, fencing, and establishing right of way access. In mountainous terrain, an additional $1 million to $1.2 million per mile was allotted for increased grading and drainage. The operating cost calculations estimated a cost of $16.70 per 1,000 gross ton miles. The maintenance costs were estimated to be from $5,140 per track mile equivalent to an additional operating cost of $50.15 per 1,000 gross ton miles. This estimate was based on a projected tonnage of 102,000 gross tons per year.

E.1.1.4 Caliente Route Conceptual Design. In June 1992, the final Caliente Route report was issued *Yucca Mountain Rail Access Study:* Caliente Route Design Report (DOE, 1992). That followed a year after the draft report was issued for external review in June 1991. The scope of the study was to develop the conceptual design, provide preliminary environmental analysis, and prepare a cost estimate for the Caliente alignment. This study included an environmental screening to aid in route establishment. The conceptual design also included the design of an access highway from U.S. Highway 95, in Amargosa Valley, to the potential site at Yucca Mountain, about 26 km (16 mi) away. Two possible routes from the vicinity of Caliente to the potential site at Yucca Mountain were developed, which constituted an envelope of possible routes between Caliente and Yucca Mountain. Approximately 11,675 km (7,256 mi) of rail alignment were included in the detail study.

Information was developed on engineering factors including distance, grade rise and fall, the amount of cut and fill required, curvature, drainage, and rail operations. Alignment maps on a horizontal scale of 2.54 cm equals 152 m (1 in equals 500 ft), and a vertical scale of 2.54 cm equals 15.2 m (1 in equals 50 ft), were developed for the alignment studied. A hydrology study was conducted to evaluate worst case runoff flows for a 100-year flood condition. Environmental constraints were evaluated to complement the engineering tradeoffs in route locations, to ensure that the base route and options did not traverse environmentally sensitive areas. In addition, archaeological studies were conducted to assure that the potential route and options did not traverse restricted, historical, archaeological, or cultural sites.

Five potential operational options were evaluated in this study. These included DOE owned, DOE operated; DOE owned, short line operated; DOE owned, contractor operated; DOE owned, Class I railroad operated; and privately owned, privately operated. Finally, engineering, construction, and operating costs were developed for each of the operational options.

The results of the rail study indicate there is a potential feasible rail route, with several options, from the existing Union Pacific railroad in the Caliente area to the potential repository site at Yucca Mountain. Conceptual plan and profile evaluations indicate that this route can be constructed within the limitations of present railroad engineering practices and normal operating standards. The base cost of doing the detail design and constructing the railroad was $108 million in 1990 dollars.

E.1.1.5 High Speed Surface Transportation between Las Vegas and the NTS. In April 1994, Raytheon Services Nevada issued a draft report High Speed Surface Transportation between Las Vegas and the Nevada Test Site (RSN, 1994). That report explored the rationale for a potential high-speed rail corridor between Las Vegas and the NTS to accommodate increased workers for new programs at the NTS in the 21st Century. The study looked at a personnel carrier from the vicinity of U.S. Highway 95 and Ann Road, in northwest Las Vegas, to Mercury and Control Point 6 in the NTS, with another branch line to Yucca Mountain. The line was not connected to any existing railroad line. It would include 185 km (115 mi) of mainline track plus sidings and passing turn-outs. There would be two train sets, each consisting of one engine and six passenger cars, with four terminals on the line. The total cost of constructing the rail line and the associated equipment was $964 million. No follow-up to this study has been initiated.

E.1.1.6 Yucca Mountain System Study. The *Nevada Potential Repository Preliminary Transportation Strategy, Study 1* (DOE, 1995) reevaluated 13 previously identified rail routes and advanced a new route called the Valley Modified Route. This route was added as the result of recent discussions with U.S. Bureau of Land Management Las Vegas District personnel regarding the status of two potential Wilderness Areas. The routes were categorized as follows:

E.1.1.6.1 Recommended for Detailed Evaluation—These rail routes were deemed the most reasonable route alternatives based on the conclusions of the (DOE, 1990) (see Section E.1.1.3) and Study 1. They were considered reasonable, based on minimal land-use conflicts, maximal use of favorable topography and federal land, avoidance of land federally withdrawn from public use, direct access to a major regional carrier, and conditions allowing design in accordance with accepted rail engineering practices. Routes in this category are Caliente, Carlin, Jean (see Figure E-1), and Valley Modified (see Figure E-2).

E.1.1.6.2 Eliminated from Detailed Evaluation Monitor—These rail routes failed to meet one or more of the evaluation criteria listed in the previous paragraph. They were considered technically feasible, but known or potential land use conflicts, indirect access to a major regional carrier, or conflict with land federally withdrawn from public use, significantly reduced the potential for these routes to be successfully developed. The routes are to be maintained by the Yucca Mountain Project at the present level of development, and the conditions that caused these route to be placed in this category will be monitored. Routes in this category, shown in Figure E-1, are Mina, Cherry Creek, and Dike.

E.1.1.6.3 Eliminated from Further Study—These rail routes failed to meet one or more of the evaluation criteria listed in the recommended status category, and the study has determined that the unfavorable conditions eliminate any potential for the route to be successfully developed. The routes are to be maintained at the present level of development by the Yucca Mountain Project and will be presented in the National Environmental Policy Act scoping process, with the route alternatives assigned to the other two status categories.

During the National Environmental Policy Act scoping process, these rail routes will be discussed briefly to identify the reasons for their elimination. Routes in this category (Section E.1.1.2 and Figure E-1) are Lincoln County A, B, & C, Crucero, Ludlow, Valley, and Arden.

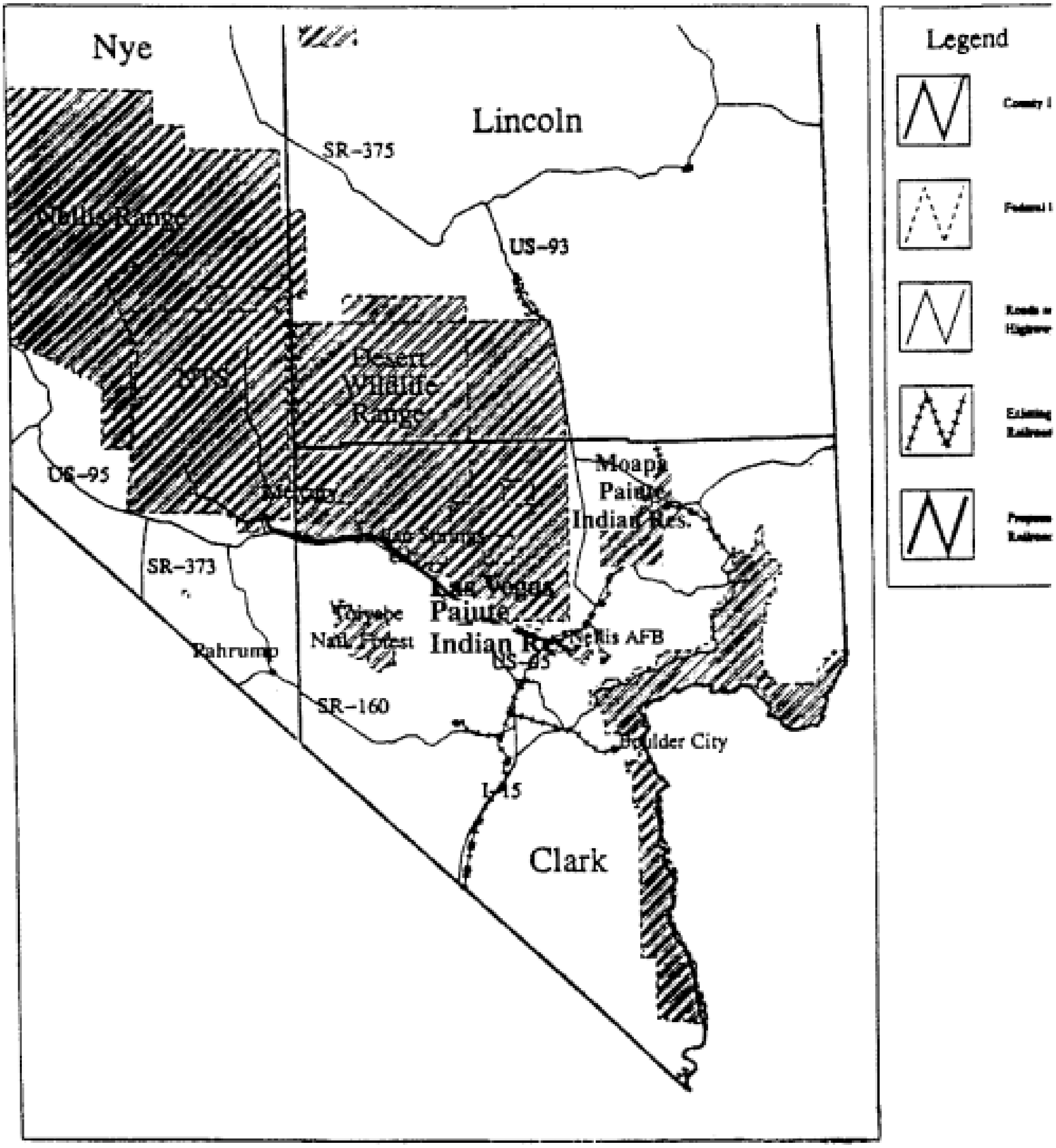
The rail routes recommended for detailed evaluation by Study 1 were comparatively evaluated against the Preliminary Rail Access Study (DOE, 1990) selection criteria. The selected routes were also evaluated using the following preliminary criteria developed by the Study 1 team

- Ease of construction
- Initial cost
- Safety
- Flexibility for personnel and freight
- Operating and maintenance costs
- Safeguards and security
- Public perception.

E.1.2 Description of Alternatives

Two options were considered in this study: (1) a no-build alternative in which the NTS would continue to be supported by truck or rail/truck intermodal shipments; and (2) construction and operation of a rail spur to the NTS as a supplement to truck transportation.

Figure E-2. Modified Valley Route Profile



E.1.2.1 No-Build Alternative. Under the no-build alternative, a rail spur would not be constructed and the existing rail and highway network would remain the same. Normal highway improvements planned by Clark County, the State of Nevada, and improvements made to the railroad by the Union Pacific Railroad would continue. This would mean that radioactive waste shipments would continue to be brought in by truck or using rail/truck intermodal systems. Any waste brought in by rail, destined for the NTS, would have to be transported from the rail line to the NTS by truck. Issues associated with truck-only shipments are described in the other attachments.

E.1.2.2 Rail Alignments. Four routes were selected for evaluation in this study based on the need to compare truck and rail systems. Shorter, less expensive routes were developed to identify potential environmental impacts. Longer routes were included for completeness. The routes considered in this report do not include all feasible routes, but do address stakeholder concerns about the continued shipment of waste through the Las Vegas Valley. If the DOE decides to propose construction of a spur, this proposal would be subjected to a separate National Environmental Policy Act action. Exclusion of routes from the detailed study in this report, likewise, does not terminate the government's potential interest in other alternatives as part of future actions.

Routes originating in northern Nevada, identified in previous DOE studies, were not given detailed consideration in this report because they offered no advantages to improve transportation to the NTS compared to the two routes selected and would require more resources to build and operate. Routes across the NAFR were also reviewed and not considered in the report. These routes offered no advantages to improve transportation to the NTS compared to the routes selected, and could significantly impact the mission of that facility.

E.1.2.2.1 Valley Modified Route—The route being proposed is a combination of the Valley route and the Dike Siding route identified in (DOE, 1990) (Figure E-2) and the repository system study (DOE, 1995). This route leaves the Union Pacific mainline north of the Valley Siding, northwest adjacent to the NAFR Complex land to near the southern boundary of the Desert National Wildlife Range. It would continue west along the boundary of the range and then northwest again between the Southern Paiute Indian Reservation and the Desert National Wildlife Range. The route would continue northwest between U.S. Highway 95 and the NAFR land, then pass in the vicinity of the Indian Springs Air Force Auxiliary Field. Past the Indian Springs Auxiliary Field, the route would be between the highway and the mountain range, entering the NTS between the main gate at Mercury and the airplane landing strip.

The advantage of the Valley Modified route is that it is the shortest of all the alignments that have been evaluated in previous reports, and does not pass through any rugged terrain. Figure E-3 shows an approximate route profile.

The major obstacle to this alignment is that it passes through Wilderness Study Areas. However, the U.S. Bureau of Land Management has recommended the removal of these Wilderness Study Area classifications, *Final Environmental Impact Statement, Preliminary Wilderness Recommendations* (DOI, 1990). If legislation removes the Wilderness Study Area designation, this entire alignment would be on federal lands managed by the U.S. Bureau of Land Management and on land withdrawn for the U.S. Air Force at Indian Springs. If right-of-way access across the Indian Springs Auxiliary Air Base is not available, it is possible to cross U.S. Highway 95 prior to reaching Indian Springs, going south of the community of Indian Springs, and then crossing U.S. Highway 95 again into the NTS. This alignment would be longer, two grade separations would be required, and there is rougher terrain to go through, which would make this option more costly. The additional cost for the grade separations and land excavation is estimated to be $25 million. An alternative alignment for this route would be to originate near Dike Siding northeast of Valley siding. This alignment would cross the Sheep Mountain Bombing Range but would allow the route to pass to the north of areas under consideration for residential development as part of the City of North Las Vegas.

