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*Office of Civilian Radioactive  
Waste Management*

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**Section 175 Report:**  
*Secretary of Energy's Report to the Congress  
Pursuant to Section 175 of the Nuclear Waste  
Policy Act, As Amended*

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**December 1988**

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**U.S. Department of Energy**  
*Office of Civilian Radioactive Waste Management*

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Washington, DC 20585***

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## EXECUTIVE SUMMARY

Section 175 of the Nuclear Waste Policy Act (NWP), as amended, requires the Secretary to:

*... report to Congress on the potential impacts of locating a repository at the Yucca Mountain site, including the recommendations of the Secretary for mitigation of such impacts and a statement of which impacts should be dealt with by the Federal Government, which should be dealt with by the State with State resources, including the benefit payments under Section 171, and which should be a joint Federal-State responsibility. The report under this subsection shall include the analysis of the Secretary of the authorities available to mitigate these impacts and the appropriate sources of funds for such mitigation.*

Based on the identification of potential effects that may occur in Nevada as a result of the repository program as well as the analyses of the authorities available to the Secretary and appropriate sources of funds for possible mitigation activities, the Secretary concludes that the Department has the necessary authorities and sources of funds, to be administered in close consultation with the State and affected units of local government, to address impacts that may occur throughout the course of the program.

It is further concluded that:

- Program-related effects might occur in at least twelve of the impact categories specified in Section 175(b) of the NWP, as amended. On a Statewide basis, these effects will be minimal. Several small communities may be impacted, but DOE believes that mitigation will be available.
- Because of the uncertainties inherent in projecting worker settlement patterns, four different residential location scenarios were evaluated. The scenarios were used in this report as a basis for identifying a range of potential effects. No one of these four scenarios is viewed as preferred. The same categories are identified as potentially affected under each scenario, although the location and magnitude of the effects vary with each scenario.
- The primary goal of DOE's policy for mitigation is to conduct its activities in a manner that would avoid or minimize significant adverse impacts to the maximum extent practicable.
- An important element in mitigation will be the implementation of a monitoring program to determine whether impacts have been avoided, whether mitigation has been effective in reducing impacts, and whether new impacts have emerged. This monitoring program will be described in the *Socioeconomic Monitoring and Mitigation Plan for Site Characterization (SMMP)*. The conduct of the monitoring program and the collection of data will be closely coordinated with the State and affected units of local government.
- Socioeconomic effects vary not only with the magnitude, duration, and timing of program activities, but also with the capabilities and priorities of the communities experiencing the effects. Therefore, the initial evaluation of need and of appropriate mitigation should be made by the communities experiencing impacts. The evalu-

ation of mitigation to address population-induced impacts should consider distinctions between those impacts that are short-term in nature versus those that are longer in duration. To the extent that these evaluations show the need for assistance from DOE, the Department will work closely with the State or affected unit of local government to reach agreement on the nature and level of such assistance.

- Impacts related to the transportation of radioactive waste and accident management will depend on programmatic decisions concerning waste transport and emergency response capabilities.
- Initial efforts at addressing changes in demand for facilities and services resulting from repository activities should focus on minimization or avoidance through modifications to DOE activities and on accommodation by the jurisdiction through the use of available resources, including additional revenues generated by the repository program, such as payments-equal-to-taxes (PETT). Financial assistance for mitigation can be provided by DOE through a negotiated agreement under authority granted by the Congress in Section 116 of the NWP, as amended. Mitigation to address adverse impacts should be administered by the jurisdictions and entities that customarily provide facilities or services.

Therefore, the Secretary recommends:

- Based on the analyses contained in this report, sufficient authority exists at the local, State, and Federal levels of government to mitigate impacts. Therefore, no additional authority or sources of funds beyond those provided by the Nuclear Waste Policy Act, as amended, are requested at this time.

## 1.0 INTRODUCTION

*This chapter describes the relationship of this report to the Nuclear Waste Policy Act (NWPA) of 1982 and the Nuclear Waste Policy Amendments Act (Amendments Act) of 1987. This chapter specifies the purposes, key assumptions, scope, and outline of this report.*

### 1.1 The Nuclear Waste Policy Act

The U.S. Department of Energy (DOE) Office of Civilian Radioactive Waste Management (OCRWM) is responsible for implementing the Nuclear Waste Policy Act (NWPA) of 1982. This Act requires that DOE develop the nation's first geologic repository for the permanent disposal of spent nuclear fuel and high-level radioactive waste.

DOE identified nine potentially acceptable sites for the repository in February 1983. The suitability of these sites was evaluated in accordance with DOE's siting guidelines, which are defined in the *Federal Register* at 10 CFR Part 960. The results of these evaluations were reported in draft Environmental Assessments (EAs) issued for public review and comment in December 1984 and in the final EAs prepared for the five sites that were nominated for site characterization. The final EAs were issued in May 1986 and incorporated responses to public comments made on the draft EAs. The Secretary of Energy then recommended to the President three sites as suitable for characterization as candidate repository sites: Yucca Mountain, Nevada; Deaf Smith County, Texas; and Hanford, Washington sites. On May 28, 1986, the President approved characterization of these three sites.

The U.S. Congress passed, and on December 22, 1987, the President signed into law, the Nuclear Waste Policy Amendments Act (Amendments Act), which amended the NWPA of 1982. The Amendments Act directs DOE to conduct site characterization at the Yucca Mountain site and to terminate, within ninety days of enactment, all activities related to the repository program, except reclamation, at the Deaf Smith County and the Hanford sites. A *Consultation Draft Site Characterization Plan* (U.S. DOE, 1988a), which provides the details of field activities to be conducted during the site characterization phase, has been prepared for the candidate site at Yucca Mountain, Nevada, and has been provided to the State of Nevada, the Nuclear Regulatory Commission, and other interested parties for comment. The Site Characterization Plan is scheduled to be published in late December 1988.

Section 175(a) of the Act, as amended, directs the Secretary of Energy to report the following to Congress within one year of enactment:

*the potential impacts of locating a repository at the Yucca Mountain site, including the recommendations of the Secretary for mitigation of such impacts and a statement of which impacts should be dealt with by the Federal Government, which should be dealt with by the State with State resources, including the benefits payments under section 171, and which should be a joint Federal-State responsibility. The report under this subsection shall include the analysis of the Secretary of the authorities available to mitigate these impacts and the appropriate sources of funds for such mitigation.*

The categories that are addressed in this report are specified in Section 175(b) and are listed therein as follows:

- (1) education, including facilities and personnel for elementary and secondary schools, community colleges, vocational and technical schools and universities;*
- (2) public health, including the facilities and personnel for treatment and distribution of water, the treatment of sewage, the control of pests and the disposal of solid waste;*
- (3) law enforcement, including facilities and personnel for the courts, police and sheriff's departments, district attorneys and public defenders and prisons;*
- (4) fire protection, including personnel, the construction of fire stations, and the acquisition of equipment;*
- (5) medical care, including emergency services and hospitals;*
- (6) cultural and recreational needs, including facilities and personnel for libraries and museums and the acquisition and expansion of parks;*
- (7) distribution of public lands to allow for the timely expansion of existing, or creation of new, communities and the construction of necessary residential and commercial facilities;*
- (8) vocational training and employment services;*
- (9) social services, including public assistance programs, vocational and physical rehabilitation programs, mental health services, and programs relating to the abuse of alcohol and controlled substances;*
- (10) transportation, including any roads, terminals, airports, bridges, or railways associated with the facility and the repair and maintenance of roads, terminals, airports, bridges, or railways damaged as a result of the construction, operation, and closure of the facility;*
- (11) equipment and training for State and local personnel in the management of accidents involving high-level radioactive waste;*
- (12) availability of energy;*
- (13) tourism and economic development, including the potential loss of revenue and future economic growth;*
- (14) other needs of the State and local governments that would not have arisen but for the characterization of the site and the construction, operation, and eventual closure of the repository facility.*

This report is the response of the Secretary of Energy to Congress pursuant to Section 175 of the Nuclear Waste Policy Act, as amended.

## **1.2 Purposes**

In accordance with Section 175(a) of the Act, the purposes of this report are to:

1. Inform Congress of the impacts on categories specified in Section 175(b) of the Act that may result within Nevada from the repository program.
2. Present the recommendations of the Secretary of Energy for mitigating impacts within Nevada.
3. Specify whether impact mitigation is the responsibility of the Federal Government, of the State of Nevada, or of the Federal and State governments jointly; and identify appropriate resources that may be used for the mitigation of impacts.
4. Identify the authorities available to mitigate impacts that may occur within Nevada as a result of the repository program.

This report does not quantify the degree of the potential impacts, specify the year when they may occur, or estimate the longevity of them. Additionally, this report does not address certain effects that might offset potential impacts, such as tax revenues generated by the repository work force or payments-equal-to-taxes, and, therefore, the analysis cannot be used to calculate the cost of mitigating potential impacts. As such, this report identifies those categories that may be affected by the repository program, but it cannot be used for detailed planning of future needs in Nevada that may result from the program. Current studies being conducted by the affected parties and other studies being conducted by DOE address such detailed planning requirements.

This report contributes to, but does not supplant, ongoing studies being conducted by DOE to ensure that potentially significant adverse effects that may result from the repository program are minimized to the maximum extent practicable. As indicated in the Environmental Assessment for the Yucca Mountain site (U.S. DOE, 1986), DOE does not believe significant adverse effects will result from site characterization activities. Nevertheless, DOE is conducting a variety of studies to determine if this conclusion is valid. These studies include, but are not limited to, monitoring of air and water quality and other environmental factors; monitoring the number of immigrating repository program workers and their residential locations; identifying cultural resources in the Yucca Mountain area and traditional cultural and religious values of American Indian people associated with those resources; evaluating possible rail access routes to the Yucca Mountain site; and evaluating possible highway routes. These studies have been implemented after consultation with affected parties in Nevada. As part of the determination of suitability, an Environmental Impact Statement will be written and will include an analysis of potential impacts associated with constructing, operating, closing, and decommissioning a repository at Yucca Mountain, Nevada.

### **1.3 Key Technical Assumptions**

There are numerous technical assumptions underlying the identification of potential effects in Nevada that may result from the repository program. These assumptions are discussed in more detail in the Appendix. Several of the key technical assumptions are listed here so that the reader may readily understand the discussion of impacts in Chapter 3.

- Because of the inherent uncertainty of economic and demographic projections, four scenarios were used to forecast the residential locations of future repository workers among counties in southern Nevada. Three of these scenarios are based on a survey of workers at the Nevada Test Site, which was conducted in 1988 for the State of Nevada by Planning Information Corporation (PIC, 1988a); one is based on historical data from the U.S. Department of Commerce, Bureau of Economic Analysis, regarding the State of Nevada and each of the counties in southern Nevada.
- Historic economic data from 1969 through 1984 are the basis for forecasting economic characteristics of southern Nevada. Economic trends within and among the counties exhibited during this period are assumed to be similar to those that will exist throughout the forecast period.
- Historic demographic data are the basis for forecasting demographic characteristics of southern Nevada. Labor force participation and mortality rates are assumed to remain at their 1984 levels, while age distribution of migrants to and from the region is assumed to remain as described by 1980 Census data. Average family size for all repository workers is assumed to be the same as that for all migrants to and from the study area.

- When local data are unavailable, national-level demographic characteristics and economic relationships are assumed to reflect local characteristics.
- Resource requirements for the repository, including the amount and cost of labor, materials, and services, are assumed to be as estimated in 1988 by contractors currently involved in the repository program. These estimates are presented in Chapter 2.
- The schedule for siting, constructing, operating, closing, and decommissioning a repository at Yucca Mountain is assumed to be as specified in Section 1.4.
- Historic relative shares of population growth evidenced by subcounty areas within a county from 1960 through 1987 are assumed to remain constant for allocating baseline population growth in the future without the repository program.
- Residential locations of future repository workers within a county are assumed to be similar to those of current Nevada Test Site (NTS) workers, adjusted for the correlation between occupation and residential location observed in the survey of NTS workers.
- Services and facilities capacity in any given subcounty area was not explicitly considered as a limiting factor in allocating the residential locations of future population.
- The most recent services and facilities environment in a subcounty area is assumed to reflect the future services and facilities environment in that area.
- The analysis of transportation effects assumes that busing will be available for transporting repository workers to the Yucca Mountain area during site characterization.

## 1.4 Scope

### 1.4.1 Temporal Scope

The Nuclear Waste Policy Act was amended on December 22, 1987, and Section 175 was included in the Amendments Act. Therefore, this report addresses potential repository-related effects occurring from January 1, 1988, through December 31, 2060. The time frame considered in this report covers the four phases of the repository program including:

• Site Characterization (and licensing)	1988-1998
• Construction	1998-2003
• Operations	2003-2053
• Closure and Decommissioning	2053-2060

Site characterization activities necessary to provide information for the license application to the Nuclear Regulatory Commission (NRC) are assumed to be completed during 1995, when a license application for construction of a geologic repository is expected to be filed with NRC if the site is determined to be suitable for a permanent repository. Some testing and some monitoring activities begun during site characterization will continue during the period from 1995 through 1998.

This schedule assumes that authorization for construction of a geologic repository at Yucca Mountain will be received from NRC in 1998 and that construction will begin pursuant to authorization. The construction phase is expected to last through 2003. The operations phase of the repository program will begin in 2003 and will continue through 2053. The operations phase consists of two components, the emplacement period from 2003 through 2028 and the caretaker period from 2028 through 2053. The closure and decommissioning phase of the repository program is expected to begin in 2053 and to be completed in 2060.

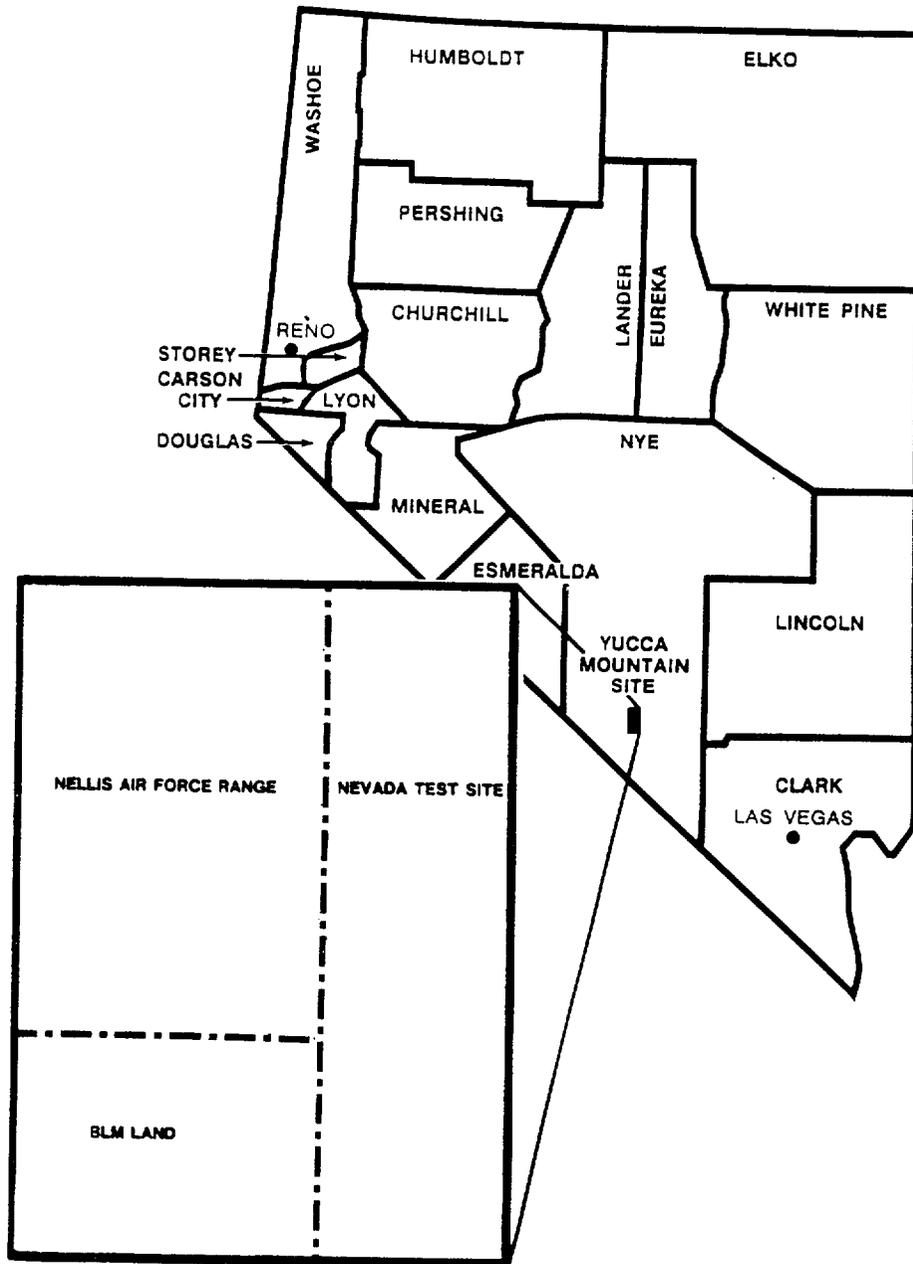
#### **1.4.2 Geographic Scope**

Figure 1-1 indicates counties in Nevada and highlights the Yucca Mountain area. The State as a whole is considered in this report relative to the management of accidents involving high-level radioactive waste and other repository-related needs of State and local governments. Specific areas through which high-level radioactive waste may be transported are not included in the geographic scope because route options are in the process of being identified.

Nye, Esmeralda, Lincoln, and Clark counties are included in the scope of this report because residents of these counties rely on the Las Vegas metropolitan area in Clark County for many services rather than other metropolitan areas. The three metropolitan areas on which Nevadans are likely to rely for the provision of a variety of services commonly provided in metropolitan areas are the Las Vegas area in southern Nevada, the Reno-Sparks-Carson City area in northwest Nevada, and the Salt Lake City area in Utah. Residents of Goldfield in Esmeralda County, of Tonopah in Nye County, and of Caliente in Lincoln County are no more than a four-hour drive from the Las Vegas area. With the exception of Tonopah, which lies halfway between Reno and Las Vegas, residents of these communities are located nearer Las Vegas than other metropolitan areas. Nevadans living in counties other than Nye, Esmeralda, and Lincoln counties are more likely to be drawn toward the Reno-Sparks-Carson City area or the Salt Lake City area because these areas are closer to them.

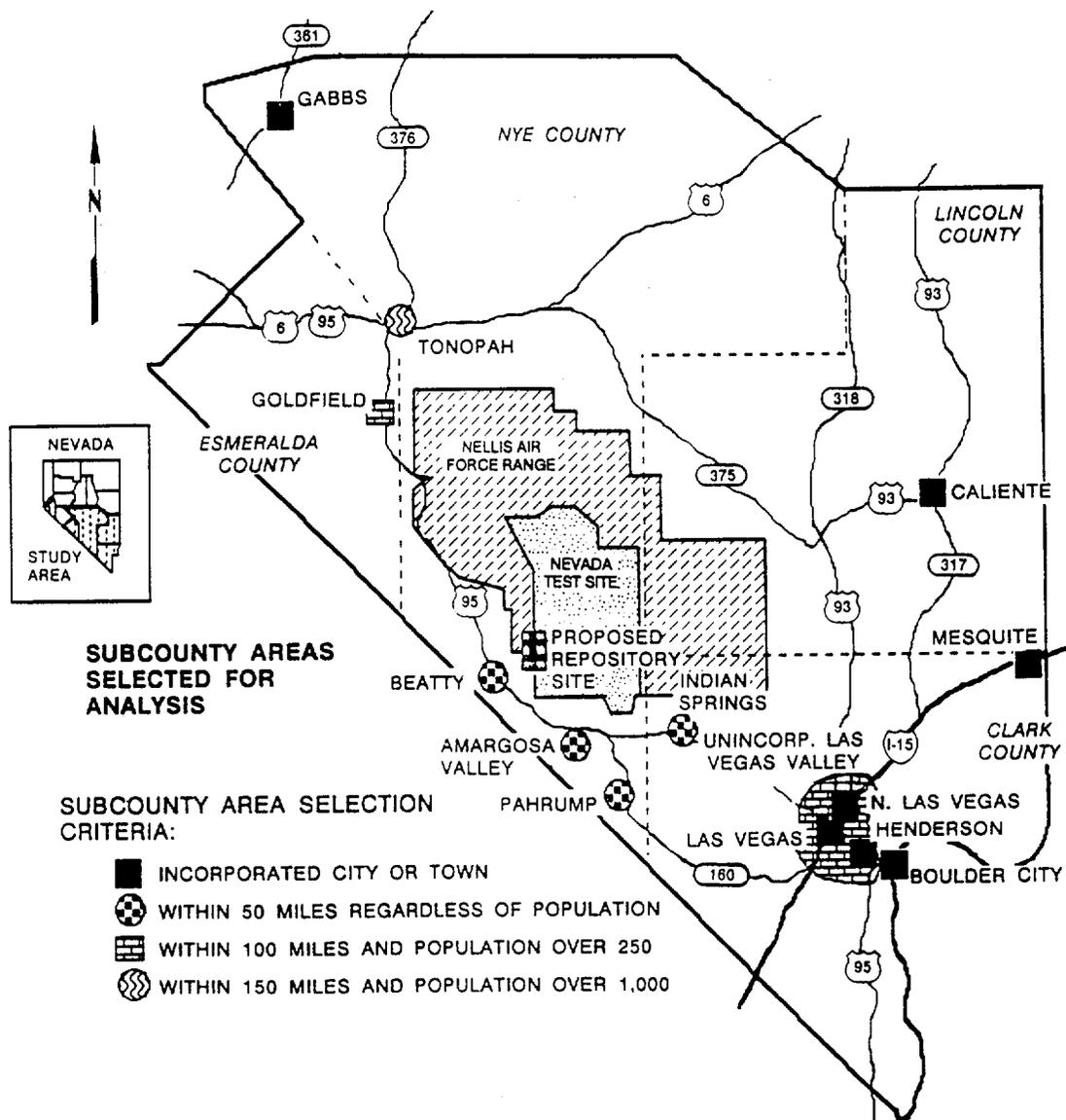
For purposes of this report, communities were selected for more detailed analysis if they met any of the following criteria, which are discussed in the Appendix.

- Incorporated town or city in the four-county area.
- Community within 50 road miles of the Amargosa Valley entrance to the Nevada Test Site, which is the intended entrance for on-site repository program workers.
- Community within 100 road miles of the Amargosa Valley entrance and a population size greater than 250 residents.
- Community within 150 miles of the Amargosa Valley entrance and a population size greater than 1,000 residents.



**Figure 1-1. Counties of Nevada with Inset of Yucca Mountain Site**

These criteria resulted in the following areas being selected for more detailed analysis: Pahrump, Amargosa Valley, Beatty, Tonopah, Gabbs, and rest-of-county in Nye County; Goldfield and rest-of-county in Esmeralda County; Caliente and rest-of-county in Lincoln County; Indian Springs, North Las Vegas, Las Vegas, Henderson, Boulder City, Mesquite, unincorporated Las Vegas Valley, and rest-of-county in Clark County. These areas are indicated in Figure 1-2.



**Figure 1-2. Subcounty Area Locations**

### 1.5 Organization of the Report

Chapter 1.0 describes the relationship between the Nuclear Waste Policy Act and this report and specifies the purposes, key technical assumptions, and geographic and temporal scopes that are addressed in this report. Chapter 2.0 provides a general description of the State of Nevada and the four counties included in this report, the repository project, and the labor and materials that are projected to be used in Nevada for the project. Identification of potential impacts is the focus of Chapter 3.0, where each of the categories specified in Section 175 of the Act is addressed. Chapter 4.0 states the responsibility for mitigation of impacts, specifies the authorities available to mitigate them, and identifies the appropriate sources of

funds for mitigation. Chapter 5.0 states the conclusions of the analyses presented in this report and the recommendation of the Secretary for mitigating impacts that may occur within Nevada from the repository program. The Appendix provides the discussion of methods used in this report to forecast economic and demographic effects of the repository program and to identify potential impacts of the program, which are described in Chapter 3.0. The Appendix also presents economic and demographic forecasts that result from the four residential location scenarios considered in this report.

## 2.0 DESCRIPTION OF THE STUDY AREA AND THE REPOSITORY PROJECT

*This chapter provides a general description of Nevada and Nye, Esmeralda, Lincoln, and Clark counties and describes recent trends in the employment and population characteristics of these areas. This chapter also provides a general description of the repository project and concludes with a description of the size of the work force and expenditures for labor, materials, equipment, and services that are projected to be used in Nevada for the repository program.*

### 2.1 Overviews of the Study Area

#### 2.1.1 State of Nevada

Centrally located in the western sunbelt, the State of Nevada is the seventh largest state in the nation in terms of geographical area, but is forty-third in population size (U.S. Department of Commerce, 1988), after three decades of very rapid population growth. Nevada abounds in public lands, with more than 85 percent of the land administered by the Federal government. Natural resources and recreational opportunities are prevalent in the State and have played an important role in its economic and cultural history. There are many communities within the State, yet Nevadans live primarily in Reno and Las Vegas. More than 80 percent of Nevada's residents lived in these two cities in 1980 (U.S. Department of Commerce, 1983). The visitor who travels outside these two major urban areas encounters great expanses of scenic, but sparsely populated, landscape.

Prior to the arrival of prospectors and miners in the 1840s and 1850s, what is today called Nevada was home to Western Shoshone and Southern Paiute people (D'Azevedo, 1986; Inter-Tribal Council of Nevada, 1976; Steward, 1938). The territory of the Western Shoshone people extended from Idaho through Nevada into California, while Southern Paiute territory extended from northern Arizona and southern Utah through Nevada into Owens Valley, California. These groups occupied well-defined territories and their populations were settled in local bands, centered on lakes, springs, and streams, and dependent on natural and domesticated vegetation and wildlife for their subsistence (Inter-Tribal Council of Nevada, 1976; Steward, 1938). Today, there are four American Indian reservations (Duckwater Shoshone, Yomba Shoshone, Moapa Paiute, and Las Vegas Paiute) located in the four-county study area.

Mineral discoveries made Nevada a destination during the 1850s. The first major gold discovery, the famous Comstock Lode, was near present-day Reno, but major mineral discoveries in southern Nevada's Nye and Lincoln counties around the beginning of the Twentieth Century launched the economic development of these areas (Elliott, 1973: 49-68; Pippin and Zerga, 1981: 54-56). By the late 1860s, prospectors throughout Nevada had penetrated the remotest parts of the State and boom towns sprung up in the desert (Steward, 1938: 7). Nevadans sought and received statehood in 1864, as prospecting for and development of the rich supply of minerals brought more people into Nevada. Other immigrants were ranchers, farmers, and sawmill operators who settled near the markets created by the booming mining districts (Elliott, 1973: 115-124).

In general, Nevada prospered and declined through boom and bust cycles associated with mining and agriculture until development and construction of Hoover Dam in the 1930s and State policy decisions, such as legalized gambling, set the stage for significant change in the State. The trend away from a mining and agricultural economy was further accelerated through Federal expansion and development of defense-related activities in Nevada during and following World War II. Much of this change was concentrated in southern Nevada.

The four counties in southern Nevada that make up the primary focus for this report account for somewhat more than a third of the State's land area. Since 1900, southern Nevada has steadily increased in population and in its influence on the State's economy. These trends were led primarily by Clark County and the Las Vegas area. The creation of Lake Mead by Hoover Dam and the legalization of gambling in 1931 were major factors in the development of southern Nevada as a vacation area that provides both outdoor recreation activities and resort entertainment (Elliott, 1973: 325-329).

Southern Nevada's low population density, rugged terrain, and vast expanses of public land made the area desirable for a variety of military uses in the 1940s. In 1950, those same factors, plus good weather and a readily available labor supply, led to the designation of the 800,000-acre Nevada Test Site (NTS). Since that time, expenditures associated with NTS and various military installations located throughout the State have made large contributions to the State's economy and to the development of southern Nevada (Elliott, 1973: 337-341). By the end of the 1950s, gaming-related services, tourist-supported trade, and government projects had replaced mining and agriculture as the major income producers in the State and in southern Nevada (U.S. Department of Commerce, 1952, 1963).

### **2.1.2 Nye County**

Nye County encompasses 18,155 square miles, making it the largest county in Nevada and one of the largest counties in the nation. It had a population of 15,500 residents in 1987 and a population density of less than one person per square mile, due in part to the large area set aside for the Nevada Test Site and various military uses.

The history of Nye County is largely one of economic and population changes resulting from the discovery and development of various minerals (Elliott, 1973: 211-215). Gold and silver were discovered around 1900 in the area between the present communities of Tonopah and Beatty. During the peak of mining activities, some of the area's mining camps swelled to over 10,000 inhabitants (Pippin and Zerga, 1981: 57), and vestiges of many of these camps are found in the famous ghost towns of the area, such as Rhyolite and Bullfrog. From time to time, as different minerals are needed or new processing technologies are developed, communities in Nye County, such as Tonopah, Beatty, and Amargosa Valley, continue to experience small boom periods during which the population grows and then declines again (Elliott, 1973: 211-282) over the 5 to 25 years of the typical life-cycle of a mine. The length of these mining periods depends on the size and quality of the body of ore, on the world market price, and on the technology available to recover the ore at that price.

The northern portion of Nye County, north of the Nevada Test Site and of the county seat of Tonopah, is mountainous and sparsely settled. Much of the northwestern part is designated as national forest. The Duckwater Shoshone Reservation is located in the northeast corner, and the Yomba Shoshone Reservation, in the northwest portion of the county. Aside from a period during World War II when magnesium mining created a boom at Gabbs in the northwest corner, the economy of the northern Nye County area has depended mainly on ranching, outdoor recreation, and some oil and gas production.

The post-World War II period saw the creation of the Nevada Test Site (NTS) in Nye County. The NTS is operated by the U.S. Department of Energy. In 1988, about 10 percent of NTS workers lived in Nye County, while about 85 percent of NTS workers resided in Clark County (PIC, 1988a).

Located in southern Nye County, the communities of Pahrump and Amargosa Valley have depended on agriculture in the past. Irrigation is possible in these areas, but by the 1980s agricultural activities were minimal. Residents of Pahrump and Tonopah attribute much of their communities' private employment opportunities to trade and services related to tourism (Stiles, 1988; Perchetti, 1988). Tourism is also important for residents of Beatty (Revert, 1988), which serves as the Nevada gateway to Death Valley National Monument.

### **2.1.3 Esmeralda County**

Like Nye County to the east, Esmeralda County is marked by rough terrain and desert shrubs, changing to pinyon and juniper at the higher elevations. Esmeralda County contains Boundary Peak, which at 13,143 feet is the highest point in Nevada. Goldfield, the county seat, is located along U.S. Highway 95 between Beatty and Tonopah.

Esmeralda County's population peaked in the early 1900s, when a large gold deposit was discovered and the Goldfield Mining District was organized. Mining and milling were conducted on a large scale for the times. Goldfield had almost 20,000 residents during the height of the mining activity (Pippin and Zerga, 1981: 58). Hydroelectric plants were developed to support mining and milling activities, and railroads were built to connect Goldfield, Tonopah, Beatty, Rhyolite, and other camps. When a railroad was opened across southern Nevada, between Salt Lake City and Los Angeles, a line was extended from the Goldfield area to the newly developed settlement of Las Vegas, thereby linking Esmeralda and Nye counties' mining activities to the southern part of the State (Elliott, 1973: 211-221). This rail line has long since been abandoned.

Currently, most of the 1,400 residents of Esmeralda County live in Goldfield, Silver Peak, and Dyer. Residents are primarily engaged in mining for their livelihoods or they work for government (State of Nevada, 1985b: 7).

### **2.1.4 Lincoln County**

The southern part of Lincoln County is characterized by relatively low precipitation and arid-land natural vegetation. In the northern half of Lincoln County, there are large areas of rabbitbrush and greasewood, but also many valleys watered by mountain streams and springs that yield wild hay and make good pasture. The county's three major settlements are Pioche, Panaca, and Caliente, all located only a few miles apart on U.S. Highway 93.

Panaca began as a farming community, while the history of Pioche, the current county seat, is linked to the series of mining booms in eastern Nevada. During the first major boom between 1870 and 1872, the Pioche mining area was supplied by communities to the north and in Utah. Several other mining areas have boomed and declined in the area southwest of Pioche and Panaca, including Delamar, Hiko, and the Pahranaagat Valley (Elliott, 1973: 105-110). In the early 1900s, the mining area was linked to Las Vegas by the Salt Lake City-Los Angeles-San Pedro Railroad. Caliente was established at that time as a railroad town (Mack and Sawyer, 1965: 82).

Hundreds of ranches were established in the 1870s to supply beef for the mining towns and feed for the freight-hauling teams (Elliott, 1973: 119). Many of these ranches survived the lean times between mining booms, and agriculture remains an important activity in the county.

Since 1900, the mines in the area have periodically gone through profitable times, most typically during wartime when demands increased for various minerals (Mack and Sawyer, 1965: 99-105). In recent decades, Caliente has been the largest community in the county. During the 1940s and 1950s, the town served as a division point for the Union Pacific Railroad, where crews changed, repairs were made, and water for the steam engines was obtained. The town suffered economic difficulty when locomotives switched from steam to diesel (see Cottrell, 1951) and when Nevada Highway 318, which by-passes Caliente, was paved in 1982 and provided a shorter and faster route between Las Vegas and Ely, Nevada (Van Roeckel, 1988).

Many Lincoln County residents are employed by some level of government, but in general Lincoln County has experienced an economic decline in its other major activities (State of Nevada, 1985c: 7-8). The qualities of the county's small towns are valued by many of the residents, and there seems to be a preference for slow growth rather than for any major project that might change the basic character of the area (Wadsworth, 1988).

### **2.1.5 Clark County**

Clark County fills the southernmost point of the State of Nevada. Clark County is characterized by variety, ranging from the large, neon-lighted resort hotels at the edge of the City of Las Vegas to the 115-mile long Lake Mead National Recreation Area on the Nevada-Arizona border. Between the rapidly urbanizing Las Vegas area and the extensive shoreline of Lake Mead lies Henderson, southern Nevada's main industrial center. The county contains several military installations, the Moapa Valley agricultural area, the Moapa Paiute Reservation, the Las Vegas Paiute Colony, and the 46,000-acre Valley of Fire State Park.

The Las Vegas Valley is quite arid and averages fewer than five inches of precipitation a year (State of Nevada, 1985a: 46-47). Water is stored for use in Lake Mead, which was created by Hoover Dam. The lake provides about 77 percent of the water needs of the Las Vegas Valley (PIC, 1988d), with the remainder of water needs fulfilled by underground wells. Summer temperatures in the Las Vegas area are frequently above 100 degrees, and winter temperatures are mild. The entertainment and gaming facilities, the sunny weather, and outdoor recreation opportunities involving both water and desert environments make the area an increasingly popular vacation destination. This popularity is reflected in the fact that there are more than 60,000 hotel rooms and suites in the county.