E. 1.2.2.2 Stateline Route—A separate alternative route would originate from the Union Pacific mainline near Stateline, Nevada (Figure E-4). This route is similar to the Jean route identified in the DOE Preliminary Rail Access Study and is designated as the Modified Jean Route in Study 1.

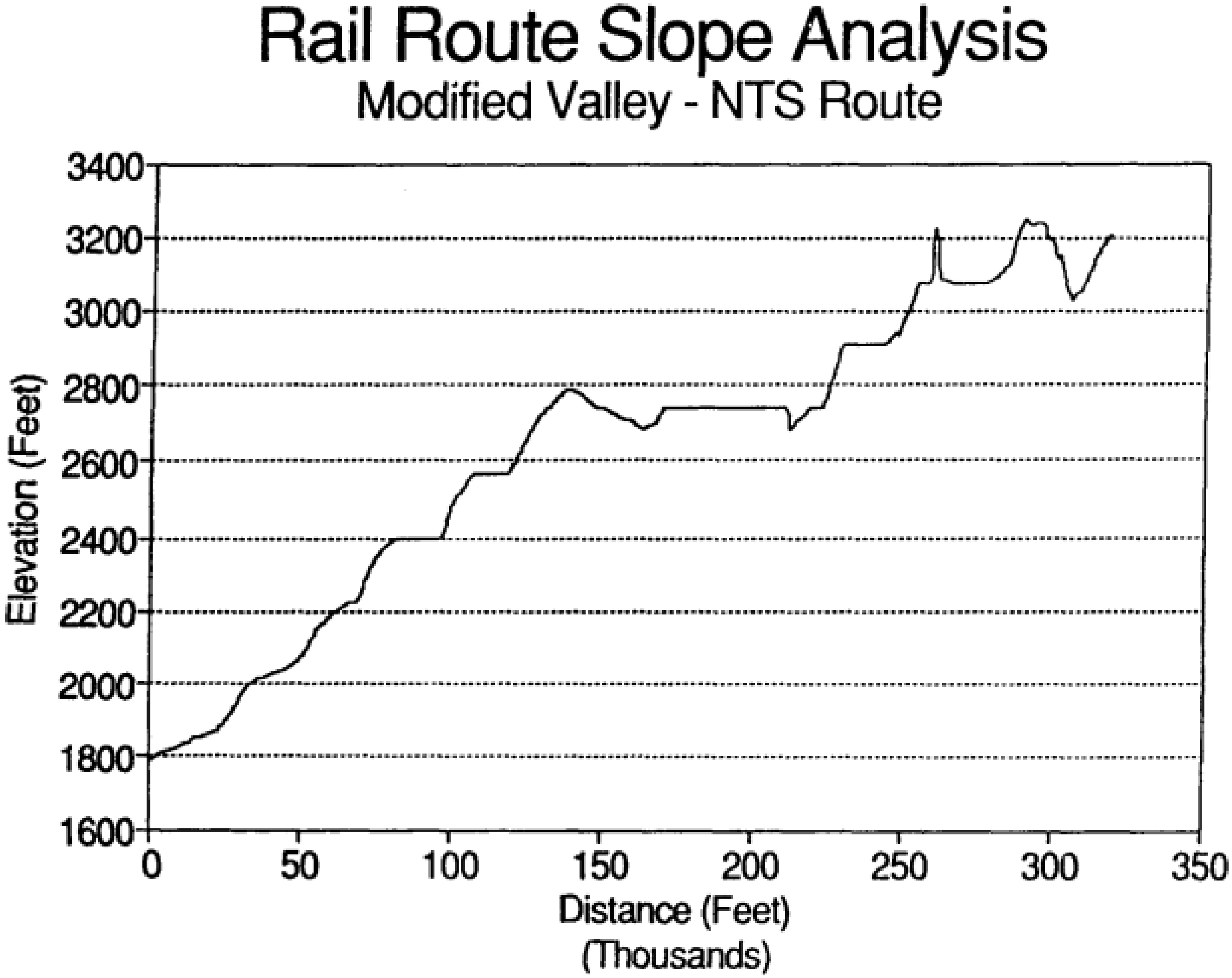


Figure E-3. Modified valley route profile

The route would cross Interstate 15 through a grade separation, proceed along the south end of the Spring Mountains, and cross the border into California and into the Mesquite Valley area. The route would proceed north along the Spring Mountains into Nevada east of the Sandy Valley area, avoiding private lands. The alignment would then cross State Route 160 through a grade separation, and skirt the community of Pahrump and the Ash Meadows Wildlife Refuge. The route would then cross U.S. Highway 95 via a grade separation between State Route 160 and State Route 373, and proceed along U.S. Highway 95, passing through Area 25 past Little Skull Mountain toward Mercury to the desired areas in the NTS.

The advantage of this route over any of the other options is that it is shorter than any other route except the route that leaves Jean and remains in Nevada. The advantage of this route is that it crosses the Spring Mountains at an elevation of nearly 304 m (1,000 ft) lower than any of the routes from Jean that remain in Nevada. Although the route is about 24 km (15 mi) longer, lower construction costs are expected to more than offset the cost for the increased distance. A route profile is shown in Figure E-5.

The disadvantage of this route is that it crosses the California Desert Conservation Area. The U.S. Bureau of Land Management can only grant a right-of-way through these lands if there is no other feasible route. Shipments would also use the Santa Fe Railroad through Barstow, California, if shipments through Las Vegas are to be minimized.

E.1.2.2.3 Caliente—This route is described in Section E.1.1 and shown in Figure E-1 of this report. It is included here for completeness but was not developed in detail in the remainder of this report.

E.1.2.2.4 Carlin—This route is described in Study 1, referenced in Section E., and is shown in Figure E-1. This route would depart from the Union Pacific/Southern Pacific paired track near Carlin, Nevada. The route parallels Nevada Highway 278 and then passes south through either the Monitor or Smokey Valley along the west side of the NTS entering the site near Amargosa Valley. This route is included here for completeness but is not developed in detail.

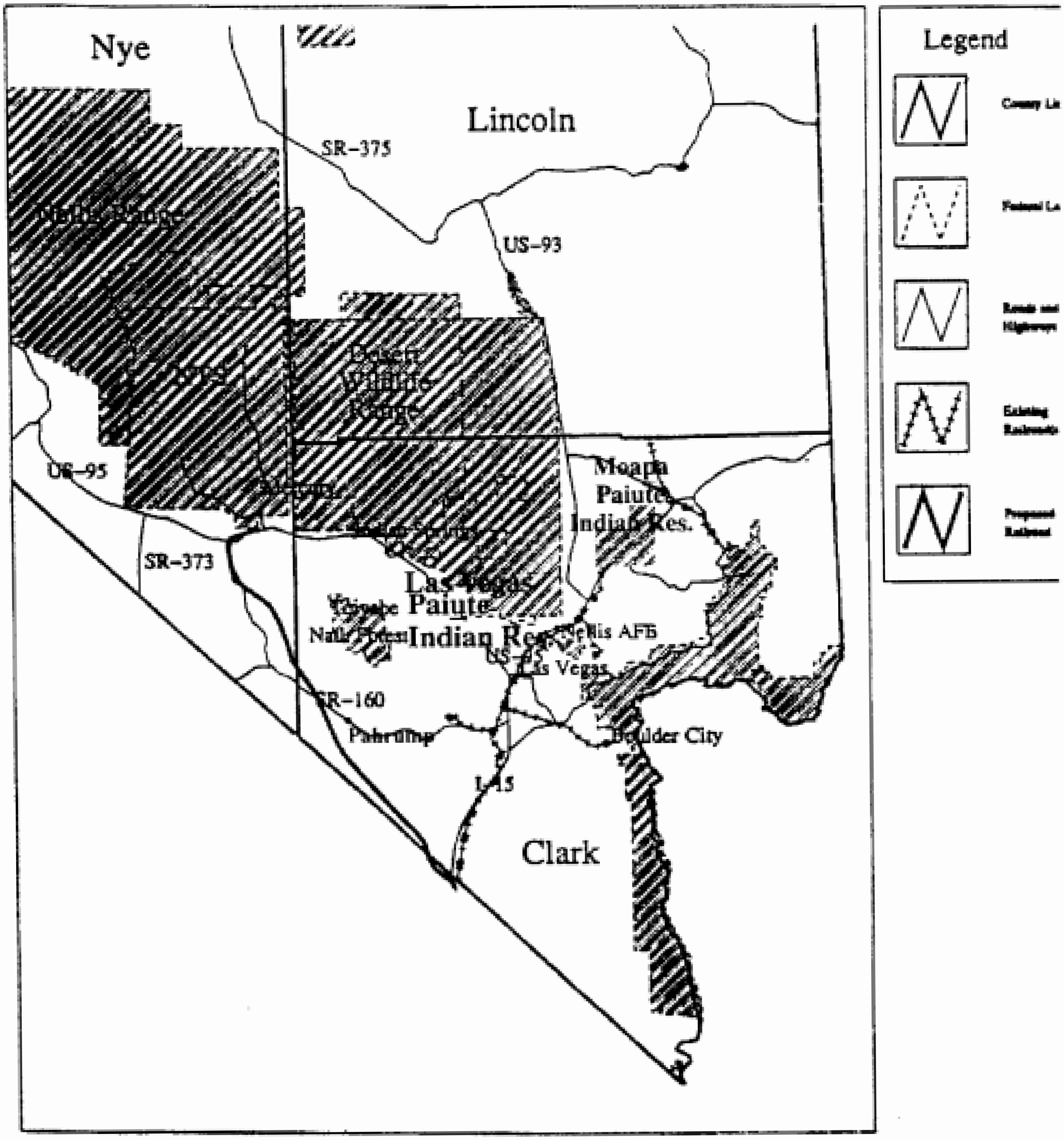
E.1.2.3 Truck Haul Routes. This section introduces truck routes evaluated for use in possible truck/rail intermodal shipments to the NTS. Truck transport of legal weight (less than 36,240 kg [80,000 lb]), overweight (36,240 kg greater than [80,000 lb]), and heavy loads (greater than 58,437 kg [129,000 lb]) in Nevada over existing U.S. and state highways and secondary roads is feasible, and can be performed without restriction for legal weight shipments or within the existing permit system for overweight and overlength loads with a number of state restrictions.

The State of Nevada's permit system for overweight and overlength truck transport allows loads in excess of 58,437 kg (129,000 lb). However, the transport of loads of this type on a regular basis would need to be evaluated with state permitting agencies. In addition to obtaining a state permit, the state permitting agency also must approve the route. The annual cost for the state overweight and overlength permit is $120 per ton in excess of 36,240 kg (80,000 lb) for each transport vehicle. An added annual cost of $1,000 is required for a hazardous materials permit for carriers with 6 to 25 vehicles. Prior to transporting loads from an existing mainline railroad in Nevada to the NTS, an intermodal transfer facility adjacent to an existing railroad will have to be developed.

For an infrequent transfer, portable cranes could be used at an existing rail siding to make that transfer. If there were frequent transfers, a permanent facility might need to be developed. Trucks would be required to meet the state requirements for maximum axle loads (9,060 kg [20,000 lb] for a single axle, 15,402 kg [34,000 lb] for a tandem axle, and 21,744 kg [48,000 lb] for a tridem axle) and minimum axle spacing.

Road grade should be limited to a maximum of 4 to 5 percent. Grades of 6 to 7 percent could be negotiated, but would require either additional tractors or larger tractors. This is very important for overweight and heavy haul trucks. Either asphalt or concrete road surfaces are acceptable. Unpaved roads are not recommended; however, if properly constructed, they could be used. Unpaved roads and some secondary roads require time-of-year restrictions as roads thawing in the spring tend to be quite soft and rutted.