Clark County received a major economic boost during the depression years of the 1930s when the Boulder Canyon Project was approved to provide navigation, flood control, and water for irrigation, municipal and industrial use, hydroelectric power generation, and recreation to the Colorado River drainage basin. Construction of Hoover Dam began in 1931 and brought thousands of people to the area in hopes of finding employment (Elliott, 1973: 275-277). Also during the 1930s, the legalization of gambling in the State set the stage for what was eventually to be a major element in the economy of Clark County and of the State (Elliott, 1973: 277-285).

The economic boom associated with World War II provided an important impetus to the development of Las Vegas as a vacation destination, in particular for servicemen and war-industry workers from southern California. The Las Vegas *Strip* began to take shape. At the same time, the city of Henderson was developing around a large magnesium processing plant placed there to take advantage of the power supply from Hoover Dam (Elliott, 1973: 310).

During the 1950s, Las Vegas continued to grow as a center for defense and space industries, and the University of Nevada, Las Vegas was established in 1957. During this period, the Las Vegas area also became an important distribution center because of its geographic proximity to southern California and the State's *free-port privilege*, which exempts goods that are warehoused but not sold in Nevada from the State's personal property tax. By 1960, the Las Vegas metropolitan area had become the State's largest urban area (Elliott, 1973: 325-347).

## 2.2 Recent Employment and Population Trends

Recent employment and population trends are discussed in this section for the State of Nevada and each of the four counties in the study area. The distribution of employment by industry<sup>1</sup> and changes in the number of persons employed and in unemployment rates<sup>2</sup> provide a picture of the condition and changing characteristics of the economy. Table 2.2-1 indicates employment and unemployment trends on a place-of-residence basis from 1960 to 1987. Table 2.2-2 indicates population trends for the same period.

### 2.2.1 State of Nevada

The number of employed persons in Nevada more than quadrupled between 1960 and 1987, from 121,300 to 521,500, reflecting the growing economy of the State. Statewide unemployment rates generally have stayed between 6 and 10 percent since 1970, for the years indicated in Table 2.2-1.

Figure 2.2-1 shows the distribution of employment across industries from 1970 through 1987, with hotels, amusement, and recreation shown separately from the rest of the services industry. The State's largest employer is its services industry, which accounted for 46 percent of 1987 employment. Employment in the gaming sector, primarily classified under hotels, amusement and recreation services, has consistently accounted for almost 25 percent of all jobs in the State since 1970.

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<sup>1</sup> Descriptions of employment by industry were derived from analysis using the REMI model, which is discussed in the Appendix. REMI uses data from the U.S. Department of Commerce, Bureau of Economic Analysis, as input for this analysis. Nye and Esmeralda counties are combined because the Esmeralda economy is too small to provide adequate data for separate analysis of employment by industry. Major employment categories are represented in this section. Industries that provide relatively small proportions of employment have been combined for purposes of presentation.

<sup>2</sup> The level of employment of the labor force in Nevada is gathered by the Nevada Employment Security Department (State of Nevada, 1987a) and is defined on the basis of where a worker resides.

**Table 2.2-1 State of Nevada and County Employment and Unemployment Trends,  
Place-of-Residence Basis, 1960-1987**

	<u>1960</u>	<u>1970</u>	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1987</u>
State of Nevada						
Total Labor Force	127,700	218,300	288,400	430,000	521,000	557,000
Employed	121,300	205,100	260,500	402,600	479,000	521,500
% Unemployed	5.0	6.0	9.7	6.4	8.1	6.4
Nye County						
Total Labor Force	n/a	2,230	1,990	2,570	7,080	7,440
Employed	n/a	2,190	1,890	2,450	6,640	6,640
% Unemployed	n/a	1.8	5.0	4.7	6.2	10.8
Esmeralda County						
Total Labor Force	n/a	210	180	240	770	700
Employed	n/a	200	170	220	720	650
% Unemployed	n/a	4.8	5.6	8.3	6.5	7.1
Lincoln County						
Total Labor Force	n/a	1,050	1,300	1,910	2,230	2,140
Employed	n/a	940	1,200	1,840	2,080	1,870
% Unemployed	n/a	10.5	7.7	3.7	6.7	12.6
Clark County						
Total Labor Force	55,400	116,200	156,000	237,700	294,500	323,700
Employed	52,500	109,000	139,400	221,300	269,200	302,700
% Unemployed	5.2	6.2	10.6	6.9	8.6	6.5

Source: Nevada Employment Security Department, years indicated

**Table 2.2-2 State of Nevada and County Population Trends, 1960-1987, with Average Annual Growth Rates from Previous Period**

	1960 <sup>1</sup>	1970 <sup>1</sup>	1975 <sup>2</sup>	1980 <sup>1</sup>	1985 <sup>3</sup>	1987 <sup>3</sup>
State of Nevada	285,278	488,738	620,000	800,493	967,820	1,053,230
Average Annual Growth <sup>4</sup>		5.4%	4.8%	5.1%	3.8%	4.2%
Nye County	4,374	5,599	5,500	9,048	14,850	15,520
Average Annual Growth <sup>4</sup>		2.5%	-0.4%	10.0%	9.9%	2.2%
Esmeralda County	619	629	700	777	1,380	1,380
Average Annual Growth <sup>4</sup>		0.2%	2.1%	2.1%	11.5%	0.0%
Lincoln County	2,431	2,557	2,800	3,732	4,200	4,250
Average Annual Growth <sup>4</sup>		0.5%	1.8%	5.7%	2.4%	0.6%
Clark County	127,016	273,288	351,300	463,087	572,140	631,920
Average Annual Growth <sup>4</sup>		7.7%	5.0%	5.5%	4.2%	5.0%

<sup>1</sup> U.S. Bureau of the Census, 1983. 1980 Census of Population, Vol. 1; Number of Inhabitants, Part 30: Nevada. PC-80-1-A30, U.S. Department of Commerce, Washington, DC.

<sup>2</sup> U.S. Department of Commerce, 1986. Bureau of Economic Analysis, Regional Economic Information System. Income by Source. April. Washington, DC.

<sup>3</sup> Bryan, Governor Richard H. 1987. Transmittal to John P. Comeaux, Executive Director, Department of Taxation. "Populations of Nevada Counties and Incorporated Cities: 1980 Actuals; 1981 through 1987 Official State Estimates." December 31. Carson City, NV.

<sup>4</sup> Average annual growth rate =  $[\text{Ln}(\text{end population}) - \text{Ln}(\text{beginning population})] / \text{years in period}$ .

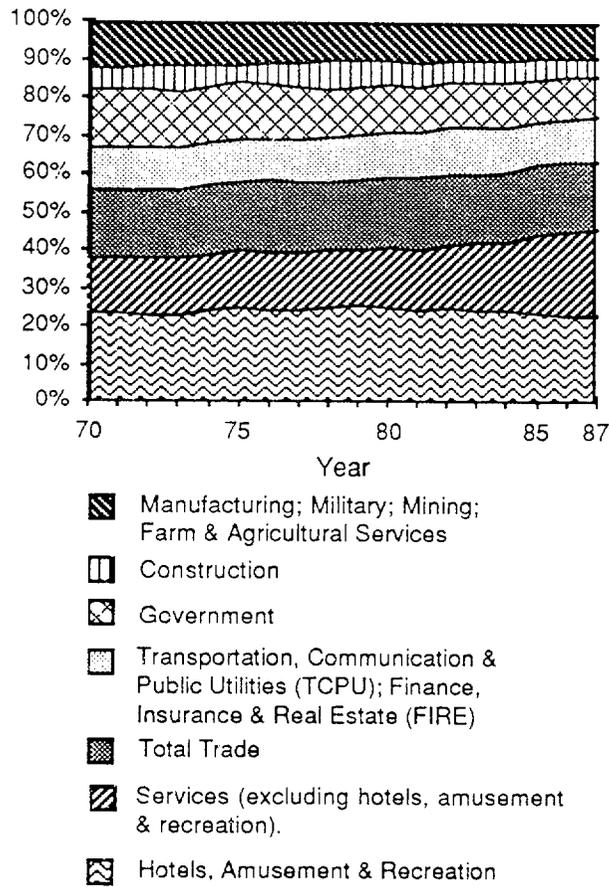


Figure 2.2-1 Distribution of Employment by Industry, State of Nevada, 1970-1987

Also included in service employment are other types of service workers, such as contractor personnel who support the military, the Nevada Test Site, and other Federal agencies' activities in the State. Retail and wholesale trade are also important support activities for tourists and residents alike, and approximately 18 percent of employed persons work in some form of trade.

About 16 percent of the State's employment is found among transportation, communications, and public utilities (TCPU); finance, insurance, and real estate (FIRE); and construction activities. The transportation network from southern Nevada allows relatively inexpensive overnight trucking service to the large California market and to markets as distant as Salt Lake City, Utah, and Albuquerque, New Mexico. As a result, Nevada has been increasingly promoted as a central location for warehousing and distribution to the Western United States and to Pacific Rim countries. Additionally, financial institutions, investors, and real estate developers have been increasing their activities in the State, which have helped stimulate construction.

Manufacturing employs about two percent of Nevada workers. Although employment in the manufacturing sector has increased since 1960, this increase has been overshadowed by the strong growth in other sectors.

The military represents about two percent of Nevada employment. Nellis Air Force Base in Clark County has the largest military population in the State and other military personnel are stationed throughout the State.

The agriculture and mining industries, which historically employed a large number of workers in Nevada, are not as dominant employers as they once were. Slightly more than one percent of Nevada workers were employed in agriculture, and only one percent of the State's workers were employed in mining in 1987. Nevertheless, Nevada is an important producer of minerals: Nevada produces all of the nation's magnesite and mercury, is the nation's leading producer of gold, and is the second leading producer of diatomite, gemstones, and silver. During 1987, 57 percent of all gold produced in the United States came from Nevada. Despite cyclical swings in the industry, mining employment in Nevada has generally increased since 1975 to a 1987 level of 8,500 jobs.

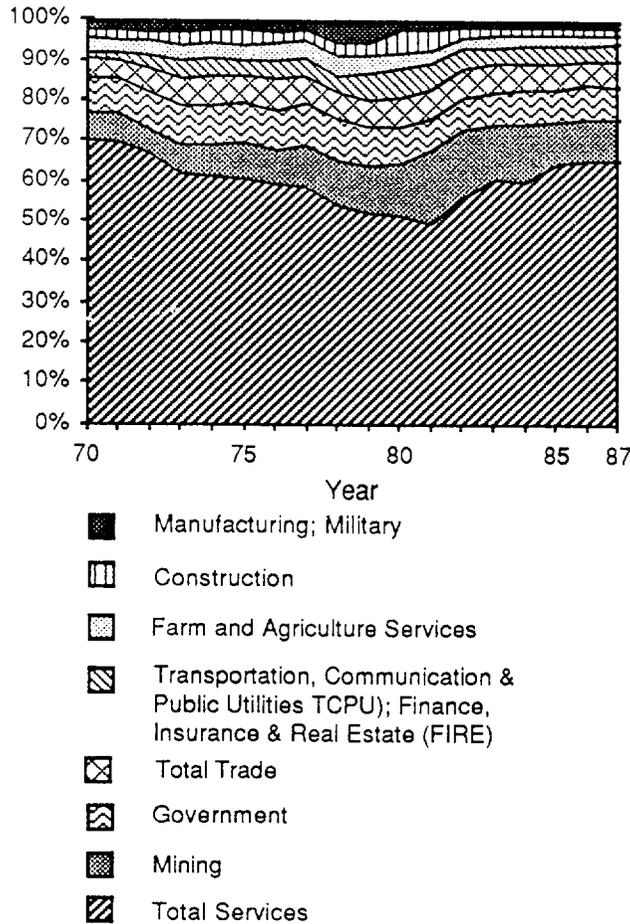
As indicated in Table 2.2-2, the State's total population nearly quadrupled from 1960 to 1987, increasing from 285,278 to 1,053,230, which is an average annual growth rate of 4.8 percent. Between 1960 and 1970, the population of Nevada increased 71 percent; during the 1970s, it increased 64 percent; and between 1980 and 1987, the population increased 32 percent. This rate of growth qualified Nevada as the fastest growing state in the nation during many of the years between 1960 and 1987. The rapid population increase reflects the growth in the tourism and gaming industry, as well as growth in other areas, such as manufacturing, distribution, and business services. The population growth rate has been relatively constant over the past thirty years, but has been slightly lower since 1980 than preceding years. Employment has grown at a somewhat higher rate than population, as indicated by the fact that the 1960 population-to-employment ratio was 2.35, while the corresponding 1987 figure was 2.02.

### 2.2.2 Nye County

In some cases, it was necessary to combine Nye and Esmeralda counties for the purposes of analysis because Esmeralda County's economy is extremely small compared with the other southern Nevada counties. Employment, unemployment, and population estimates are presented for Nye and Esmeralda counties separately, but these counties are combined for presentation of the distribution of employment across industries.<sup>3</sup>

After moderate growth from 1970 to 1980, the number of employed Nye County residents more than doubled between 1980 and 1985, and then leveled out (Table 2.2-1). This growth appears to be related to increased employment in the services and mining industries. Until 1987, unemployment rates in Nye County had been below the statewide rates.

Mining has continued to be an important source of employment in Nye County. As indicated in Figure 2.2-2, mining has been the second largest employer in Nye County during the past 10 years. In 1986, the net proceeds from mines in Nye County were the second largest of any county in Nevada (Dobra, 1988). Mineral resources in Nye County include metals, oil, and gas.



**Figure 2.2-2 Distribution of Employment by Industry, Nye and Esmeralda Counties, 1970-1987**

<sup>3</sup> See Footnote 1.

A large proportion of the services industry employment in Nye County is attributable to the Nevada Test Site (NTS). NTS employed 9,900 persons in 1987, 5,400 of them on-site and the rest employed in other locations, such as Las Vegas. The number of on-site workers has increased slightly since 1982, when about 5,000 workers were employed on-site.

After very little growth between 1960 and 1975, the population of Nye County nearly tripled between 1975 and 1985, from 5,500 to 14,850 (Table 2.2-2). This growth appears to be related both to renewed, if temporary, mining activities near some of the communities and to the promotion of southern Nye County as a desirable alternative to living in urban Las Vegas. As shown in Table 2.2-2, the population growth rate again moderated after the growth spurt between 1975 and 1985.

There are several population centers in the county. The fastest growing and largest town is Pahrump, located in southern Nye County about 60 miles west of Las Vegas. Reasons for the growth of Pahrump include marketing activities of a local developer, proximity to NTS and Las Vegas, and increasing attractiveness to retirees (Stiles, 1988). By 1987, more than 40 percent of Nye County residents lived in Pahrump. Local estimates placed Pahrump's 1988 population at over 7,700 residents. Other population centers in Nye County include Tonopah, the county seat, which is estimated to have about 4,000 residents. Currently, Beatty, which is experiencing a small boom because of gold mining activities a few miles from town, has about 1,200 residents and Amargosa Valley has about 900.

### 2.2.3 Esmeralda County

Esmeralda County has the least employment and the smallest population of the four counties in the study area. The mid-1980s brought relatively high employment growth to the county due to nearby mining activities, creating a significant boom for such a small economy. The number of employed residents in 1980 was 220, compared to 720 in 1985. Due to a slight reduction in regional mining activities, employment fell after 1985. As indicated in Table 2.2-1, unemployment rates have generally increased since the 1970s.<sup>4</sup>

Services, manufacturing, transportation, and finance industries are virtually absent in Esmeralda County. The major employers are the mining industry and government, employing 45 and 31 percent of the work force, respectively, in 1987.<sup>5</sup>

Population in Esmeralda County increased from 619 to 777 between 1960 and 1980. As indicated in Table 2.2-2, the growth rate increased dramatically for the period 1980 to 1985, when the county population nearly doubled between 1980 and 1984. The population declined slightly in 1985 and has remained at that level. The rapid increase in population between 1980 and 1984 was due to a renewed mining development in the Goldfield area.

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<sup>4</sup> Data for years between 1980 and 1985 indicate there was a significant increase in unemployment rates early in the 1980s (State of Nevada, 1985b). Interviews with county officials indicate renewed mining activity lowered those rates by 1985 (Dahlstrom, 1988).

<sup>5</sup> These estimates are based on data from the Nevada Employment Security Department (State of Nevada, 1987a) rather than data from the U.S. Department of Commerce, Bureau of Economic Analysis.

### 2.2.4 Lincoln County

Lincoln County's employed labor force grew rapidly from 1975 to 1985, from 1,200 to 2,080, but declined to 1,870 by 1987. As shown in Table 2.2-1, the county has experienced fluctuating unemployment rates in recent years, but its unemployment rates have been generally lower than statewide averages.

As indicated in Figure 2.2-3, the services industry currently dominates the Lincoln County economy. This sector of the economy has grown sharply in relative importance as an employer since 1970, when it accounted for only 10 percent of total employment. The services sector is the only economic sector that has experienced significant growth in its relative share of employment; most other sectors have experienced relative declines.

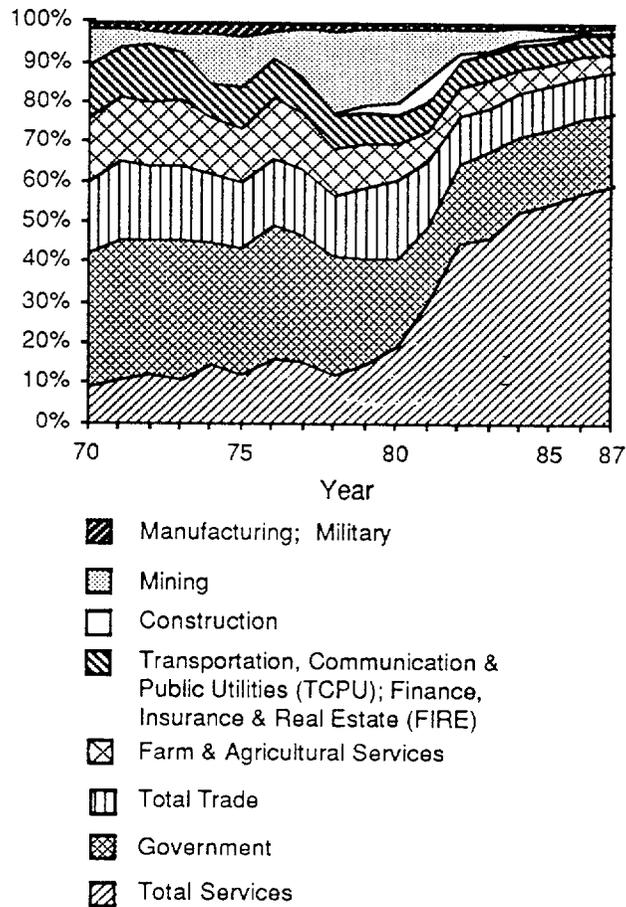


Figure 2.2-3 Distribution of Employment by Industry, Lincoln County, 1970-1987

The mining sector has declined sharply from nine percent of total employment in 1970 to one percent in 1987. Government employment has also declined as a percent of total employment during this period, decreasing from 33 percent to 18 percent, but the number of jobs provided has grown, and government remains an important employer in Lincoln County.

The population of Lincoln County grew by approximately 50 percent between 1960 and 1980. The period with the highest population growth rate was between 1975 and 1980 (Table 2.2-2). The rate of population growth had slowed by 1985, and the size of the population grew slowly through 1987, when the county's population was 4,250.

### 2.2.5 Clark County

Between 1960 and 1987, Clark County's employed work force increased from 52,500 to 302,700. An increasing share of the State's total employment since 1960 has been located in Clark County. Forty-two percent of the State's employed residents lived in the county in 1960, while the county contained over half of the State's jobs in 1987.<sup>6</sup> As indicated in Table 2.2-1, unemployment rates in Clark County have remained slightly above the state-wide rates over the past thirty years.

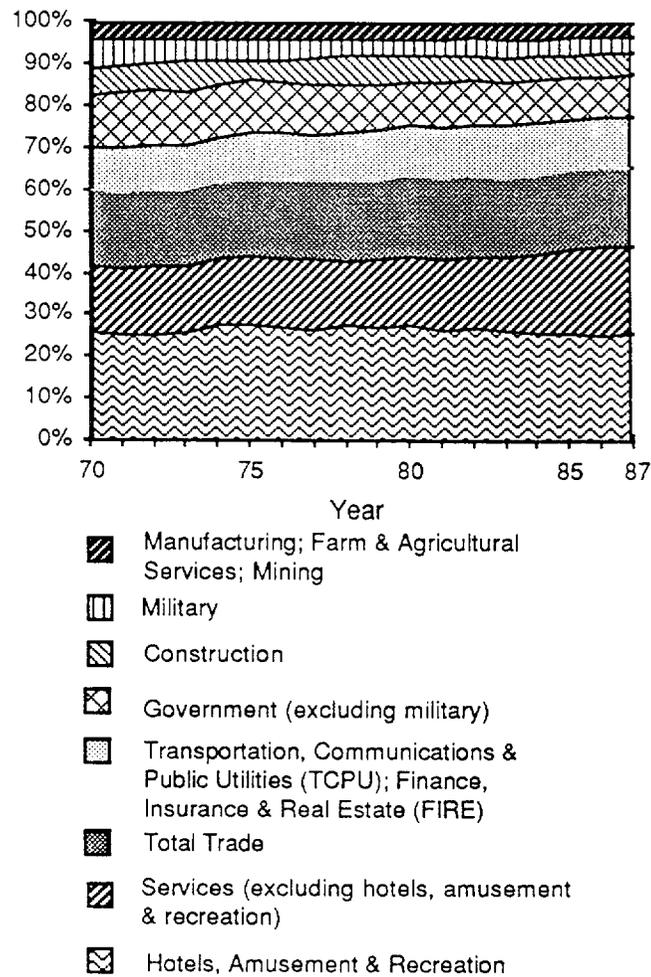
The services industry, including hotels, amusement, and recreation, is the major employer in Clark County, accounting for 47 percent of employment in 1987. The services sector is, in turn, dominated by hotels, amusement, and recreational services, which account for somewhat over half of the total services employment. As indicated in Figure 2.2-4, this level of contribution of the services industry to Clark County employment has remained essentially the same between 1970 and 1987.

Nellis Air Force Base (NAFB), which is located in Clark County, is the largest base in the U.S. Air Force Tactical Air Command. The base is the largest single employer in southern Nevada and employs about 15,000 military personnel and civilian staff. NAFB now employs more military and civilian personnel than at any time during the 1970s and is a substantial contributor to the economy. The employment at NAFB is mostly distributed between the military and services industries.

Fueled by rapid employment growth, Clark County's population grew from 127,016 in 1960 to 631,920 in 1987 (Table 2.2-2). This growth constitutes a fairly steady rate because of the much larger population base in Clark County than in the rural counties. Clark County also represented a steadily increasing share of the State's total population; by 1987, 60 percent of the State's residents resided in Clark County.

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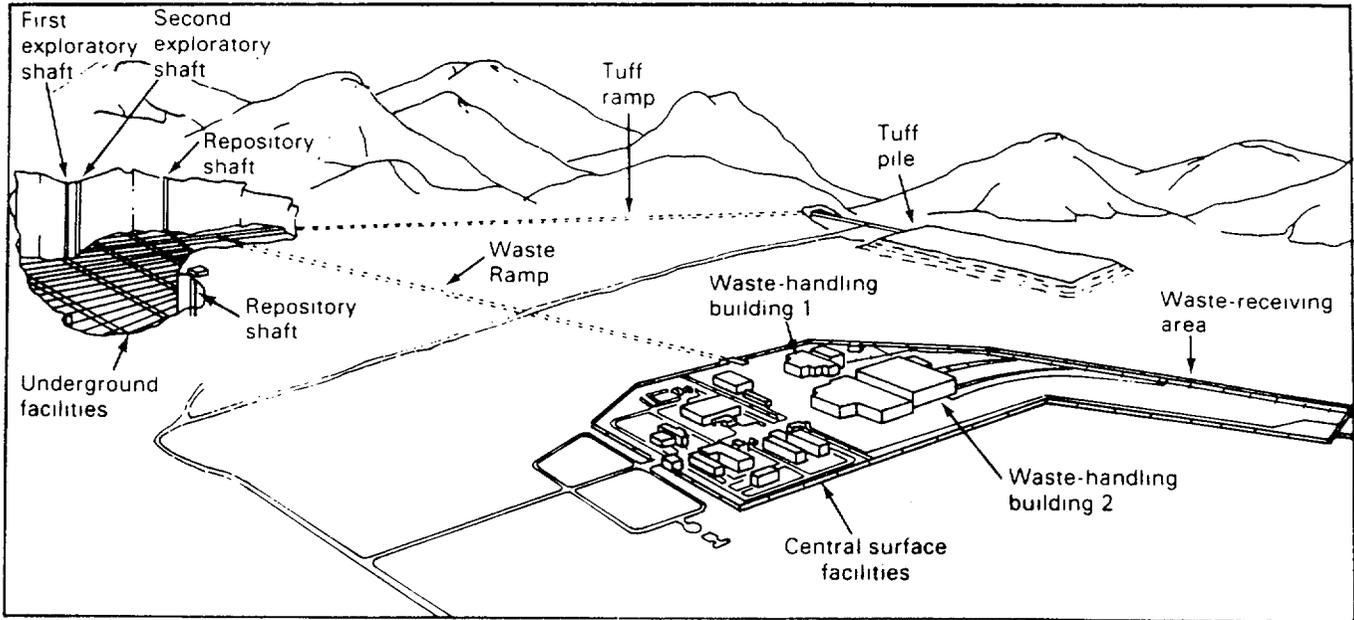
<sup>6</sup> Nevada Employment Security Department, data for 1960 to 1987 (State of Nevada, 1987a)



**Figure 2.2-4 Distribution of Employment by Industry, Clark County, 1970-1987**

### **2.3 General Description of the Repository Project**

Should the Yucca Mountain site prove to be suitable, the purpose of the proposed geologic repository is to permanently dispose of spent nuclear fuel and other high-level radioactive waste. The following description of the repository is compiled from the *Consultation Draft Site Characterization Plan Overview* (U.S. DOE, 1988b) and the *Site Characterization Plan Conceptual Design Report* (Sandia National Laboratories, 1987). Figure 2.3-1 is an artist's sketch of the proposed repository at Yucca Mountain.



**Figure 2.3-1. Artist's Rendition of the Proposed Repository at Yucca Mountain (U.S. DOE, 1988c: 37)**

The proposed repository would consist of surface and subsurface facilities and the shafts and ramps connecting these facilities. The surface facilities would be used to receive high-level radioactive waste and to prepare it for permanent disposal underground. The surface facilities would be connected to the underground repository through two ramps and four shafts. One of the ramps, known as the waste ramp, would be used to transport the waste containers from the surface to the underground area. The second ramp, known as the tuff ramp, would be used for removing the excavated tuff, which is a type of volcanic rock, from the underground to a point near the tuff pile on the surface.

The four shafts developed for the repository project would be located about one mile west of the central surface-facilities area. Two of the shafts would be the exploratory shafts constructed for site characterization. Both of these shafts would be used to provide fresh air to the waste-emplacement area. A third shaft would be used to transport laborers and materials to the underground facilities. The fourth shaft would serve as the air exhaust shaft for the emplacement area.

The underground repository, where the emplacement of the waste would occur, would be constructed more than 1,000 feet below the surface of Yucca Mountain. The main component of the underground repository would be the emplacement panels, which consist of tuff rock in which holes have been bored and into which the enclosed waste would be placed.

The emplaced waste would be retrievable for 50 years after the beginning of emplacement. After the waste-emplacement period, which is scheduled to last 25 years, a caretaker period of 25 years would begin. During both of these periods, a variety of tests would be conducted to confirm that the repository is performing as expected. At the end of the caretaker period, the repository would be prepared for permanent closure by backfilling the underground areas and permanently sealing the shafts and ramps. The surface facilities would be decontaminated, decommissioned, and razed, and the site would be returned to a condition that is as close to its natural state as practicable. Permanent site markers would be placed over or around the repository site.

#### **2.4 Labor and Materials Projected To Be Used In Nevada for the Repository Program**

The Department of Energy and its contractors estimated the number of workers to be employed in Nevada by the repository program and the locations of the jobs, which are indicated in Figure 2.4-1. Payroll for these workers from January 1, 1988, through December 31, 2060, was estimated and is indicated in Figure 2.4-2. Expenditures for materials, equipment, and services that would be used in Nevada for the repository program for the same period were also estimated. These estimates are provided in Figure 2.4-3. The estimates for payroll and for expenditures are given in constant 1988 dollars and are discussed in greater detail in the Appendix.

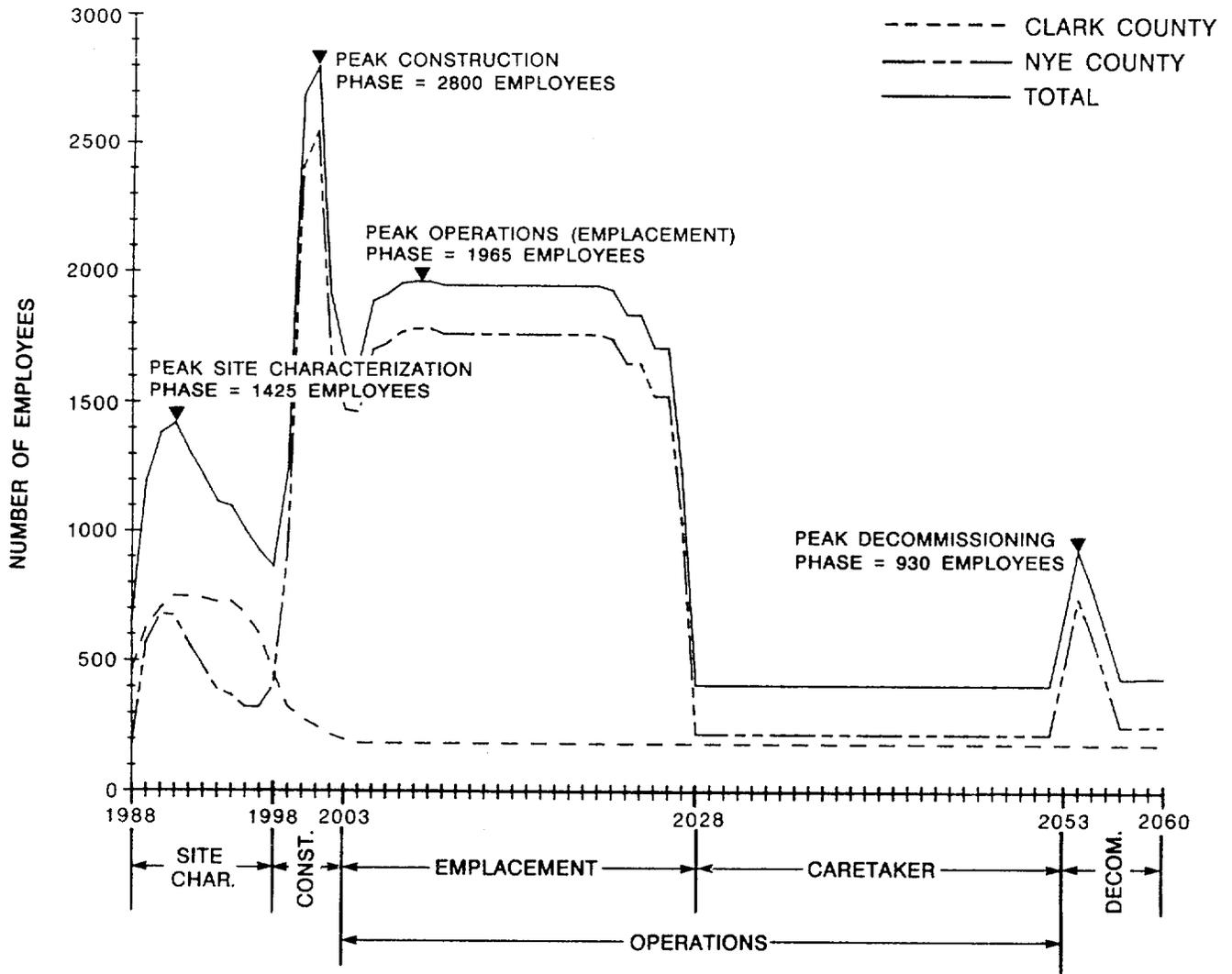
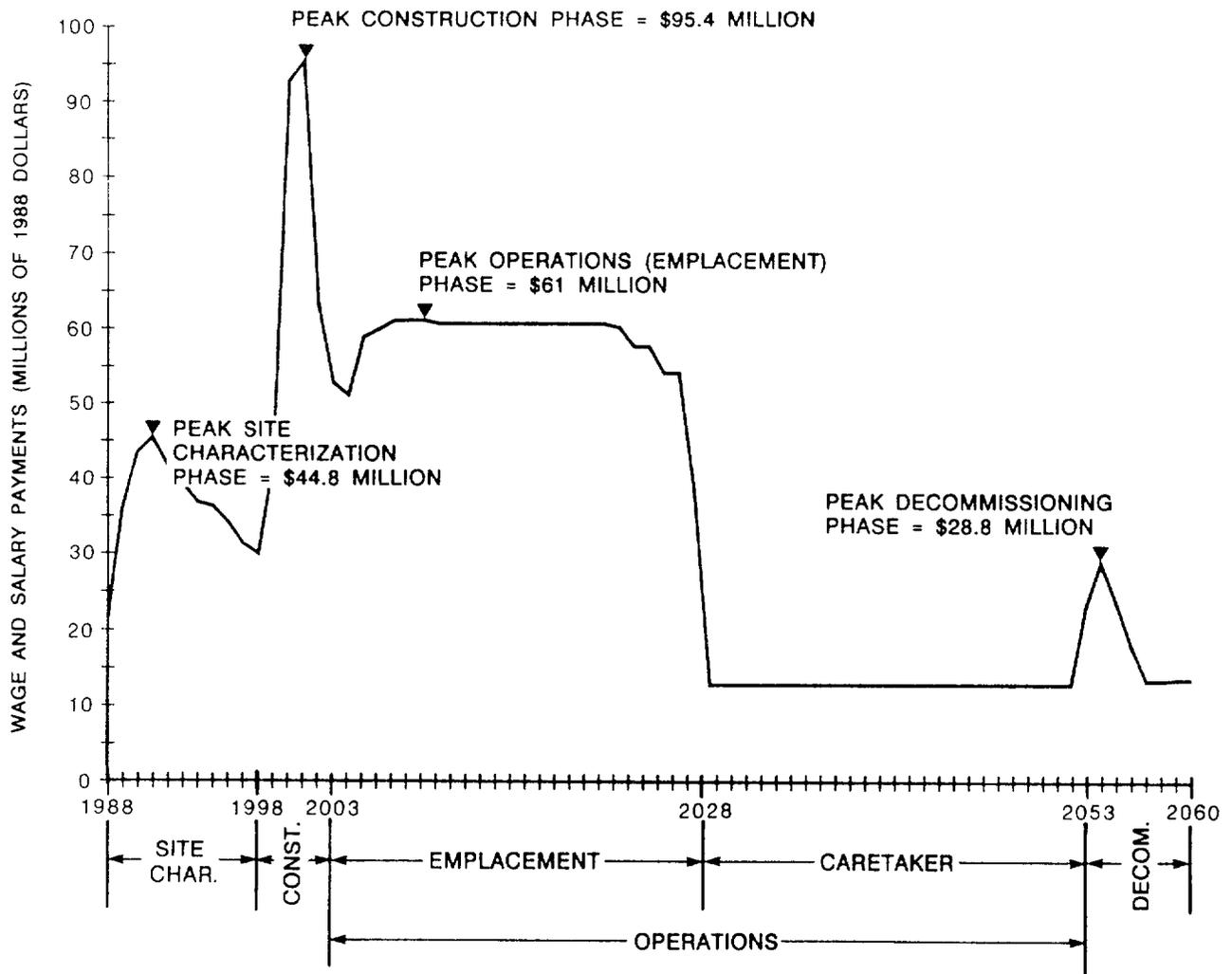
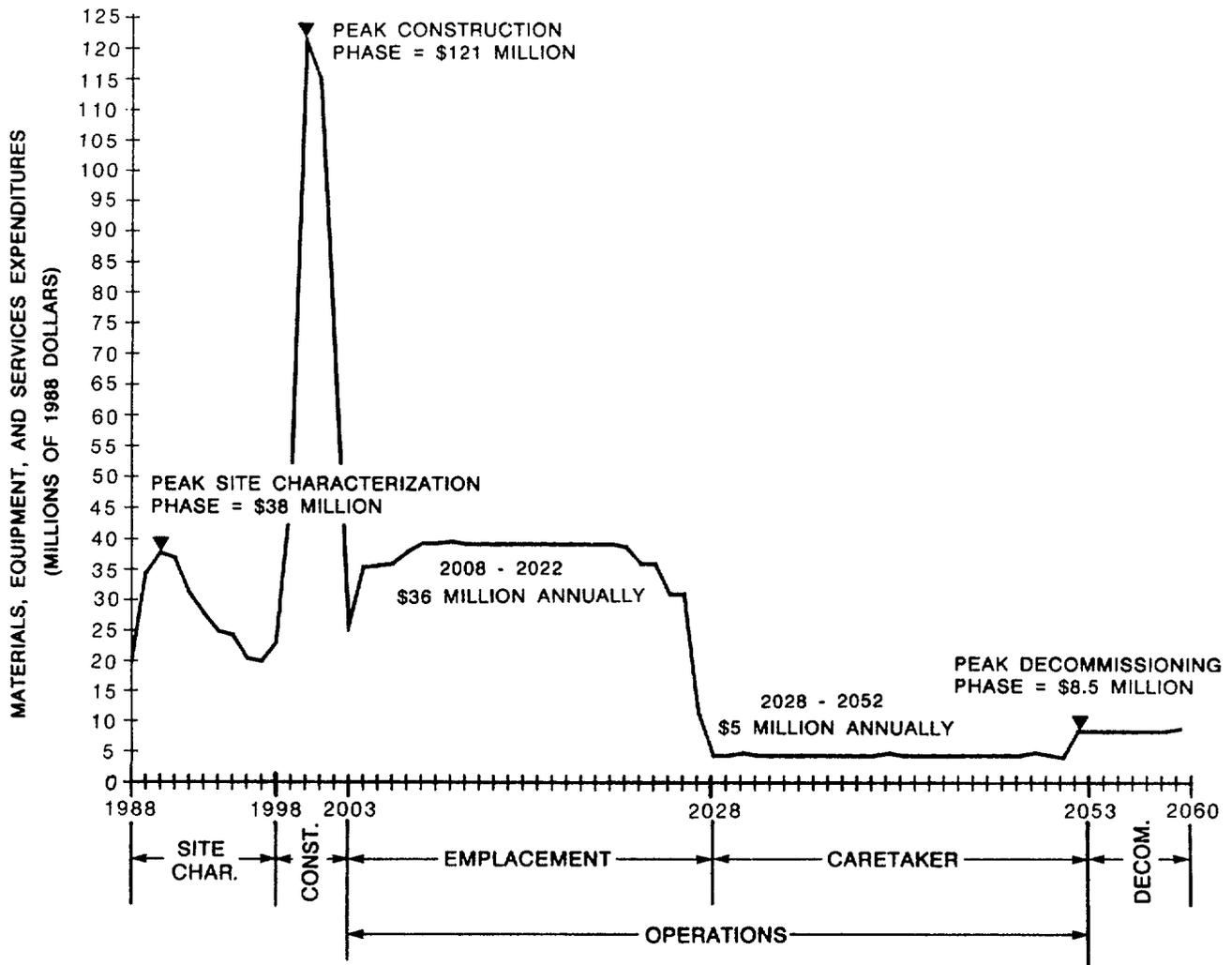