Figure E-4. Stateline alternative rail alignment



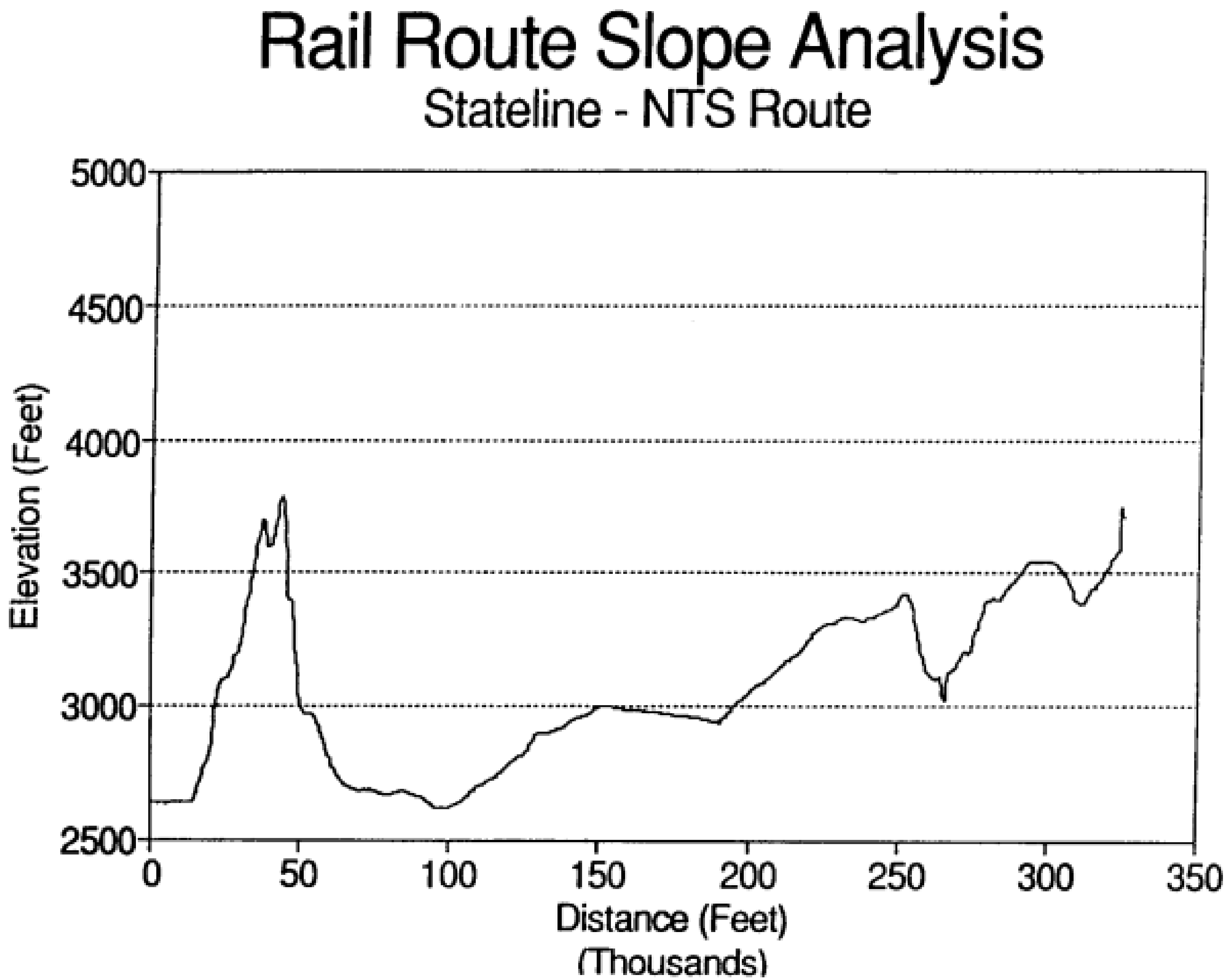


Figure E-5. Rail route slope analysis

E.1.2.3.1 Apex/Valley Truck Haul Route—This truck route would start at one of the sidings between Apex and Valley on the Union Pacific mainline. The route would use existing highways either across Craig Road or to the intersection of Interstate 15 and U.S. Highway 95. The route would then take U.S. Highway 95 north to Mercury and into the NTS.

The advantage of this route is that it uses multiple lane divided highways without significant local road access, with the exception of Craig Road, if that road is used. The major disadvantage of this route is that it has to pass through Las Vegas and, in particular, through the high-traffic intersection at Interstate 15 and U.S. Highway 95.

E.1.2.3.2 Arden Truck Haul Route—The Arden truck route would originate at the Union Pacific siding in Arden, just south of Las Vegas and near State Route 160. This route would take Route 160 through Pahrump to U.S. Highway 95 and then south on U.S. Highway 95 to Mercury. The advantage to this route is that it does not go through the populated sections of Las Vegas. The disadvantage of this route is that it goes through the populated and business sections of Pahrump. State Route 160 is also not a desirable heavy haul highway, according to the Nevada Department of Transportation.

E.1.2.3.3 Other Truck Haul Routes—Other alternatives to the movement of trucks through Las Vegas would result in an extremely long route, going through other communities or both. An example would be to make the intermodal transfer in the vicinity of Caliente, using U.S. Highway 93 to State Route 375, then using State Route 375 to U.S. Highway 6, then to U.S. Highway 95 in Tonopah, and finally U.S. Highway 95 south to Mercury. This would be a distance of about 579 km (360 mi), passing through the communities of Tonopah, Goldfield, and Beatty. Use of California State Route 127 to State Route 373 and then to Mercury via U.S. Highway 95 is an example of a longer route originating south of Las Vegas.

E.2 Cost Analysis

E.2.1 Rail Construction Costs

Cost drivers in the development of rail access include the design activity and the survey work needed to support the design, administration, and contract management.

The major material cost drivers for construction include: (1) earthwork and rock excavation, (2) ballast and sub-ballast processing and transport, (3) track and ties, (4) grade separations, and (5) drainage structures.

The cost for the Modified Valley route is estimated to be $320 million for the approximately 161-km (100-mi) spur. The cost for the Stateline alternative is estimated to be $400 million for the approximately 201-km (125-mi) spur. These estimates are based on the cost estimate from the Caliente conceptual design report (DOE, 1992), considering the difference in distances. These estimates include the design costs, all construction costs, and a 35 percent contingency factor on construction.

E.2.2 Intermodal Truck/Rail Construction Costs

If intermodal systems are used, there would be a construction cost of developing and operating an intermodal transfer station. It is estimated that the design and construction of a covered transfer station with a sufficient overhead crane would cost about $2.5 million. There would also be the operational cost of the intermodal transfer station, which would depend on the frequency of its use.

E.2.3 A Comparison of Truck, Rail, and Intermodal Shipping Costs

Estimated shipping costs for radioactive waste shipments by rail and by intermodal truck/rail modes were developed using a combination of the truck costs, and a verbal rail transportation cost estimate obtained from the Union Pacific Transportation Company. The costs developed for trucks were based on twelve 1.2 x 1.2 x 2.1 m (4 x 4 x 7 ft) waste boxes on a trailer. The cost per mile based on the trip length. The rail cost developed in this appendix is based on a single railcar carrying two cargo containers, each holding nine 1.2 x 1.2 x 2.1 m (4 x 4 x 7 ft) waste boxes. The Union Pacific estimated costs are based on the movement of a railcar with 2 cargo containers having 18 waste boxes from Chicago to Las Vegas and returning the two empty cargo containers. No adjustment was made in the cost per rail car mile for multiple railcars per train or for increased trip lengths. Additional cost savings may be possible if these parameters are included.

Estimates were made for representative shipments to the NTS from sites in two general areas. Costs for intermodal shipments are not significantly different between shipping by rail using the Union Pacific to Clive, Utah, and then by truck to the NTS; shipping by rail using the Union Pacific to North Las Vegas and then by truck to the NTS; or shipping by rail using the Santa Fe Railroad Company to Barstow, California by rail and then by truck to NTS. On the basis of distance from a site to the NTS, Argonne National Laboratory-East (ANL-E), Bettis Atomic Power Laboratory (BAPL), Fernald (FEMP), Mound, Oak Ridge National Laboratory (ORNL), Portsmouth Gaseous Diffusion Plant (PORTS), the RMI Extrusion Plant, and the Savannah River Site (SRS) are nearly the same 3,339 ± 362 km (2,075 ± 225 mi); and so the radioactive waste transportation costs from each site to the NTS would be about the same. The Knolls Atomic Power Laboratory (KAPL) is somewhat farther 4,183 km (2,600 mi) and the cost would be somewhat higher. Also, Lawrence Livermore National Laboratory (LLNL), Rocky Flats (RFETS), Hanford, Los Alamos National Laboratory (LANL), the Stanford Linear Accelerator (SLAC), and the Idaho National Engineering Laboratory (INEL) are about the same distance from the NTS (1,512 ± 257 km [940 ± 160 mi]), and so the cost of shipping the waste from those sites to the NTS would be about the same.

The resulting cost estimate for an intermodal truck/rail shipment from any of the distant sites to the NTS is about $416 per box, whereas a truck shipment from the originator site to the NTS is about $678 per box. The cost estimate for an intermodal truck/rail shipment from one of the closer sites to the NTS is about $247 per box, whereas a truck shipment all the way is about $342 per box. The main reason for the smaller difference is that the truck rate for short hauls (approximately 161 km [100 mi]) is more than twice the rate for truck shipments of more than 1,126 km (700 mi), so the effect of the short (approximately 161 km [100 mi]) intermodal truck shipment is more pronounced. As a comparison, if a rail spur were constructed to the NTS, the shipping cost is estimated to be about $307 per box for the distant sites and about $139 per box for the closer sites.

Based on the "No Action Alternative Volumes," shipments from the distant sites (FEMP, Mound, ORNL, and RMI), a total of about $14.6 million could be saved using intermodal truck/rail transportation, and about $20.7 million would be saved if the NTS rail spur is constructed. Savings of about $2.5 million could be realized on shipments from the closer sites using intermodal transportation. Additional savings of $5.4 million could be made if shipments could go all the way by rail. Total savings could be $17.1 million for intermodal shipments, and $26.1 million for an NTS rail spur.

Based on the Expanded Use Alternative Volumes from the distant sites, a total of about $43.3 million could be saved for intermodal truck/rail transportation, and a savings of $61.3 million, using a rail spur to the NTS. From the closer sites, an additional savings of $12.2 million could be realized using intermodal transportation or $26 million for an NTS rail spur. Potential savings total $55.5 million for intermodal transportation and $87.3 million for an NTS rail spur in this alternative.

One caution with regard to these cost estimates is that they are based on a truck load of only 12 boxes and an intermodal truck load of 9 boxes. This means that to meet the maximum legal-weight truck requirement of 36,240 kg (80,000 lb) maximum, the boxes had to average less than 2,039 kg (4,500 lb). In recent discussions with FEMP transportation personnel, future boxes of waste from FEMP for NTS would contain contaminated equipment weighing between 2,265 kg (5,000 lb) and 2,718 kg (6,000 lb) per box, and there wouldbe boxes of transite (concrete) weighing 3,624 kg (8,000 lb) to 4,077 kg (9,000 lb) per box. Therefore, future truck shipments from FEMP to the NTS may not contain the 12 boxes without exceeding the maximum gross vehicle weight of 80,000 lb. This means that some future shipments from FEMP would cost the same per shipment but would have fewer boxes per truckload, thereby increasing the cost per box. Rail shipments having higher weight limits would not be subject to this reduction in efficiency.

In conclusion, there is an opportunity for significant cost savings in transporting low-level waste using intermodal rail/truck shipments versus shipping all the way from the originator site to the NTS site by truck. In addition, if a rail spur is constructed out to the NTS, substantial additional savings could be realized that could partially offset the capital costs of this alternative.

E.5 References

REGULATION, ORDER, LAW

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Attachment F to Appendix I

GENERATOR ROUTES

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Attachment F. National Generator Routes

Generator: Aberdeen Proving Ground (APG-1), Aberdeen, Maryland

The primary transportation route from the Aberdeen Proving Ground to the Nevada border departs the Aberdeen Proving Ground heading northwest on State Route 22 to U.S. Highway 40 for approximately 2 mi^2. At this point, Interstate 95 is taken southwest 21 mi into Baltimore, Maryland. At Baltimore, Interstate 695 is then taken past Interstate 83 for 10 mi to Interstate 70. Interstate 70 is then traveled for 116 mi northwest and into Breezewood, Pennsylvania. Interstate 70 turns in a westerly direction and is traveled 2 mi until Interstate 70 and Interstate 76 merge. Interstate 70/76 is then traveled 87 mi to New Stanton, Pennsylvania at which point Interstate 70 branches off from Interstate 76. Interstate 70 is then driven northwest 5 mi into Washington, Pennsylvania where Interstate 70 intersects with Interstate 79. Travel continues on Interstate 70 from Washington, Pennsylvania 149 mi into Columbus, Ohio. At the city limits of Columbus, Interstate 270 (a by-pass) is taken north 21 mi until it reconnects with Interstate 70. Interstate 70 is then taken west 160 mi to Indianapolis, Indiana. At Indianapolis, Interstate 465 is driven south around Indianapolis for about 19 mi until it reconnects with Interstate 70. Interstate 70 is then traveled west 131 mi into Teutopolis, Illinois. At Teutopolis, Interstate 70 becomes Interstate 57 and is driven approximately 6 mi back to Interstate 70 in Effingham, Illinois. Interstate 70 is then traveled 77 mi west into Edwardsville, Illinois. At Edwardsville, Interstate 270 is taken and traveled 30 mi into St. Louis, Missouri. At St. Louis, Interstate 70 is taken west, 224 mi to Kansas City, Missouri. At Kansas City, Missouri, Interstate 435 is taken and is driven 31 mi west into Kansas City, Kansas. At Kansas City, Kansas, Interstate 70 is taken 46 mi west to Topeka, Kansas. Interstate 470 is traveled for 12 mi around the Topeka city limits. At this point, Interstate 470 reconnects with Interstate 70, which is driven for 1,037 mi west through Colorado and into Cove Fort, Utah. At Cove Fort, Interstate 15 is driven southwest 161 mi through northwest Arizona and to the Nevada border. This national route would likely use NV-1 or NV-2.

Generator: Ames Laboratory (Ames-1), Ames, Iowa

The primary transportation route from the Ames Laboratory to the Nevada border consists of traveling 3 mi^2 on local roads to Ames, Iowa. At Ames, U.S. Highway 30 is traveled to Interstate 35. Interstate 35 is then driven south 25 mi to Des Moines, Iowa. In Des Moines, Interstate 35 merges with Interstate 80 and is traveled west for 14 mi around the Des Moines city limits until Interstate 80 branches off from Interstate 35. Interstate 80 is then taken west for 96 mi to Minden, Iowa. At Minden, Interstate 680 is driven 16 mi to Loveland, Iowa where Interstate 680 combines with Interstate 29. At Loveland, Interstate 680/29 is traveled for 10 mi to Crescent, Iowa. At Crescent, Interstate 680 branches off from Interstate 29 and is traveled west 17 mi into Omaha, Nebraska. At Omaha, Interstate 80 is driven 343 mi to Big Springs, Nebraska. At Big Springs, Interstate 76 is traveled west 186 mi to Arvada, Colorado. At Arvada, Interstate 70 is taken southwest 502 mi to Cove Fort, Utah. At Cove Fort, Interstate 15 is driven 161 mi through northwest Arizona to the Nevada border. This route would likely continue on NV-1 or NV-2.

Generator: Argonne National Laboratory-East (ANLE-1), Chicago, Illinois

The primary transportation route from the Argonne National Laboratory-east to the Nevada border consists of traveling 1 mi over local roads to Interstate 55 in Darien, Illinois. Interstate 55 is then taken southwest for 23 mi into Joliet, Illinois. At Joliet, Interstate 80 is traveled west for 117 mi to Green Rock, Illinois where Interstate 74 intersects Interstate 80. At Green Rock, Interstate 74 is then traveled west for 9 mi to Quad City Airport, Moline, Illinois and Interstate 280 is taken at that point. Interstate 280 is driven 18 mi around the southwest perimeter of Rock Island, Illinois and Davenport, Illinois. At this point, Interstate 80 is driven west 153 mi into Des Moines, Iowa. At Des Moines, Interstate 80 combines with Interstate 35 and is taken 14 mi until Interstate 80 splits off from Interstate 80/35. Interstate 80 is driven 96 mi from Des Moines to Minden, Iowa. At Minden, Interstate 680 is driven 16 mi to Loveland, Iowa where Interstate 680 merges with Interstate 29. At Loveland, Interstate 680/29 is traveled for 10 mi to Crescent, Iowa. At Crescent, Interstate 29 branches off from Interstate 680 is travel west on Interstate 29 for 17 mi into Omaha, Nebraska. At Omaha, Interstate 80 is driven 343 mi to Big Springs, Nebraska. At Big Springs, Interstate 76 is traveled west 186 mi to Arvada, Colorado. At Arvada, Interstate 70 is then taken southwest 502 mi to Cove Fort, Utah. At Cove Fort, Interstate 15 is driven 161 mi through northwest Arizona to the Nevada border. This route would likely continue on NV-1 or NV-2.

Generator: Argonne National Laboratory - West (ANLW-1), Idaho Falls, Idaho

The primary transportation route from the Argonne National Laboratory-West to the Nevada border begins by traveling 4 mi on local roads to U.S. Highway 20. U.S. Highway 20 is then driven 12 mi to Atomic City, Idaho. At Atomic City, U.S. Highway 26 is driven 36 mi to Blackfoot, Idaho. At Blackfoot, Interstate 15 is taken 112 mi to Tremonton, Utah. At Tremonton, Interstate 15 combines with Interstate 84 and is traveled 30 mi to Ogden, Utah. At Ogden, Interstate 15 is traveled 27 mi to North Salt Lake. At North Salt Lake, Interstate 215 is driven 17 mi to Midvale, Utah back to Interstate 15. At Midvale, Interstate 15 is driven 331 mi through northwest Arizona to the Nevada border. This route would likely continue on NV-1 or NV-2.

Generator: Bettis Atomic Power Laboratory (BAPL), West Mifflin, Pennsylvania

The primary transportation route from the Bettis Atomic Power Laboratory to the Nevada border consists of traveling on local roads for 1 mi to State Route 837 at Dravosburg, Pennsylvania. State Route 837 is driven for 5 mi to Clairton, Pennsylvania to State Route 51. State Route 51 is driven south 12 mi to Interstate 70 located in Wickhaven, Pennsylvania. Interstate 70 is then traveled west 32 mi to Washington, Pennsylvania. From Washington, Interstate 70 is traveled 27 mi southwest into Wheeling, West Virginia. At Wheeling, Interstate 470 is taken 11 mi west to St. Clairsville. At St. Clairsville, Interstate 70 is taken to Columbus, Ohio. At the city limits of Columbus, Interstate 270 is taken north 21 mi until it intersects with Interstate 70. Interstate 70 is then taken west 160 mi to Indianapolis, Indiana. At Indianapolis, Interstate 465 is driven south around Indianapolis for about 19 mi where it re-connects with Interstate 70. Interstate 70 is then traveled west 131 mi into Teutopolis, Illinois. At Teutopolis, Interstate 70 becomes Interstate 57 and is driven approximately 6 mi back to Interstate 70, located in Effingham, Illinois. Interstate 70 is then traveled 77 mi west into Edwardsville, Illinois. At Edwardsville, Interstate 270 is traveled 30 mi into St. Louis, Missouri. At St. Louis, Interstate 70 is once again taken west 224 mi to Kansas City, Missouri. At Kansas City, Missouri, Interstate 435 is driven 31 mi west into Kansas City, Kansas. At Kansas City, Kansas, Interstate 70 is taken approximately 46 mi west past Bonner Springs, Kansas to Topeka, Kansas. At this point, Interstate 470 is traveled for 12 mi around the Topeka city limits until Interstate 470 reconnects with Interstate 70. Interstate 70 is then driven for 1,037 mi west through Colorado and into Cove Fort, Utah. At Cove Fort, Interstate 15 is driven southwest 161 mi through northwest Arizona and to the Nevada border. This route would likely continue on NV-1 or NV-2.

Generator: Brookhaven National Laboratory (BNL-1), Brookhaven, New York

The primary transportation route from the Brookhaven National Laboratory to the Nevada border consists of traveling 1 mi northeast on local roads to Yaphank, New York. Local CR-46 is obtained at Yaphank and traveled 2 mi south to Upton, New York, where Interstate 495 can be taken 51 mi west to New York, New York. At

New York, Interstate 295 is taken from Bayside, New York, northwest for about 3 mi to Locust Point, New York, and then 1 mi to Bronx, New York. Interstate 95/278 is driven through the Bronx until Interstate 95 splits off from Interstate 278. Interstate 95 is taken for 7 mi from the Bronx to the George Washington Bridge, past the bridge for 1 mi to Fort Lee, New Jersey. Interstate 95 is driven through Fort Lee for 4 mi to Bogota, New Jersey, at which point Interstate 95 turns into Interstate 80. Interstate 80 is then traveled 64 mi west to Pahaquarry, New Jersey, and then 2 mi to East Stroudsburg, Pennsylvania. At East Stroudsburg, Interstate 80 is driven west 330 mi to North Jackson, Ohio. At North Jackson, Interstate 80 is taken northwest 74 mi to Elyria, Ohio, where Interstate 80 combines with Interstate 90. Interstate 80/90 is then taken 281 mi to Portage, Indiana, where Interstate 80 branches off from Interstate 90. At Portage, Interstate 80 is taken for approximately 1 mi to Lake Station, Indiana, at which point Interstate 80 combines with Interstate 94. Interstate 80/94 is then traveled 19 mi to Lansing, Illinois, where Interstate 94 branches off, and Interstate 80 combines with Interstate 294. Interstate 80/294 is driven west for 5 mi to Homewood, Illinois. At Homewood, Interstate 80 branches off and is taken 146 mi to Green Rock, Illinois. At Green Rock, Interstate 74 is then traveled west for 9 mi to Quad City Airport, Moline, Illinois. At that point Interstate 280 is driven 18 mi around the southwest perimeter of Rock Island, Illinois, and Davenport, Illinois, until Interstate 80 is once again picked up. At this point, Interstate 80 is driven west 153 mi into Des Moines, Iowa. At Des Moines, Interstate 80 combines with Interstate 35 and is taken 14 mi until Interstate 80 splits off from Interstate 80/35. Interstate 80 is driven 96 mi from Des Moines to Minden, Iowa. At Minden, Interstate 680 is driven 16 mi to Loveland, Iowa, where Interstate 680 merges with Interstate 29. At Loveland, Interstate 680/29 is traveled for 10 mi to Crescent, Iowa. At Crescent, Interstate 680 branches off from Interstate 29 and is traveled west 17 mi into Omaha, Nebraska. At Omaha, Interstate 80 is driven 343 mi to Big Springs, Nebraska. At Big Springs, Interstate 76 is traveled west 186 mi to Arvada, Colorado. At Arvada, Interstate 70 is then taken southwest 502 mi to Cove Fort, Utah. At Cove Fort, Interstate 15 is driven 161 mi through northwest Arizona and to the Nevada border. This route would likely continue on NV-1 or NV-2.

Generator: Fernald Environmental Management Project (FEMP-1), Fernald, Ohio

The primary transportation route from the Fernald Environmental Management Project to the Nevada border consists of traveling 7 mi from the Fernald Plant to Miamitown, Ohio. At Miamitown, Interstate 275/274 is traveled west for 2 mi to Harrison, Ohio, at which point Interstate 274 branches off from Interstate 74. At Harrison, Interstate 74 is driven 81 mi northwest to Indianapolis, Indiana, where Interstate 74 combines with Interstate 465. Interstate 465 is taken for about 20 mi until it intersects with Interstate 70. Interstate 70 is then traveled west 131 mi into Teutopolis, Illinois. At Teutopolis, Interstate 70 becomes Interstate 57 and is driven approximately 6 mi to Interstate 70, located in Effingham, Illinois. Interstate 70 is then traveled 77 mi west into Edwardsville, Illinois. At Edwardsville, Interstate 270 is traveled 30 mi into St. Louis, Missouri. At St. Louis, Interstate 70 is once again taken west 224 mi to Kansas City, Missouri. At Kansas City, Missouri Interstate 435 is driven 31 mi west into Kansas City, Kansas. At Kansas City, Kansas Interstate 70 is taken approximately 46 mi west past Bonner Springs, Kansas to Topeka, Kansas. At this point, Interstate 470 is traveled for 12 mi around the Topeka city limits until Interstate 470 intersects with Interstate 70. Interstate 70 is then driven for 1,037 mi west through Colorado and into Cove Fort, Utah. At Cove Fort, Interstate 15 is driven southwest 161 mi through northwest Arizona and to the Nevada border. This route would likely continue on NV-1 or NV-2.

Generator: Fernald Environmental Management Project (FEMP-2), Fernald, Ohio

One alternate transportation route from the Fernald Environmental Management Project to the Nevada border consists of traveling south for 7 mi on State Route 128 to Miamitown, Ohio. Interstate 275/74 is taken west 2 mi to Harrison, Ohio, where Interstate 275 branches off from Interstate 74. Interstate 275 is taken west 25 mi to Erlanger, Kentucky to Interstate 71/75. Interstate 71/75 is driven south for 12 mi to Walton, Kentucky, at which point Interstate 71 and Interstate 75 branch off. Interstate 71 is then traveled from Walton southwest 76 mi to Louisville, Kentucky. At Louisville, Interstate 64 is traveled 181 mi to Mt. Vernon, Illinois. At Mt. Vernon, Interstate 64 combines with Interstate 57 for 5 mi. At this point, Interstate 64 branches off from Interstate 57 and is traveled 67 mi to Washington Park, Illinois. At Washington Park, Interstate 255 is driven 21 mi west to St. Louis, Missouri. At St. Louis, Interstate 270 is taken around the city limits 6 mi to Interstate 44. Interstate 44 is then traveled 276 mi west past Joplin, Missouri, and another 17 mi past Miami, Oklahoma, continuing 72 mi past Catoosa, Oklahoma, and another 20 mi past Oakhurst, Oklahoma proceeding 86 mi to Oklahoma City, Oklahoma, where Interstate 35 and Interstate 44 combine. Interstate 35/44 is driven 5 mi through Oklahoma City to the point where Interstate 44 branches off from Interstate 35. Interstate 44 is then driven from Oklahoma City 10 mi to Interstate 40. Interstate 40 is driven 1,004 mi through the Texas Panhandle and New Mexico to Kingman, Arizona. At Kingman, U.S. Highway 93 is driven northwest 72 mi to the Nevada border. This route would likely continue on NV-4 or NV-5.