Figure 2.4-1 Direct Repository Employment Projections by Job Location in Nevada, 1988-2060



**Figure 2.4-2 Total Annual Repository Wage and Salary Projections for Nevada Workers, 1988-2060**



**Figure 2.4-3 Projected Annual Repository Expenditures for Materials, Equipment, and Services to be Used in Nevada, 1988-2060**

## 2.4.1 Site Characterization Phase

**2.4.1.1 Work Force** During 1991, the work force is estimated to peak at approximately 1,425 workers, of which 675 workers are expected to work at the Yucca Mountain site in Nye County. On-site workers will be involved in drilling and trenching activities, as well as construction of the exploratory shafts and the support facilities. The workers will be primarily from the construction, crafts, and operator trades. Engineers, scientists, and technicians, who will collect a variety of geologic, hydrologic, and environmental data, are also expected to work in Nye County during this phase. On-site work in Nye County is expected to decline after 1991, when analysis of the data will involve workers located primarily in Clark County.

Employment in Clark County during site characterization is expected to be related to engineering and design studies, technical and management support services, and preparation of the EIS and license application. Much of this employment will be in management, administration, engineering, and life, physical, and social sciences, as well as other professional and technical occupations.

**2.4.1.2 Wages and Salaries** The peak annual payroll during site characterization is estimated to be almost \$45 million for 1991. Annual payroll for repository workers in Nevada is expected to decline after 1992 until authorization to construct a repository is received from the Nuclear Regulatory Commission in 1998. Total payroll for repository workers in Nevada during this period is estimated to be approximately \$400 million.

**2.4.1.3 Expenditures for Materials, Equipment, and Services** The average annual expenditures for materials, equipment, and services for site characterization work performed in Nevada is estimated to be about \$30 million, with the peak for expenditures occurring during 1990 when approximately \$38 million will be spent. Total expenditures for materials, equipment, and services to be used in Nevada between 1988 and 1998 are estimated to be \$300 million.

In Clark County, research and design will be conducted, reports will be written, and management support services will be located. These activities will require expenditures for office supplies, electronic and computer equipment, communication and public utilities, air transportation, and lodging.

In Nye County, activities associated with drilling and trenching, testing, and construction of the exploratory shafts and of the support facilities are expected to occur. These activities will require expenditures for heavy equipment, drilling and mining equipment, scientific instruments, explosives, fabricated metals and structural steel, concrete, and other construction materials.

## 2.4.2 Construction Phase

**2.4.2.1 Work Force** The repository program work force in Nevada during the construction phase is projected to peak during 2001 at approximately 2,800 workers, of which an estimated 2,550 are expected to work on-site in Nye County. These workers will be skilled primarily in construction crafts, labor, management, administration, and engineering. Employment during this phase is projected to peak in Clark County during 1999, when most of the workers will be managers or administrators, engineers, and other professionals.

**2.4.2.2 Wages and Salaries** Average annual wages and salaries for program workers employed in Nevada during this phase is estimated to be approximately \$70 million. More than \$95 million is projected to be spent for wages and salaries during 2001, which is the height of the construction phase. Total payroll for program workers in Nevada during the construction phase is estimated to be approximately \$350 million.

**2.4.2.3 Expenditures for Materials, Equipment, and Services** The total amount of expenditures for materials, equipment, and services for use in Nevada during this phase is projected to be almost \$376 million, the annual expenditure of which is estimated to peak during 2000 at \$121 million. The majority of these expenditures will be for fabricated metal, mining and construction equipment, and machinery and supplies needed for construction of the repository.

### 2.4.3 Operations Phase

**2.4.3.1 Work Force** The peak number of repository program workers employed in Nevada during the emplacement period is projected to be 1,965 during 2008 to 2009, with an estimated 1,780 employees working at the repository and 185 support personnel working in Clark County. From 2010 to 2021, the average annual number of workers in Nevada will be about 1,950. The number of administrative and support personnel working in Clark County is projected to stabilize between 185 to 190 employees from the beginning of the operations phase through decommissioning during 2060. The types of skills required by the repository program in Clark County are engineering, professional, and clerical. The occupations likely to be needed at the Yucca Mountain site during emplacement are engineers, technicians, craftsmen, and operators.

During the caretaker period, the number of program workers is projected to be 185 persons in Clark County and 225 persons in Nye County. Skills required by the program in Clark County during the caretaker period are the same as those skills required during the emplacement period. The Yucca Mountain facility work force during the caretaker period is expected to be comprised of a relatively diverse mix of occupations, including engineers, technicians, craftsmen, operators, managers, administrative personnel, and service personnel.

**2.4.3.2 Wages and Salaries** Average annual payroll for repository program workers in Nevada during the emplacement period is estimated to be approximately \$56 million. Peak annual payroll is expected to occur during 2008-2009, during which an estimated \$61 million will be spent for wages and salaries in Nevada. Approximately \$13 million will be spent annually for wages and salaries during the caretaker period of the operations phase. A total of \$1.75 billion is projected to be spent for wages and salaries in Nevada during the operations phase of the repository program.

**2.4.3.3 Expenditures for Materials, Equipment, and Services** Expenditures for materials, equipment, and services to be used within Nevada during the operations phase are projected to stabilize at approximately \$36 million per year during the emplacement period and \$5 million per year during the caretaker period. Expenditures during the emplacement period are expected to be for the procurement of mining machinery, fabricated metals,

muck-handling equipment, and waste-transport equipment. During the caretaker period, major expenditures are expected to be for the procurement of maintenance and replacement parts, testing and monitoring equipment, and food, uniforms, and safety equipment for the facility work force. Almost \$2 billion is projected to be spent for materials, equipment, and services that will be used in Nevada during the operations phase of the program.

#### **2.4.4 Closure and Decommissioning Phase**

**2.4.4.1 Work Force** The number of workers during this phase of the program is expected to peak during 2054, when 185 workers in Clark County and 745 workers in Nye County are projected to be employed. Skills required by the program in Clark County are expected to be engineering, professional, and clerical. Occupations required at Yucca Mountain will include engineers and technicians, construction crafts, laborers, operatives, management, and administration.

**2.4.4.2 Wages and Salaries** Wages and salaries paid to repository program workers in Nevada are estimated to average almost \$18 million annually during this phase, with a peak of almost \$29 million for 2054. A total of almost \$125 million is projected to be spent for repository program wages and salaries in Nevada during this phase.

**2.4.4.3 Expenditures for Materials, Equipment, and Services** Total expenditures for materials, equipment, and services during this phase are estimated to be approximately \$155 million, with a peak of slightly less than \$39 million for the first year of the phase. Closure and decommissioning activities would require expenditures for crushed-tuff conveyer systems, earthmoving and demolition equipment, and materials and equipment necessary for the construction and installation of permanent site markers.

## 3.0 IDENTIFICATION OF POTENTIAL IMPACTS

*This chapter identifies those categories specified in Section 175(b) that may be affected by the repository program. The reader is advised to refer to the Appendix, which provides a discussion of the methods used to identify potential impacts, the assumptions and limitations of those methods, and the economic and demographic projections resulting from different scenarios.*

### 3.1 Introduction

The purpose of this chapter is to identify those categories, specified in Section 175(b) of the Nuclear Waste Policy Act, as amended, that may experience effects<sup>7</sup> as a result of the repository program in Nevada. The rationale for identifying a given category as potentially affected is given. The economic and demographic effects that may occur in Nevada as a result of the program, which provide the basis for assessing many of the categories, are described in the Appendix. The methods used to assess the categories are also described in the Appendix.

It is important for the reader to understand what this report does not accomplish, but what will be accomplished through ongoing studies by the Department of Energy. This report does not indicate the degree, specific timing, or longevity of potential repository-related effects. The degree of impact, the year in which the impact is expected, and the length of time the impact is expected to last are very important considerations to local community planners and to State agencies responsible for various functions. Information necessary for detailed planning will be provided to the affected parties in Nevada by DOE in a timely manner that will allow them to address the potential effects of the program.

This report also does not consider certain repository-related effects that will offset potential impacts in Nevada. These offsetting effects include payments-equal-to-taxes, which DOE will make to the affected parties in Nevada, and tax revenues generated by repository-induced population growth. These factors will be taken into consideration in the future in order to identify the net effects of the program.

### 3.2 Projected Effects on Services and Facilities

In this section, potential effects on publicly provided services are identified for counties and communities where population growth may occur as a result of the repository program. As discussed in the Appendix, population projections rely on historical data, and patterns evident in these data are extrapolated into the future. There are many events that may occur in the future that could drastically change the pattern of population growth evident in historical data. These events include projects in southern Nevada other than the repository program,

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<sup>7</sup> For the purpose of this report, the term *effects* refers to repository-related changes in conditions within the study area or the State of Nevada. The term *impacts* refers to those changes that are deemed to warrant mitigation, as determined through consultation with the State of Nevada and units of local government, which is described in Chapter 4.0.

new businesses producing different goods and services, and improvements in service capabilities. Because of these uncertainties, four different scenarios were used to forecast population growth related to the repository program and to allocate these forecasts among the counties. The scenarios are described in greater detail in the Appendix.

The first scenario, labeled *BEA*, is based on historical data from the U.S. Department of Commerce, Bureau of Economic Analysis, regarding the State of Nevada and each of the counties in southern Nevada, and incorporates an assumption that increases the number of part-time residents in Nye County during construction. Although this scenario tends to reconcile discrepancies between where income is earned and where it is reported, *BEA* does not focus on current residential location data regarding workers at the Nevada Test Site (NTS). The assumptions that underlie *BEA* function to allocate relatively larger repository-induced population effects to Nye County than Clark County.

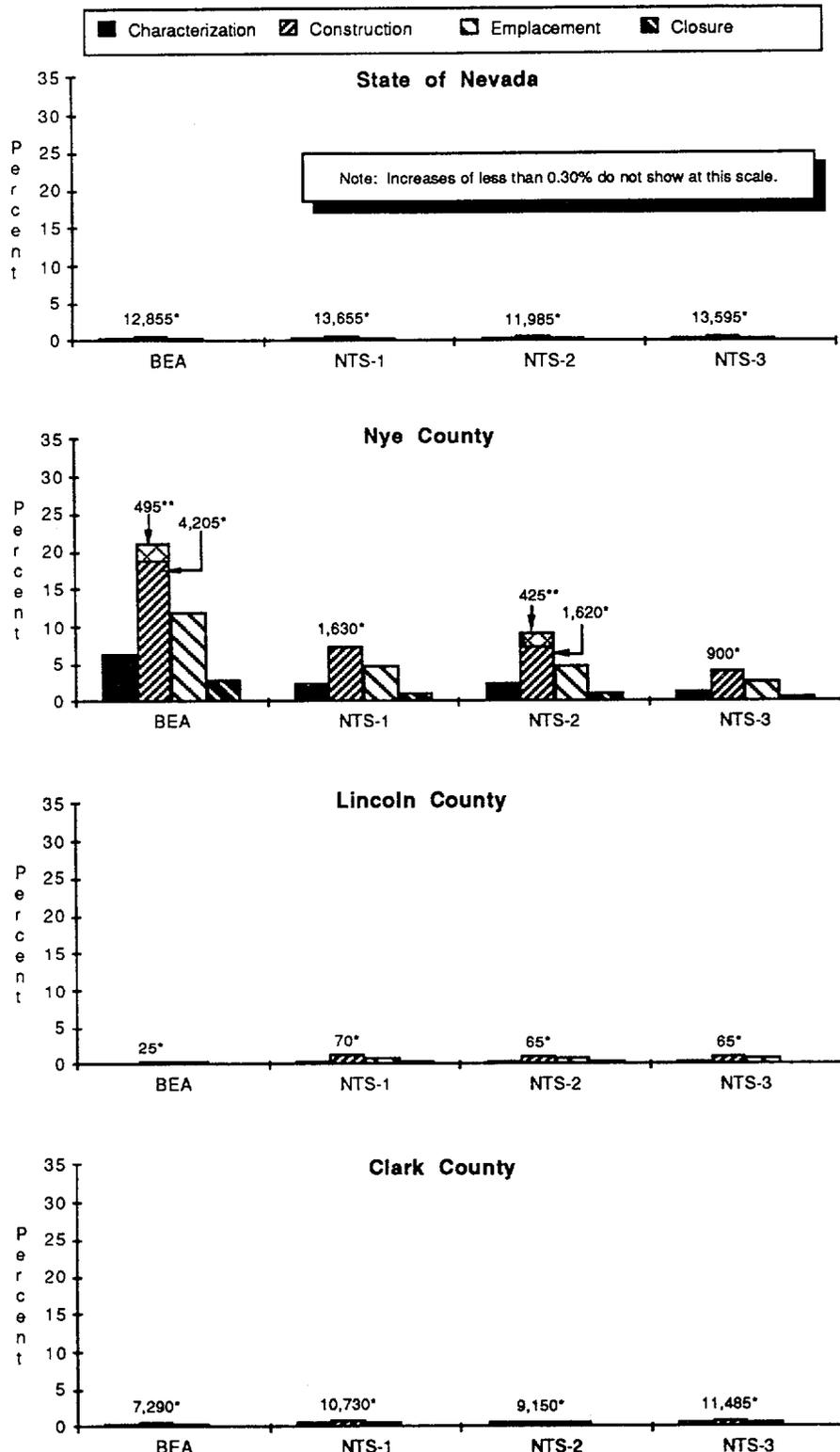
The fourth scenario, labeled *NTS-3*, is based on the residential locations of all NTS workers who were surveyed in 1988 (PIC, 1988a). This scenario tends not to account for the more recent residential real estate opportunities near Yucca Mountain, such as those available in the Pahrump area. The assumptions that underlie *NTS-3* function to allocate relatively larger population effects to Clark County than Nye County.

The remaining two scenarios, labeled *NTS-1* and *NTS-2*, are based on the same survey of NTS workers as *NTS-3*. *NTS-1* uses residential locations of NTS workers who have resided in their communities five years or less; *NTS-2* also uses the residential locations of these workers, but increases the number of part-time residents in Nye County during construction. The assumptions that underlie *NTS-1* and *NTS-2* result in a relatively more equal distribution of repository-induced population effects between Nye and Clark counties.

Peak population effects are defined as occurring in those years when the largest percentage differences occur between the population projections with the repository program and the projections without the program. The peak effect does not necessarily correspond to the year in which the largest absolute population change associated with the program may occur since the peak effect depends on both the size of the absolute change and the size of the baseline projection.

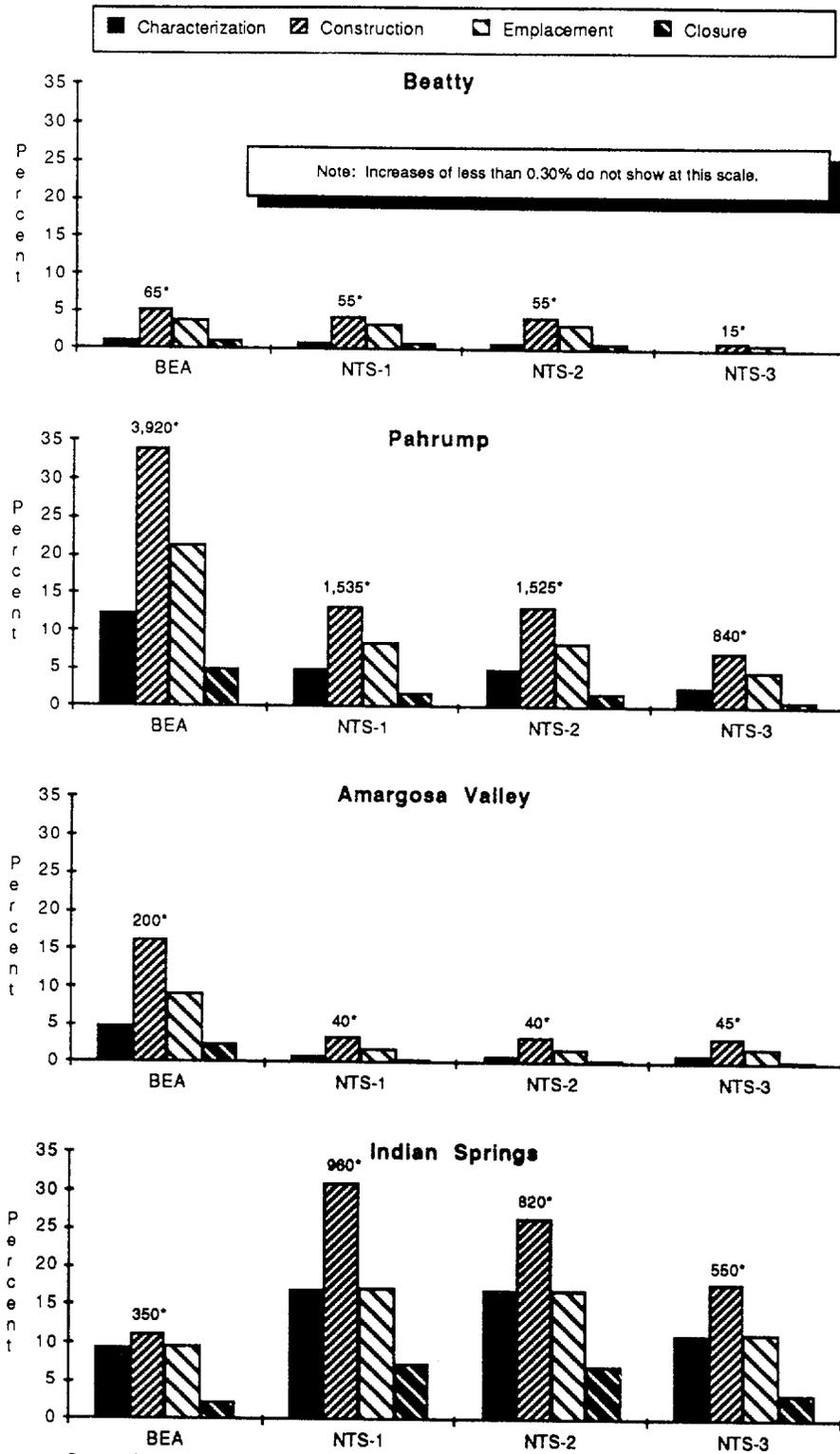
Figure 3.2-1 indicates the peak population effect in Nevada and in Nye, Lincoln, and Clark counties for each phase of the repository program and for each scenario. Esmeralda County is not exhibited because the largest population increase under any scenario is 15 new residents. These forecasts and the methods used are discussed in the Appendix. The increase in population that may result in Esmeralda County or Lincoln County as a result of the repository program is not projected to be large enough under any of the alternative scenarios to affect publicly provided services. Therefore, these counties are not discussed in this section.

The county-level population forecasts were allocated to subcounty areas using the methods described in the Appendix. The Appendix also describes the subcounty population forecasts for all areas that met the criteria for more detailed analysis, which are specified in Section 1.4.2. Figure 3.2-2 is a summary of the four communities that may experience repository-induced population growth in any of the four scenarios at a level that may affect the provision of some publicly provided services and facilities.



See text for description of alternatives.  
 \*Approximate population projected to result from repository program during year of peak percent change.  
 \*\*Estimated proportion of repository-related Nye County population residing there part time.

**Figure 3.2-1 Projected Peak Population Effect for the State of Nevada and Nye, Lincoln, and Clark Counties by Scenario and Repository Program Phase**



See text for description of alternatives.  
 Note: Part-time residents depicted in Nye County figure are not included in sub-county figures.  
 \*Approximate population projected to result from repository program during year of peak percent change.

**Figure 3.2-2. Projected Peak Population Effect for Beatty, Pahrump, Amargosa Valley, and Indian Springs by Repository Program Phase**

The remainder of this section discusses possible effects on publicly provided services and facilities that may result if repository-induced population growth occurs according to any of the alternative residential location scenarios. The categories specified in Section 175(b) that correspond to these services and facilities are education, public health, law enforcement, fire protection, medical care, cultural and recreational needs, social services, availability of energy, and general administrative needs of local government.

### 3.2.1 Education

Some repository workers and others moving into the area as a result of the repository program will be accompanied by school-age children. Their choice of residence within southern Nevada may create the need for additional capacity and teachers beyond what will otherwise be required to accommodate projected enrollments in the Pahrump Valley area or the Indian Springs area.

**3.2.1.1 Nye County** The Pahrump Valley elementary and secondary schools were at or near capacity at the time of a recent inventory conducted for the State of Nevada by Planning Information Corporation (PIC, 1988b: 256). The Nye County School District was reported as having no plans to build new facilities, however, citing the difficulty in obtaining voter approval for bond issues. The District plans to continue to accommodate projected enrollment growth by adding modular facilities that do not require long-term debt financing.

Population forecasts associated with the *BEA* scenario indicate a large population increase in Pahrump as a result of the repository program; forecasts associated with the other scenarios indicate smaller population increases. When the largest site characterization population effect is projected using the *BEA* scenario, approximately 270 additional school-age children, aged 5 through 19<sup>a</sup>, may live in Nye County as a result of the repository program. About 95 percent of these additional children may reside in Pahrump. School-age populations in Amargosa Valley and Beatty may increase only slightly as a result of site characterization. When the largest construction population effect is projected, about 1,000, or approximately 19 percent, more school-age children may reside in the county. More than 90 percent of these children may reside in Pahrump, with Amargosa Valley and Beatty receiving the balance. When operation population effects are largest, about 900 more school-age children, or 17 percent additional children, may live in the county. Again, more than 90 percent of these children may reside in Pahrump, with the remainder spread among Amargosa Valley and Beatty.

Using the NTS scenarios, possible peak increases in Nye County's school-age population are about one-third or less the size of possible increases under the *BEA* scenario. Pahrump may receive nearly all of the repository-related increase in school-age children in Nye County.

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<sup>a</sup> Projections of school-aged children are not equivalent to projections of school enrollments. Projections of school-aged children are derived from the REMI model, which is discussed in the Appendix. The projections generated by REMI exceed the county school districts' projections of enrollment because some individuals aged 5 through 19 are not in the public school system. The projections of school-age children should, therefore, be viewed as overstating the potential effect on education services.

Given that the Pahrump Valley schools are currently at or near capacity and that there are no current plans to build new facilities, an increase in the school-age population as a result of the repository program may have an effect on the provision of primary and secondary education in the Pahrump educational service area. No other area in Nye County is projected to experience an effect on the provision of primary and secondary education.

**3.2.1.2 Clark County** Without the repository program, the Clark County School District projects an increase of about 65 percent, from 95,400 in 1987 to 157,600 in 1997, in its elementary and secondary enrollments (Clark County School District, 1988). More than 80 percent of this increase is expected to occur in the Las Vegas attendance area, which essentially covers the incorporated Las Vegas and North Las Vegas municipalities in addition to much of the unincorporated urbanized area. Although the County School District does not provide enrollment projections beyond the 10-year planning horizon, it is clear that an ambitious building program is required to keep up with the anticipated need for additional capacity in all of the District's attendance areas except Indian Springs, which has considerable excess projected capacity for at least the next ten years (Clark County School District, 1988), and the smaller outlying rural areas. Voters recently approved a bond issue to finance construction of school buildings throughout the District beginning in 1988.

Using the *BEA* scenario, an increase of nearly 1,000 school-age children may occur in Clark County at the peak of site characterization population effects. This increase represents less than 1 percent increase in the size of the school-age population projected without the program. The number of school-age children in Indian Springs may be about 75 more children, or an increase of about 14 percent, at the peak of the site characterization phase. Under this scenario, the population effect in Indian Springs may be largest during this phase and may be smaller during subsequent phases; the percent of the school-age population in Indian Springs represented by repository-related children may follow a similar pattern.

Using the *NTS* scenarios, the increase of school-age children in Indian Springs due to the repository program may be almost double the increase using the *BEA* scenario. Using *NTS-1* and *NTS-2* scenarios, Indian Springs may experience a 25 percent increase in its school-age population during site characterization; an increase of about 30 percent during construction; and an increase of about 25 percent during emplacement. Using the *NTS-3* scenario, Indian Springs may experience an increase in school-age children from 15 percent during emplacement, to about 20 percent during construction.

Although the Clark County School District forecasts excess seating capacity in the Indian Springs attendance area for the ten-year period ending in 1997, it is possible that the additional students resulting from the repository program may affect the provision of primary and secondary education in Indian Springs schools. No other attendance area in Clark County is likely to be affected by an increase in the number of students that may result from the repository program.

### 3.2.2 Public Health

Public health services include provision of water for municipal and industrial uses, wastewater treatment systems, solid waste disposal, and pest control.<sup>9</sup> Facilities for providing these services, especially water and wastewater treatment, must be built to accommodate not only the average demand, but peaks in demand that occur in daily and seasonal cycles.

Population growth due to the repository program may have an effect on the ability of local service providers in Pahrump in Nye County to accommodate either average or peak demands on water delivery systems and wastewater treatment services. In Beatty, greater water system capacity and improved water quality will be needed to accommodate any future population growth, part of which may result from the repository program. Population growth in Amargosa Valley is not likely to affect the provision of water or wastewater treatment systems in that community. Additional repository-related residents in Indian Springs may have an effect on the town's capability to provide water services and wastewater treatment. No effects are projected on the provision of other public health services in any other area of Nye County or Clark County.

**3.2.2.1 Nye County** During the construction and emplacement phases of repository operation, the size of the population in Nye County may increase because of the repository program. Pahrump and, to a lesser extent, Amargosa Valley may absorb the greatest portion of this growth. In Pahrump, some residents receive water from Central Nevada Utilities Company, but many have private wells. Current annual water use is less than one half of existing appropriations and permits (PIC, 1988c). While water supply is expected to be adequate with any level of repository-related growth, delivery of water may be problematic.

Residences on lots smaller than one acre in Pahrump are required to connect to the town's wastewater treatment plant. A 200,000 gallon-per-day (gpd) plant is currently planned, which will serve approximately 2,000 residents, assuming an average of 100 gpd per resident. The vast majority of Pahrump's residences, however, are located on parcels larger than one acre and are served by individual septic systems. With a rapid influx of relatively temporary construction workers, accompanying household members, and others attracted to the area because of repository-induced employment opportunities, the number of Pahrump residents living on lots less than one acre in size may increase. The larger number of lots less than one acre may create a need for wastewater treatment capacity expansion beyond the 200,000 gpd plant that is currently planned. Thus, there may be an effect on the provision of wastewater treatment services in Pahrump, especially during the construction phase of the program.

Currently, the Beatty Water and Sanitation District is at capacity in terms of provision of water and the wastewater treatment pond. Both systems must be expanded before additional population growth can be accommodated. The District began drilling for additional water in May 1988 with assistance from Bond Gold Corporation (PIC, 1988c), and the District is planning to construct rapid infiltration basins to increase wastewater capacity (PIC, 1988c). The

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<sup>9</sup> Weed and pest control services are included in the "Public Health" service category, but the additional demand for weed and pest control services due to repository development is likely to be a highly localized issue that will be dealt with on a case by case basis.

water supply problem has been alleviated somewhat by the discovery of water in one test hole and the community is now allowing a limited number of new connections (Walker, 1988). The wastewater treatment problem remains unsolved at this time. The supply of water and the treatment of wastewater may be affected by any repository-induced population growth in Beatty. No other community in Nye County is likely to experience effects on the provision of water or wastewater treatment systems.

The repository program is not projected to affect the provision of solid waste disposal in any area in Nye County.

**3.2.2.2 Clark County** The population may increase in Indian Springs as a result of the repository program. Indian Springs is within the service area of the Las Vegas Valley Water District, but water is supplied to Indian Springs residents from a private groundwater system that the District is considering buying (PIC, 1988b: 70). Although these wells are considered adequate to accommodate projected demand under *BEA* and *NTS-3* scenarios, they may not be adequate to fulfill the demand under *NTS-1* or *NTS-2* scenarios. Therefore, groundwater supply and residential distribution service in Indian Springs may need to be upgraded as a result of an increase in population associated with the repository program.

Almost all of the current Indian Springs residences are served by a privately owned wastewater treatment system. A correctional facility located within the town's boundaries has its own package waste treatment plant. While an assessment by Clark County in 1982 (Clark County, 1982: 248) reported that "the existing system is considered adequate to meet future needs," a more recent assessment suggests that the system's deferred maintenance requirements are sufficient to make the Clark County Sanitation District unwilling to purchase the system, which is currently for sale (Turnier, 1988). Additional repository-related residents may affect the town's ability to provide wastewater treatment with its current system.

Solid waste disposal service is provided to Clark County residents by several private firms under contract with the county and the municipal governments. Capital equipment and availability of landfill sites do not appear to be constraints to growth. Repository-related population growth in any area of Clark County, including Indian Springs, is not expected to affect the provision of solid waste disposal.

### 3.2.3 Law Enforcement

Additional demands may be placed on law enforcement agencies in Nye County because of repository-related population growth. Population growth that may occur in Pahrump, combined with the town's boundaries that encompass several hundred square miles, may have an effect on the provision of law enforcement in and around Pahrump. The already overcrowded conditions in Beatty facilities may be further aggravated by the repository program, unless these conditions are improved. Additionally, during certain phases of the program, Nye County law enforcement agencies may be in greater demand because of the national attention the repository may receive and the possible increase in antinuclear protests directed at the repository. Thus, the repository program may have an effect on the provision of law enforcement in Nye County. The provision of law enforcement in Indian Springs in Clark County may also be affected by repository-induced population growth.