Generator: Fernald Environmental Management Project (FEMP-3), Fernald, Ohio

One alternate transportation route from the Fernald Environmental Management Project to the Nevada border consists of traveling south for 7 mi on State Route 128 to Miamitown, Ohio. Interstate 275/ 74 is taken west 2 mi to Harrison, Ohio, where Interstate 275 branches off from Interstate 74. Interstate 275 is taken west 25 mi to Erlanger, Kentucky, to Interstate 71/75. Interstate 71/75 is driven south for 12 mi to Walton, Kentucky, at which point Interstate 71 and Interstate 75 branch off. Interstate 71 is then traveled from Walton southwest 76 mi to Louisville, Kentucky. At Louisville, Interstate 64 is traveled 181 mi to Mt. Vernon, Illinois. At Mt. Vernon, Interstate 64 combines with Interstate 57 for 5 mi. At this point, Interstate 64 branches off from Interstate 57 and is traveled 67 mi to Washington Park, Illinois. At Washington Park, Interstate 255 is driven 21 mi west to St. Louis, Missouri. At St. Louis, Interstate 270 is taken around the city limits 6 mi to Interstate 44. Interstate 44 is then traveled 276 mi west past Joplin, Missouri, and another 17 mi past Miami, Oklahoma. Interstate 44 is continued past Miami 72 mi to Catoosa, Oklahoma, and another 20 mi to Oakhurst, Oklahoma proceeding 86 mi to Oklahoma City, Oklahoma, where Interstate 35 and Interstate 44 combine. Interstate 35/44 is driven 5 mi through Oklahoma City to the point where Interstate 44 branches off from Interstate 35. Interstate 44 is then driven from Oklahoma City 10 mi to Interstate 40. Interstate 40 is driven 1,085 mi through the Texas Panhandle, New Mexico and Arizona to Needles, California. At Needles, U.S. Highway 95 is driven 23 mi north to the Nevada border. This route would likely continue on NV-6 or NV-7.

Generator: Fernald Environmental Management Project (FEMP-4), Fernald, Ohio

One alternate transportation route from the Fernald Environmental Management Project to the Nevada border consists of traveling south for 7 mi on State Route 128 to Miamitown, Ohio. Interstate 275/74 is taken west 2 mi to Harrison, Ohio, where Interstate 275 branches off from Interstate 74. Interstate 275 is taken west 25 mi to Erlanger, Kentucky, to Interstate 71/75. Interstate 71/75 is driven south for 12 mi to Walton, Kentucky, at which point Interstate 71 and Interstate 75 branch off. Interstate 71 is then traveled from Walton southwest 76 mi to Louisville, Kentucky. At Louisville, Interstate 64 is traveled 181 mi to Mt. Vernon, Illinois. At Mt. Vernon, Interstate 64 combines with Interstate 57 for 5 mi. At this point, Interstate 64 branches off from Interstate 57 and is traveled 67 mi to Washington Park, Illinois. At Washington Park, Interstate 255 is driven 21 mi west to St. Louis, Missouri. At St. Louis, Interstate 270 is taken around the city limits 6 mi to Interstate 44. Interstate 44 is then traveled 471 mi west to Oklahoma City, Oklahoma, where Interstate 35 and Interstate 44 combine.

Interstate 35/44 is driven 5 mi through Oklahoma City to the point where Interstate 44 branches off from Interstate 35. Interstate 44 is then driven from Oklahoma City 10 mi to Interstate 40. Interstate 40 is driven 1,217 mi through the Texas Panhandle, New Mexico, and Arizona to Barstow, California. At Barstow, Interstate 15 is driven 112 mi north to the Nevada border. This route would likely continue on NV-8 or NV-9.

Generator: Fermi National Accelerator Laboratory (FNAL-1), Batavia, Illinois

The primary transportation route from the Fermi National Accelerator Laboratory to the Nevada border consists of traveling on local roads west 3 mi to Batavia, Illinois. At Batavia, State Route 31 is taken south for 4 mi to North Aurora, Illinois, where Interstate 88 is located. Interstate 88 is then traveled west 117 mi to Rapids City, Illinois. At Rapids City, Interstate 80 is driven 7 mi to Green Rock, Illinois. At Green Rock, Interstate 74 is then taken west for 9 mi to Quad City Airport, Moline, Illinois, where Interstate 280 is driven 18 mi around the southwest perimeter of Rock Island, Illinois, and Davenport, Illinois, until Interstate 80 is once again intercepted. At this point, Interstate 80 is driven west 153 mi into Des Moines, Iowa. At Des Moines, Interstate 80 combines with Interstate 35 and is taken 14 mi until Interstate 80 splits off from Interstate 80/35. Interstate 80 is driven 96 mi from Des Moines to Minden, Iowa. At Minden, Interstate 680 is driven 16 mi to Loveland, Iowa, where Interstate 680 combines with Interstate 29. At Loveland, Interstate 680/29 is traveled for 10 mi to Crescent, Iowa. At Crescent, Interstate 680 branches off from Interstate 29 and is traveled west 17 mi into Omaha, Nebraska. At Omaha, Interstate 80 is driven 343 mi to Big Springs, Nebraska. At Big Springs, Interstate 76 is traveled west 186 mi to Arvada, Colorado. At Arvada, Interstate 70 is then taken southwest 502 mi to Cove Fort, Utah. At Cove Fort, Interstate 15 is driven 161 mi through northwest Arizona and to the Nevada border. This route would likely continue on NV-1 or NV-2.

Generator: Hanford Site (HS-1), Richland, Washington

The primary transportation route from the Hanford Site to the Nevada border consists of traveling 4 mi on LR-4S to Richland, Washington. At Richland, State Route 240 is driven west for 7 mi through Richland to Interstate 182. Interstate 182 is then traveled for 5 mi to West Richland, Washington, to Interstate 82. Interstate 82 is then driven from West Richland south for 41 mi to Hermiston, Oregon, to Interstate 84. Interstate 84 is driven 512 mi southeast through Idaho and into Tremonton, Utah, where Interstate 82 combines with Interstate 15. Interstate 15/82 is then traveled 39 mi south to Ogden, Utah, at which point Interstate 15 branches off from Interstate 84. At Ogden, Interstate 15 is taken south 27 mi to North Salt Lake, Utah. At North Salt Lake, Interstate 215 is driven 17 mi around Salt Lake City, Utah, to Midvale, Utah. At Midvale, Interstate 15 is traveled south for 331 mi into northwest Arizona and up to the Nevada border. This route would likely continue on NV-1 or NV-2.

Generator: Hanford Site (HS-2), Richland, Washington

One alternate transportation route from the Hanford Site to the Nevada border consists of traveling 4 mi on LR-4S to Richland, Washington. At Richland, State Route 240 is driven west for 7 mi through Richland to Interstate 182. Interstate 182 is driven 5 mi to West Richland, Washington, to Interstate 82. At West Richland, Interstate 82 is driven 41 mi to Hermiston, Oregon to Interstate 84. Interstate 84 is then driven 371 mi southeast to Twin Falls, Idaho. U.S. Highway 93 is traveled south 7 mi through Twin Falls to U.S. Highway 30/95. U.S. Highway 30/95 is driven for 5 mi west to Filer, Utah, to U.S. Highway 93. U.S. Highway 93 is then traveled 42 mi from Filer to the Nevada border. This route would likely continue on NV-3.

Generator: Idaho National Engineering Laboratory (INEL-1), Idaho Falls, Idaho

The primary transportation route from the Idaho National Engineering Laboratory to the Nevada border consists of traveling 1 mi on local roads through the Idaho National Engineering Laboratory to U.S. Highway 20/26. U.S. Highway 20/26 is then driven 4 mi to Atomic City, Idaho. U.S. Highway 26 is then driven southeast 36 mi to Blackfoot, Idaho, to Interstate 15. Interstate 15 is then traveled south 112 mi to Tremonton, Utah. At Tremonton, Interstate 15/84 is then taken 39 mi south to Ogden, Utah, at which point Interstate 15 branches off from Interstate 84. At Ogden, Interstate 15 is taken south 27 mi to North Salt Lake, Utah. At North Salt Lake, Interstate 215 is driven 17 mi around Salt Lake City, Utah, to Midvale, Utah. At Midvale, Interstate 15 is traveled south for 331 mi into northwest Arizona and up to the Nevada border. This route would likely continue on NV-1 or NV-2.

Generator: Idaho National Engineering Laboratory (INEL-2), Idaho Falls, Idaho

One alternate transportation route from the Idaho National Engineering Laboratory to the Nevada border consists of traveling 1 mi on local roads through the Idaho National Laboratory to U.S. Highway 20/26. U.S. Highway 20/26 is then driven 4 mi to Atomic City, Idaho. U.S. Highway 26 is then driven southeast 36 mi to Blackfoot, Idaho, to Interstate 15. At Blackfoot, Interstate 15 is driven 20 mi to Chubbuck, Idaho. At Chubbuck, Interstate 86 is driven 63 mi southwest to Raft River, Idaho. At Raft River, Interstate 84 is taken 49 mi to Twin Falls, Idaho, to U.S. Highway 93. U.S. Highway 93 is traveled south 7 mi through Twin Falls to U.S. Highway 30/95. U.S. Highway 30/95 is driven for 5 mi west to Filer, Utah, to U.S. Highway 93. U.S. Highway 93 is then traveled 42 mi from Filer to the Nevada border. This route would likely continue on NV-3.

Generator: Inhalation Toxicological Research Institute (ITRI-1), Albuquerque, New Mexico

The primary transportation route from the Inhalation Toxicological Research Institute to the Nevada border consists of traveling through Albuquerque, New Mexico for 11 mi on local roads to Interstate 40. Interstate 40 is then driven 474 mi west to Kingman, Arizona. At Kingman, U.S. Highway 93 is traveled 72 mi northwest to the Nevada border. This route would likely continue on NV-4 or NV-5.

Generator: Inhalation Toxicological Research Institute (ITRI-2), Albuquerque, New Mexico

One alternate transportation route from the Inhalation Toxicological Research Institute to the Nevada border consists of traveling through Albuquerque, New Mexico for 11 mi on local roads to Interstate 40. Interstate 40 is then driven 555 mi west through Arizona to Needles, California. At Needles, U.S. Highway 95 is traveled 23 mi northwest to the Nevada border. This route would likely continue on NV-6 or NV-7.

Generator: Inhalation Toxicological Research Institute Albuquerque (ITRI-3), New Mexico

One alternate transportation route from the Inhalation Toxicological Research Institute to the Nevada border consists of traveling through Albuquerque, New Mexico for 11 mi on local roads to Interstate 40. Interstate 40 is then driven 687 mi west through Arizona to Barstow, California. At Barstow, Interstate 15 is traveled 112 mi northwest to the Nevada border. This route would likely continue on NV-8 or NV-9.

Generator: Knolls Atomic Power Laboratory (KAPL-1), Schenectady, New York

The primary transportation route from the Knolls Atomic Power Laboratory to the Nevada border consists of traveling 4 mi on local roads to Schenectady, New York. State Route 7 is then taken about 2 mi to Interstate 890 in Schenectady. Interstate 890 is driven south from Schenectady for about 1 mi to Interstate 90, which is then driven west 266 mi to Buffalo, New York. Interstate 90 is then traveled for 9 mi south to Lackawanna, New York. At Lackawanna, Interstate 90 is continued 66 mi along the coast of Lake Erie southwest to Ripley, New York. At Ripley, Interstate 90 is again continued 106 mi to Willoughby Hills, Ohio. At Willoughby Hills, Interstate 271 is driven 14 mi to Bedford, Ohio. At Bedford, Interstate 480 is driven west through Cleveland 30 mi to North Ridgeville, Ohio. Interstate 80 is acquired in North Ridgeville and is traveled 8 mi to Elyria, Ohio. At Elyria, Interstate 80 combines with Interstate 90. Interstate 80/Interstate 90 is then taken 281 mi to Portage, Indiana, where Interstate 80 branches off from Interstate 90. At Portage, Interstate 80 is taken for approximately 1 mi to Lake Station, Indiana, at which point Interstate 80 combines with Interstate 94. Interstate 80/94 is then traveled 19 mi to Lansing, Illinois, where Interstate 94 branches off and Interstate 80 combines with Interstate 294. Interstate 80/294 is driven west for 5 mi to Homewood, Illinois. At Homewood, Interstate 80 branches off and is taken 146 mi to Green Rock, Illinois. At Green Rock, Interstate 74 is then traveled west for 9 mi to Quad City Airport, Moline, Illinois, where Interstate 280 is driven 18 mi around the southwest perimeter of Rock Island, Illinois, and Davenport, Illinois, until Interstate 80 is once again intercepted. At this point, Interstate 80 is driven west 153 mi into Des Moines, Iowa. At Des Moines, Interstate 80 combines with Interstate 35 and is taken 14 mi until Interstate 80 splits off from Interstate 80/35. Interstate 80 is driven 96 mi from Des Moines to Minden, Iowa. At Minden, Interstate 680 is driven 16 mi to Loveland, Iowa, where Interstate 680 combines with Interstate 29. At Loveland, Interstate 680/29 is traveled for 10 mi to Crescent, Iowa. At Crescent, Interstate 680 branches off from Interstate 29 and is traveled west 17 mi into Omaha, Nebraska. At Omaha, Interstate 80 is acquired and driven 343 mi to Big Springs, Nebraska. At Big Springs, Interstate 76 is traveled west 186 mi to Arvada, Colorado. At Arvada, Interstate 70 is then taken southwest 502 mi to Cove Fort, Utah. At Cove Fort, Interstate 15 is driven 161 mi through northwest Arizona and to the Nevada border. This route would likely continue on NV-1 or NV-2.