**3.2.3.1 Nye County** The Fifth District Court, which serves Nye, Mineral, and Esmeralda counties, is located in the Nye County Courthouse in Tonopah. The District Attorney's main office is located in Tonopah, and a Deputy District Attorney is located in Pahrump. Justice of the Peace Courts are located in Tonopah, Beatty, Pahrump, and Gabbs. Public defenders

are private attorneys who are appointed, when a need arises, by the courts in Nye County. The District Attorney's Office reports a significant increase in the misdemeanor caseload due to the number of antinuclear protesters prosecuted in Nye County. The District Attorney regards these prosecutions as placing a significant financial and social burden on the county (PIC, 1988b: 231).

The County Sheriff's Department is the principal law enforcement agency in the county. Headquartered in Tonopah, the Department operates substations in Beatty, Amargosa Valley, Pahrump, at the Tonopah Test Range, and at Mercury on the Nevada Test Site. The jail facility in Tonopah is reported as not meeting current Federal standards, and the holding facilities at the substations located at Beatty, Amargosa Valley, and Pahrump are characterized as overcrowded (PIC, 1988b: 237-238).

The Sheriff's Department is responsible for, and is reimbursed by DOE for, law enforcement during protest demonstrations at the Nevada Test Site. As the repository gains increasing levels of national attention, antinuclear protests against the repository may occur. The Sheriff's Department may be responsible for law enforcement during these protests, as well as during protests against the Nevada Test Site.

Pahrump may receive most of the repository-related population growth in Nye County and the County Sheriff's Department may need to reallocate resources to address the needs of the widely dispersed population within the Pahrump service area. Therefore, the provision of law enforcement services may be affected in the Pahrump area.

**3.2.3.2 Clark County** The Offices of Constable, District Attorney, and Public Defender, along with the Grand Jury and Juvenile Court Services divisions, account for nearly 80 percent of Clark County's judicial expenditures; the District Court and Justice Court account for the remaining 20 percent (PIC, 1988b: 11). All divisions report a concerted effort to improve efficiency in the face of increasing caseloads. District Court officials report that the average monthly caseload per judge is higher than the national average, and the court plans to request an additional two to four judges during the 1991 legislative session (PIC, 1988b: 4).

The Las Vegas Metropolitan Police Department is responsible for general law enforcement in the City of Las Vegas and in unincorporated areas of Clark County, including Indian Springs. Henderson, Boulder City, and North Las Vegas have municipal police departments. The Las Vegas Metropolitan Police Department currently has about half the number of police officers per thousand residents than the national average for cities of comparable size. The Department operates a maximum security detention facility, which is reported to be overcrowded and used more for pretrial detention than for its designated purpose. In the rural areas of the county, a Resident Officer Program maintains personnel and some limited substation office space, often in the officer's home. With the exception of the Laughlin substation, all of the rural substations, including the one at Indian Springs, are reported to be substandard (PIC, 1988b: 69). Any repository-related population growth in Indian Springs may result in an effect on the provision of law enforcement in that community.

#### **3.2.4 Fire Protection**

The capability to provide fire protection to Nye County residents in Pahrump may be affected by repository-related population growth. Also, the capability to provide fire protection to Clark County residents in Indian Springs may be affected by population growth that may result from the repository program. No other locations in Nye or Clark counties are likely to experience effects on the provision of fire protection.

**3.2.4.1 Nye County** Equipment for fire protection is provided by the County, the communities, and associations affiliated with volunteer fire departments. The County also coordinates training for volunteers. These volunteers provide most of the fire fighting and ambulance services to county residents. The fire departments in Pahrump, Amargosa Valley, and Beatty have a paid fireman in addition to their volunteer corps. In Pahrump, fire protection is limited by the availability of water at sufficient pressure to be of use in fighting fires. Hydrants are limited to one part of the service area, and most wells in other portions of the service area do not pump water rapidly enough to meet emergency requirements. Tankers must be sent a considerable distance to fast-flowing wells. Capital improvements and added equipment may be needed to accommodate projected demands for fire protection services due to repository-related population growth in Pahrump. The same current limitations on fire protection exist in Amargosa Valley, but the peak repository-related population effect may not be large enough to affect current provision of fire protection to Amargosa Valley residents. The provision of fire protection is not likely to be affected in any other area of Nye County.

**3.2.4.2 Clark County** The Clark County Fire Department provides fire protection and emergency medical services to unincorporated Clark County. In addition to a full-time, paid staff in the urbanized Las Vegas area and in Laughlin, the department coordinates volunteer departments for the outlying areas in the county. Las Vegas, North Las Vegas, Henderson, and Boulder City operate municipal fire departments. Cooperative agreements among these departments coordinate dispatch of fire protection and emergency services for the Las Vegas Valley. Rather than focusing on the additional demand for fire protection services due to repository-related population growth, specific fire department concerns arising from development of a repository focus on issues of communications, emergency response, personnel training and equipment, and community warning and broadcast systems (PIC, 1988b: 83). Potential effects on emergency response that may result from the repository program are discussed in Section 3.7. Clark County maintains a fire station at Indian Springs and has a mutual aid agreement with Indian Springs Air Force Base. The demand for fire protection services in Indian Springs may increase as a result of repository-related population growth and the capability to provide fire protection may be affected. Fire protection is not likely to be affected by repository-related population growth in other areas of Clark County.

### **3.2.5 Medical Care**

In Nye County, the repository program may have an effect on the provision of medical care in Pahrump and on the provision of this service in Amargosa Valley and Beatty. An effect on medical care may occur in Indian Springs as a result of increased demands associated with repository-related population growth.

**3.2.5.1 Nye County** The Nye County Hospital is located in Tonopah and typically serves patients within a 75-mile radius of the town, an area which includes the town of Beatty. In addition to its four resident physicians, the hospital is visited regularly by specialists based in Reno or Las Vegas. Hospital officials report difficulties in attracting physicians to the area because of the few urban amenities available and because of the competition with major metropolitan area hospitals. Residents of Amargosa Valley and Pahrump, which are located outside the Nye County Hospital District, typically travel to Las Vegas for major medical treatment. The Central Nevada Rural Health Consortium provides physician assistants for medical clinics located in Amargosa Valley and Beatty. Pahrump has two medical clinics staffed with physicians and physician assistants or nurses. Ambulance services are provided

in Nye County by certified emergency medical technician volunteers. A State-sponsored community health nursing program, under contract with Nye County, serves county residents and has offices in Tonopah and Pahrump. This program provides immunization, screening, diagnostic, and wellness services to area residents, in addition to providing nursing services for schools in Nye and Esmeralda counties.

Increases in the demand for patient care services that may result from repository-related population growth in Pahrump and Amargosa Valley may outstrip currently available local capacity to provide such services. Additionally, service coordinators in Pahrump and Beatty believe that any significant increases in population would require a paid ambulance service (PIC, 1988c). Population growth resulting from the repository program may have an effect on the provision of medical care in Pahrump, Beatty and Amargosa Valley.

**3.2.5.2 Clark County** A full range of publicly and privately provided medical facilities are available in Clark County and serve not only the resident and visitor populations, but also the specialized needs of residents in rural areas of southern Nevada and nearby portions of Utah, Arizona, and California. Many local officials regard the cost of health care in the Las Vegas area, which is among the highest in the nation, as a limiting factor in the choice of the area by retirement-oriented immigrants. Contributing to these costs is the relatively low occupancy rate for area hospitals, which was less than 60 percent in 1987 (PIC, 1988b: 41). Local officials expect costs to increase more slowly in the future, as the area's growing population causes existing and currently planned health care facilities to be used more efficiently (Kuminecz, 1988).

Residents of Indian Springs currently travel to the Las Vegas metropolitan area for medical services. These locations are a 30- to 60-minute drive from Indian Springs. An increase in demand for medical care in Indian Springs may result from repository-related population growth. If new residents continue to be willing to travel to the Las Vegas area to receive medical care, no effect on the provision of this service will occur in Indian Springs.

### **3.2.6 Cultural and Recreational Needs**

The capability of existing and planned cultural and recreational facilities to accommodate repository-related population growth is assessed on the basis of locally available services and facilities. The abundance of outdoor recreation opportunities available in the region is noted, although the local availability of parks and playgrounds is variable. Additional population in Pahrump and Indian Springs resulting from the repository program may affect the manner in which recreational services and facilities are developed and maintained. It is not likely that the repository program will have any effects on other aspects related to cultural and recreational needs in Nye or Clark counties.

**3.2.6.1 Nye County** The communities in southern Nye County have a number of recreational facilities. Facilities include playgrounds, tennis courts, baseball fields, a golf course, fairgrounds, dirt go-cart tracks and drag strips, swimming pools, and community centers with indoor play areas (PIC, 1988c). There are also plans to develop more park facilities in Amargosa Valley and Beatty. Many of these facilities are developed and maintained by groups of volunteers. For example, Amargosa Valley, Pahrump, and Beatty have local libraries managed by part-time staff and administered by Library Boards. Possible repository-related effects may be felt in all of these communities if pressure from additional users becomes great enough that volunteer facility maintenance must be replaced by paid staff. Also, an increase in demand for library use by any additional repository-related population may require an increase in staff and in the number of hours a library is open.

**3.2.6.2 Clark County** The Clark County Parks and Recreation Department maintains over 2,100 acres of park lands, including 1,000 acres in the Desert Wetlands Park. The Department offers a full range of services, including ball leagues, swimming pools, and a wide variety of other activities. Currently, the amount of park space available to Clark County residents and visitors is below national standards, as well as the county's internal standards. However, outdoor recreation opportunities are available in abundance at the nearby Lake Mead National Recreation Area and at other State and Federal park facilities (PIC, 1988b). Nine branch libraries are distributed throughout the Las Vegas urban area and in seven rural communities in Clark County, including Indian Springs. Clark County libraries currently provide more personnel services in terms of full-time equivalents than standards dictate, but provide fewer books per capita than the national average (PIC, 1988b). Repository-related population growth in Indian Springs may result in demands for improvements and additional maintenance at existing local facilities. An increase in demand for library use in Indian Springs may require an increase in staff and in the number of hours the library is open.

### **3.2.7 Social Services**

Additional demands may be placed on social service agencies in Nye County because of repository-related population growth and unemployed workers potentially attracted to the area in search of employment. Not only may the repository program result in additional residents in the southern portion of the county, some of whom may need social services, but the nature of the problems may be different from those to which the smaller town agencies are accustomed. The effect on social services in Nye County that may result from repository-related population growth may require a reallocation of already existing resources to southern Nye County. A similar reallocation of resources in Clark County may need to occur to accommodate repository-related population growth in Indian Springs.

**3.2.7.1 Nye County** Social services in Nye County are administered by the Health and Welfare Department from the county seat in Tonopah, with a small branch office located in Pahrump. The Department's largest responsibility is administering the Medical Indigents Assistance program. Nutritional programs and mental health treatment, including substance abuse treatment, are available only in the northern portion of Nye County and in the Las Vegas metropolitan area. Increases in the need for social services that currently are unavailable in the Pahrump area may occur if repository-induced population growth occurs in southern Nye County.

**3.2.7.2 Clark County** A full range of publicly and privately provided social services is available to county residents through State, County, and local government agencies as well as nonprofit organizations, most of which are located in the Las Vegas Valley. Repository-related effects on these services are not likely to occur in the urbanized area; however, in outlying areas of the county such as Indian Springs, where residents do not have immediate local access to as wide a range of services, a redistribution of resources may be required if repository-induced population growth occurs.

### **3.2.8 Availability of Energy**

Load forecasts from energy suppliers, including per capita consumption rates, were used to determine the presence of potential problem areas related to the availability of energy. In Beatty, a small repository-related population increase may cause an effect on the cost of

electricity during the construction and operations phases. No other area in Nye County or Clark County is likely to have difficulty supplying the need for energy created by repository-related population growth.

**3.2.8.1 Nye County** Currently, a gold mine is being developed in the vicinity of Beatty. Valley Electric Association, Incorporated, anticipates expanding its system to meet the demand associated with the gold mine and accompanying population growth. Additional demand for electricity will require extension of the distribution system within Beatty (Gollnick, 1988). Additional repository-related population in the Beatty area, although small in size, may have an effect on the cost of providing electricity to area residents because it may require purchase of additional electricity at a higher rate than the present rate. No other areas in Nye County are projected to have difficulty meeting the demand for energy by the repository-related population.

**3.2.8.2 Clark County** No potential impacts on the availability of energy were identified for any area in Clark County.

### **3.2.9 General Administrative Needs of Local Governments**

**3.2.9.1 Nye County** The county's large land area and great distances between population centers dictates that many general government functions maintain satellite stations in the southern portion of the county, in addition to their offices in Tonopah, which is the county seat. Repository-related population growth in southern Nye County may lead to increased demand for nearly all general government functions, such as tax assessment, permitting, planning, and engineering.

**3.2.9.2 Clark County** Repository-related population growth in the unincorporated town of Indian Springs may lead to an increase in demand for County-level government services such that a modest satellite office facility may be warranted. No effects on provision of general administrative functions of local governments other than Indian Springs are expected as a result of the repository program.

### **3.3 Vocational Training and Employment Services**

Since a labor market is larger than any single county, this section focuses on the southern Nevada labor market area rather than on each of the counties. During the construction phase of the repository program, a shortage of locally experienced, highly skilled laborers and a shortage of skilled laborers without local experience may develop as a result of the program. However, all of the occupations that are likely to experience an increase in demand as a result of the repository are supported by apprenticeship training programs administered by the various unions located in Clark County. Vocational schools in the labor market area, Clark County Community College, and continuing education courses offered through the county school districts also support training programs for occupations that are likely to be required by the repository program. The State operates the State Job Training Office, which prepares youth and unskilled adults for entry into the labor force and affords training to dislocated workers. The State also operates the Employment Security Department, which provides job searches and placement service to Nevada residents. Additional need for vocational training and employment services is not likely to result from the repository program.

The occupations for which the greatest demand will be created as a result of the repository program are the following: crafts, including machinists, mechanics, and sheet metal workers; construction crafts, including carpenters, painters, and plumbers; operatives, including machine operators, insulation workers, and assemblers; and laborers, including construction and other laborers. All of these occupations are supported by various union halls located primarily in Clark County. Many of the Clark County union halls have local business people who drive throughout the southern Nevada area offering union services to non-Clark County residents. This program is offered outside of Clark County in lieu of establishing local halls.

The economic environment in Clark County dictates that training and apprenticeship programs are constantly conducted by local unions to satisfy the demand for large-scale construction projects that occur on a regular basis in the county. As a result of these programs, there is a steady stream of qualified apprentice and journeymen laborers in Clark County and throughout southern Nevada. These programs are available to residents who live outside of Clark County, but they must complete the required union apprenticeship program and maintain active union membership in order to take advantage of job opportunities. In addition to opportunities that are available through local unions, the southern Nevada area has community colleges, the University of Nevada-Las Vegas, and vocational and technical schools, which offer the academic credits required as part of the apprenticeship programs.

If the economy of southern Nevada continues to expand, as it has in recent years, and given the additional demands placed on the labor supply in response to the construction phase of the repository program, there may be a shortage of particular types and skill levels of construction or crafts labor. The labor supply is classified into three categories: *a* laborers are highly skilled and have extensive local experience; *b* laborers are skilled but do not have local experience; *c* laborers are not skilled and have no local experience. Currently, the list of available *a* workers in most union halls in southern Nevada is exhausted and the availability of laborers in the *b* classification is very low. Thus, a shortage of laborers with *a* and *b* characteristics may result from the increased demand during the construction phase of the repository program, and job opportunities for laborers who possess these skill levels will increase as a result (Enus, 1988).

### **3.4 Tourism and Economic Development**

In this section, possible changes in economic development patterns and in the tourism industry in southern Nevada that may result from the repository program are discussed. In general, the effect of the repository on prospects for economic development is encouraging, especially given the possibility of a rail spur linking parts of northern or central Nevada with parts of southern Nevada. However, the possibility exists that legislatively-mandated regulations governing the siting of hazardous and industrial activities may be developed and may increase the cost of production in the State. Regarding the effects of the repository program on the tourism industry, the population that will accompany the program will likely participate to a limited degree in the services offered by resort hotels and other amusement and recreation sectors. These repository-related effects on the tourism industry, however, are expected to be very small compared to the overall southern Nevada tourism economy.

#### **3.4.1 Tourism and the Repository Program**

Urban Clark County is at the center of the tourism market, but smaller communities in the county, such as Laughlin and Mesquite, are developing their own tourist market. Tourism represents an important part of the economies of Nye, Esmeralda, and Lincoln counties as well. Major local efforts, such as the restoration of the Goldfield Hotel in Esmeralda County,

are under way to enhance travel between the northern and southern tourism centers of Reno and Las Vegas. U.S. Highway 95 connects these two cities as it traverses Nye and Esmeralda counties and links with Nevada Highway 374 in Beatty to provide easy access to Death Valley National Monument in California. Many of the jobs in the service industry in Tonopah, Beatty, and Goldfield are directly related to tourist traffic through these communities (Perchetti, 1988; Revert, 1988; Dahlstrom, 1988). Pahrump also serves tourists along Nevada Highway 160 (Stiles, 1988), and some residents believe that a repository visitor's center and technical museum at Amargosa Valley would provide an additional attraction for travelers, as well as for school groups, service clubs, and residents of southern Nevada (Revert, 1988).

The tourism market is segmented into gaming resort visitors, convention attendees, and outdoor recreation participants. Local residents participate in each of these activities, and the repository-related population is expected to participate also, thereby contributing positively to the tourism industry. This contribution, however, will be very small given the magnitude of the tourism industry in southern Nevada.

A variety of factors underlie the tourism industry in southern Nevada. These factors include the legal status of gaming, the legal status of brothels in some rural counties, the relatively low travel costs, in time and money, from population centers in southern California and elsewhere, the availability of extensive convention and exhibition facilities, the levels of disposable income of visitors, and the unique intermingling of entertainment and outdoor recreation opportunities. These and other factors are transforming southern Nevada into a destination resort area that attracted 16.2 million visitors to Las Vegas in 1987 (Las Vegas Review-Journal et al., 1988). Given the complex array of factors that underlie the phenomenal growth of the tourism industry and the future of the industry in southern Nevada, it is impossible to isolate and forecast the effect of the repository on individuals' decisions to recreate in the area.

In general, local tourism and economic development experts expect growth in tourism to continue (Rolenkotter, 1988; Richer, 1988; Gross, 1988), barring national or international events, such as a major depression, a sustained gasoline shortage, legalized gambling in other cities, or a major war (Rolenkotter, 1988). There is some concern that perceptions of risk related to a repository may inhibit growth in tourism (Richer, 1988). Nevertheless, there are currently about 62,000 hotel rooms and suites in Clark County (Las Vegas Review-Journal et al., 1988), about 4,000 rooms under construction (Richer, 1988), and 20,000 rooms proposed to be added over the next ten years (Gross, 1988). These levels of investment in the continued construction of destination resorts may be taken as evidence that the financial community is convinced that a reduction in tourist visitation is very unlikely.

A draft report (PIC, 1988d) prepared for the State of Nevada Nuclear Waste Project Office provides corroboration for the expectation that investment in the tourism industry is likely to continue. First, there is a sense of sustained interest, in general, in Las Vegas' potential for market growth and above average returns on investment in the tourism industry. Second, there is a drive to define a new Las Vegas family-oriented casino resort concept that will appeal to middle-class families. Third, there is growing representation of Asian capital in the ownership of Las Vegas casino hotels, which indicates an increasing attractiveness of the Las Vegas tourism industry to overseas investors.

### **3.4.2 Economic Development and the Repository Program**

The concept of economic development is a reflection of economic structure and does not simply reflect increases in economic output. As discussed in Chapter 2, the economy of southern Nevada has historically undergone many structural changes, from a mining and agricultural economy in its early years, to an economy based primarily on tourism and government-related activities. Economic development implies a diversified economic structure, one in which there are many different types of industries rather than a structure that is overwhelmingly dominated by one or two industries. Many State and local officials consider diversification of Nevada's economy to be a top priority, and many efforts have been made to achieve this goal. These efforts include taking advantage of southern Nevada's proximity to the southern California markets for warehousing, aerospace manufacturing, financial services, and innovative transportation technology.

Perhaps the most important opportunity for economic development provided by the repository program is the possibility of a rail spur to Yucca Mountain from either the Southern Pacific rail line in the northern portion of the State or the Union Pacific rail line in the southern portion of the State. The preferred location for a rail spur has not been selected at this time. Also, the possibility of public and private shared use of a rail spur on which spent fuel is transported is currently being considered by DOE. Nevertheless, if a rail spur were to be built and shared use were possible, economic development prospects for rural Nevada counties through which the spur would pass could be enhanced since the spur would link these counties directly with the transportation infrastructures that currently exist in the northern or southern urban areas of the State. With such a linkage, businesses located in these rural counties could more easily ship their products to urban markets, thereby enhancing the export base of the counties. Additionally, businesses seeking a new location may find these rural counties more attractive because of a transportation link to export markets. Thus, the repository program may contribute to the economic viability, diversification, and development of portions of Nevada.

Because the repository may be defined by some as a hazardous activity, some limitations on the prospects for economic development in Nevada may result. High-level radioactive waste is a hazardous material that will be enclosed in casks specially designed for safe transport and long-term storage. Nevertheless, residents of Nevada may demand increased levels of government regulation over all industries engaged in hazardous activities as a result of increased public awareness of the repository program. Such regulations may increase the cost of production within Nevada or may discourage some types of firms from locating in Nevada.

### **3.5 Distribution of Public Lands for Towns that May Experience Population Growth**

The towns identified in Figure 3.2-2 that may experience noticeable repository-related population growth are Pahrump, Amargosa Valley, and Beatty in Nye County and Indian Springs in Clark County. Analyses of the distribution of public and private land surrounding these communities indicated that public land should not be a constraint on population growth. The potential necessity for the distribution of public land was investigated in terms of current land ownership patterns near potentially affected communities. Each community is bounded by public land to some degree. Pahrump is subdivided into about 42,000 private lots of which approximately 2,000 have dwellings on them (Stiles, 1988). Amargosa Valley covers about

300 square miles of private land with a current population of about 900 (Copeland, 1988). Beatty has over 900 acres of relatively undeveloped private land north and to the south of town along U.S. Highway 95 and near the airport. The Indian Springs townsite covers about 1,200 acres which is surrounded by military reservation and Bureau of Land Management (BLM) public lands. Discussions with the State Office of the BLM indicated that it is the policy of the BLM not to allow the existence of public land to impede community growth and that procedures exist for the transfer of public lands administered by the BLM to local communities (Wolder, 1988).

### **3.6 Transportation**

This section identifies potential repository-related changes in traffic patterns within the study area and potential effects to roadways from repository-induced population growth and shipments. It also identifies projected maximum annual maintenance costs associated with shipment of high-level radioactive waste on mainline railroads in Nevada.<sup>10</sup> These forecasts were developed using the methods described in Section A1.8 of the Appendix. This section also discusses possible effects of a rail spur linking one of the mainline railroads to Yucca Mountain.

The potential effects of the repository on the roadway transportation system of southern Nevada may be separated into two categories: the effects on the highway users and the effects on the highway facilities. User effects were estimated through an evaluation of existing and future levels of service (LOS). The LOS is a measure of the operational conditions on a roadway, especially the delay, congestion, and conflicting movements experienced by a driver. Factors used to calculate LOS include average daily traffic, vehicle mix, type of roadway, number of lanes, and other physical characteristics. A level of service definition generally describes these conditions in terms of factors such as speed and travel time, freedom to maneuver, traffic interruptions, convenience, and safety. Appendix A1.8 describes the criteria for LOS A through F and discusses the methods used to forecast potential effects on highway users and highway facilities. The six levels of service, A through F, represent a continuum of operating conditions, A being the best and F the worst. Facility effects were estimated in terms of the potential degradation of the transportation routes and the potential costs associated with their maintenance.

Potential maintenance costs for mainline railroads in Nevada were forecasted on the basis of a comparison of the estimated maximum annual gross tonnage of waste shipments projected to enter Nevada, with the annual gross tonnage that each mainline carries as a designated Class A railroad (U.S. Department of Transportation, 1977). Discussion of the assumptions used for projecting maintenance costs for mainline railroads is presented in Section A1.8 of the Appendix.

#### **3.6.1 Effects on Highway Users**

Southern Nevada's diverse geographic region, with its growing and active metropolitan area surrounded by a sparsely populated rural area, is exemplified in the characteristics of the existing roadway transportation system. Within metropolitan Clark County, a well defined and maintained roadway system exists. The rural areas in southern Nye County are served primarily by U.S. Highway 95, Nevada Highway 160, and rural transportation routes. These

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<sup>10</sup> At this time, no transportation routes have been determined. See Section A1.8 in the Appendix for the assumptions used for the purposes of this report.

systems are supported by planning processes, the objective of which is to ensure adequate service for the needs of the current and future population and level of economic activity. Figure 3.6-1 illustrates the highway network in the four-county area.

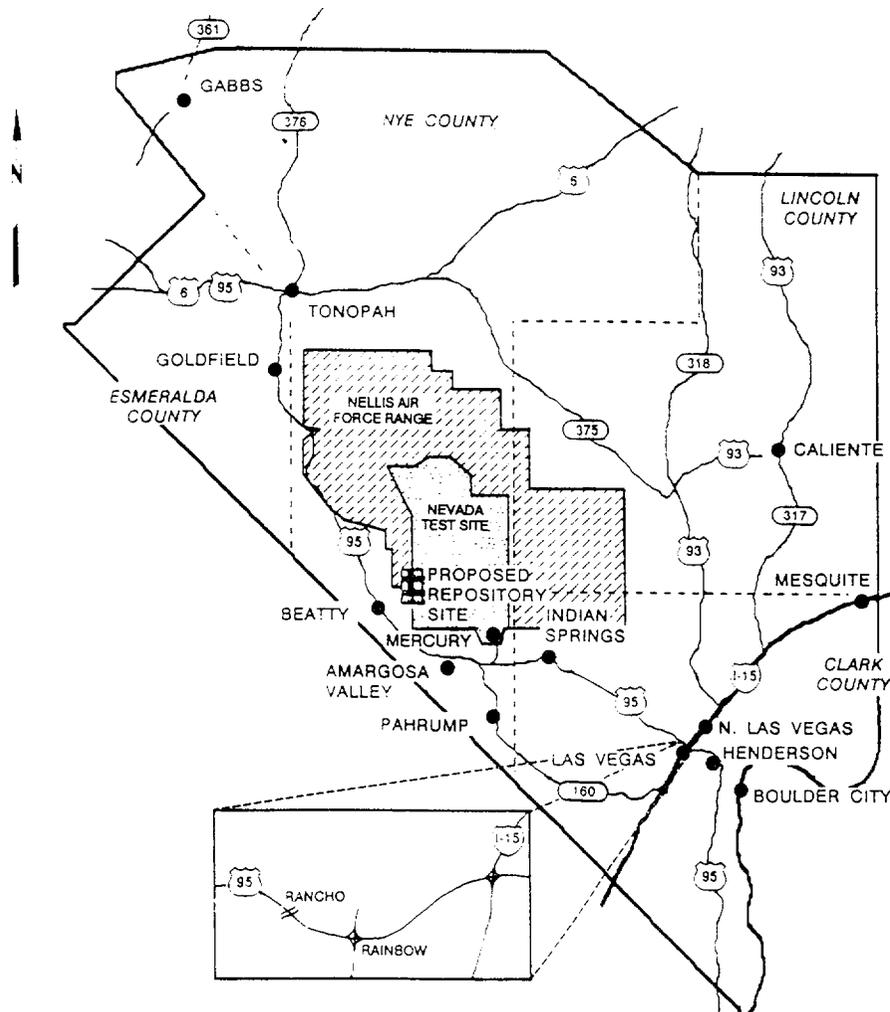


Figure 3.6-1. Highway Network in the Four-County Area

**3.6.1.1 Levels of Service (LOS)** Using the average daily traffic (ADT) counts provided by the Nevada Department of Transportation (1988), traffic conditions without the repository program were forecasted. It was assumed that the baseline traffic conditions would develop at a rate directly proportional to the baseline population growth. Based on the ADT counts and baseline population growth, LOS for peak hour traffic<sup>11</sup> were estimated for the years 1988,

<sup>11</sup> All repository workers are assumed to report to work at the same time, which is defined as peak hour for purposes of this analysis. The amount of traffic generated by repository workers, as well as other repository-related traffic, is added to the maximum hourly traffic flow (the baseline), which is approximately 8 percent of daily traffic (Nevada Department of Transportation, 1988).

1990, 2000, and 2008 using the *Highway Capacity Manual* of the Transportation Research Board (1985). The latter three years correspond to years estimated to have the highest repository-induced traffic volumes for the site characterization, construction, and operation phases, respectively. Using the assumption that buses will be available during site characterization to transport workers to the Yucca Mountain site, the other assumptions stated in the Appendix, and the four scenarios described in the Appendix, estimated LOS with repository-induced traffic were also projected for the years 1990, 2000, and 2008. Comparison of peak-hour traffic flows from these projections, which are summarized in Table 3.6-1, indicate some potential effect to LOS on six segments of the transportation network of southern Nevada over the life of the repository program. These effects are projected to occur during peak hours only and do not affect daily traffic during other hours.

**3.6.1.2 Projections of Traffic Accidents** The number of accidents is assumed to rise proportionately to the number of vehicles using the roadway. If the repository program adds traffic to the system, accidents will increase. Accident projections are made by applying an accident rate to the number of vehicle miles traveled on a section of roadway. Therefore, as the repository program adds traffic to the roadway, the projected number of accidents increases. Accident rates obtained from Nevada Department of Transportation (1988) were calculated using data from 1985 through 1987. The incremental accidents from the repository traffic are the product of the projected daily trips to the repository, the estimated miles traveled for each round trip, and the accident rates. Table 3.6-2 contains the accident projections for the 72-year life of the repository for both the base traffic and repository-generated traffic for each of the four scenarios described in the Appendix.

With the additional traffic generated by the repository, more accidents will occur during the project's life if the average accident rates remain constant and if site workers are subject to those rates. These accidents represent an increase over the 72-year life of the project of less than 1.5 percent over the expected number of accidents on these highway segments without the repository program.

### **3.6.2 Effects on Highway Facilities**

Degradation of the roadway transportation network is directly related to increased traffic flow or a change of the mix of vehicle types over a particular segment of the network. Passenger automobiles cause very little pavement damage compared to trucks and buses. Increased repository-related truck traffic would cause some adjustment in the current schedule for maintenance maintained by the Nevada Department of Transportation (1988) for the road network. The increase in traffic volume due to the repository program is projected to result in an increase of about 0.5 percent in the expected pavement maintenance costs for the southern Nevada transportation system over the life of the program. Table 3.6-3 summarizes projected highway maintenance costs without the repository and the incremental costs that may be attributable to repository-generated traffic for each of the scenarios described in the Appendix.

**Table 3.6-1 Peak Hour Levels of Service\*: Without and With Repository-Generated Traffic**

Segment	1988	Site		Const.		Operation	
		Charact. w/o	w	w/o	w	w/o	w
US-95: Beatty to Amargosa Valley							
BEA	A	A	A	B	B	B	B
NTS-1	A	A	A	B	B	B	B
NTS-2	A	A	A	B	B	B	B
NTS-3	A	A	A	B	B	B	B
US-95: Amargosa Valley to SR-160							
BEA	A	A	B	B	F	B	E
NTS-1	A	A	B	B	F	B	E
NTS-2	A	A	B	B	F	B	E
NTS-3	A	A	B	B	F	B	E
US-95: SR-160 to Mercury Interchange							
BEA	A	A	B	B	D	C	D
NTS-1	A	A	B	B	E	C	E
NTS-2	A	A	B	B	E	C	E
NTS-3	A	A	B	B	E	C	E
US-95: Mercury Int. to Indian Springs							
BEA	A	A	A	A	A	A	B
NTS-1	A	A	A	A	C	A	B
NTS-2	A	A	A	A	B	A	B
NTS-3	A	A	A	A	C	A	B
US-95: Indian Springs to Rancho Rd.							
BEA	A	A	A	A	B	B	B
NTS-1	A	A	A	A	C	B	C
NTS-2	A	A	A	A	C	B	C
NTS-3	A	A	A	A	C	B	C
US-95: Rancho Rd. to Rainbow Ave.							
BEA	A	A	A	B	C	C	C
NTS-1	A	A	A	B	D	C	D
NTS-2	A	A	A	B	D	C	D
NTS-3	A	A	A	B	D	C	D
US-95: Rainbow Ave. to I-15							
BEA	E	F	F	F	F	F	F
NTS-1	E	F	F	F	F	F	F
NTS-2	E	F	F	F	F	F	F
NTS-3	E	F	F	F	F	F	F
SR-160: Pahrump to US-95							
BEA	A	A	A	A	E	A	D
NTS-1	A	A	A	A	C	A	B
NTS-2	A	A	A	A	D	A	B
NTS-3	A	A	A	A	B	A	B

\* See Section A1.8 in the Appendix for definitions of levels of service.

**Table 3.6-2 Accident Projections**

**Base Traffic (Without Repository)**

	<u>Property</u>	<u>Injury</u>	<u>Fatal</u>	<u>Total</u>
Site Characterization (10 years)	6,067	3,326	126	9,519
Construction (5 years)	4,269	2,340	89	6,698
Operation (50 years)	73,408	40,239	1,528	115,176
Closure (7 years)	13,712	7,516	286	21,514
<b>72 Year Total</b>	<b>97,456</b>	<b>53,421</b>	<b>2,029</b>	<b>152,907</b>

**Repository-Generated Traffic\***

	<u>Property</u>	<u>Injury</u>	<u>Fatal</u>	<u>Total</u>
Site Characterization (10 years)				
BEA	28	24	2	54
NTS-1	28	24	2	54
NTS-2	28	24	2	54
NTS-3	25	21	2	48
Construction (5 years)				
BEA	117	99	8	224
NTS-1	153	123	8	284
NTS-2	143	116	9	268
NTS-3	163	129	9	301
Operation (50 years)				
BEA	798	660	51	1,509
NTS-1	963	795	57	1,815
NTS-2	961	768	56	1,785
NTS-3	1,018	806	57	1,881
Closure (7 years)				
BEA	45	38	3	86
NTS-1	55	44	3	102
NTS-2	55	44	3	102
NTS-3	58	46	3	107
<b>72 Year Total</b>				
BEA	988	821	64	1,873
NTS-1	1,199	986	70	2,255
NTS-2	1,187	952	70	2,209
NTS-3	1,264	1,002	71	2,337

\* The incremental accidents from repository-generated traffic are the product of projected daily trips to the repository, the estimated miles traveled for each round trip, and current accident rates.

**Table 3.6-3 Pavement Maintenance Costs\* (in thousands of constant 1988 dollars)**

Without Repository Traffic

	<u>Trucks</u>	<u>Autos</u>	<u>Total</u>
Site Characterization (10 years)	\$17,500	\$200	\$17,700
Construction (5 years)	12,300	100	12,400
Operation (50 years)	212,100	2,500	214,600
Closure (7 years)	39,600	500	40,100
72 Year Total	\$281,500	\$3,300	\$284,800

Repository-Generated Traffic

	<u>Trucks</u>	<u>Autos</u>	<u>Total</u>
Site Characterization (10 years)			
BEA	\$313	\$3	\$316
NTS-1	278	3	281
NTS-2	278	3	281
NTS-3	619	3	622
Construction (5 years)			
BEA	\$420	\$13	\$433
NTS-1	418	15	433
NTS-2	418	14	432
NTS-3	449	16	465
Operation (50 years)			
BEA	\$747	\$86	\$833
NTS-1	747	95	842
NTS-2	747	95	842
NTS-3	747	99	846
Closure (7 years)			
BEA	\$37	\$5	\$42
NTS-1	37	5	42
NTS-2	37	5	42
NTS-3	37	6	43
72 Year Total			
BEA	\$1,517	\$107	\$1,624
NTS-1	1,480	118	1,598
NTS-2	1,480	117	1,597
NTS-3	1,852	124	1,976

\* The cost of maintaining the pavement at the present condition was estimated by multiplying projected Equivalent Single Axle Loads (ESAL) miles by a constant cost of \$0.05 per ESAL-mile.

### **3.6.3 Maintenance Effects on Railroad Mainlines in Nevada**

Nevada is currently served by the Union Pacific and Southern Pacific railroads. These mainlines are designated as Class A railroads by the U.S. Department of Transportation (1977) and currently carry more than 20 million gross shipped tons per year. Using the assumptions specified in Section A1.8 of the Appendix, the projected annual maximum gross tonnage of waste shipped to the Yucca Mountain facility was compared to the annual gross shipped tonnage currently handled by each mainline through Nevada (20 million tons). Maintenance costs for railroad mainlines in Nevada are assumed to be directly proportional to annual gross tonnage handled by these lines. This comparison indicated that waste shipments may result in an increase in maintenance costs of less than 1.0 percent in the year when the maximum number of waste shipments may occur.

### **3.6.4 Possible Effects of a Rail Spur**

A rail spur from either the Union Pacific mainline or the Southern Pacific mainline to the Yucca Mountain site will be constructed; however, the location for the spur has not been determined. Nevertheless, effects associated with a rail spur fall into three categories, regardless of its location: economic effects, effects on services and facilities, and effects on the management of accidents involving high-level radioactive waste.

Construction and maintenance of a rail spur will create both direct and secondary employment in Nevada, although employment levels will be small compared to those generated by constructing and operating the repository. Because the location of the spur has not been determined, employment associated with it cannot be forecasted. In addition to employment effects, a rail spur may create opportunities for economic development in rural areas through which it may pass by linking such areas to transportation networks located in the Reno-Sparks-Carson City area of Nevada or in the Las Vegas area. The possible effects on economic development are discussed in Section 3.4.2.

Minor and temporary population effects on the capabilities to provide some types of services and facilities in areas close to a rail spur may occur during its construction. Examples of such population-related services and facilities are described in Section 3.2. Construction of the spur is estimated to take one-to-two years and the possible effects on services and facilities cannot be estimated until its location is determined.

This report assumes, although it has not been determined, that DOE will bear the costs associated with obtaining rights-of-way for a rail spur and costs of construction, maintenance, and operation of the rail access to Yucca Mountain. Therefore, these costs and any associated effects of a rail spur are not considered in this report.

Plans for managing accidents involving high-level radioactive waste may have to be modified for counties or Indian reservations through which the waste may be transported. Management of accidents involving high-level radioactive waste is discussed in Section 3.7.

### 3.7 Management of Accidents Involving High-Level Radioactive Waste

Issues related to the management of accidents may be categorized into planning for high-level radioactive materials incidents, training of emergency response personnel, the availability of radiation detection equipment, and the care of patients potentially contaminated with radioactive materials. Changes in each of these four categories may be needed as a result of the repository program.

Currently, the capabilities within the State and counties have been focused on managing accidents involving industrial and medical sources of radiation, commercial low-level radioactive waste shipments, and effects resulting from potential accidents occurring at the Nevada Test Site. As a result of this focus, training and equipment for managing accidents are concentrated primarily in the Reno-Carson City area and in the southern half of Nevada.

Under the *Hazardous Materials Operations Support Plan* (State of Nevada, 1986), the Radiological Health Bureau of the State of Nevada has primary responsibility for assessing, managing, and mitigating radioactive materials incidents that occur on non-Federal property within Nevada. The Bureau is currently staffed by six health physics professionals, one of whom is located in Beatty, two of whom are in Las Vegas, and three of whom are in Carson City. The Bureau is the State agency that would receive prenotification of all high-level radioactive waste shipments.

The Nevada Division of Emergency Management is responsible for coordinating State responses to radioactive materials incidents on non-Federal lands. Through an agreement with the San Francisco regional office of DOE and a Memorandum of Understanding with the State of Nevada, the Radiological Assistance Team of DOE/Nevada Operations Office (DOE/NV) is available to assist State, local, and county officials in responding to incidents when formally requested. DOE/NV houses the largest collection of radiological emergency response equipment in the United States, and can respond to a radiological accident anywhere in Nevada, the U.S., or throughout the world, if requested.

Planning for a response to incidents involving radioactive materials varies by county within Nevada. For example, Clark County has specific plans for dealing with such incidents and has participated in exercises with both DOE and the City of Las Vegas (Ryckman, 1988); Esmeralda County, however, does not have a plan for dealing with radioactive incidents (PIC, 1987a). Because of this variability, the Nevada Division of Emergency Management prepared a model plan for response to hazardous materials, including radioactive materials, and provided the plan to all counties for their modification and adoption (Ozawa, 1988). Follow-up on the modification and adoption of this model plan by each county in Nevada will be needed irrespective of the repository program. Additional modification of the model plan may be needed in those counties or Indian reservations through which high-level radioactive waste may be transported.

The Federal government, through the Federal Emergency Management Agency (FEMA) and DOE, has played a central role in training State, county, and local emergency response personnel. Together, FEMA and DOE developed and provide, free of charge, a series of radiological emergency response training courses in Nevada. These courses, their target audiences, and the frequency with which they are presented are indicated in Table 3.7-1.

Currently, all of the staff at the Nevada Radiological Health Bureau have taken the Radiological Emergency Response course (Marshal, 1988). In addition to the staff of the Bureau, nearly 3,000 attendees have participated in these training courses since they were initiated in 1981. Because of activities at the Nevada Test Site and the existence of a low-level radioactive waste repository at Beatty, a large percentage of the number of people who have been trained are from the southern half of the State.

**Table 3.7-1. Radiological Emergency Response Training Courses in Nevada**

<u>Course</u>	<u>Duration</u>	<u>Audience</u>	<u>Frequency</u>
● Radiological Emergency Response (RER)	8 1/2 days	State, county, local radiological emergency response team members	Monthly at the Nevada Test Site
● First-on-Scene (FOS) Radiological Response	3 days	State, county, local fire fighting personnel	Quarterly at the Nevada Test Site
● First-on-Scene (FOS) Radiological Response	4 days	State, county, local law enforcement personnel	Semiannually at the Nevada Test Site
● Refresher Course	1 day	State, county, local law enforcement personnel	Quarterly at the Nevada Test Site
● Radiological Seminar for Medical Personnel	1 day	Emergency medical personnel including EMT's, paramedics, and nurses	Annually throughout Nevada
● Emergency Radiological Response Training	1 day	First response personnel at all levels	Periodically throughout Nevada
● Basic Transportation Workshop	5 day	Persons handling and transporting hazardous materials, including radioactive materials, includes emergency response (1 day)	Periodically throughout Nevada

In addition to the training courses offered by DOE and FEMA, the State's Emergency Response Commission has directed the Nevada State Fire Marshal's Office to establish a Hazardous Materials Training Center in cooperation with DOE. This center will provide hands-on training for all hazardous materials incidents, including radioactive materials. The center will provide training for State, County, and local emergency response personnel (Williams, 1988).

There are a number of radiation detection kits throughout the State of Nevada as a result of the training of law enforcement officers for radiological emergency response. These kits are located in patrol vehicles. The Nevada Radiological Health Bureau is also equipped with radiation detection and monitoring equipment. This equipment includes calibrated instruments designed to detect alpha, beta, and gamma radiation.

The availability of radiation detection equipment, however, varies widely throughout the State. Discussions with the Coordinator of the Office of Emergency Management for Clark County indicated that every fire chief within the county has a civil defense radiation kit available (Ryckman, 1988). Lincoln County also has radiation detection equipment and radiation dosimeters available for the emergency response department in that county (PIC, 1987b). The only radiation detection equipment available in southern Nye County, however, is limited to several Geiger counters that are available to the Sheriff's Department (PIC, 1987c), and Esmeralda County has no specific equipment available to deal with incidents involving radioactive materials (PIC, 1987a). The availability of radiological response equipment in other counties or on Indian reservations in the State is not known at this time; however, the availability of such equipment appears to be concentrated in the Reno-Carson City area and in the Las Vegas-Clark County area. The need for radiation detection equipment will be further evaluated and may need to be upgraded and expanded in areas of Nevada or on Indian reservations through which high-level waste may be transported.

While an extensive training program for medical emergency response personnel already exists and many people have been trained, there is only one medical facility in the State that has a formal agreement to handle patients who have been contaminated with radioactive materials. This facility is the University Medical Center of Southern Nevada in Las Vegas. Additional training, cooperative agreements, or equipment may need to be provided as a result of the repository program.

### **3.8 Other Repository-Related Administrative Needs of State and Local Governments In Nevada**

The Nuclear Waste Policy Act of 1982 and as amended in 1987 recognizes that the repository program is a complicated planning process that requires participation by the affected State, by affected units of local government, by affected Indian Tribes, and by the general public. Participation grants have been available to the State and affected units of local government and will be required in the future to ensure effective participation through development of State and local organizations.

## 4.0 MITIGATION

*This chapter describes the authority available to the Secretary of Energy under the Nuclear Waste Policy Act, as amended, to mitigate impacts that may occur within Nevada as a result of the repository program and describes the process through which impacts will be mitigated. This chapter concludes with an analysis of existing responsibilities, authorities, and sources of funds to provide those services and facilities specified in Section 175(b) of the Act.*

### 4.1 Introduction

Mitigation, as defined in this report, is a process whereby the effects<sup>12</sup> of a project are managed to avoid, minimize, or ameliorate adverse impacts. There are no specific rules about mitigation approaches, because each combination of project, area, and situation is unique. Mitigation takes place in a context of complex interactions among many factors, including project and work force characteristics, project management decisions, uncertainty, timing of various activities, local preferences, economic conditions, the regulatory environment, rates and location of growth, and the ability and desire of existing communities to accommodate growth.

Some effects due to the project might be regarded as positive by those communities that encourage growth and actively expand the capacity of their services and facilities to accommodate it. Other communities may view any change as a negative effect. For these reasons, the determination of impacts and mitigation must result from consultation with those experiencing the effects of the project.

The responsibility and authority to provide services and facilities in Nevada and to expand or change them is usually provided in State-enabling legislation. Exceptions include those categories of services or facilities that are the responsibility of the Federal government, namely, the distribution of public lands, which is the responsibility of Federal agencies such as the Bureau of Land Management, and the provision of guidance and funding for emergency response activities, which is the responsibility of the Federal Emergency Management Agency. The funds to provide facilities and services typically come from a variety of local, State, and Federal sources, some of which are discussed in Section 4.3.

### 4.2 The Secretary's Authority for Mitigation Under the Nuclear Waste Policy Act (NWSA), as Amended

The provisions of the NWSA, as amended, authorize the Secretary to mitigate impacts that may occur as a result of the repository program. Under Section 113(a), DOE is required to avoid or minimize significant adverse impacts to the maximum extent practicable. In the event that such impacts cannot be adequately minimized or avoided through modifications to the conduct of DOE's activities, DOE will seek appropriations from Congress to provide financial assistance from the Nuclear Waste Fund, under Section 116(c)(2), to address such

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<sup>12</sup> For the purpose of this report, the term *effects* refers to repository-related changes in conditions within the study area or the State of Nevada. The term *impacts* refers to those changes that are deemed to warrant mitigation, as determined through consultation with the State of Nevada and units of local government.

impacts. Moreover, under Section 116(c)(3), DOE will provide payments-equal-to-taxes, which will be available to mitigate impacts. The repository program, particularly over the long term, will generate taxes and other additional revenues in the State and local economy. Further, DOE will work with other Federal agencies to implement appropriate mitigation.

In addition to the provisions for impact mitigation outlined in Section 113(a) and Section 116, the NWPA, as amended, provides two other mechanisms to address impact mitigation. Under Section 171, the State may agree to enter into a Benefits Agreement. Such an agreement would provide for annual payments to the State in accordance with the schedule provided in the Act. Under Title IV of the Act, a Negotiator is empowered to enter into negotiations with any State (including Nevada) or Indian Tribe to specify the terms and conditions under which such State or Tribe would agree to host a repository.

### **4.3 The Mitigation Process**

For clarity, the following principal steps in the mitigation process are described sequentially. They may, however, occur simultaneously.

#### **4.3.1 Identification of Potential Effects**

The mitigation process begins with an initial identification of potential effects associated with the Yucca Mountain project. This report contains an initial identification of potential effects within Nevada that may result from the repository program.

#### **4.3.2 Implementation of a Monitoring Program**

A second step in the mitigation process is the implementation of a monitoring program. Monitoring affords the opportunity to identify emerging impacts and to address those impacts early with a variety of management techniques. It also provides accurate data with which new projections of effects can be made with greater certainty. The effectiveness of implemented mitigation options can be determined and alterations to those options can be made.

Currently, DOE is monitoring the size of the repository program work force employed in Nevada, the household size of program workers who relocate to Nevada, and residential locations of new workers. This program is described in the *Socioeconomic Monitoring and Mitigation Plan for Site Characterization, Revision 1* (SMMP) (U.S. DOE, 1988d). The SMMP will be revised and will incorporate monitoring of those categories identified in this report as potentially affected by the repository program. DOE will also monitor the repository program's procurement of materials and services, short-term future procurement requirements, and short-term employment needs.

DOE will periodically provide short-term projections of potential effects on the categories identified in this report as possibly affected by the repository program and on other categories that emerge in the future that have been included in the monitoring program. These projections will facilitate timely, effective, and interactive mitigation.

#### **4.3.3 Selection and Implementation of Appropriate Mitigation**

Consultation represents a third step in the mitigation process. Mitigation requires a common understanding among DOE and State and local parties about the nature and size of potential effects, the relationship of one effect to another, and the need for mitigation of those effects determined through consultation to be impacts. Such an understanding requires consultation with appropriate local representatives, providers of services and facilities, and other

appropriate parties to determine their preferences.

The preferences that emerge from consultation will guide the selection of appropriate and specific mitigation strategies, which fall into three general approaches. In the first general approach, project characteristics, particularly project work force characteristics, can, to some extent, be modified. Such changes could include adjusting the sequence of project activities, changing hiring practices, and providing training programs. Programmatic decisions will consider mitigation of those impacts not related to population growth such as those associated with emergency preparedness and the transportation of nuclear waste.

The second general approach involves influencing the incidence of project-related population growth by encouraging immigrating workers to reside in communities that have expressed a desire for growth and either have or can develop sufficient facilities and services to accommodate growth within the existing resource framework.

The third approach to mitigating impacts focuses on increasing the capacity of community facilities and services to accommodate new residents where the existing resources are insufficient. This approach could include expanding existing facilities, constructing new facilities, and increasing services.

The first two approaches are supported by Section 113(a) of the NWPA, as amended, which requires that DOE, to the maximum extent practicable, "conduct site characterization activities in a manner that minimizes any significant adverse environmental impacts." DOE will minimize significant adverse impacts beyond site characterization through all phases of the repository program to the maximum extent practicable. The third approach is supported by Section 116 of the Act, under which the State and affected units of local government may request and receive impact assistance from DOE.

An understanding of the timing, severity, and duration of a projected impact is of particular importance in the selection of appropriate mitigation. A rapid influx of relatively short-term residents may create transitory or temporary impacts upon services and facilities. Such temporary impacts should be distinguished in the monitoring program from impacts that may result from long-term population changes that may accompany the operations phase of the repository program. This distinction is important because mitigating temporary impacts with techniques more appropriately applied to long-term impacts can result in a burden on service providers after the temporary impact subsides. Temporary solutions can often be found to mitigate short-term impacts.

#### **4.4 Existing Responsibilities, Authorities, and Sources of Funds to Provide Facilities and Services**

Chapter 3 identified potential effects in twelve of the fourteen categories described in Section 175 of the NWPA, as amended, that may result from the repository program. DOE anticipates that those entities that customarily provide facilities and services are in the best position to identify and administer mitigation, and that they will continue to provide these facilities and services in accordance with the authority provided under State statutes and ordinances. The information presented in the following sections is intended to serve as an initial step in identifying those entities responsible for administering mitigation. DOE will consult with the State and units of local government to clarify the responsibilities, the authorities,

typical sources of funds for the provision of facilities and services, and the need for mitigation funds beyond those normally available from existing sources.

The following information is based on inventories of local facilities and services prepared in 1987 and 1988 for the State of Nevada by Planning Information Corporation (PIC), and other available sources including the Nevada Revised Statutes, Biennial Report of Nevada State Agencies, and Legislative Appropriations Report.

#### **4.4.1 Education**

Elementary and secondary schools may experience some effects as a result of the repository program. No effects are projected for community colleges, vocational and technical schools, and universities. Because elementary and secondary education is primarily the responsibility of Nevada county school districts, the affected districts would be responsible for administering mitigation in accordance with State requirements and regulations. The primary source of funds for education are local property taxes, the Local School Support Tax, and the State Distributive School Fund (PIC, 1987d: 80-82). School district bond issues are the principal means for supporting major permanent capital improvements (PIC, 1988b: 256-257). A small percentage of district funds comes from county privilege and franchise taxes, nonrecurring local and Federal revenues, district-specific revenues, private contributions, and State Improvement Incentive Grants (PIC, 1987d: 80-82).

#### **4.4.2 Public Health**

Water systems and wastewater treatment systems may experience some effects as a result of the repository program. No effect is projected on the control of pests or the disposal of solid waste. In some cases, water and wastewater treatment systems are established by communities as special districts under the auspices of State-enabling legislation, while some operate on an enterprise basis (PIC, 1987d: 96-101). Investor-owned water and wastewater treatment utilities are formed by private sector entrepreneurs with the Nevada Public Service Commission regulating the business activities, designating operating territories, and monitoring service quality (PIC, 1987d: 140-144; 1988b: 188-190). Water drilling and use and wastewater discharge are regulated by a number of county and State commissions, boards, councils, and departments. Funds for publicly and investor-owned water and wastewater treatment system development and operation are derived primarily from connection fees and user charges (PIC, 1987d: 100-101, 118, 140-141; 1988b: 188-189). Additional funding and technical assistance may be available from special State grants.

#### **4.4.3 Law Enforcement**

Law enforcement agencies, including their facilities, may experience some effects as a result of the repository program. Law enforcement in Nevada is provided primarily by the counties through their county sheriff's offices and substations, district courts, justices of the peace courts, and district attorney's offices (PIC, 1987d: 25-32, 48-54; 1988b: 4-19, 225-242). In Clark County, the Las Vegas Metropolitan Police Department is responsible for the City of Las Vegas and unincorporated areas in the county, including Indian Springs (PIC, 1988b: 63, 192). In Nye County, the Sheriff's Department is responsible primarily for the entire county, except for the unincorporated City of Gabbs, which has a police department (PIC, 1988b: 235). In Esmeralda County, the Sheriff's Department provides services to the whole county (PIC, 1987a: 11-12). In Lincoln County, the Sheriff's Department provides services to all areas of the county, except for the City of Caliente, which has a police department (PIC,

1987b: 11-12). Counties are responsible for constructing and operating their own jails (PIC, 1987d: 25; 1988b: 235). The Nevada Highway Patrol polices the public highways, enforces traffic and criminal laws of the State, and investigates motor vehicle accidents. The State Law Enforcement Academy provides training to community and county officers (PIC, 1987d: 27; 1988b: 235). The majority of funds for county law enforcement services comes from general county revenues (PIC, 1987d: 32, 48, 52-53; 1988b: 5, 8, 12, 64, 225, 227, 230, 236). County and community bond issues are used to fund permanent law enforcement capital facilities (PIC, 1987d: 26, 111; 1988b: 237). The Nye County Sheriff's Department is reimbursed by DOE for law enforcement provided during protest demonstrations at the Nevada Test site.

#### **4.4.4 Fire Protection**

Fire protection services may experience some effects as a result of the repository program. Counties are responsible for the fire protection and emergency needs in their respective incorporated areas. Local fire departments can be established by petition or by the county commissions in incorporated and unincorporated communities, and they have proscribed district boundaries (PIC, 1987d: 32; 1987b: 118). Most services for fire protection and emergency medical care (ambulance corps) in rural areas are staffed by volunteers, with a limited number of paid professionals (PIC, 1987d: 132). The State Fire Marshal's Office provides training for firemen (PIC, 1987d: 92). Sources of funds for fire protection and emergency services are local general revenues, county general funds, run reimbursement fees, service clubs, and private contributions (PIC, 1987d: 92, 132, 133). Communities and counties can use bond issues to fund permanent improvements, such as new fire stations, and have the option of using capital leases for fire trucks (PIC, 1987b: 19; 1987d: 38, 111). Counties can provide grants to local fire departments for equipment and vehicle purchases (PIC, 1987d: 92, 132). County agencies often provide ambulances and manage policy, procedures, and budgets for local ambulance services within their jurisdictions under State licensing and permitting authority (PIC, 1988b: 249-250).

#### **4.4.5 Medical Care**

Medical facilities and personnel may experience increased demands for services as a result of population increases associated with the repository program. Medical care is available to county and community residents from four providers—the State, counties, hospital districts, and private practitioners. Emergency medical care service (ambulance service) is generally provided in conjunction with local fire departments. The State provides Community Health Nurse services under contract to rural counties for their communities and schools (PIC, 1987a: 9; 1988b: 263-264). Hospital districts are authorized and operated as special improvement districts, pursuant to Nevada statutes in accordance with State standards (PIC, 1988b: 259-261). Counties provide Medical Indigents Assistance, funded primarily by property taxes, to those in need. The State has a Medical Indigent Fund, whose revenue is also derived from property taxes, to assist counties in case of heavy demands for assistance (PIC, 1987d: 43). Community medical clinic facilities are provided by counties, their respective communities, or private organizations. Clinics are operated by both private health care groups and quasi-government agencies—rural health consortia organized by Nevada counties under the authority of county commissioners under Nevada regulations (PIC, 1987d: 101-102, 116-117, 137-139). Many communities still have no doctors and dentists (PIC,

1987d: 102, 117). Operational funding for hospital districts is from *ad valorem* taxes on property assessments and patient fees; new capital facility funding comes from district bond issues (PIC, 1987d: 72-75; 1987b: 22-24; 1988b: 259-261). The operation of community clinics is funded primarily by patient fees; expenditures not reimbursed by patient fees are often covered by county health clinic funds. Facility construction is funded by the community or county bonds (PIC, 1987d: 72-75; 1988b: 259-261).

#### **4.4.6 Cultural and Recreational Needs**

The manner in which cultural and recreational facilities and services are developed and maintained may experience effects because of repository-related population growth. In areas that may be affected, provision of libraries, parks, swimming pools, senior and community centers, and indoor and outdoor sports facilities is primarily the responsibility of local communities (PIC, 1987d: 89-91, 111-113, 129-131). Funding sources for these recreation facilities and services vary by community, coming from such sources as county and community general funds, special improvement district revenues, library assessment district revenues, school district reimbursements based on school use, user charges, supplemental city/county relief taxes, hotel room taxes, county park and recreation funds, and private donations (PIC, 1987d: 90-91, 111-113, 129-131; 1988b: 248). The U.S. Department of the Interior's National Park Service, Bureau of Land Management, and Fish and Wildlife Service can also change the type of use that is available on public lands, should the need arise.

#### **4.4.7 Distribution of Public Lands**

No effects from the repository are projected on the distribution of public lands that would affect the timely expansion or creation of communities or the construction of needed residential and commercial facilities. The U.S. Department of Interior's Bureau of Land Management administers the majority of Federal public lands in Nye County. Communities can acquire the use of public lands for specific purposes and under varying conditions, such as through the provisions of Recreation and Public Purposes Act of 1926, as amended, under which the Bureau of Land Management can sell or lease Federal lands below market rates to State or local governments for schools, parks, recreational facilities and sanitary landfills. If public land is to be made available for local development, the Federal agency that administers that land has the authority to transfer it to local ownership.

#### **4.4.8 Vocational Training and Employment Services**

No effects are expected as a result of the repository program on vocational training and employment services in Nevada, although there may be a temporary shortage of highly skilled laborers with local experience and a shortage of skilled laborers without local experience. The primary responsibility for vocational training and employment services lies with the State, whose departments provide job research and placement services to State residents, operate a job training program, and provide rehabilitation services. Training is also available in area trade centers and vocational-technical schools, which are supported by county school districts. The State, in cooperation with post-secondary institutions, may sponsor continuing education and accelerated courses for specialty skills. Union halls regularly conduct training and apprenticeship programs. The State is a source of funds for training and employment assistance, as well as for targeted programs for dislocated workers and veterans.

#### **4.4.9 Social Services**

Additional demands for social services may occur in some areas due to population increases, both from repository worker immigration and transient workers seeking employment, and may require a reallocation of resources. This could include public assistance, vocational and physical rehabilitation, mental health service, and controlled substance and alcohol abuse programs. Public social services are a joint county and State responsibility, often provided on an outreach or traveling basis to rural areas of counties (PIC, 1987d: 20, 41-48; 1988b: 26-29, 249-253, 263-268). In addition, many social services are provided through private community service organizations, fraternal organizations, and service organizations to a greater extent in urban areas than rural areas. Counties provide information and referrals, as well as direct aid assistance programs for transients, elderly, handicapped, and families with children (PIC, 1987d: 43; 1988b: 26). The State provides clinics for mental health evaluation and treatment, including alcoholism and drug abuse, as well as mental health counseling (PIC, 1988b: 48, 268). State human service agencies, such as the Welfare Department, have offices in Clark County, but do not have a full-time presence in Nye, Lincoln, or Esmeralda counties (PIC, 1988b: 252; 1988c). The Federal government provides numerous social service and public assistance programs, all of which are administered by State or local agencies. These programs include the food stamp and nutrition programs. Funding for public social services comes from Federal revenues supplemented by county and State general revenues (PIC, 1987d: 44; 1988b: 27).

#### **4.4.10 Transportation**

Some effects may occur with respect to road systems in some areas, causing increases in traffic volume, accidents, and degradation; and to railroad mainlines, affecting maintenance costs, as a consequence of activities related to the repository program. The design, construction, repair, and maintenance of roads and highways are the responsibility of various agencies—Federal, State, county, or town governments. The State and counties fund their road, highway, and bridge construction from general funds and bond issues, from Federal grants, and from several special revenue sources, such as road funds (including revenue from the property tax; Supplemental City/County Reserve Tax and gas tax; intergovernmental payments from the National Forest receipts; transfers from other funds including the Regional Highway Fund, and a county's General and Capital Project funds), regional street and highway funds, public transit funds, and capital projects funds (PIC, 1987d: 34-37; 1988b: 21, 243). Priorities for the construction, maintenance, and paving of county roads are established by the appropriate boards and councils of jurisdictions in which the roads are located.

#### **4.4.11 Management of Accidents Involving High-Level Radioactive Waste**

There may be repository-related effects in the area of management of accidents involving high-level radioactive waste that would require additional planning, training, cooperative patient care agreements, and equipment. The State has overall responsibility on non-Federal lands for emergency preparedness and accident management and coordinates its emergency preparedness planning, inspection, and training activities through its Division of Emergency Management (PIC, 1987a: 9-10; 1987b: 8-10; 1987d: 32-33). Other State agencies are also involved when nuclear projects and materials are present (PIC, 1987d: 33). County emergency management councils prepare emergency plans for each type of disaster, run drills, and ensure that emergency response agencies maintain their equipment (PIC,

1987b: 8-9; 1987d: 33; 1988b: 253). These councils consist of local and county officials, representatives from the sheriff and fire departments and medical and ambulance services, and private sector personnel. Only one medical facility in the State (the University Medical Center of Southern Nevada in Las Vegas) has a formal agreement to handle patients who have been contaminated with radioactive materials. Funds for emergency preparedness activities are from county, State, and Federal sources (PIC, 1987b: 10; 1987d: 33).

#### **4.4.12 Availability of Energy**

Increased demand for electricity due to repository-induced population growth may affect its cost in some areas. For areas where electricity is supplied by rural cooperatives, service levels are set and approved by members. Other areas are served by public power companies and the Nevada Public Service Commission regulates their business activities, designates operating territories, and monitors service quality. Ratepayers supply the funds for construction, operation, and maintenance of electric service. Counties are authorized to issue economic development revenue bonds for construction of new generation and transmission facilities.

#### **4.4.13 Tourism and Economic Development**

Possible changes in economic development patterns, generally, and in the tourism industry, specifically, in southern Nevada may result from the repository program. Promotion of tourism and economic development in Nevada is performed by a variety of State, county, and local government agencies, authorities, boards, commissions, and committees, as well as many private sector organizations and associations. They have a range of capabilities, which includes providing funding, technical assistance, and information. Funding for the State, county, and local authorities comes primarily from general revenues, special taxes, industrial bonds, redevelopment loans and bonds, revolving loans, Federal grants, and private contributions. Many private organizations and committees also participate in the promotion of tourism and stimulation of economic development, supported by a combination of public-sector and private-sector voluntary and assessed contributions. State and community chambers of commerce are major participants

#### **4.4.14 State and Local Government Administrative Needs**

Nevada and affected units of local government are participating in the planning process for the repository. The Nuclear Waste Policy Act, as amended, recognizes that as a result of the repository project, these governments are facing needs that would not have otherwise arisen and provides funding to address these needs during the life of the project. Additionally, repository-related population growth in some rural areas may necessitate a reallocation of general government functions to satellite offices to serve these communities. County governments in Nevada provide a broad range of services and facilities to unincorporated areas, including unincorporated towns (PIC, 1987d: 21-23). County administrators provide management services and are accountable to elected county commissioners. Generally, county administration staffs are small, located in crowded office space, and not easily accessible to the dispersed resident population (PIC, 1987d: 23). Many public services are provided by volunteers or by a combination of volunteers and local government funding (PIC, 1987d: 17). County services are funded primarily from a combination of property taxes and supplemental city/county relief taxes, including a sales and use tax (PIC, 1987d: 55-56). Under the 1981 State of Nevada statute, the amount of revenues available to local governments has been capped, limiting the flexibility to respond to facility and service demands

(PIC, 1987d: 18-19). Voters have often turned down general obligation bonds as a source of revenue for major capital improvements. Assistance is available from the State in special grants and revenue sharing.

## 5.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

*Based on the analyses contained in the preceding chapters, this chapter summarizes the findings and presents the major conclusions and recommendations.*

### 5.1 Introduction

Section 175(a) of the Nuclear Waste Policy Act (NWPA), as amended, requires the Secretary to:

*...report to Congress on the potential impacts of locating a repository at the Yucca Mountain site, including the recommendations of the Secretary for mitigation of such impacts and a statement of which impacts should be dealt with by the Federal Government, which should be dealt with by the State with State resources, including the benefit payments under Section 171, and which should be a joint Federal-State responsibility. The report under this subsection shall include the analysis of the Secretary of the authorities available to mitigate these impacts and the appropriate sources of funds for such mitigation.*

Based on the identification of potential effects that may occur in Nevada as a result of the repository program, as well as the analysis of the authorities available to the Secretary and appropriate sources of funds for possible mitigation activities, the Secretary concludes that the Department has the necessary authorities and sources of funds, to be administered in close consultation with the State and units of local government in Nevada, to address impacts that may occur throughout the course of the program.

### 5.2 Summary and Conclusions

The following conclusions are based on the analyses presented in the preceding chapters:

- Program-related effects might occur in at least twelve of the categories specified in Section 175(b) of the NWPA, as amended. On a Statewide basis, these effects will be minimal. Several small communities may be impacted, but DOE believes that mitigation will be available.
- Because of the uncertainties inherent in projecting worker settlement patterns, four different residential location scenarios were evaluated. The scenarios were used in this report as a basis for identifying a range of potential effects. No one of these four scenarios is viewed as preferred. The same categories are identified as potentially affected under each scenario, although the location and magnitude of the effects may vary.
- The primary goal of DOE's policy for mitigation is to conduct its activities in a manner that would avoid or minimize significant adverse impacts to the maximum extent practicable.

- An important element in mitigation will be the implementation of a monitoring program to determine whether impacts have been avoided, whether mitigation has been effective in reducing impacts, and whether new impacts have emerged. This monitoring program will be described in the *Socioeconomic Monitoring and Mitigation Plan (SMMP)*. The conduct of the monitoring program and the collection of data will be closely coordinated with the State and affected units of local government.
- Socioeconomic effects vary not only with the magnitude, duration, and timing of the program activities, but also with the capabilities and priorities of the communities experiencing the effects. Therefore, the initial evaluation of need and of appropriate mitigation should be made by the communities experiencing impacts. The evaluation of mitigation to address population-induced impacts should consider distinctions between those impacts that are short-term in nature versus those that are longer in duration. To the extent that these evaluations show the need for assistance from DOE, the Department will work closely with the State or affected unit of local government to reach agreement on the nature and level of such assistance.
- Impacts related to the transportation of radioactive waste and accident management will depend on programmatic decisions concerning waste transport and emergency response capabilities.
- Initial efforts at addressing changes in demand for facilities and services resulting from repository activities should focus on minimization or avoidance through modifications to DOE activities and accommodation by the jurisdiction through the use of available resources, including additional revenues generated by the repository program, such as payments-equal-to-taxes (PETT). Financial assistance for mitigation can be provided by DOE through a negotiated agreement under authority granted by the Congress in Section 116 of the NWRPA, as amended. Mitigation to address adverse impacts should be administered by the jurisdictions and entities that customarily provide facilities or services.

### **5.3 Recommendation**

- Based on the analyses contained in this report, sufficient authority exists at the local, State, and Federal levels of government to mitigate impacts. Therefore, no additional authority or sources of funds beyond those provided by the Nuclear Waste Policy Act, as amended, are requested at this time.