Generator: Los Alamos National Laboratory (LANL-1), Los Alamos, New Mexico

The primary transportation route from the Los Alamos National Laboratory to the Nevada border consists of traveling local roads to State Route 4 in Bandelier, New Mexico. At Bandelier, State Route 4 is driven 1 mi to State Route 502. State Route 502 is then traveled for 12 mi to Pojoaque, New Mexico, where U.S. Highway 285/84 is traveled 18 mi south into Santa Fe, New Mexico, to U.S. Highway 4. U.S. Highway 4 is driven 2 mi south to Interstate 25, which is then driven 56 mi south to Albuquerque, New Mexico. At Albuquerque, Interstate 40 is driven 468 mi to Kingman, Arizona. At Kingman, U.S. Highway 93 is traveled 72 mi northwest to the Nevada border. This route would likely continue on NV-4 or NV-5.

Generator: Los Alamos National Laboratory (LANL-2), Los Alamos, New Mexico

One alternate transportation route from the Los Alamos National Laboratory to the Nevada border consists of traveling local roads to State Route 4 in Bandelier, New Mexico. At Bandelier, State Route 4 is driven 1 mi to State Route 502. State Route 502 is then traveled for 12 mi to Pojoaque, New Mexico, where U.S. Highway 285/84 can be acquired. U.S. Highway 285/84 is then traveled 18 mi south into Santa Fe, New Mexico, where U.S. Highway 84 is driven 2 mi south to Interstate 25. Interstate 25 is then taken 56 mi south to Albuquerque, New Mexico. At Albuquerque, Interstate 40 is driven 549 mi across Arizona to Needles, California. At Needles, U.S. Highway 95 can be accessed and driven north for 23 mi to the Nevada border. This route would likely continue on NV-6 or NV-7.

Generator: Los Alamos National Laboratory (LANL-3), Los Alamos, New Mexico

One alternate transportation route from the Los Alamos National Laboratory to the Nevada border consists of traveling local roads to State Route 4 in Bandelier, New Mexico. At Bandelier, State Route 4 is driven 1 mi to State Route 502. State

Route 502 is then traveled for 12 mi to Pojoaque, New Mexico, where U.S. Highway 285/84 is traveled 18 mi south into Santa Fe, New Mexico. U.S. Highway 84 is driven 2 mi south to Interstate 25. Interstate 25 is then taken 56 mi south to Albuquerque, New Mexico. At Albuquerque, Interstate 40 is driven 681 mi across Arizona to Barstow, California. At Barstow, Interstate 15 can be accessed and driven north for 112 mi to the Nevada border. This route would likely continue on NV-8 or NV-9.

Generator: Lawrence Berkeley Laboratory (LBL-1), Berkeley, California

The primary transportation route from the Lawrence Berkeley Laboratory to the Nevada border consists of traveling 3 mi on local roads to Berkeley, California. At Berkeley, Interstate 580/80 is traveled 2 mi to Oakland, California where Interstate 580 splits off by itself. Interstate 580 is then driven 1 mi south to Interstate 980 in Piedmont, California. Interstate 980 is driven 2 mi to Oakland, California, to Interstate 880. Interstate 880 is then driven 11 mi southeast to San Leandro, California. At San Leandro, Interstate 238 is traveled for 2 mi to Castro Valley, California, where Interstate 580 is found. Interstate 580 is then taken 47 mi to Vernalis, California. At Vernalis, Interstate 5 is driven 291 mi south to San Fernando, California, where Interstate 210 is then driven 48 mi to Interstate 10 in Pomona, California. Interstate 10 is traveled 17 mi to Ontario, California, where Interstate 15 is accessed and driven 186 mi northeast to the Nevada border. This route would likely continue on NV-8 or NV-9.

Generator: Lawrence Berkeley Laboratory (LBL-2), Berkeley, California

One alternate transportation route from the Lawrence Berkeley Laboratory to the Nevada border consists of traveling 3 mi on local roads to Berkeley, California. At Berkeley, Interstate 580/80 is traveled 2 mi to Oakland, California, where Interstate 580 splits off. Interstate 580 is then driven 1 mi south to Interstate 980 in Piedmont, California. Interstate 980 is driven 2 mi to Oakland, California, to Interstate 880. Interstate 880 is then driven 11 mi southeast to San Leandro, California. At San Leandro, Interstate 238 is traveled for 2 mi to Castro Valley, California, where Interstate 580 is found. Interstate 580 is then taken 47 mi to Vernalis, California. At Vernalis, Interstate 5 is driven 291 mi south to San Fernando, California, where Interstate 210 can be acquired. Interstate 210 is taken 48 mi east to Pomona, California to the Interstate 10. Interstate 10 is then traveled 17 mi to Ontario, California, where Interstate 15 can then be driven 137 mi northeast to Baker, California. At Baker, State Route 127 can be taken 56 mi to Shoshone, California, where State Route 127 combines with State Route 373. State Route 127/373 is driven 34 mi north to the Nevada border. This route would likely continue on NV-10.

Generator: Lawrence Livermore National Laboratory (LLNL-1), Livermore, California

The primary transportation route from the Lawrence Livermore National Laboratory to the Nevada border consists of traveling approximately 3 mi on local roads to Altamont, California. At Altamont, Interstate 580 is accessed and driven south 24 mi to Vernalis, California, to Interstate 5. Interstate 5 is then traveled south 291 mi to San Fernando, California, to Interstate 210. Interstate 210 is then taken 48 mi east to Pomona, California. At Pomona, Interstate 10 is driven 17 mi east to Ontario, California, to Interstate 15. Interstate 15 is then traveled 186 mi northeast from Ontario to the Nevada border. This route would likely continue on NV-8 or NV-9.

Generator: Lawrence Livermore National Laboratory (LLNL-2), Livermore, California

One alternate transportation route from the Lawrence Livermore National Laboratory to the Nevada border consists of traveling approximately 3 mi on local roads to Altamont, California. At Altamont, Interstate 580 is accessed and driven south 24 mi to Vernalis, California, to Interstate 5. Interstate 5 is then traveled south 291 mi to San Fernando, California, to Interstate 210.

Interstate 210 is then taken 48 mi east to Pomona, California. At Pomona, Interstate 10 is driven 17 mi east to Ontario, California, to Interstate 15. Interstate 15 is then taken 137 mi northeast to Baker, California. At Baker, State Route 127 is driven north for 56 mi to Shoshone, California. At Shoshone, State Route 127 combines with State Route 373 and is traveled 34 mi north to the Nevada border. This route would likely continue on NV-10.

Generator: Mound Plant (Mound-1), Miamisburg, Ohio

The primary transportation route from the Mound Facility to the Nevada border consists of traveling 1 mi on local roads to Miamisburg, Ohio, to State Route 725. State Route 275 is then traveled for 3 mi through Miamisburg, to Interstate 75. Interstate 75 is then accessed and driven 18 mi through Dayton, Ohio, to Vandalia, Ohio. At Vandalia, Interstate 70 is driven west 101 mi to Indianapolis, Indiana. At Indianapolis, Interstate 465 is taken past Interstate 74 for about 20 mi until it intersects with Interstate 70. Interstate 70 is then traveled west 131 mi into Teutopolis, Illinois. At Teutopolis, Interstate 70 becomes Interstate 57 and is driven approximately 6 mi to Interstate 70, located in Effingham, Illinois. Interstate 70 is then traveled 77 mi west into Edwardsville, Illinois. At Edwardsville, Interstate 270 is traveled 30 mi into St. Louis, Missouri. At St. Louis, Interstate 70 is again taken west 224 mi to Kansas City, Missouri. At Kansas City, Missouri, Interstate 435 is driven 31 mi west into Kansas City, Kansas. At Kansas City, Kansas, Interstate 70 is taken approximately 4 mi west to Bonner Springs, Kansas. At Bonner Springs, Interstate 70 is continued 42 mi west to Topeka, Kansas. At this point, Interstate 470 is traveled for 12 mi around the Topeka city limits until Interstate 470 intersects with Interstate 70. Interstate 70 is then driven for 1,037 mi west through Colorado and into Cove Fort, Utah. At Cove Fort, Interstate 15 is driven southwest 161 mi through northwest Arizona and to the Nevada border. This route would likely continue on NV-1 or NV-2.

Generator: Oak Ridge Reservation (ORISE-1), Oak Ridge, Tennessee

The primary transportation route from the Oak Ridge Reservation to the Nevada border consists of traveling from Oak Ridge, Tennessee, 7 mi on State Route 62 to Solway, Tennessee. At Solway, State Route 162 is traveled 6 mi east to Knoxville, Tennessee. At Knoxville, Interstate 40/75 is accessed and driven 10 mi west to Farragut, Tennessee, where Interstate 40 splits off from Interstate 75. Interstate 40 is then traveled 156 mi west to Nashville, Tennessee. At Nashville, Interstate 24 is taken south for 1 mi to Interstate 440 where it is driven west 7 mi to Interstate 40. Interstate 40 is then driven from Nashville west for another 215 mi to West Memphis, Tennessee. At West Memphis, Interstate 40 combines with Interstate 55 for 3 mi when Interstate 40 once again splits off. Interstate 40 is then taken west for 443 mi through Arkansas and into Oklahoma City, Oklahoma. At Oklahoma City, Interstate 240 is driven for 17 mi west around Oklahoma City to Interstate 44. Interstate 44 is then traveled north for 5 mi to Interstate 40. Interstate 40 is again accessed and traveled west 1,004 mi through the Texas Panhandle, through New Mexico, and into Kingman, Arizona. At Kingman, U.S. Highway 93 can then be taken northwest 72 mi to the Nevada border. This route would likely continue on NV-4 or NV-5.

Generator: Oak Ridge Reservation (ORISE-2), Oak Ridge, Tennessee

One alternate transportation route from the Oak Ridge Reservation to the Nevada border consists of traveling from Oak Ridge, Tennessee, 7 mi on State Route 62 to Solway, Tennessee. At Solway, State Route 162 is traveled 6 mi east to Knoxville, Tennessee.At Knoxville, Interstate 40/75 is accessed and driven 10 mi west to Farragut, Tennessee, where Interstate 40 splits off from Interstate 75. Interstate 40 is then traveled 156 mi west to Nashville, Tennessee. At Nashville, Interstate 24 is taken south for 1 mi to Interstate 440 where it is driven west 7 mi to Interstate 40. Interstate 40 is then driven from

Nashville west for another 215 mi to West Memphis, Tennessee. At West Memphis, Interstate 40 combines with Interstate 55 for 3 mi when Interstate 40 once again splits off. Interstate 40 is then traveled west for 443 mi through Arkansas and into Oklahoma City, Oklahoma. At Oklahoma City, Interstate 240 is obtained and driven for 17 mi west around Oklahoma City to Interstate 44. Interstate 44 is then traveled north for 5 mi to Interstate 40. Interstate 40 is again accessed and traveled west 1,085 mi through the Texas Panhandle, New Mexico, Arizona, and into Needles, California. At Needles, U.S. Highway 95 can then be taken north 72 mi to the Nevada border. This route would likely continue on NV-6 or NV-7.