## **APPENDIX**

### **METHODS, ASSUMPTIONS, LIMITATIONS, AND ECONOMIC- DEMOGRAPHIC FORECASTS**

# A1 Methods

## A1.1 General Approach for Addressing Potential Effects

The categories specified in Section 175 of the Nuclear Waste Policy Act, as amended, may be generally grouped into two types of potential effects. One type of effect is driven or potentially caused by economic or population changes, referred to as economic-demographic changes, associated with siting, constructing, operating, and closing a repository at Yucca Mountain. The other type of effect is not directly related to economic-demographic changes, but potentially results from other aspects of the repository program. Figure A1.1-1 presents the logic and sequential approach used to address the categories specified in Section 175 of the Act. In this figure, the potential effects associated with economic-demographic changes are addressed in the top half of the diagram; those effects that are not driven by economic-demographic changes are addressed in the bottom left portion of the the diagram.

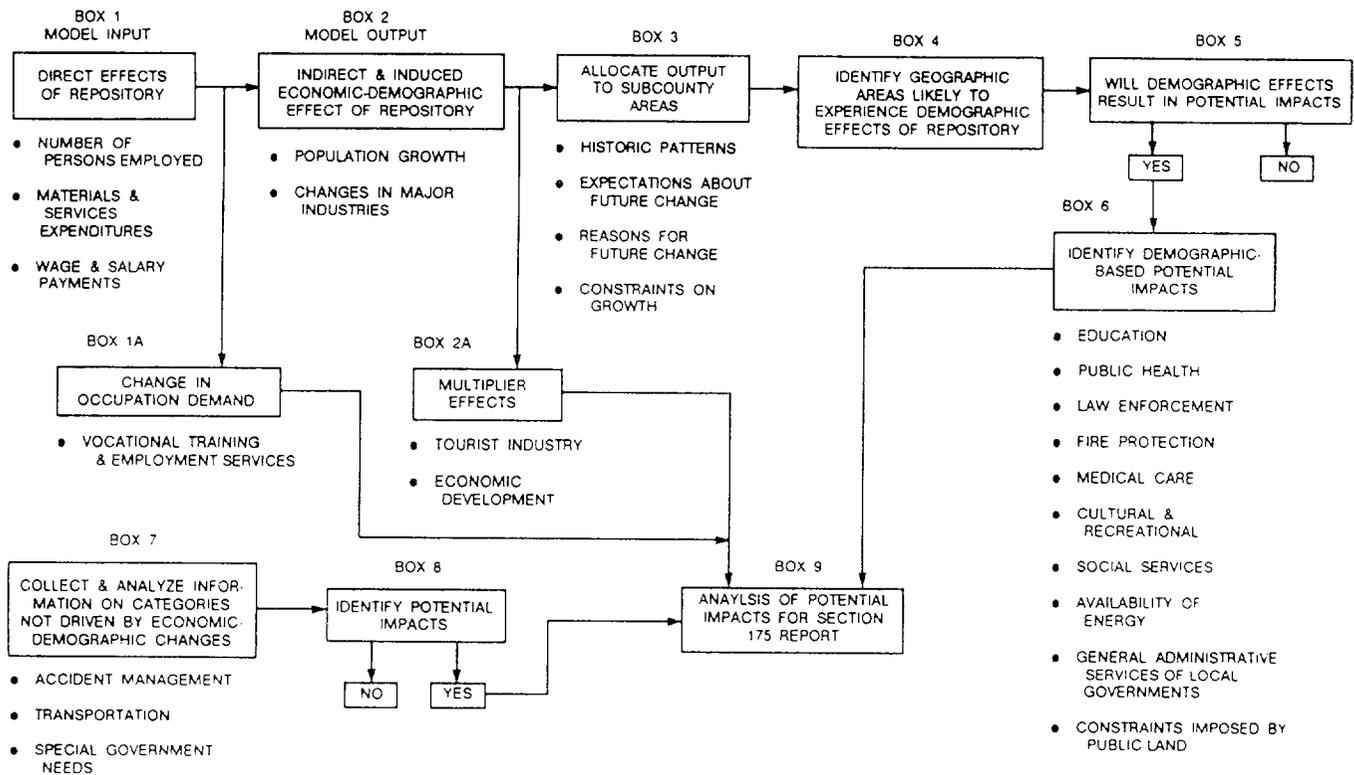


Figure A1.1-1. General Approach for Addressing Potential Impacts

**Box 1.** The economic-demographic model uses annual projections of labor force, wage and salary payments, and expenditures for materials, equipment, and services that are likely to be employed or used by the repository program in Nevada. These projections were discussed in Chapter 2.

**Box 1a.** Annual projections of occupations required by the repository program were developed by DOE and the repository-related contractors. Vocational training opportunities and employment services are assessed on the basis of these projections.

**Box 2.** Based on historic and current information about Nevada and the four counties in the study area, and on four residential location scenarios developed for this analysis, the model forecasts economic-demographic changes that may be induced by the labor force, wage and salary payments, and expenditures for materials, equipment, and services.

**Box 2a.** The effects of the repository program on the tourist industry and economic development in the four-county area are addressed, in part, by assessing the multiplier effects associated with wage and salary payments and expenditures for materials, equipment, and services that are projected to be employed or used in Nevada for the program.

**Box 3.** The model forecasts demographic changes at the county level for each of the residential location scenarios. Discussions were held with knowledgeable local residents, for example, county and city planners, land developers, and residential developers, so that county-level demographic changes could be allocated to specific geographic areas within the four counties.

**Box 4.** Allocation of the model's output to subcounty areas permits the identification of areas that may experience population growth as a result of the program under any of the residential location scenarios.

**Box 5.** For geographic areas that are not likely to experience repository-related population growth, no effects on services and facilities are likely to occur.

**Box 6.** For areas where repository-related population growth may occur under the alternative scenarios, potential effects on services and facilities are addressed.

**Box 7.** Three of the categories addressed in this report are not contingent on economic-demographic changes. These categories are management of accidents involving high-level radioactive waste, transportation, and special repository-related needs of the State and local governments. Information related to these categories and to the characteristics of the repository program were collected and analyzed.

**Box 8.** Possible effects of the repository program on accident management, transportation, and special governmental needs were identified.

**Box 9.** The potential effects resulting from the repository program on categories specified in Section 175(b) of the Act are described and discussed in Chapter 3.

The remainder of this appendix describes the methods used to assess the potential effects on the categories specified in Section 175 and addressed in this report. Key technical assumptions and limitations associated with the methods are also discussed. This appendix concludes by presenting the economic and demographic forecasts associated with each of the residential location scenarios for the counties and subcounty areas.

## A1.2 The REMI Economic-Demographic Model

Understanding potential effects on community services and facilities, tourism, and economic development that may result from the repository program requires forecasts of changes in the economic characteristics and changes in the size and demographic characteristics of the population that are likely to result from the program. A variety of models have been developed to forecast economic and demographic changes associated with proposed projects. For purposes of this report, DOE selected a model developed by Regional Economic Models, Inc. (REMI) and tailored the model for analysis of the study area and the State of Nevada. This section provides a general description of the REMI model and explains how the model was used to estimate economic and demographic changes in the study area that may result from the repository program.

**A1.2.1 An Overview of the REMI Model** The REMI model is designed for multiregional analysis.<sup>1</sup> The economy of any region may be viewed as trading relationships between three components: production for export to other regions, production to fulfill local demand, and imports into the region. Thus, economic regions are integrated with other regions because of the trading relationships that exist between each region. Interregional trade is measured by the dollar value of the goods and services that flow between regions. The REMI model estimates these interregional trading relationships, which provide a basis for forecasting the economic and demographic effects of a proposed project.

Like most regional models, the REMI model reflects the theoretical perspective that goods and services produced within a region for export to other regions provide the main base of economic support for that region. Exports from a region vary with the levels of national and international demand for those goods and services, and the REMI model incorporates variables, such as interest rates, U.S. demand, and national exports, that are designed to reflect national and international demand. In addition to providing goods and services for export, local firms can sell their goods and services to households or other local firms within the region. Households, government, and investment are included in the REMI model as final demand sectors, that is, their purchases are not resold for further use. A third component of the trading relationships is imports into a region, which may be viewed simply as the exports from another region. The REMI model links structurally identical models of the study area, of the State of Nevada, and of the United States so that the trading relationships represented by exports, imports, and final demand can be estimated. These relationships are expressed in the form of a 49-industry input-output model.

In addition to the input-output component, the REMI model incorporates four modules that take into account many elements that drive a regional economy. As indicated in Figure A1.2-1, these modules are a product market module, a labor market module, a production module, and a population module.

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<sup>1</sup> Information on the economic theory underlying the REMI model may be found in Treyz, Friedlaender, and Stevens, 1980; Treyz, 1981; Stevens, Treyz, Ehrlich, and Bower, 1983; Treyz and Stevens, 1985.

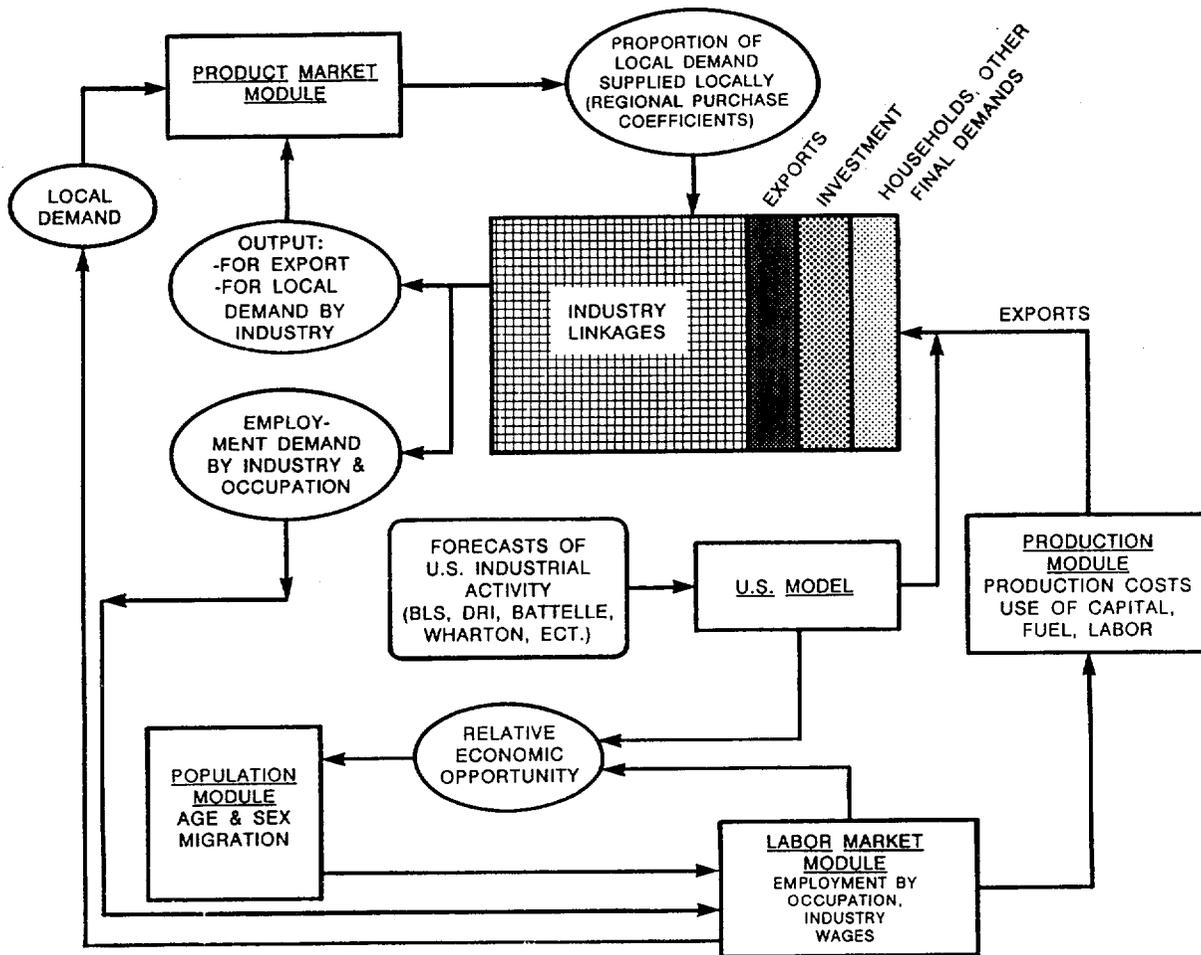


Figure A1.2.1-1 Flow Diagram for the Nevada REMI Model

Changes in the income of a region, which, for example, may result from changes in employment or wage and salary rates, lead to changes in demand for both locally-produced and imported goods and services. The Product Market Module of the REMI model quantifies the amount of total demand for goods and services that is met by local production rather than imports. These measures of local self-sufficiency are labeled regional purchase coefficients, which indicate the percent of total local demand that is fulfilled by local production. Regional purchase coefficients are localized at the area level (see Section A1.2.2 for the five areas in the Nevada REMI model) on the basis of the 1977 Census of Transportation by the U.S. Department of Commerce and local employment and wages by industry (see Stevens et al., 1983). Regional purchase coefficients are calculated for the 49 Bureau of Economic Analysis industrial sectors in the model that are not sectors of final demand.

Employment and wage and salary rates in a region change as labor supply and labor demand change. If the labor force increases through population growth, for example, wages and salaries will usually decrease if there is not a corresponding increase in demand for labor. Conversely, if employment demand increases, wages will typically rise. The Labor Market Module estimates labor demands for 96 Bureau of Labor Statistics occupations and the changes in wages and salaries in these occupations caused by changes in labor supply and labor demand.

The Production Module addresses capital and energy as inputs to production and quantifies changes in the use of labor that reflect the cost of labor relative to the cost of capital and energy. For example, if the Labor Market Module estimates that wage and salary costs are increasing relative to other inputs to production, the Production Module will reflect a substitution of capital for labor because firms will typically substitute other production inputs for labor during periods of increasing relative wage and salary costs.

The Production Module also creates indices of total production costs for each industry so that the competitiveness of the region's export industries may be determined. If production costs in a particular regional industry increase relative to national production costs in that industry, the region will be less competitive in its export markets and will suffer a loss of exports.

The Population Module estimates and forecasts migration and population by age and gender. The forecasts are based primarily on birth and death rates, the age structure of migrants, and employment opportunities in a region. If a region's employment opportunities increase, population immigration will ultimately occur. Thus, population and employment forecasts are consistent with each other.

Economic and demographic changes within a region do not occur instantaneously when factors are introduced that will eventually lead to changes. Industrial firms, businesses, and workers adjust to changing conditions with varying speeds. The REMI model is dynamic, which means that the model incorporates the fact that economic and demographic effects of projects, such as the effects that may result from the repository program, take some time to be realized.

The REMI model is capable of projecting economic and demographic characteristics from the present through 2034. For the remainder of the period under consideration in this report, from 2035 through 2060, each consecutive year was renamed to a year beginning with 1988, that is, 2035 was labeled 1988, 2036 was labeled 1989, on through 2060, and the model was run again to produce economic-demographic effects. Population effects for the period from 2035-2060 were projected by extrapolating the 1985-2034 ratios of population-to-employment effects to the year 2060, and applying these ratios to the total employment effects determined for each year from 2035 through 2060. These effects were then added to projected baseline conditions for the years 2035-2060 to yield forecasts with the repository.

**A1.2.2 The Nevada REMI Model** There are three reasonably integrated economic areas in Nevada. These areas are comprised of Nye, Esmeralda, Lincoln, and Clark counties, which are located in the southern part of the State and are tied most closely to Las Vegas, Nevada; the northeast part of the State, comprised of White Pine and Elko counties, which has primary trading relationships with the region whose central city is Salt Lake City, Utah; and the remainder of the State, which is part of an economic area whose central city is Reno, Nevada. The study area for this report coincides with the southern Nevada area of Nye, Esmeralda, Lincoln, and Clark counties.

In the Nevada REMI model, the State was divided into five economic components so that trading relationships between each area, as well as between the State and the rest of the nation, could be determined. The following components comprise the Nevada REMI model.

- Nye and Esmeralda counties combined.
- Lincoln County.
- Clark County.
- White Pine and Elko counties combined.
- The remaining counties in Nevada.

Nye and Esmeralda counties were combined in the Nevada REMI model because Esmeralda County has few industrial sectors and a small population, which made it difficult to calibrate a model specifically for Esmeralda County. The subcounty allocation procedure, which is described in Section A1.3, was used to distinguish between Nye and Esmeralda counties.

Projections of the economic effects of a project on any one of the five areas is an iterative process that takes into account the trading relationships with each of the other areas in the State. Thus, the model calculates the economic effects of a project located in one area on each of the other areas. Although the projections for areas other than Nye, Esmeralda, Lincoln, and Clark counties are not described in this appendix, they are subsumed within the economic and demographic effects for the State of Nevada.

**A1.2.3 Forecasts of Economic and Demographic Changes** Forecasts of economic and demographic effects potentially associated with the repository program were produced in the following manner.

**Step 1.** Economic and population forecasts were produced for Nye and Esmeralda counties, Lincoln County, and Clark County assuming that no further repository-related activities would be undertaken and that the repository program would not proceed in Nevada. These forecasts are labeled the *baseline* economic and population projections.

**Step 2.** Four scenarios were developed representing alternative residential locations for repository program workers. These scenarios are labeled *residential location scenarios* in this report.

**Step 3.** Estimates of labor, materials, equipment, and services to be used in Nevada for the repository program were input to the REMI model. These estimates were described in Chapter 2. Economic and demographic forecasts were generated for each residential location scenario. The economic and demographic forecasts generated in this step are labeled the *with-project forecasts*.

**Step 4.** The differences between the with-project and baseline forecasts were calculated. These differences represent the *potential economic and population effects* of the repository program in Nevada.

**A1.2.3.1 Baseline Forecasts** Two credible scenarios were developed based on an appraisal of future economic events without the repository program that could affect the economy of the study area most significantly. Two scenarios were developed because economic and population forecasts are always uncertain, regardless of the quality of the model. For example, future trends in tourism cannot be predicted with certainty since they depend on events such as changes in the price of gas and legalization of gambling in states other than Nevada. Such uncertainties were addressed by developing two baseline forecasts on the basis of alternative assumptions regarding the future of certain key economic activities in the study area. After analysis of the two baseline forecasts, a single forecast representing the most likely future without the repository was created for use in this report.

**A1.2.3.2 Residential Location Scenarios** Four residential location scenarios were developed in order to forecast county-level economic and demographic changes that might occur if repository program workers lived in alternative locations. An assumption common to all four scenarios is that program workers who work in Clark County will live in Clark County. Thus, the four scenarios represent alternative assumptions regarding where program workers who work in Nye County will live.

The residential locations of program workers who work in Nye County were allocated to Clark County, Nye and Esmeralda counties, Lincoln County, other counties in Nevada, and areas outside of Nevada using different assumptions in each of the four scenarios. These different assumptions were input into the Nevada REMI model through the use of residential adjustment factors and the model then forecasted the county-level economic and demographic projections resulting from each of the residential location scenarios. The county-level demographic forecasts were then allocated to subcounty areas using the methods described in Section A1.3. County-level and subcounty-level projections resulting from each of the four residential location scenarios are presented in this appendix and are the basis for the identification of potential impacts associated with repository-related population growth.

One residential location scenario is based on 1984 data from the U.S. Department of Commerce, Bureau of Economic Analysis, regarding the State of Nevada and each of the counties in southern Nevada. This scenario, labeled *BEA* in this report, uses a procedure from the Bureau of Economic Analysis that takes into consideration the fact that workers may work and earn money in one county ("place-of-work" county) and may live in another

county ("place-of-residence" county). The procedure estimates the proportion of income earned in a county by workers who live in a different county. Based on the *BEA* scenario, the residential locations of program workers who work in Nye County were input into the Nevada REMI model in the following manner:

Nye/Esmeralda counties: 56 percent of Nye County workers during all phases of the repository program.

Clark County: 40 percent of Nye County workers during site characterization, operation, closure and decommissioning; 25 percent during construction.

Lincoln County: no Nye County workers during any phase of the program.

Other Nevada: no Nye County workers during any phase of the program.

Outside of Nevada: 4 percent during site characterization, operation, closure and decommissioning; 19 percent during construction. The construction period adjustment assumes that many construction workers will want to live near Yucca Mountain during the week and will return to their permanent residences outside of Nevada on the weekends.

Three residential location scenarios are based on a survey of Nevada Test Site (NTS) workers that was conducted by Planning Information Corporation (PIC, 1988a) for the State of Nevada Nuclear Waste Projects Office. The assumption common to these scenarios is that repository program workers will reside in patterns that are similar to NTS workers. Another assumption common to these scenarios is that program workers who work in Clark County will reside in Clark County.

In the scenario labeled *NTS-1*, only NTS workers who had lived in their communities for five years or less were considered. Adjustment factors that represented the county-level residential locations of these workers were then input into the Nevada REMI model and county-level economic and demographic effects of the repository program were forecasted. Based on the *NTS-1* scenario, the residential locations of repository program workers who work in Nye County were input into the Nevada REMI model in the following manner:

Nye/Esmeralda counties: 20.8 percent of Nye County workers.

Clark County: 76 percent of Nye County workers.

Lincoln County: 0.64 percent of Nye County workers.

Other Nevada: 0.96 percent of Nye County workers.

Out of Nevada: 1.6 percent of Nye County workers.

In the scenario labeled *NTS-2*, the county-level residential allocations are the same as those for *NTS-1*, except during the construction phase of the program. During the construction phase, *NTS-2* assumes that 61 percent of Nye County workers will live in Clark County and that 16.6 percent of Nye County workers will be individuals who will want to live near Yucca Mountain during the week and will return to their permanent residences outside of Nevada on the weekend.

In the scenario labeled *NTS-3*, the county-level residential locations of all NTS workers are considered as the basis for allocating the residential locations of repository program workers among the counties. Based on the *NTS-3* scenario, the residential locations of repository workers were input into the Nevada REMI model in the following manner:

Nye/Esmeralda counties: 10.7 percent of Nye County workers.

Clark County: 85.5 percent of Nye County workers.

Lincoln County: 0.6 percent of Nye County workers.

Other Nevada: 0.6 percent of Nye County workers.

Out of Nevada: 2.6 percent of Nye County workers.

**A1.2.3.3 Forecasts of Economic and Demographic Characteristics with the Repository Program** The with-project forecasts of economic and population characteristics were developed by incorporating levels of annual employment, wages and salaries, and purchases of materials, equipment, and services that were estimated to be used in Nevada for the repository program from January 1, 1988, through closure and decommissioning in 2060. These estimates were described in Chapter 2. The estimates for wages, salaries, materials, equipment, and services are in terms of 1988 dollars. Estimates for wages and salaries do not include fringe benefits. Estimates for materials, equipment, and services do not include overhead, management and administrative costs, sales tax, or contingencies for cost increases that may occur in the future. The estimates do not include costs associated with an off-site rail spur or off-site roads. Many factors on which the estimates are based will change as the project design proceeds through the stages of advanced conceptual design, license application, and final procurement and construction design. The Nevada REMI model generated forecasts of county-level economic and demographic characteristics with the repository program for each of the four residential location scenarios using the estimates of annual employment, wages and salaries, and purchases of materials, equipment, and services.

**A1.2.3.4 Economic and Demographic Effects of the Repository Program** The baseline and with-project forecasts for each residential location scenario were compared, and the differences were attributed to the repository program. Forecast economic and population characteristics that are reported in this appendix are population and direct and indirect employment. Baseline and with-project characteristics were forecast for the State of Nevada, Clark County, Lincoln County, and Nye and Esmeralda counties and were allocated to areas within each county by using the subcounty allocation method described in Section A1.3.

### **A1.3 Subcounty Allocation Method**

The four counties in the study area represent a considerable degree of socioeconomic diversity, ranging from a large metropolitan area to small rural communities. Because of the area's diversity and the likelihood that potential effects would not be evenly distributed within a given county, areas within the counties were selected, and the county-level population projections produced by the Nevada REMI model for each residential location scenario were allocated to these subcounty areas, using the methods described in this section.

**A1.3.1 Selection Criteria** Places within the four-county area were selected if they met any of the following criteria.<sup>2</sup>

- Incorporated town or city in the four-county area.
- Community within 50 road miles of the Amargosa Valley entrance to the Nevada Test Site.
- Community within 100 road miles of the Amargosa Valley entrance and a population size greater than 250 residents.
- Community within 150 miles of the Amargosa Valley entrance and a population size greater than 1,000 residents.

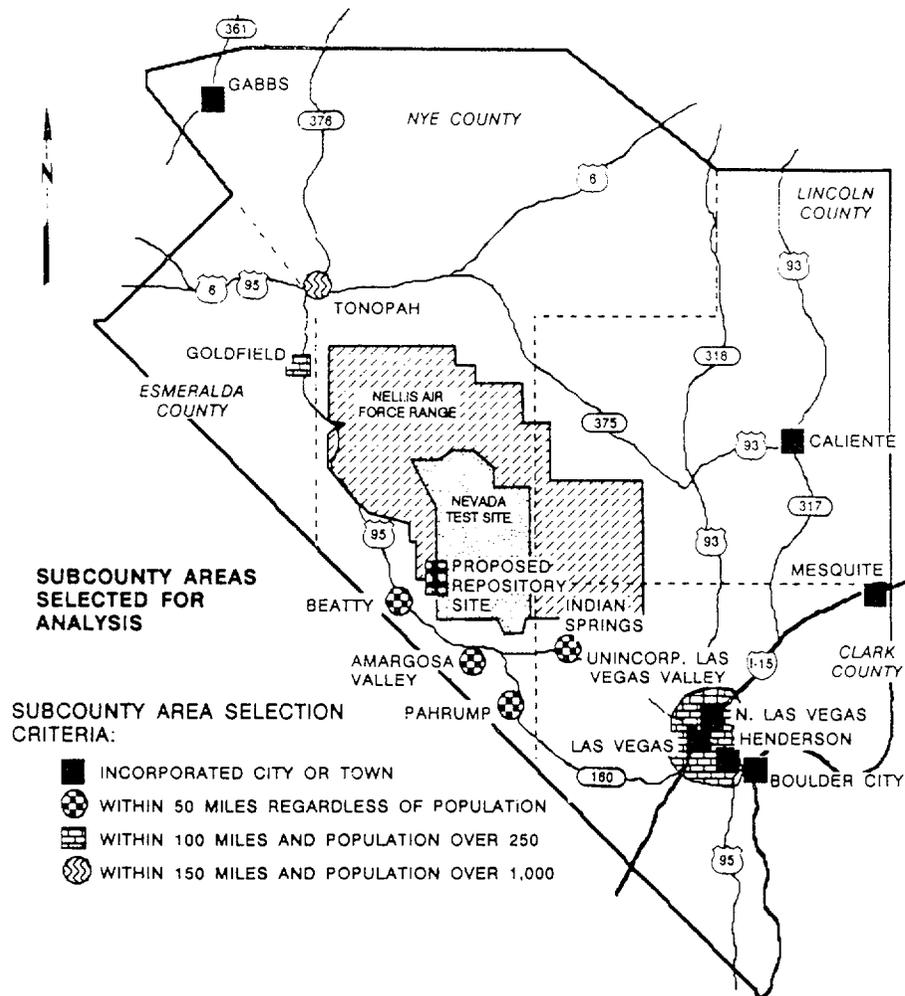
These criteria resulted in 14 subcounty areas being selected. These areas are indicated in Figure A1.3-1. The rest-of-county for each of the four counties is also included as a subcounty area.

Incorporated towns and cities in the four-county area are included in this report because they are frequently responsible for providing services to their residents. Population size and distance to the proposed Amargosa Valley entrance to the Yucca Mountain facility are included as selection criteria because these factors frequently influence where people choose to live. Places close to the proposed repository are likely to attract workers because the workers will have short commutes to work; places with larger populations but that are farther from the work site will attract workers because of the amenities such places offer.

Boundaries of the subcounty areas were defined in several ways, depending on the characteristics of the area. For incorporated towns and cities, legal boundaries of the towns, as used by the U.S. Bureau of the Census for data reporting, were used and historical changes in these boundaries were accounted for to the extent possible. Boundaries for unincorporated areas in Clark County were adopted from the definitions used by the Clark County Department of Comprehensive Planning in its various reports. Boundaries for the unincorporated areas in Nye and Esmeralda counties were adopted from definitions developed by Planning Information Corporation for the Nevada Nuclear Waste Project Office (PIC, 1987e, 1987f).

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<sup>2</sup> Population estimates were taken from the *1986 Rand McNally Commercial Atlas and Marketing Guide*, (Rand McNally, 1986), which gives 1980 Census population figures where possible and gives estimates for areas for which census figures are not available. The estimates are provided for small, isolated population clusters and are developed through a survey of local authorities conducted by Rand McNally. Road miles were computed from the point along U.S. Highway 95 four miles west of Amargosa Valley where an access road to the repository is proposed to be located (U.S. DOE, 1986; Figure 3-3).



**Figure A1.3-1. Subcounty Area Locations**

**A1.3.2 Allocation Method for Baseline Population Forecasts** Allocation of county-level baseline population projections, which were produced by the Nevada REMI model, to subcounty areas was based on an area's historical share of total population change between 1960 and 1987 within the county. This approach was augmented by interviews with knowledgeable local individuals who helped assess limits to population growth and the likelihood that future trends within each county would differ from historic trends.

Population estimates, indicated in Table A1.3-1, were collected for each of the counties and subcounty areas for 1960, 1970, and 1980. Estimates of the 1987 population were obtained from the State of Nevada Department of Taxation (State of Nevada, 1987b), Clark County Department of Comprehensive Planning (Clark County, 1987a, 1987b), and Planning Information Corporation (1987a, 1987e, 1987f), which supports the State of Nevada Nuclear Waste Project Office. The percent of total county population accounted for by each subcounty area was computed. This share indicates the changing relative size of each area within a county. Table A1.3-1 indicates that population distributions within the counties have changed over the 27-year historical period.

**Table A1.3-1 Historical Population of Subcounty Areas and Share of County Change,  
1960-1987**

	1960	1970	1980	Est. 1987	% of Tot. County Pop(i)			1987 Estimate	Share of 60-87 Change
					1960	1970	1980		
Study Area	134,440	282,073	476,644	675,915					
<b>Clark County(a)</b>	127,016	273,288	463,087	654,765(b)					
North Las Vegas(a)	18,422	45,542	42,739	47,132(b)	14.5	16.7	9.2	7.2	5.4%
Las Vegas(a)	64,405	125,787	164,674	222,752(b)	50.7	46.0	35.6	34.0	30.0%
Henderson(a)	12,525	16,395	24,363	44,934(b)	9.9	6.0	5.3	6.9	6.1%
Boulder City(a)	4,059	5,223	9,590	12,166(b)	3.2	1.9	2.1	1.9	1.5%
Mesquite Township(a)	517	674	922	1,722(b)	0.4	0.3	0.2	0.3	0.2%
Indian Springs(a)		855	955	1,145(b2)		0.3	0.3	0.4	0.2%
Uninc. LV Valley(b)	23,928	74,832	211,954	311,144	18.8	27.4	45.8	47.5	54.4%
Other Clark County(h)	3,160	3,980	7,890	13,770	2.5	1.5	1.6	1.9	2.0%
<b>Esmeralda County(a)</b>	619	629	777	1,380(e)	12.4	10.1	7.9	8.2	
Goldfield District(a)	184	216(c)	487(f)	400(g)	29.7	34.3	62.7	29.0	28.4%
Other Esmeralda County(h)	435	413	290	980	70.3	65.7	37.3	71.0	71.6%
<b>Lincoln County(a)</b>	2,431	2,557	3,732	4,250(e)					
Caliente City(a)	792	916	982	1,200(e)	32.6	35.8	26.3	28.2	22.4%
Other Lincoln County(h)	1,639	1,641	2,750	3,050	67.4	64.2	73.7	71.8	77.6%
<b>Nye County(a)</b>	4,374	5,599	9,048	15,520(e)	87.6	89.9	92.1	91.8	
Gabbs(a)	770	874	811	950(e)	17.6	15.6	9.0	6.1	1.6%
Beatty(a)	1,153	950(c)	666(d)	1,134(d)	26.4	17.0	7.4	8.4	-0.2%
Pahrump(d)		963	3,311	7,100			36.6	45.8	63.7%
Tonopah(d)	1,679	1,716	2,319	4,000	38.4	30.7	21.6	25.8	20.8%
Amargosa Valley(d)		39(c)	902	600			10.0	3.9	5.4%
Other Nye County(h)	772	1,057	1,039	1,736	17.6	36.1	15.6	10.1	8.6%
<b>Reservations(j)</b>									
Yomba Shoshone				60					
Duckwater Shoshone				106					
Moapa Paiute				185					
Las Vegas Paiute				113					

**Table A1.3-1 Historical Population of Subcounty Areas and Share of County Change,  
1960-1987 (continued)**

Sources:

- (a) U.S. Bureau of the Census, 1983. 1980 Census of Population and Housing, Vol. 1: Number of Inhabitants, part 30: Nevada. PC-80-1-A30, U.S. Bureau of Commerce: Washington, DC.
- (b) Clark County Department of Comprehensive Planning, 1987. Clark County Population Estimates by Entity 1980-1987, Las Vegas. The 1970 reported figure for Unincorporated Las Vegas Valley was 84,158, which was based on a population of 36,212 for N. Las Vegas. In a correction the Bureau of the Census states that the 1970 population for N. Las Vegas should be 45,542 due to recent annexations. Therefore, the newly annexed population was added to N. Las Vegas and subtracted from the unincorporated areas, which reduced the 1970 population of unincorporated Las Vegas Valley to 74,832.
- (b2) Clark County Department of Comprehensive Planning, 1987. Clark County Population Estimates of Townships and Rural Areas, Las Vegas.
- (c) Walters Engineering, 1972. Nevada Rural Communities Water and Waste Water Plan 1972, Nye County, Reno, NV.
- (d) Planning Information Corporation, 1987. Selected Demographic Information and Trends: Nye County, March. Denver, CO.
- (e) Bryan, Governor Richard H., 1987, transmittal to John P. Comeaux, Executive Director, Department of Taxation, "Population of Nevada's Counties and Incorporated Cities: 1980 Actuals: 1981 through 1987 Official State Estimates," December 31. Carson City, NV.
- (f) Planning Information Corporation, 1987. Selected Demographic Information and Trends: Clark, Lincoln, Esmeralda Counties, March. Denver, CO.
- (g) Planning Information Corporation, 1987. Reconnaissance of Community Facilities and Service Systems in Esmeralda County, February. Denver. CO.
- (h) Computed by adding subcounty units and subtracting from county total.
- (i) Computed by dividing subcounty population by county total.
- (j) The population of reservations is included in other Clark County and other Nye County and are included here to indicate their populations. Population estimates were derived from ongoing DOE studies involving American Indian cultural resources in the Yucca Mountain area.