Generator: Oak Ridge Reservation (ORISE-3), Oak Ridge, Tennessee

One alternate transportation route from the Oak Ridge Reservation to the Nevada border consists of traveling from Oak Ridge, Tennessee, 7 mi on State Route 62 to Solway, Tennessee. At Solway, State Route 162 is traveled 6 mi east to Knoxville, Tennessee. At Knoxville, Interstate 40/75 is accessed and driven 10 mi west to Farragut, Tennessee, where Interstate 40 splits off from Interstate 75. Interstate 40 is then traveled 156 mi west to Nashville, Tennessee. At Nashville, Interstate 24 is taken south for 1 mi to Interstate 440 where it is driven west 7 mi to Interstate 40. Interstate 40 is then driven from Nashville west for another 215 mi to West Memphis, Tennessee. At West Memphis, Interstate 40 combines with Interstate 55 for 3 mi when Interstate 40 once again splits off. Interstate 40 is then traveled west for 443 mi through Arkansas and into Oklahoma City, Oklahoma. At Oklahoma City, Interstate 240 is driven for 17 mi west around Oklahoma City to Interstate 44. Interstate 44 is then traveled north for 5 mi to Interstate 40. Interstate 40 is again acquired and traveled west 1,217 mi through the Texas Panhandle, New Mexico, Arizona, and into Barstow, California. At Barstow, Interstate 15 is taken north 112 mi to the Nevada border. This route would likely continue on NV-8 or NV-9.

Generator: Paducah Gaseous Diffusion Plant (PGDP-1), Paducah, Kentucky

The primary transportation route from the Paducah Gaseous Diffusion Plant to the Nevada border consists of traveling 3 mi on local roads to Kevil, Kentucky. At Kevil, U.S. Highway 60 is traveled east 8 mi to Paducah, Kentucky. At Paducah, Interstate 24 is driven 44 mi north to Pulleys Mill, Illinois, where Interstate 57 can be found. Interstate 57 is then traveled for 48 mi north to Mt. Vernon, Illinois, at which point Interstate 57 and Interstate 64 combine. Interstate 57/64 are driven 5 mi north to Mt. Vernon where Interstate 64 branches off from Interstate 57. Interstate 64 is then driven 67 mi west to Washington Park, Illinois. Interstate 255 is obtained in Washington Park and is driven 11 mi to Edwardsville, Illinois. At Edwardsville, Interstate 270 is taken 22 mi west to St. Louis, Missouri. At St. Louis, Interstate 70 is taken west 224 mi to Kansas City, Missouri. At Kansas City, Missouri, Interstate 435 is driven 31 mi west into Kansas City, Kansas. At Kansas City, Kansas, Interstate 70 is taken approximately 46 mi west to Topeka, Kansas. At this point, Interstate 470 is traveled for 12 mi around the Topeka city limits until Interstate 470 intersects with Interstate 70. Interstate 70 is then driven for 1,037 mi west through Colorado and into Cove Fort, Utah. At Cove Fort, Interstate 15 is driven southwest 161 mi through northwest Arizona and to the Nevada border. This route would likely continue on NV-1 or NV-2.

Generator: Pantex Plant (Pantex-1), Amarillo, Texas

The primary transportation route from the Pantex Plant to the Nevada border consists of traveling south 4 mi on FR-683 to Pantex, Texas. At Pantex, U.S. Highway 60 is then taken west 7 mi to Amarillo, Texas. At Amarillo, LR-335 is driven west 22 mi around Amarillo to Interstate 40. Interstate 40 is then driven 745 mi west through New Mexico to Kingman, Arizona. At Kingman, U.S. Highway 93 is driven northwest 72 mi to the Nevada border. This route would likely continue on NV-4 or NV-5.

Generator: Pantex Plant (Pantex-2), Amarillo, Texas

One alternate transportation route from the Pantex Plant to the Nevada border consists of traveling south 4 mi on FR-683 to Pantex, Texas. At Pantex, U.S. Highway 60 is then taken west 7 mi to Amarillo, Texas. At Amarillo, LR-335 is driven west 22 mi around Amarillo to Interstate 40. Interstate 40 is then picked up in Amarillo and driven 826 mi west through New Mexico and Arizona to Needles, California. At Needles, U.S. Highway 95 is driven north 23 mi to the Nevada border. This route would likely continue on NV-6 or NV-7.

Generator: Pantex Plant (Pantex-3), Amarillo, Texas

One alternate transportation route from the Pantex Plant to the Nevada border consists of traveling south 4 mi on FR-683 to Pantex, Texas. At Pantex, U.S. Highway 60 is then taken west 7 mi to Amarillo, Texas. At Amarillo, LR-335 is driven west 22 mi around Amarillo to Interstate 40. Interstate 40 is then taken from Amarillo and driven 958 mi west through New Mexico and Arizona to Barstow, California. At Barstow, Interstate 15 is driven north 112 mi to the Nevada border. This route would likely continue on NV-8 or NV-9.

Generator: Portsmouth Gaseous Diffusion Plant (PORTS-1), Portsmouth, Ohio

The primary transportation route from the Portsmouth Gaseous Diffusion Plant to the Nevada border consists of traveling 25 mi north on U.S. Highway 23 to Chillicothe, Ohio. At Chillicothe, U.S. Highway 23 and U.S. Highway 35 combine, and U.S. Highway 23/35 is driven 2 mi until U.S. Highway 23 splits off. U.S. Highway 23 is then taken 37 mi north to Shadeville, Ohio. At Shadeville, Interstate 270 is traveled 11 mi to Columbus, Ohio. At Columbus, Interstate 70 is then taken west for 160 mi to Indianapolis, Indiana. At Indianapolis, Interstate 465 is driven south around Indianapolis for about 20 mi until it intersects with Interstate 70. Interstate 70 is then traveled west 131 mi into Teutopolis, Illinois. At Teutopolis, Interstate 70 becomes Interstate 57 and is driven approximately 6 mi to Interstate 70, located in Effingham, Illinois. Interstate 70 is then traveled 77 mi west into Edwardsville, Illinois. At Edwardsville, Interstate 270 is traveled 30 mi into St. Louis, Missouri. At St. Louis, Interstate 70 is taken west 224 mi to Kansas City, Missouri. At Kansas City, Missouri, Interstate 435 is driven 31 mi west into Kansas City, Kansas. At Kansas City, Kansas, Interstate 70 is taken approximately 46 mi west to Topeka, Kansas. Interstate 470 is traveled for 12 mi around the Topeka city limits. At this point, Interstate 470 intersects with Interstate 70 and is driven for 1,037 mi west through Colorado and into Cove Fort, Utah. At Cove Fort, Interstate 15 is driven southwest 161 mi through northwest Arizona and to the Nevada border. This route would likely continue on NV-1 or NV-2.

Generator: Princeton Plasma Physics Laboratory (PPPL-1), Princeton, New Jersey

The primary transportation route from the Princeton Plasma Physics Laboratory to the Nevada border consists of traveling from the Princeton Laboratory on U.S. Highway 1 for 7 mi to Bakersville, New Jersey. At Bakersville, Interstate 295 is traveled 9 mi to White Horse, New Jersey. At White Horse, Interstate 195 is driven 1 mi to Bordentown, New Jersey. At Bordentown, U.S. Highway 206 is taken south for 2 mi to the point U.S. Highway 130 and U.S. Highway 206 come together. U.S. Highway 130/ U.S. Highway 206 is then traveled 1 mi through Bordentown to where U.S. Highway 206 splits off from U.S. Highway 130. U.S. Highway 206 is then taken 1 mi to Mansfield Square, New Jersey. At Mansfield Square, U.S. Highway 206 is driven 2 mi to Hedding, New Jersey, where Interstate 276 can be found. Interstate 276 is then driven 4 mi to Florence, New Jersey at the New Jersey-Pennsylvania border, and on for 3 mi west to Bristol, Pennsylvania. At Bristol, Interstate 276 is then driven for 31 mi to Valley Forge, Pennsylvania, where Interstate 276 turns into Interstate 76. Interstate 76 is then traveled 166 mi to Breezewood, Pennsylvania. At Breezewood, Interstate 70 and Interstate 76 combine, and Interstate 70/76 is traveled 87 mi to New Stanton, Pennsylvania. At New Stanton, Interstate 70 splits from Interstate 76 and is driven for 38 mi to Laboratory, Pennsylvania. At Laboratory, Interstate 70 and Interstate 79 combine and the road is traveled for 5 mi into Washington, Pennsylvania. At Washington, Interstate 70 splits off from Interstate 79 and is taken west 27 mi to Interstate 470 in Wheeling, West Virginia. Interstate 470 is then traveled to the south of Wheeling for 11 mi. Interstate 70 is once again picked up in St. Clairsville, Ohio. Interstate 70 is then taken from St. Clairsville to Columbus, Ohio, which is 111 mi away. At the city limits of Columbus, Interstate 270 is taken north 21 mi until it intersects with Interstate 70. Interstate 70 is then taken west 160 mi to Indianapolis, Indiana. At Indianapolis, Interstate 465 is driven south for about 19 mi until it intersects with Interstate 70. Interstate 70 is then taken west 131 mi into Teutopolis, Illinois. At Teutopolis, Interstate 70 becomes Interstate 57 and is driven approximately 6 mi to Interstate 70, located in Effingham, Illinois. Interstate 70 is then traveled 77 mi west into Edwardsville, Illinois. At Edwardsville, Interstate 270 is obtained and traveled 30 mi into St. Louis, Missouri. At St. Louis, Interstate 70 is taken west 224 mi to Kansas City, Missouri. At Kansas City, Missouri, Interstate 435 is driven 31 mi west into Kansas City, Kansas. At Kansas City, Kansas, Interstate 70 is taken approximately 46 mi west to Topeka, Kansas. Interstate 470 is taken for 12 mi around the Topeka city limits. At this point, Interstate 470 intersects with Interstate 70 and Interstate 70 is driven for 1,037 mi west through Colorado and into Cove Fort, Utah. At Cove Fort, Interstate 15 is driven southwest 161 mi through northwest Arizona and to the Nevada border. This route would likely continue on NV-1 or NV-2.

Generator: Rocketdyne Division (RD-1), Canoga Park, California (also identified as Energy Technology Engineering Center)

The primary transportation route from the Rocketdyne Division to the Nevada border consists of traveling north 3 mi on State Route 27 to Woodland Hills, California. At Woodland Hills, U.S. Highway 101 is driven 13 mi east to North Hollywood, California. At North Hollywood, State Route 134 is driven 13 mi to Pasadena, California. At Pasadena, Interstate 210 is driven 23 mi to Pomona, California, to Interstate 10. Interstate 10 is then traveled 17 mi east into Ontario, California. At Ontario, Interstate 15 is taken 186 mi northeast to the Nevada border. This route would likely continue on NV-8 or NV-9.

Generator: Rocketdyne Division (RD-2), Canoga Park, California (also identified as Energy Technology Engineering Center)

One alternate transportation route from the Rocketdyne Division to the Nevada border consists of traveling north 3 mi on State Route 27 to Woodland Hills, California. At Woodland Hills, U.S. Highway 101 is taken 13 mi east to North Hollywood, California. At North Hollywood, State Route 134 is driven 13 mi to Pasadena, California, at which point Interstate 210 is driven 23 mi to Pomona, California, to Interstate 10. Interstate 10 is then traveled 17 mi east into Ontario, California. At Ontario, Interstate 15 is driven northeast 137 mi to Baker, California. At Baker, State Route 127 is taken north 56 mi to Shoshone. State Route 127/373 is then traveled 34 mi north to the Nevada border. This route would likely continue on NV-10.

Generator: Rocky Flats Plant (RFP-1), Golden, Colorado

The primary transportation route from the Rocky Flats Plant to the Nevada border consists of traveling 2 mi on local roads to Rocky Flats. At Rocky Flats, State Route 93 is traveled 3 mi to Marshall, Colorado. At Marshall, State Route 128 is then traveled 8 mi to Broomfield, Colorado. At Broomfield, U.S. Highway 36 is driven 9 mi to Thornton, Colorado. Interstate 25 is then traveled 1 mi to Interstate 76 in Commerce City. Interstate 76 is taken 5 mi through Denver, Colorado, to Interstate 70. Interstate 70 is then traveled 502 mi to Cove Fort, Utah. At Cove Fort, Interstate 15 is then taken 161 mi across northwest Arizona and to the Nevada border. This route would likely continue on NV-1 or NV-2.