The percent of change in a county's population between 1960 and 1987 that was attributable to each area within the county was computed and became the basis for allocating the county-level population baseline projections to subcounty areas. These historical shares are indicated in Table A1.3-1. For example, Clark County increased by 527,749 persons between 1960 and 1987, while the City of North Las Vegas increased by 28,710 persons, which is 5.4 percent of the change in Clark County. Thus, 5.4 percent of the baseline projections of total population change in Clark County were allocated to the City of North Las Vegas.

The subcounty allocations based on historical shares of population change were modified as appropriate on the basis of information from knowledgeable local residents. These individuals provided information about opportunities for growth during the next 15 years and on long-term limits to growth. The only adjustment pertinent to this report was an adjustment to include more rapid population increase in Beatty and Amargosa Valley because of a gold mine being developed nearby. This adjustment was removed from the forecasts after ten years, which is the projected life of the mining operation.

**A1.3.3 Allocation Method for With-Project Population Forecasts** A second set of subcounty allocations was developed to account for projected population changes in the four-county area as a result of the repository program. The with-project subcounty allocations were based on the with-project county-level population projections generated by the Nevada REMI model for each residential location scenario.

The with-project subcounty allocations within each county required assumptions about likely residential locations for the repository work force and members of their households. Table A1.3-2 summarizes the residential distribution of workers at the Nevada Test Site (NTS), which resulted from a survey of NTS workers conducted in April 1988 by Planning Information Corporation in support of the State of Nevada Nuclear Waste Project Office (PIC, 1988a).

One assumption was that residential locations are likely to be correlated with occupation. This assumption was tested through analysis of the survey of NTS workers. Table A1.3-3 indicates the distribution of NTS workers by occupation and residential location. Table A1.3-4 converts this distribution into the percent of each NTS occupation that resides in the subcounty areas. The residential patterns of the different occupations employed at NTS were analyzed, and the occupations expected to be employed at each phase of the repository program were matched with occupations employed at NTS. Analysis of the NTS workers' survey indicated that residential locations were influenced by occupation. These relationships were applied annually to the projected repository work force and their households.

Table A1.3-2 NTS Worker Residential Distributions

	<u>NTS Workers</u> Percent Within Study Area	<u>All Workers</u> Percent Within Each County	Workers Who Have Lived in Their Communities Five Years or Less Percent Within Each County
CLARK COUNTY	85.5	100.0	100.0
North Las Vegas	5.4	6.3	3.9
Las Vegas	72.3	84.3 <sup>(b)</sup>	84.5
Henderson	3.4	4.0	5.2
Boulder City	0.4	0.5	0.2
Mesquite Township	0.1	0.1	0.0
Indian Springs	3.4	4.0	5.6
Uninc. Las Vegas Valley	0.2	0.3 <sup>(b)</sup>	0.2
Other Clark County	0.5	0.6	0.4
NYE COUNTY	10.4	100.0	100.0
Gabbs	0.0	0.0	0.0
Beatty	0.2	1.5	1.6
Pahrump	9.5	91.8	95.9
Tonopah	0.1	0.6	0.0
Amargosa Valley	0.6	6.1	2.5
Other Nye County	0.0	0.0	0.0
ESMERALDA COUNTY	0.03	100.0	100.0
Goldfield District	0.03	100.0	100.0
Other Esmeralda County	0.00	0.0	0.0
LINCOLN COUNTY	0.6	100.0	100.0
Caliente City	0.2	23.8	25.0
Other Lincoln County	0.5	76.2	75.0
<u>TOTAL</u>	<u>96.8</u>		
Other Nevada	0.6		
Non-Nevada	1.2		
Not reported	1.4		

(a) Source: Planning Information Corporation (PIC, 1988a) survey of NTS workers April 1988, sponsored by DOE and the Nevada Nuclear Waste Project Office excludes workers stating they live at Mercury.

(b) It is assumed that many workers stated they live in Las Vegas while actually residing in unincorporated Las Vegas Valley. For the subcounty allocation of the impact population Las Vegas and Unincorporated Las Vegas Valley impact populations were combined then divided between the two based on the distribution of the baseline population.

**Table A1.3-3 Distribution of NTS Workers by Occupation and Subcounty Area**

**CLARK**

	Totals	N Las Vegas	Las Vegas	Henderson	Boulder City	Mesquite	Indian Spgs	Unincorp. Las Vegas	Other Clark
Engineer	267	6	243	11	0	4	1	2	
Technician	350	13	309	10	4	1	11	1	1
Scientist	37	0	37	0	0	0	0	0	1
Clerical Worker	234	12	200	5	0	0	16	0	1
Craftsman/Prof/Tech/Oper/Labor	1069	83	843	62	6	1	62	2	10
Computer Specialist	39	1	35	2	0	0	1	0	0
Manager/Administrator	278	7	259	3	1	1	6	1	0
Account/Libr/Writer/Art/Teach	9	1	8	0	0	0	0	0	0
Health Professional	70	3	63	3	0	0	0	1	0
Food Service workers	111	29	75	1	1	0	5	0	0
Protective Service Worker	255	11	221	12	2	0	5	1	3
<b>TOTAL</b>	<b>2719</b>	<b>166</b>	<b>2293</b>	<b>109</b>	<b>14</b>	<b>7</b>	<b>107</b>	<b>8</b>	<b>15</b>

**NYE**

	Totals	Beatty	Pahrump	Tonopah	Amargosa	Other Nye
Engineer	37	0	34	0	3	0
Technician	63	2	53	1	7	0
Scientist	1	0	1	0	0	0
Clerical Worker	29	0	29	0	0	0
Craftsman/Prof/Tech/Oper/Labor	148	2	138	0	8	0
Computer Specialist	5	0	5	0	0	0
Manager/Administrator	20	1	18	1	0	0
Account/Libr/Writer/Art/Teach	0	0	0	0	0	0
Health Professional	4	0	4	0	0	0
Food Service workers	9	0	9	0	0	0
Protective Service Worker	19	0	19	0	0	0
<b>TOTAL</b>	<b>335</b>	<b>5</b>	<b>310</b>	<b>2</b>	<b>18</b>	<b>0</b>

Table A1.3-3 Distribution of NTS Workers by Occupation and Subcounty Area  
(continued)

ESMERALDA

	Totals	Goldfield	Other Esmer
Engineer	0	0	0
Technician	0	0	0
Scientist	0	0	0
Clerical Worker	0	0	0
Craftsman/Prof/Tech/Oper/Labor	1	1	0
Computer Specialist	0	0	0
Manager/Administrator	0	0	0
Account/Libr/Writer/Art/Teach	0	0	0
Health Professional	0	0	0
Food Service workers	0	0	0
Protective Service Worker	0	0	0
<b>TOTAL</b>	<b>1</b>	<b>1</b>	<b>0</b>

LINCOLN

	Totals	Caliente	Other Lincoln
Engineer	1	0	1
Technician	0	0	0
Scientist	0	0	0
Clerical Worker	0	0	0
Craftsman/Prof/Tech/Oper/Labor	15	4	11
Computer Specialist	0	0	0
Manager/Administrator	1	1	0
Account/Libr/Writer/Art/Teach	0	0	0
Health Professional	0	0	0
Food Service workers	0	0	0
Protective Service Worker	4	0	4
<b>TOTAL</b>	<b>21</b>	<b>5</b>	<b>16</b>

**Table A1.3-4 Percent Distribution of NTS Workers by Occupation and Subcounty Area**

**CLARK**

	Totals	N. Las Vegas	Las Vegas	Henderson	Boulder City	Mesquite	Indian Spgs	Unincorp. Las Vegas	Other Clark
Engineer	100.00	2.25	91.01	4.12	0.00	0.00	1.50	0.37	0.75
Technician	100.00	3.71	88.29	2.86	1.14	0.29	3.14	0.29	0.29
Scientist	100.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Clerical Worker	100.00	5.13	85.47	2.14	0.00	0.00	6.84	0.00	0.43
Craftsman/Prof/Tech/Oper/Labor	100.00	7.76	78.86	5.80	0.56	0.09	5.80	0.19	0.94
Computer Specialist	100.00	2.56	89.74	5.13	0.00	0.00	2.56	0.00	0.00
Manager/Administrator	100.00	2.52	93.17	1.08	0.36	0.36	2.16	0.36	0.00
Account/Libr/Writer/Art/Teach	100.00	11.11	88.89	0.00	0.00	0.00	0.00	0.00	0.00
Health Professional	100.00	4.29	90.00	4.29	0.00	0.00	0.00	1.43	0.00
Food Service workers	100.00	26.13	67.57	0.90	0.90	0.00	4.50	0.00	0.00
Protective Service Worker	100.00	4.31	86.67	4.71	0.78	0.00	1.96	0.39	1.18
<b>TOTAL</b>	100.00	6.11	84.33	4.01	0.51	0.11	4.05	0.26	0.63

**NYE**

	Totals	Gabbs	Beatty	Pahrump	Tonopah	Amargosa	Other Nye
Engineer	100.00	0.00	0.00	91.89	0.00	8.11	0.00
Technician	100.00	0.00	3.17	84.13	1.59	11.11	0.00
Scientist	100.00	0.00	0.00	100.00	0.00	0.00	0.00
Clerical Worker	100.00	0.00	0.00	100.00	0.00	0.00	0.00
Craftsman/Prof/Tech/Oper/Labor	100.00	0.00	1.35	93.24	0.00	5.41	0.00
Computer Specialist	100.00	0.00	0.00	100.00	0.00	0.00	0.00
Manager/Administrator	100.00	0.00	5.00	90.00	5.00	0.00	0.00
Account/Libr/Writer/Art/Teach	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Health Professional	100.00	0.00	0.00	100.00	0.00	0.00	0.00
Food Service workers	100.00	0.00	0.00	100.00	0.00	0.00	0.00
Protective Service Worker	100.00	0.00	0.00	100.00	0.00	0.00	0.00
<b>TOTAL</b>	100.00	0.00	1.49	92.26	0.60	5.36	0.00

**Table A1.3-4 Percent Distribution of NTS Workers by Occupation and Subcounty Area  
(continued)**

**ESMERALDA**

	<u>Totals</u>	<u>Goldfield</u>	<u>Other Esmer</u>
Engineer	100.00	0.00	0.00
Technician	100.00	0.00	0.00
Scientist	100.00	0.00	0.00
Clerical Worker	100.00	0.00	0.00
Craftsman/Prof/Tech/Oper/Labor	100.00	100.00	0.00
Computer Specialist	100.00	0.00	0.00
Manager/Administrator	100.00	0.00	0.00
Account/Libr/Writer/Art/Teach	100.00	0.00	0.00
Health Professional	100.00	0.00	0.00
Food Service workers	100.00	0.00	0.00
Protective Service Worker	100.00	0.00	0.00
<b>TOTAL</b>	<b>100.00</b>	<b>100.00</b>	<b>0.00</b>

**LINCOLN**

	<u>Totals</u>	<u>Caliente</u>	<u>Other Lincoln</u>
Engineer	100.00	0.00	100.00
Technician	100.00	0.00	0.00
Scientist	100.00	0.00	0.00
Clerical Worker	100.00	0.00	0.00
Craftsman/Prof/Tech/Oper/Labor	100.00	26.67	73.33
Computer Specialist	100.00	0.00	0.00
Manager/Administrator	100.00	100.00	0.00
Account/Libr/Writer/Art/Teach	100.00	0.00	0.00
Health Professional	100.00	0.00	0.00
Food Service workers	100.00	0.00	0.00
Protective Service Worker	100.00	0.00	100.00
<b>TOTAL</b>	<b>100.00</b>	<b>23.81</b>	<b>76.19</b>

A second assumption was that there would be access to the repository site on a road located at a point four miles west of Amargosa Valley on U.S. Highway 95 (U.S. DOE, 1986: Figure 3-3). An entrance at, and an improved road from, Amargosa Valley would reduce the commuting time to the repository site from Pahrump, Amargosa Valley, Beatty, and Goldfield, when compared to the main entrance to NTS at Mercury. These communities would become relatively more attractive as residential locations for repository workers than they currently are because of reduced commuting time. However, the attractiveness of larger places with more amenities, such as Las Vegas and Pahrump, is indicated by the willingness of over three-fourths of NTS workers to commute past closer communities, such as Amargosa Valley, Beatty, and Indian Springs. Thus, the assumption of an Amargosa Valley entrance did not affect the allocation of repository workers.

The repository work force was allocated to subcounty areas within each county in the same proportions as the NTS workers within each county, adjusted for the relationship between occupation and residential location discussed above.

#### **A1.4 Projecting Effects on Services and Facilities from Changes in Population**

Nine of the categories addressed in this report are services that may be affected by increases in the size of the population to which the services are provided. These categories are as follows:

- Education.
- Public health.
- Law enforcement.
- Fire protection.
- Medical care.
- Cultural and recreational services.
- Social services.
- Availability of energy.
- General administrative services of a local government that are a function of population size.

The effects these services from population increases associated with the repository program under the alternative scenarios were addressed by a process that involved screening service jurisdictions and service categories; collecting information from secondary sources for those jurisdictions and service categories warranted after screening; assessing the service environment relative to population size; and applying this relationship to population growth that may occur with and without the repository program. This process is summarized in the following four steps.

In Step 1, jurisdictions that provide services were screened to determine whether the subcounty allocation of the with-project population for each residential location scenario resulted in an increase in the population served by the jurisdiction. Increases in population due to the repository program were then differentiated in terms of the likely duration of the work force in the area. For example, workers required for construction of a repository would reside in an area for a brief time relative to workers required for operation. Workers residing in an area only briefly would affect only certain service categories.

In Step 2, information was collected for key indicators of each type of service addressed in this report that remained after the screening conducted in Step 1. Key indicators, which are identified in Table A1.4-1, were selected for both labor and capital components of the service categories when appropriate to the category. Most of the information was provided by Planning Information Corporation, which conducted services and facilities inventories for the State of Nevada Nuclear Waste Project Office (PIC, 1987a, 1987b, 1987c, 1987d, 1987e, 1987f, 1988b, 1988c).

In Step 3, the relationship between the size of population in each subcounty area and service environment in each area was assessed.<sup>3</sup> Current problems or excess capacities were noted and addressed in the assessments.

In Step 4, the current population and service environment observed through Step 3 was applied to the subcounty allocations of the baseline and with-project population projections for each residential location scenario to determine the potential for an effect on the services from any repository-induced population growth.

The fundamental assumption in projecting potential effects on services and facilities is that the service environment that exists currently will remain in the future irrespective of the repository program. That is, as population growth occurs without the repository, the level of services will change in a corresponding manner so that the population-to-service environment will remain as it is currently. The potential effect on services and facilities is the result of any incremental population growth attributable to the repository program that has the potential for changing the service environment.

#### **A1.5 Projecting Tourism and Economic Development**

The Nevada REMI model was used to forecast possible economic changes resulting from expenditures associated with labor, materials, equipment, and services to be employed or used in Nevada by the repository program. The effects of the repository program on the local economy were addressed by considering two ways in which repository-related economic effects would occur. First, employees living in Nevada and associated with the repository program will receive wages and salaries, some of which they will spend on local goods and services. This spending of wages and salaries will result in additional employment for firms selling their goods and services, and some of the income earned by these firms would again be spent locally. The result is an increase in the region's employment and income that is larger than the actual levels of repository-related employment and income earned by repository workers. These effects are labeled *multiplier effects*.

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<sup>3</sup> The most current local service environment was used rather than national planning standards because it is assumed that recent levels of service reflect local residents' ability and willingness to pay for publicly provided services.

**Table A1.4-1. Key Indicators for Facilities and Services**

Education

Elementary and Secondary:	Average annual enrollment by attendance area. Capacity by attendance area
Postsecondary:	Average annual Full Time Student Equivalents Annual Operating Expenditures

Public Health

Water Systems:	Percentage of population on municipal systems Capacity of system (Surface and groundwater) Peak demand
Sewage Treatment Systems:	Percentage of population on municipal sewers Peak sewage treatment volume Existing daily treatment capacity Planned expansion of treatment capacity
Weed and Pest Control:	Pass until further screening warrants <sup>1</sup>
Solid Waste Disposal:	Existing landfill sites capacity Annual volume of solid waste Publicly/privately provided

Law Enforcement

Court Systems:	Judges Court rooms Public Defenders
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Police and Sheriff Depts:	Sworn Officers Jail cells
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<u>Fire Protection</u>	Volunteer/Professional Personnel per capita
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<u>Medical Care</u>	Physicians In-patient care beds
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Cultural and Recreational

Libraries:	Number of paid staff
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Parks/Recreation Depts:	Summary of outdoor recreation orientation and role of jurisdictions in resource management
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<u>Social Services</u>	Location of offices Service area demand by office
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<u>Availability of Energy</u>	Load forecasts from electrical and gas utilities
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<u>Other Govt Needs</u>	General administrative services
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<sup>1</sup> For weed and pest control, relatively few jurisdictions are expected to encounter repository-related potential problem areas, and the specific impact management issues may vary considerably from jurisdiction to jurisdiction. Rather than specify any indicators ahead of time, indicators should be carefully tailored to local circumstances in the cases where initial screening suggests the potential for problems.

Second, site characterization, construction, operation, decommissioning, and closure of the repository will require a variety of goods and services, such as concrete, business services, machines, and utilities. Some of these purchases will likely be made from firms in the local economy. The added demand for local goods and services directly related to the repository will support additional employment and income for the supplying firms and will induce additional rounds of spending and multiplier effects.

Direct employment in, and purchase of goods and services for, the repository program will provide economic opportunities for the local economy. Additionally, since population tends to increase with employment opportunities, the local population will grow in response to the multiplier effects of the repository program, which will further reinforce the economic effects of the program.

The Nevada REMI model incorporates the additional employment and purchases associated with the repository program in Nevada, including the increased population and the spending of household income on local goods and services. The repository effects on economic growth were estimated by incorporating the amount of employment and purchases associated with the repository and calculating the multiplier effects emanating from the repository program. The effects of these multipliers are described in this appendix in terms of secondary employment generated by the repository program.

Some of these economic effects will accrue to industries classified as the tourism industry, in particular the hotels, amusement, and recreation sector. This industry, while oriented primarily toward visitors, is also supported by local residents. Some of the personal income brought into the area by the repository program and its multiplier effects will be spent in the hotels, amusement, and recreation sector and will support further growth in the tourist industry.

Discussions were held with individuals knowledgeable about the tourism industry as it currently exists in southern Nevada and as it is likely to exist in the future. The results of these discussions are presented in Chapter 3.

#### **A1.6 Vocational Training and Employment Services**

Occupations that are most likely to be employed by the repository program in Nevada were identified by DOE and its contractors. After these occupations and changes in employment demand were identified, interviews were conducted with a number of private and public vocational training centers in Nevada to determine the current and future availability of training programs for these occupations. Officials of various unions were also interviewed to determine the availability of apprenticeship programs for these occupations.

### **A1.7 Distribution of Public Lands**

It is possible that some communities that may experience population growth from the repository program may be inhibited from growing because of the existence of public land surrounding the communities. In order to place the amount of public land in Nevada into perspective, consider that there are 109,900 square miles and 1,053,230 residents in the State (see Table 2.2-2 in text). Thus, there are fewer than 10 individuals per square mile. When consideration is given to the fact that 85.4 percent of the land is public land on which settlement is prohibited, the population density increases dramatically to about 62 persons per square mile, which is roughly equivalent to the population density in Vermont.

The following steps were taken to determine whether the existence of public land surrounding communities in the four-county area would inhibit a community from growing as a result of the repository program.

**Step 1.** Comparison of the subcounty allocation of the baseline population and the with-project population for each residential location scenario permitted the identification of communities that may grow as a result of the repository program.

**Step 2.** The latest edition of the Bureau of Land Management (BLM) Surface Management Status map for each of the communities identified in Step 1 was consulted to determine the extent of surrounding public land.

**Step 3.** Discussions were held with the appropriate BLM Office to obtain the opinions of this office relative to community expansion for economic development or population growth.

### **A1.8 Projecting Changes in Transportation**

Potential effects of the repository program on the existing and future transportation system were estimated using standard transportation planning techniques. The effects on the transportation system were based on a comparative analysis of potential levels of service and volume-to-capacity ratios for each segment of the transportation system that may be affected by the development of the repository. Projections were developed using future socioeconomic characteristics of the area, with and without the repository for each residential location scenario, and standard transportation planning trip generation methods.

The level of service (LOS) of the transportation network is measured in terms of volume-to-capacity (V/C) relationships that exist on a particular segment of the transportation network. The segments of the transportation network that may handle the home-to-work trips were analyzed in terms of their V/C relationships, with and without the development of the repository. The V/C ratios reflected by the various levels of service are shown in Table A1.8-1.

**Table A1.8-1 Design Capacities of Typical Highways**

V/C Ratios	Level of Service
0.00 - 0.30	A
0.31 - 0.50	B
0.51 - 0.75	C (Design Capacity)
0.76 - 0.90	D
0.91 - 1.00	E (Ultimate Capacity)
+ 1.00	F

Source: Transportation Research Board, 1985

The six levels of service, *A* through *F*, represent the following continuum of operating conditions, *A* being the best and *F* the worst:

- *A* represents "free flow" whereby users are unaffected by the presence of others in the traffic stream.
- *B* is stable flow with maneuverability slightly less than LOS *A*. Comfort and convenience are also somewhat decreased.
- *C* is still in stable flow, but users become significantly affected by others in the traffic stream. Selection of speed also becomes dependent on other users, and comfort and convenience decline noticeably.
- *D* represents high-density stable flow. Speed and freedom to maneuver are severely restricted, and increases in traffic flow will generally cause problems at this level.
- *E* has operating conditions at or near the capacity of the roadway. Maneuverability, comfort, and convenience are poor. Speeds are reduced to a low but uniform value.
- *F* conditions are commonly referred to as a "traffic jam". The system breaks down and queues are likely to develop at certain points. Operations are typically stop-and-go.

Capacity impacts were based on procedures specified by the Transportation Research Board (1985). Historical and current traffic volumes and capacities were obtained from the Nevada Department of Transportation (NDOT).

The repository-related effects on LOS were forecasted from current and projected LOS, which were based on data from the NDOT and the four sets of employment and repository work force population distributions described in this appendix. Daily car trips from the various projected residential areas were calculated by applying a passenger-per-vehicle (ppv) factor to the repository work force allocations for that area. For employees living in Las Vegas and traveling to the Yucca Mountain site, an average ppv factor for private cars of 1.65 was used. For all other residential areas, a ppv factor of 1.2 was used. The larger factor for the Las Vegas area is based on the assumption that carpools and vanpools will be

the primary mode of travel, given the longer commuting distances. During the site characterization phase, it has been assumed that bus service will be available for those workers living in Las Vegas and Pahrump. The distribution of workers living in Las Vegas and Pahrump who use the buses for transport to the site is 80.2 percent and 50.8 percent, respectively (PIC, 1988a). The number of passengers per bus was assumed to be 30 persons.

Truck traffic generated by repository-related activities will generally result from hauling construction equipment, materials, and spent fuel or high-level radioactive waste to the repository site. It is expected that the larger flow of truck shipments will occur during the first two years of the construction phase, when an average of 28 and 31 trucks per day, respectively, will travel to the repository site. Once rail access to the repository site is constructed and the rail is operational, which is assumed to occur by the end of the second year of repository construction, the number of truck shipments will decrease substantially. This report assumes, although it has not been determined, that DOE will bear the costs associated with obtaining rights-of-way for a rail spur and costs of construction, maintenance, and operation of the rail access to Yucca Mountain. Therefore, maintenance effects to the rail spur are not considered in this report. During the operations phase, the number of trucks expected to arrive at the repository is 7 per day, and they are expected to carry 5 high-level waste shipments and 2 shipments of construction materials and equipment. The projected number of daily high-level waste shipments is based on the average annual number of truck shipments for the five years with the largest annual number of shipments, divided by 250 operational days per year. The number of truck shipments is very uncertain at this time and does not assume or reflect any specific modal split. Truck shipments of high-level waste are in addition to those shipments that may arrive by rail.

The current truck volumes and weight distributions along with average daily traffic (ADT) counts were obtained from Nevada Department of Transportation (1988). These data were used to determine the 18,000 pound Equivalent Single Axle Loads (ESALs) currently experienced by the pavement through the application of the AASHTO method of ESAL calculation (American Association of State Highway and Transportation Officials, 1986). In this method, the actual axle load is converted to an equivalent number of 18,000 pound axle loads. The equivalency factors are presented in a series of tables relating actual load to pavement thickness (structural number for flexible or asphalt pavements) for a given pavement serviceability index (PSI) and axle configuration. In this case, the equivalency factors were taken from the tables for PSI = 3.0, which is the current average condition for the pavements under consideration.

The ESALs were projected into the future using the study area population growth rates from the REMI model and the subcounty allocation of population for each residential location scenario. Multiplying the ESALs by the length of each segment of highway produces the ESAL-mile measurement for those segments.

The current pavement conditions were obtained from Nevada Department of Transportation pavement management system. The cost of maintaining the pavement to the present condition was estimated by multiplying the projected ESAL-miles by a constant cost of \$0.05 per ESAL-mile. A similar procedure was followed for the truck traffic generated by the repository.

The specific effects of transporting high-level waste over mainline railroads in Nevada cannot be identified due to (a) pending decisions related to shipping methods, i.e., dedicated trains or common carriage; (b) pending decisions of mainline routes and rail access spur locations; and (c) pending decisions on shipment schedules. Nevertheless, the maximum possible effect on railroad mainline maintenance activities can be forecasted with the following assumption.

tions: (a) shipments will be made as general freight using loaded rail cars weighing 140 gross tons; (b) the maximum number of shipments in any one year is 225; and (c) maintenance costs per mile of existing track are directly proportional to the total tonnage moved along the track. These assumptions are incorporated in the analysis presented in Section 3.6 of the report.

#### **A1.9 Management of Accidents Involving High-level Radioactive Waste**

The *State of Nevada Hazardous Materials Operations Support Plan* (State of Nevada, 1986) specifies that two State agencies must be contacted in the event of an incident involving radioactive materials. These agencies are the Radiological Health Bureau of the Nevada Department of Health and the Division of Emergency Management. The Radiological Health Bureau is the lead agency for response to any incident involving radioactive materials other than incidents that may occur on non-Federal facilities and is responsible for assessment and evaluation of the incident. The Division of Emergency Management provides coordination among agencies involved in responding to an incident and provides support in responding to incidents.

The Directors of the Radiological Health Bureau and the Division of Emergency Management were interviewed by telephone to determine the existing capabilities to manage accidents involving radioactive materials, especially high-level radioactive waste. The Directors identified other State personnel who could provide information regarding the State's emergency response capabilities. Personnel in the offices of the State's Fire Marshal, Emergency Medical Services Division, and the State Highway Patrol were interviewed.

The Division of Emergency Management provided a list of county Emergency Management Directors for counties in Nevada. Some information related to county emergency response capabilities was obtained from these individuals.

DOE, through the Nevada Operations Office, has established a close working relationship with the State of Nevada for the purpose of responding to potential incidents involving radioactive materials. Officials with the Nevada Division of Emergency Management have expressed a high degree of confidence in DOE's willingness and capabilities to respond to such potential incidents (Ozawa, 1988). As a result, the radiological response capabilities and support efforts of the Nevada Operations Office were considered as part of the State's response capabilities for purposes of this report. Telephone interviews were held with members of the Emergency Management Division and the Health Physics Division of the Nevada Operations Office to determine the current levels of support in responding to potential incidents involving radioactive materials.

#### **A1.10 Projecting Other Repository-Related Needs of State and Local Governments**

Several local committees and the Nevada Nuclear Waste Project Office (NWPO) exist solely as the result of the repository program. These organizations include the Amargosa Nuclear Waste Advisory Committee, the Beatty Nuclear Waste Advisory Committee, the Pahrump Nuclear Waste Advisory Committee, the Lincoln County-City of Caliente Joint Impact Alleviation Committee, and the Nevada State and Local Government Steering Committee. Members of many of these committees were interviewed to determine the functions and responsibilities of each organization.

## **A2 Assumptions and Limitations of Methods**

### **A2.1 Economic and Demographic Projections**

Socioeconomic impact analyses generally incorporate a theoretical model of the regional economic system and worker demographic characteristics to forecast potential effects. Such models are invariably based on assumptions and have inherent limitations. The analysis in this report is no exception to this rule. This section discusses uncertainty associated with long-term projections, the primary assumptions underlying the projections of potential socioeconomic impacts in Nye, Clark, Lincoln, and Esmeralda counties using the Nevada REMI model, and the limitations of these assumptions.

Generally, forecasts of three, five, or ten years in the future are subject to increasing differences from actual occurrences. The 72-year forecast period for the repository program, from 1988 through 2060, is significantly longer than the usual forecast horizon. The estimates of economic and demographic changes discussed in this appendix are point estimates, which can infer an unwarranted level of precision due to the uncertainty associated with such a long horizon. The levels of precision used in the report, e.g., the percentages indicated in this report, reflect this limitation. The actual economic and demographic effects of the repository could be less or more than those presented, particularly for the distant future.

Uncertainty exists in any projection of absolute levels of future characteristics of a regional economy, such as employment and its related population. As a result, the crucial element of impact analysis is the relative magnitude of changes in these characteristics, assuming development of the repository when compared with those forecasted without the project.

Projections of changes in future economic and demographic characteristics using a forecasting model requires professional judgment of the analyst and an extensive variety of socioeconomic assumptions. Examples of model assumptions and their inherent limitations are as follows:

- Forecasting techniques require historical time series. The REMI model assumes that the trends in the relationship between the U.S. and Nevada economies evident over the 1969-1984 data period will continue throughout the forecast period.
- The REMI model estimates the wage, export, and factor substitution effects derived from careful statistical analysis of United States data when local data are unavailable or inadequate for statistical analysis. These estimates may differ from actual local conditions in small rural counties such as Nye, Lincoln, or Esmeralda, and may result in aberrant forecasts, such as those indicating long-term, negative secondary effects after 2034.
- Like other input-output models, the REMI model does not simulate industries being created during the forecast period. Only those industries that existed during the data period from 1969 to 1984 are included in the analysis.
- Local purchases of goods and services are allocated to the five sub-areas of the Nevada REMI model, as well as out-of-state, according to 1984 proportional captive rates estimated through the standard REMI procedure.
- The proportion of local demand fulfilled by imports rather than locally-supplied goods and services is assumed to remain the same during the forecast period.

- The productivity of the Nevada labor force, in terms of output per employee, is assumed to be identical to the U.S. average forecasts for each industry.
- Labor force participation and mortality rates are assumed to remain at their 1984 level for the forecast. Fertility rates are assumed to trend toward forecasted national rates.
- The age distribution of migrants to and from the region is assumed to remain as described by 1980 Census data.
- The average family size for all repository workers is assumed to be the same as that for all migrants to and from the study area.

The reasonableness of the resulting projections is based upon the accuracy with which these assumptions reflect future conditions.

### **A2.2 Subcounty Allocation of Population and Economic-Related Changes**

The distribution of the Nevada REMI model projections among subcounty areas within each county is based upon two assumptions. First, the relative rates of growth among the subcounty areas within each county will remain constant throughout the forecast period. The 1960-1987 time period was analyzed to identify the relative rates of growth. The second assumption is that the residential location preferences of potential repository workers within a county will be similar to those of the current NTS employees. This assumption is further defined by identifying and assigning residential locations based on occupation.

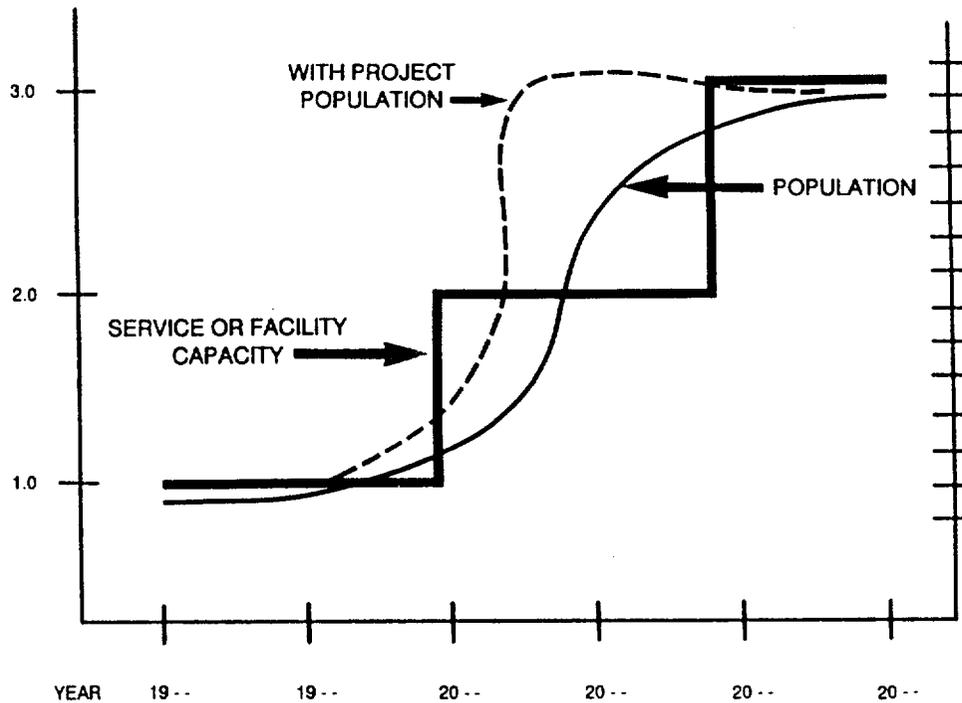
As can be seen from the historical population data, many of the communities in the study area have histories of boom and bust economies. These rather severe fluctuations are masked, however, at higher levels of aggregation, such as the county or State levels. They also tend to be masked by using the historical share of county-level change to allocate future residents, as incorporated in the procedure used for this analysis. Regardless of the procedure used for subcounty allocations, small-area fluctuations are always difficult to model and, thus, to forecast and, as such, they are subject to higher degrees of uncertainty than projections for larger aggregates. Like regional or county-wide forecasts, the factors affecting community growth may vary substantially throughout the forecast period. The population distribution within counties such as Nye, Lincoln, or Esmeralda can shift substantially in relatively short periods of time and, therefore, there are increasing levels of uncertainty associated with projections for the later years of the forecast period.

### **A2.3 Population-Related and Employment-Related Services and Facilities Effects**

Three assumptions are central to the analysis of potential effects on services and facilities. First, it is assumed that existing jurisdictions will continue through repository closure and decommissioning and that no new jurisdictions will be created. Second, it is assumed that no new categories of publicly provided services will emerge to meet an as yet unanticipated demand. Third, historical local service environments are used rather than national standards for the provision of services. It is assumed that the recent levels of service reflect local residents' ability and willingness to pay for publicly provided services.