Generator: Reactive Metals, Inc., (RMI-1), Ashtabula, Ohio

The primary transportation route from the Reactive Metals, Inc., to the Nevada border consists of traveling 3 mi on State Route 11 to Ashtabula, Ohio. In Ashtabula, Interstate 90 is traveled southwest 42 mi to Willoughby Hills, Ohio. At Willoughby, Interstate 271 is driven 14 mi to Bedford, Ohio. At Bedford, Interstate 271 and Interstate 480 combine and are driven 4 mi south to Northfield, Ohio. At Northfield, Interstate 271 splits off from Interstate 480 and is traveled 21 mi to Weymouth, Ohio. At Weymouth, Interstate 71 is driven 12 mi north to Strongsville, Ohio. Interstate 80 is then driven west for 17 mi to Elyria, Ohio. At Elyria, Interstate 80 combines with Interstate 90 and Interstate 80/90 is traveled 281 mi to Portage, Indiana, where Interstate 80 branches off from Interstate 90. At Portage, Interstate 80 is taken for approximately 1 mi to Lake Station, Indiana, at which point Interstate 80 combines with Interstate 94. Interstate 80/94 is then traveled 19 mi to Lansing, Illinois, where Interstate 94 branches off and Interstate 80 combines with Interstate 294. Interstate 80/294 is driven west for 5 mi to Homewood, Illinois. At Homewood, Interstate 80 branches off and is taken 146 mi to Green Rock, Illinois. At Green Rock, Interstate 74 is then traveled west for 9 mi to Quad City Airport, Moline, Illinois, and Interstate 280. Interstate 280 is driven 18 mi around the southwest perimeter of Rock Island, Illinois, and Davenport, Illinois. At this point, Interstate 80 is driven west 153 mi into Des Moines, Iowa. At Des Moines, Interstate 80 combines with Interstate 35 and is taken 14 mi until Interstate 80 splits off from Interstate 80/35. Interstate 80 is taken 96 mi from Des Moines to Minden, Iowa. At Minden, Interstate 680 is driven 16 mi to Loveland, Iowa, where Interstate 680 combines with Interstate 29. At Loveland, Interstate 680/29 is traveled for 10 mi to Crescent, Iowa. At Crescent, Interstate 680 branches off from Interstate 29 and Interstate 680 is traveled west 17 mi into Omaha, Nebraska. At Omaha, Interstate 80 is driven 343 mi to Big Springs, Nebraska. At Big Springs, Interstate 76 is traveled west 186 mi to Arvada, Colorado. At Arvada, Interstate 70 is then taken southwest 502 mi to Cove Fort, Utah. At Cove Fort, Interstate 15 is driven 161 mi through northwest Arizona to the Nevada border. This route would likely continue on NV-1 or NV-2.

Generator: Stanford Linear Accelerator Center (SLAC-1), Palo Alto, California

The primary transportation route from the Stanford Linear Accelerator Center to the Nevada border consists of traveling on Interstate 280 for 22 mi to San Jose, California. At San Jose, Interstate 680 is taken north to Dublin, California. At Dublin, Interstate 580 is driven east 37 mi to Vernalis, California, to Interstate 5. Interstate 5 is then traveled south 291 mi to San Fernando, California, to Interstate 210. Interstate 210 is then taken 48 mi east to Pomona, California. At Pomona, Interstate 10 is driven 17 mi east to Ontario, California, to Interstate 15. Interstate 15 is then traveled 186 mi northeast from Ontario to the Nevada border. This route would likely continue on NV-8 or NV-9.

Generator: Stanford Linear Accelerator Center (SLAC-2), Palo Alto, California

One alternate transportation route from the Stanford Linear Accelerator Center to the Nevada border consists of traveling on Interstate 280 for 22 mi to San Jose, California. At San Jose, Interstate 680 is taken north to Dublin, California. At Dublin, Interstate 580 is driven east 37 mi to Vernalis, California. Interstate 5 is then traveled south 291 mi to San Fernando, California. Interstate 210 is then taken 48 mi east to Pomona, California. At Pomona, Interstate 10 is driven 17 mi east to Ontario, California, to Interstate 15. Interstate 15 is then taken 137 mi northeast to Baker, California. At Baker, State Route 127 is driven north for 56 mi to Shoshone, California. At Shoshone, State Route 127 combines with State Route 373 and is traveled 34 mi north to the Nevada border. This route would likely continue on NV-10.

Generator: Sandia National Laboratories (SNLA-1), Albuquerque, New Mexico

The primary transportation route from Sandia National Laboratories, Albuquerque to the Nevada border consists of traveling 3 mi on local roads to Albuquerque, New Mexico. At Albuquerque, Interstate 40 is taken west for 474 mi to Kingman, Arizona. At Kingman, U.S. Highway 93 is taken north for 72 mi to the Nevada border. This route would likely continue on NV-4 or NV-5.

Generator: Sandia National Laboratories (SNLA-2), Albuquerque, New Mexico

One alternate transportation route from Sandia National Laboratories, Albuquerque, to the Nevada border consists of traveling 3 mi on local roads to Albuquerque, New Mexico. At Albuquerque, Interstate 40 is traveled west 555 mi to Needles, California. At Needles, U.S. Highway 95 is taken north for 23 mi to the Nevada border. This route would likely continue on NV-6 or NV-7.

Generator: Sandia National Laboratories (SNLA-3), Albuquerque, New Mexico

One alternate transportation route from Sandia National Laboratories, Albuquerque, to the Nevada border consists of traveling 3 mi on local roads to Albuquerque, New Mexico where Interstate 40 is accessed and traveled west 687 mi to Barstow, California. At Barstow, Interstate 15 is taken north for 112 mi up to the Nevada border. This route would likely continue on NV-8 or NV-9.

Generator: Sandia National Laboratories, Livermore (SNLL-1), Livermore, California

The primary transportation route from Sandia National Laboratories, Livermore to the Nevada border consists of traveling 2 mi on local roads to Livermore Valley, California. At Livermore Valley, Interstate 580 is driven 25 mi to Vernalis, California. Interstate 5 is then traveled south 291 mi to San Fernando, California. Interstate 210 is then taken 48 mi east to Pomona, California. At Pomona, Interstate 10 is driven 17 mi east to Ontario, California, to Interstate 15. Interstate 15 is then traveled 186 mi northeast from Ontario to the Nevada border. This route would likely continue on NV-8 or NV-9.

Generator: Sandia National Laboratories, Livermore (SNLL-2), Livermore, California

One alternate transportation route from Sandia National Laboratories, Livermore, to the Nevada border consists of traveling 2 mi on local roads to Livermore Valley, California. At Livermore Valley, Interstate 580 is driven 25 mi to Vernalis, California. Interstate 5 is then traveled south 291 mi to San Fernando, California. Interstate 210 is then taken 48 mi east to Pomona, California. At Pomona, Interstate 10 is driven 17 mi east to Ontario, California, to Interstate 15. Interstate 15 is then taken 137 mi northeast to Baker, California. At Baker, State Route 127 is driven north for 56 mi to Shoshone, California. At Shoshone, State Route 127 combines with State Route 373 and is traveled 34 mi north to the Nevada border. This route would likely continue on NV-10.

Generator: Savannah River Site (SRS-1), Aiken, South Carolina

The primary transportation route from the Savannah River Site to the Nevada border consists of traveling 4 mi on local roads to New Ellenton, South Carolina. At New Ellenton, State Route 19 is then taken 12 mi north to Aiken, South Carolina. At Aiken, State Route 19 is driven 6 mi north to Interstate 20. Interstate 20 is traveled west 155 mi to Atlanta, Georgia. At Atlanta, Interstate 285 is traveled 26 mi around the southern part of Atlanta to Interstate 75. Interstate 75 is then traveled 93 mi northwest to East Ridge, Tennessee. At East Ridge, Interstate 24 is taken 133 mi northwest to Nashville, Tennessee. At Nashville, Interstate 24 is taken south for 1 mi to Interstate 440 where it is driven west 7 mi to Interstate 40. Interstate 40 is then driven from Nashville west for 658 mi into Oklahoma City, Oklahoma. At Oklahoma City, Interstate 240 is taken for 17 mi west around Oklahoma City to Interstate 44. Interstate 44 is then traveled north for 5 mi to Interstate 40. Interstate 40 is traveled west 1,004 mi through the Texas Panhandle, through New Mexico, and into Kingman, Arizona. At Kingman, U.S. Highway 93 is taken northwest 72 mi to the Nevada border. This route would likely continue on NV-4 or NV-5.

Generator: Savannah River Site (SRS-2), Aiken, South Carolina

One alternate transportation route from the

Savannah River Site to the Nevada border consists of traveling 4 mi on local roads to New Ellenton, South Carolina. At New Ellenton, State Route 19 is then taken 12 mi north to Aiken, South Carolina. At Aiken, State Route 19 is driven 6 mi north to Interstate 20. Interstate 20 is traveled west 155 mi to Atlanta, Georgia. At Atlanta, Interstate 285 is traveled 26 mi around the southern part of Atlanta to Interstate 75. Interstate 75 is then traveled 93 mi northwest to East Ridge, Tennessee. At East Ridge, Interstate 24 is taken 133 mi northwest to Nashville, Tennessee. At Nashville, Interstate 24 is taken south for 1 mi to Interstate 440 is then driven west 7 mi to Interstate 40. Interstate 40 is taken from Nashville west for 658 mi into Oklahoma City, Oklahoma. At Oklahoma City, Interstate 240 is driven for 17 mi west around Oklahoma City to Interstate 44. Interstate 44 is then traveled north for 5 mi to Interstate 40. Interstate 40 is traveled west 1,085 mi through the Texas Panhandle, New Mexico, and Arizona into Needles, California. At Needles, U.S. Highway 95 can then be taken north 23 mi to the Nevada border. This route would likely continue on NV-6 or NV-7.

Generator: Savannah River Site (SRS-3), Aiken, South Carolina

One alternate transportation route from the Savannah River Site to the Nevada border consists of traveling 3 mi on local roads to Jackson, South Carolina. At Jackson, State Route 125 is then taken 10 mi north to Beech Island, South Carolina. At Beech Island, State Route 28 is driven 11 mi north to Interstate 20. Interstate 20 is traveled west 135 mi to Atlanta, Georgia. At Atlanta, Interstate 285 is traveled 26 mi around the southern part of Atlanta to Interstate 75. Interstate 75 is then traveled 93 mi northwest to East Ridge, Tennessee. At East Ridge, Interstate 24 is taken 133 mi northwest to Nashville, Tennessee. At Nashville, Interstate 24 is taken south for 1 mi to Interstate 440 where it is driven west 7 mi to Interstate 40. Interstate 40 is then driven from Nashville west for 658 mi into Oklahoma City, Oklahoma. At Oklahoma City, Interstate 240 is driven for 17 mi west around Oklahoma City to Interstate 44. Interstate 44 is then traveled north for 5 mi to Interstate 40. Interstate 40 is taken west 1,217 mi through the Texas Panhandle, New Mexico, and Arizona into Barstow, California. At Barstow, Interstate 15 can then be taken north 112 mi up to the Nevada border. This route would likely continue on NV-8 or NV-9.

Generator: West Valley Demonstration Project (WVDP-1), West Valley, New York

The primary transportation route from the West Valley Demonstration Project to the Nevada border consists of traveling 2 mi on CR-85 to Springville, New York. At Springville, U.S. Highway 219 is traveled north 17 mi to North Boston, New York, to State Route 391. State Route 391 is driven 4 mi to Hamburg, New York. At Hamburg, State Route 75 is driven 2 mi to Interstate 90. Interstate 90 is taken 165 mi to Willoughby Hills, Ohio. At Willoughby Hills, Interstate 271 is driven 14 mi to Bedford, Ohio. At Bedford, Interstate 271 and Interstate 480 combine and is driven 4 mi south to Northfield, Ohio. At Northfield, Interstate 271 splits off from Interstate 480 and is traveled 21 mi to Weymouth, Ohio. At Weymouth, Interstate 71 is driven 12 mi north to Strongsville, Ohio. Interstate 80 is then driven west for 17 mi to Elyria, Ohio. At Elyria, Interstate 80 combines with Interstate 90 and Interstate 80/90 is traveled 281 mi to Portage, Indiana, where Interstate 80 branches off from Interstate 90. At Portage, Interstate 80 is taken for approximately 1 mi to Lake Station, Indiana, at which point Interstate 80 combines with Interstate 94. Interstate 80/Interstate 94 is then traveled 19 mi to Lansing, Illinois, where Interstate 94 branches off and Interstate 80 combines with Interstate 294. Interstate 80/294 is driven west for 5 mi to Homewood, Illinois. At Homewood, Interstate 80 branches off and is taken 146 mi to Green Rock, Illinois. At Green Rock, Interstate 74 is then traveled west for 9.0 mi to Quad City Airport, Moline, Illinois. Interstate 280 is driven 18 mi around the southwest perimeter of Rock Island, Illinois and Davenport, Illinois. At this point, Interstate 80 is driven west 153 mi into Des Moines, Iowa. At Des Moines, Interstate 80 combines with Interstate 35 and is taken 14 mi until Interstate 80 splits off from Interstate 80/35. Interstate 80 is driven 96 mi from Des Moines to Minden, Iowa. At Minden, Interstate 680 is driven 160 mi to Loveland, Iowa, where Interstate 680 combines with Interstate 29. At Loveland, Interstate 680/29 is traveled for 10 mi to Crescent, Iowa. At Crescent, Interstate 680 branches off from Interstate 29 and is traveled west 17 mi into Omaha, Nebraska. At Omaha, Interstate 80 is driven 343 mi to Big Springs, Nebraska. At Big Springs, Interstate 76 is traveled west 186 mi to Arvada, Colorado. At Arvada, Interstate 70 is then taken southwest 502 mi to Cove Fort, Utah. At Cove Fort, Interstate 15 is driven 161 mi through northwest Arizona and to the Nevada border. This route would likely continue on NV-1 or NV-2.

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