While population growth is continuous, expansion of service delivery capacity is more efficiently undertaken in discrete stages. The relationship between population growth and efficient expansion of service delivery systems is portrayed in Figure A2.3-1. A hypothetical project-induced population growth is also illustrated in this figure.

As illustrated in the figure, population growth is continuous, but service capacity is expanded most economically in discrete blocks. There will be times when service capacity is greater than the demand and other times when demand exceeds capacity. Major project developments typically advance the point in time when service or facility expansion is needed, with the maximum difference between the capacity level and population-based demand typically associated with the construction period of a project. Over time, however, as the construction work force is replaced by the operational work force, the difference between the baseline population and the project-induced population tends to decrease, as does the degree of impact to services and facilities caused by the project.



**Figure A2.3-1 Illustration of Population-to-Service Relationship**

The most recent population-to-service environments are assumed to reflect future population-to-service environments. At any given point, however, service capacity may be underused or overused. Thus, the method of analysis used in this report incorporates any abnormal characteristics of the current service environments and continues these abnormalities throughout the forecast period. Interviews with local planning officials were used to determine whether

the presence of unusual circumstances might warrant adjustments to the projected demand or estimated level-of-service capacity. The extent of potential effects will vary depending on the specific intersect of nonproject-related population and service provision in the future. Therefore, the only mechanism for determining the extent of actual impacts on services and facilities is constant monitoring throughout the life of project activities. Descriptions of some of the service environments are subject to change because the data are in the process of being reviewed by local service providers (PIC, 1988c).

#### **A2.4 A General Limitation**

All forecasting techniques and impact analyses depend, to some degree, on extrapolation of historical trends and relationships into the future. In addition to the assumption that historical trends and relationships are indications of changes that are likely to occur in the future, there are numerous technical decisions regarding alternative assumptions that must rely on professional judgment and on the best information currently available. Many of these assumptions pertain to future choices of Nevada residents. For example, in what communities will new residents choose to live? For purposes of this report, DOE has assumed that the relative historical share of population change in a community is indicative of the residential distribution of future residents, and that the residential distribution of repository workers will be similar, though not identical, to current NTS workers. If, however, future residents choose to live in different communities than these assumptions indicate, then the projections of economic and demographic change and, hence, the identification of potential impacts on services and facilities may not be indicative of the future of southern Nevada with the repository program. The degree to which the technical assumptions incorporated in this report are indicative of the future characteristics of Nevada can only be assessed through a monitoring program, as discussed in Chapter 4.

### **A3 Economic and Demographic Effects of the Repository Program**

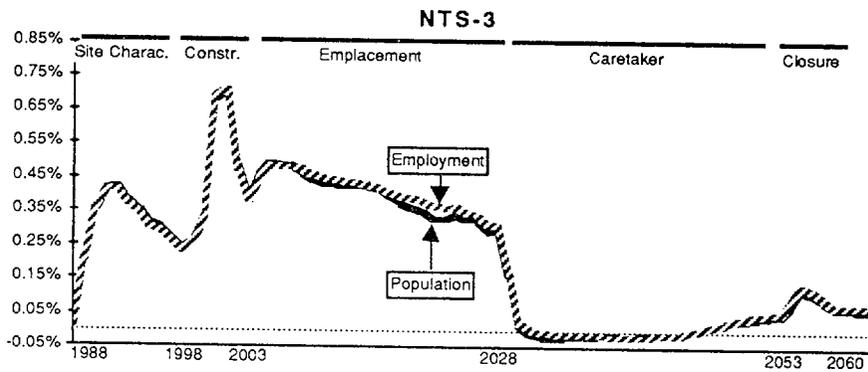
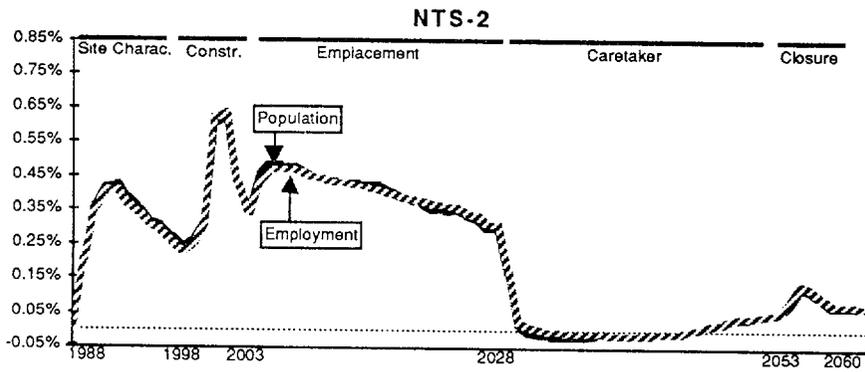
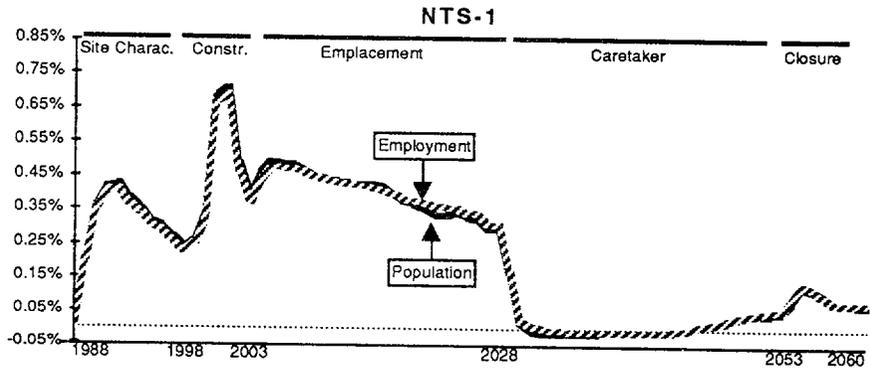
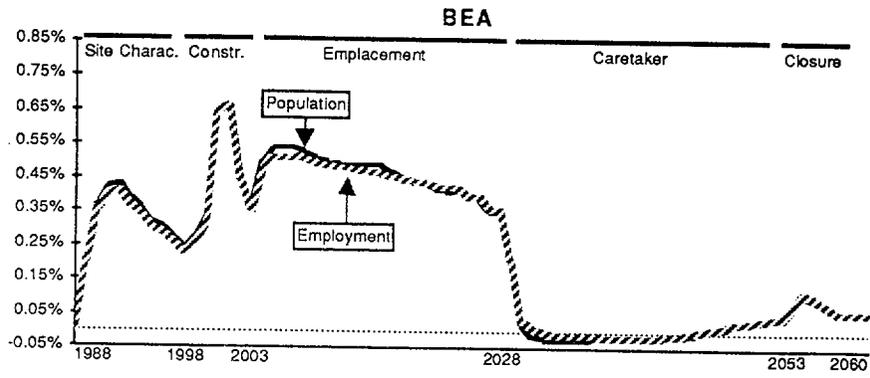
This section provides forecasts of economic and demographic effects that may result in Nevada and Nye, Esmeralda, Lincoln, and Clark counties from the repository program for each residential location scenario. Employment effects are the only type of economic effect addressed because demographic change is a reflection, in part, of changing employment opportunities in an area. The demographic effects are presented in terms of peak effects for each phase of the program. Peak effects are defined as occurring in the years when the largest percentage differences occur between the projections with the repository program and the baseline projections without the program. The peak effect does not necessarily correspond to the year in which the largest absolute demographic change associated with the program may occur since the peak effect depends on both the size of the absolute change and the size of the baseline projection in a given year.

A brief reiteration of the definitions of the residential location scenarios, which are discussed in Section A1.2.3, is warranted before proceeding. The scenario labeled *BEA* uses a Bureau of Economic Analysis procedure that allocates repository workers between counties based on the 1984 relationship between the county in which one works and earns income, and the county in which one resides. The scenario labeled *NTS-1* is based on a 1988 survey of workers at the Nevada Test Site (NTS) (PIC, 1988a) and allocates repository workers between counties in the same proportion as NTS workers who have lived in their communities five years or less. Assumptions in the scenario labeled *NTS-2* are identical to assumptions

in *NTS-1*, except during the construction phase when more construction workers are assumed to reside in Nye County during the work week only and are assumed to maintain permanent residences outside Nevada. These workers are labeled part-time residents in the figures. The scenario labeled *NTS-3* is based on the NTS workers' survey and allocates repository workers between counties in the same proportion as the entire NTS work force, irrespective of length of residence.

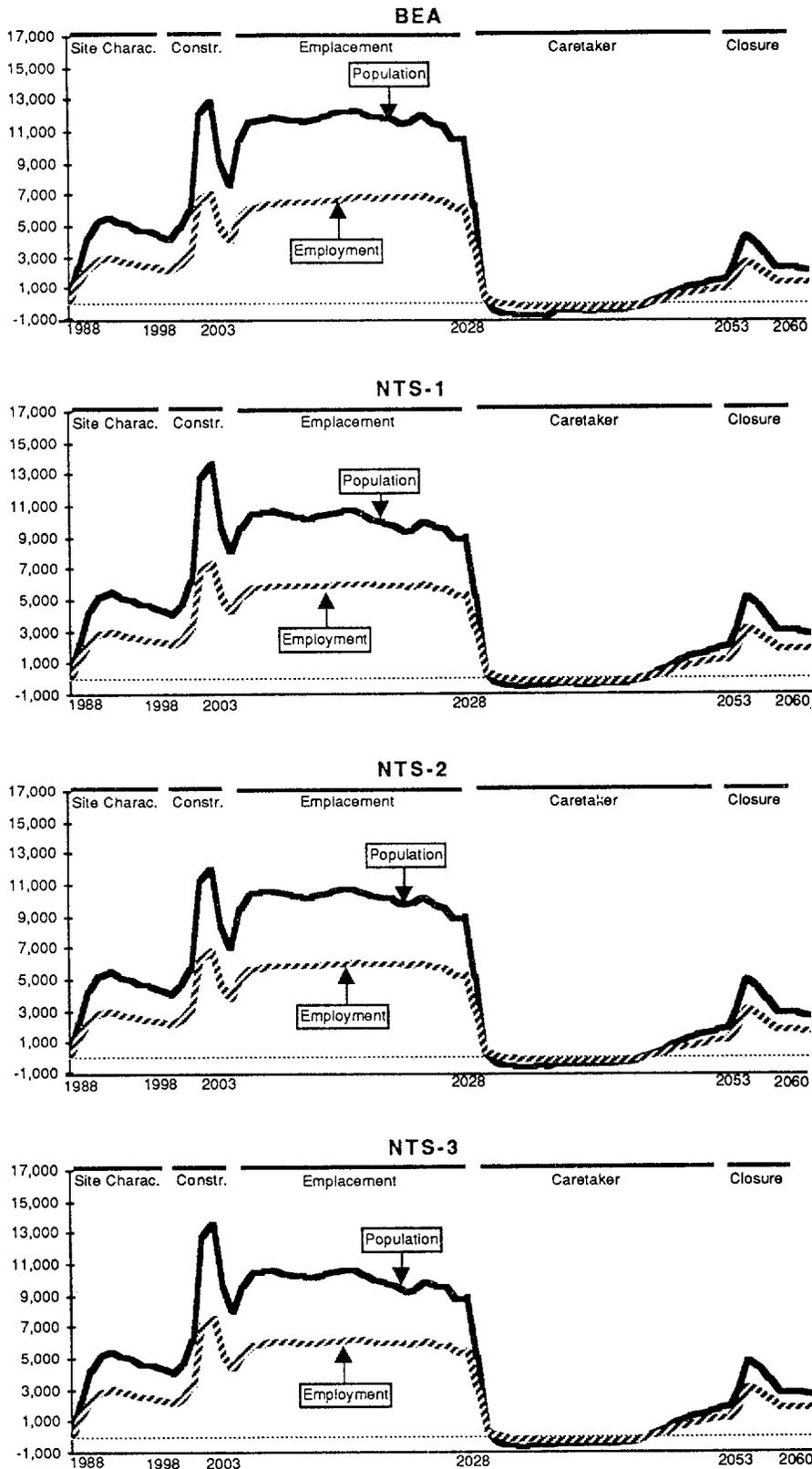
### **A3.1 State of Nevada**

Figure A3-1 indicates the percentage change from baseline employment and population forecasts represented by employment and population that may result from the repository program under each residential location scenario. Figure A3-2 indicates the numbers of jobs and the change in population that may result from the program. Figure A3-3 indicates the number of direct and secondary jobs that may be generated by the program. Figure A3-4 indicates the peak population effects that may occur in Nevada and in Nye, Esmeralda, Lincoln, and Clark counties under each residential location scenario.

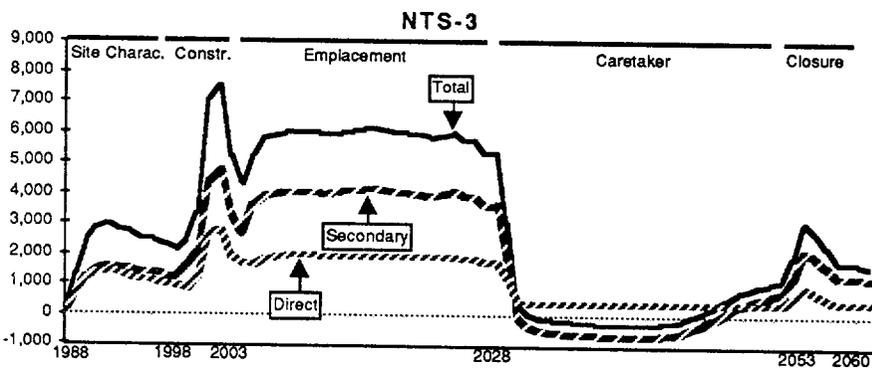
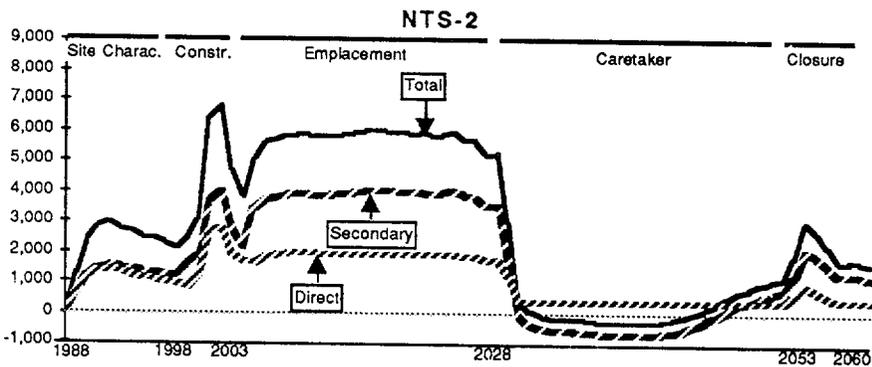
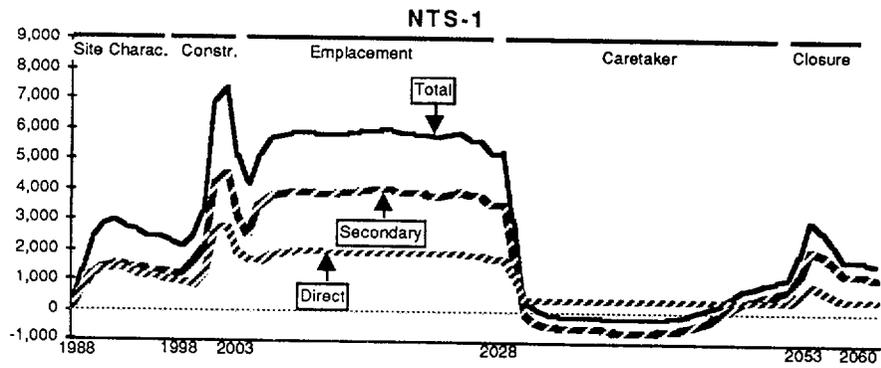
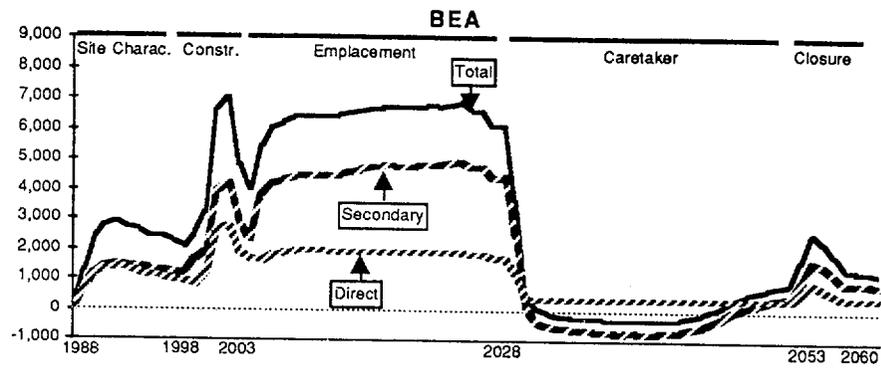


Note: Percent change depicted in these figures is less than one percent.

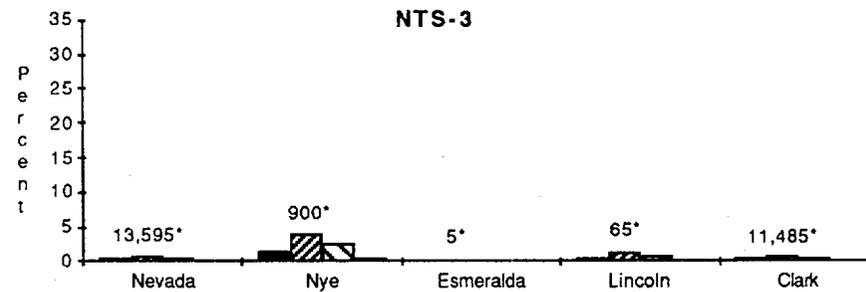
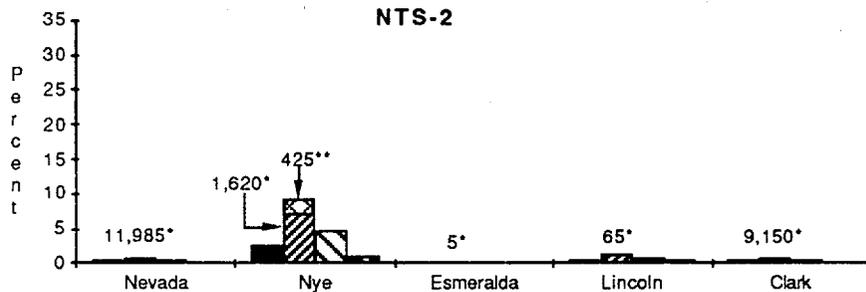
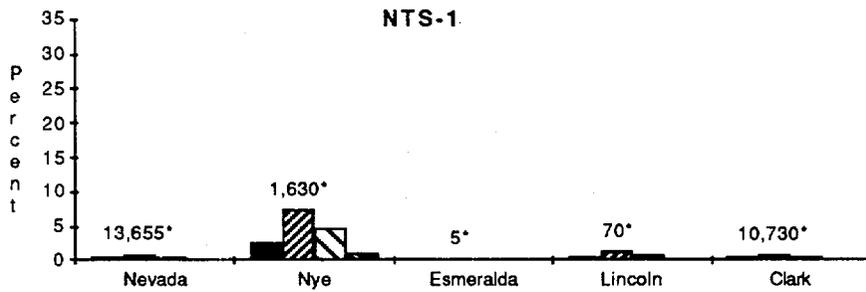
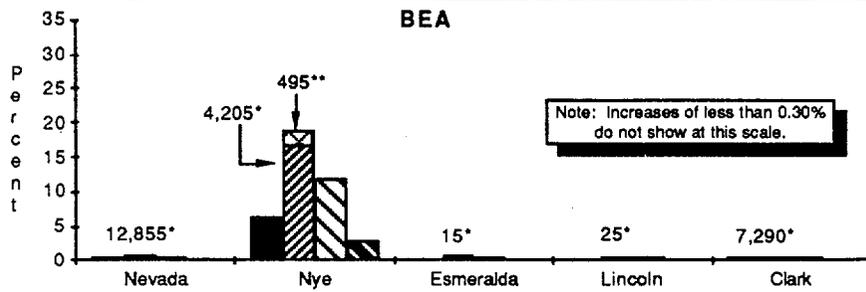
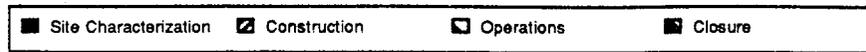
**Figure A3-1. Population and Employment Projected to Result from the Repository Program: Percent Change from Baseline, State of Nevada, 1987-2060 (See Section A1.2.3.2 for Definition of Scenarios)**



**Figure A3-2. Population and Employment Projected to Result from the Repository Program: Total, State of Nevada, 1987-2060 (See Section A1.2.3.2 for Definition of Scenarios)**



**Figure A3-3. Total, Direct, and Secondary Employment Projected to Result from the Repository Program: Total Jobs, State of Nevada, 1987-2060 (See Section A1.2.3.2 for Definition of Scenarios)**



\*Approximate population projected to result from repository program during year of peak percent change.  
 \*\*Estimated proportion of repository-related Nye-County population residing there part-time.

**Figure A3-4. Projected Peak Population Effect for the State of Nevada and Each of the Four Counties by Repository Program Phase (See Section A1.2.3.2 for Definition of Scenarios)**

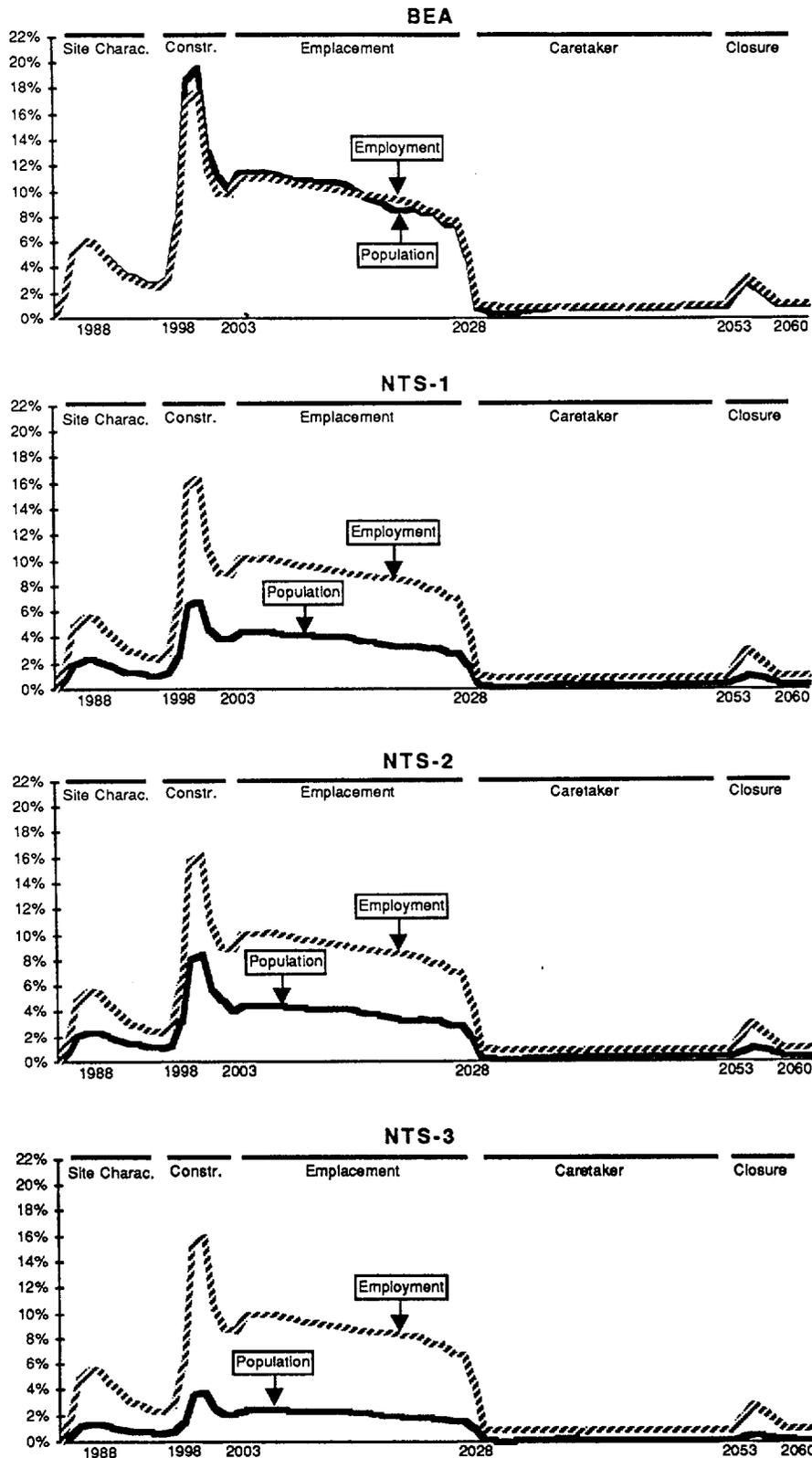
### **A3.2 Nye and Esmeralda Counties**

As discussed in Section A1.2.2, Nye and Esmeralda counties were combined for economic-demographic modeling purposes. However, on the basis of the allocation of the repository-related population (see Figure A3-4, above), it is evident that the vast majority of the economic and demographic changes will occur in Nye County rather than Esmeralda County.

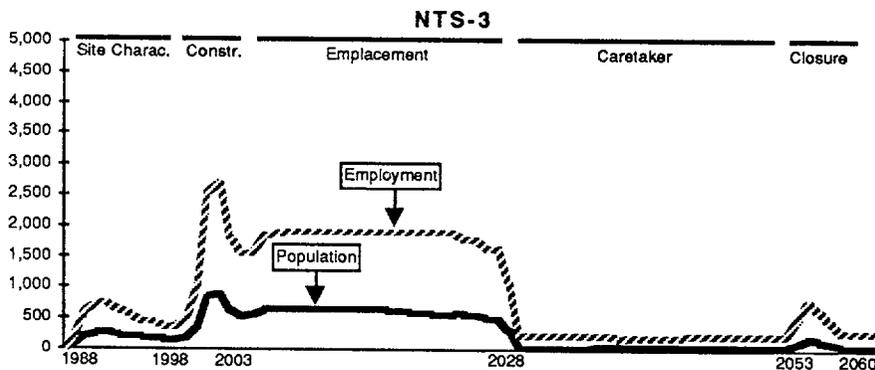
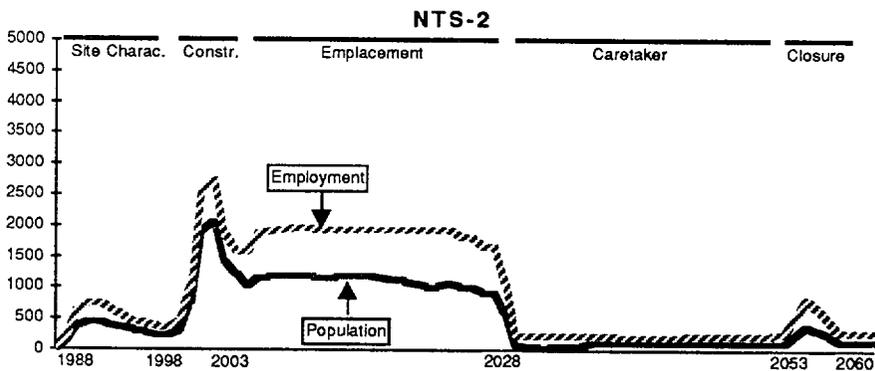
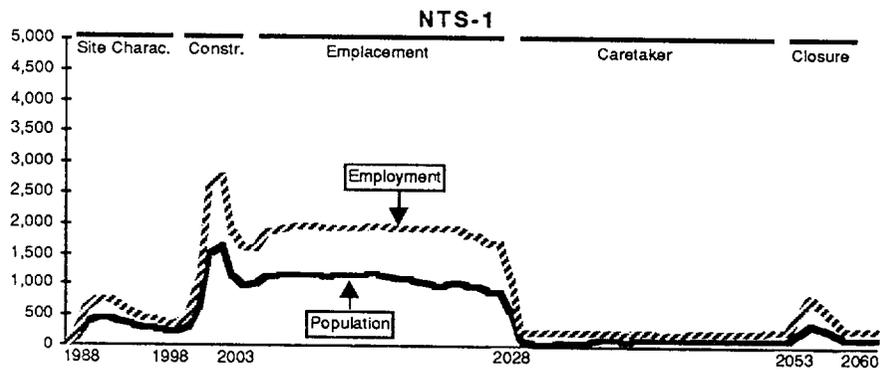
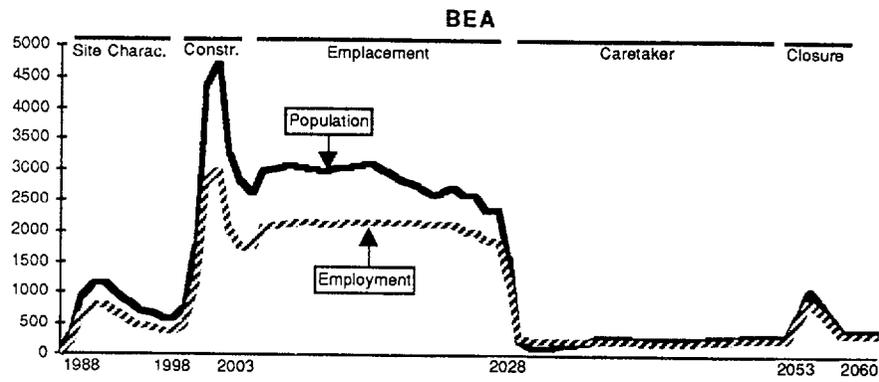
All scenarios indicate the repository program may create an increase of 15 percent or more jobs in Nye County than what would occur without the program. From approximately 2,500 to 3,000 jobs would be created in Nye County, most of which would be direct employment for the program. The program may generate relatively few secondary jobs in Nye County under any of the scenarios. Relatively few secondary jobs may be created in the county because businesses that could supply goods and services for the repository are not currently located there and because individuals and businesses in Nye County may purchase goods and services from elsewhere, such as Clark County, where they are more readily available.

Repository-related employment in Nye County may attract new residents, although the number of additional residents varies by residential location scenario. Depending on the scenario, population in Nye County may increase from less than 1,000 additional residents, to more than 4,500.

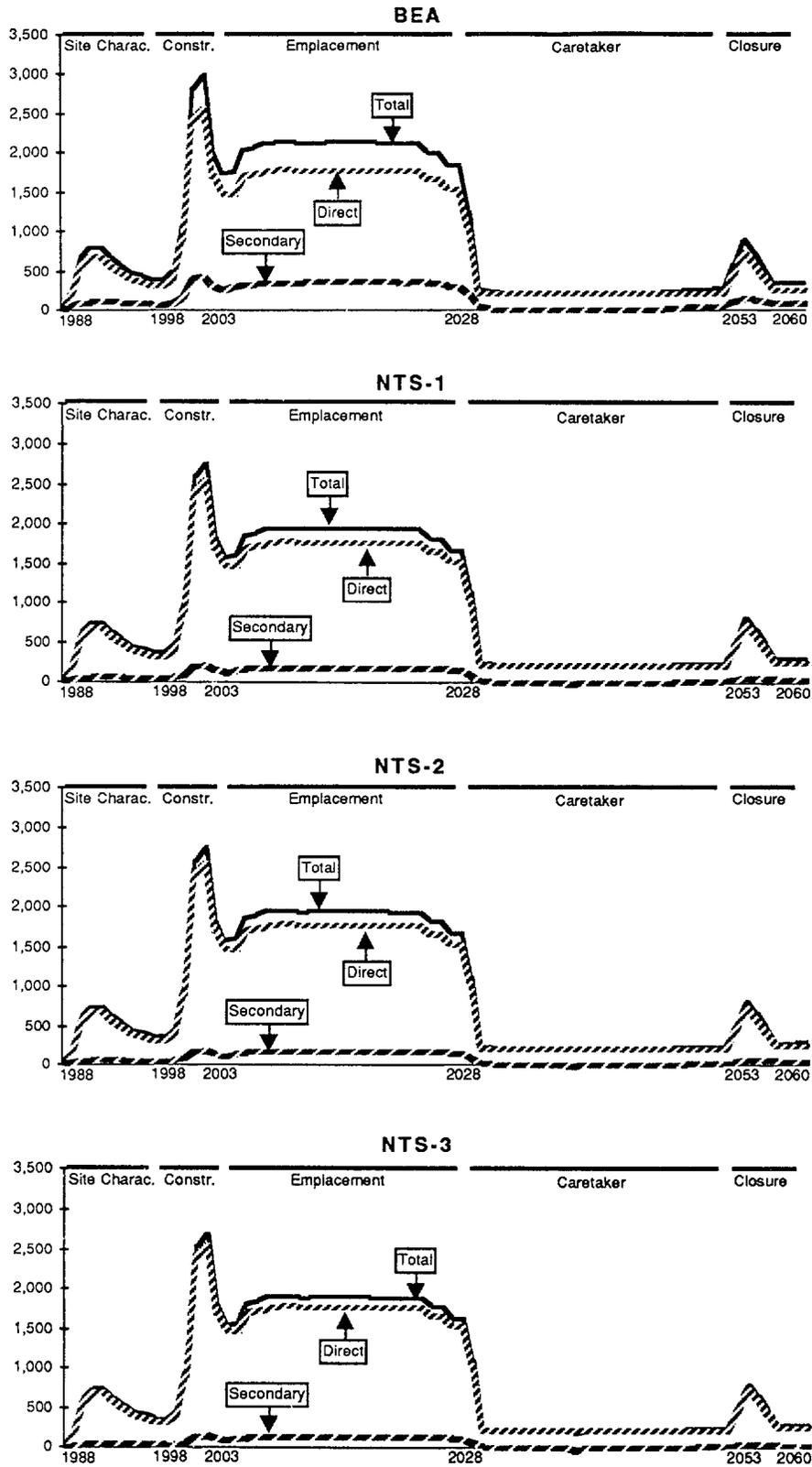
Figure A3-5 indicates the percent change from baseline employment and population forecasts represented by employment and population that may result in Nye and Esmeralda counties from the repository program under each residential location scenario. Figure A3-6 indicates the numbers of jobs and the change in population in these counties that may result from the program. Figure A3-7 indicates the number of direct and secondary jobs in these counties that may be generated by the program. Figure A3-8 indicates the peak population effects that may occur in subcounty areas of Nye County under each residential location scenario. The peak population effect in Esmeralda County is not indicated in Figure A3-8 because the peak effect under any of the four residential location scenarios is 15 additional residents.



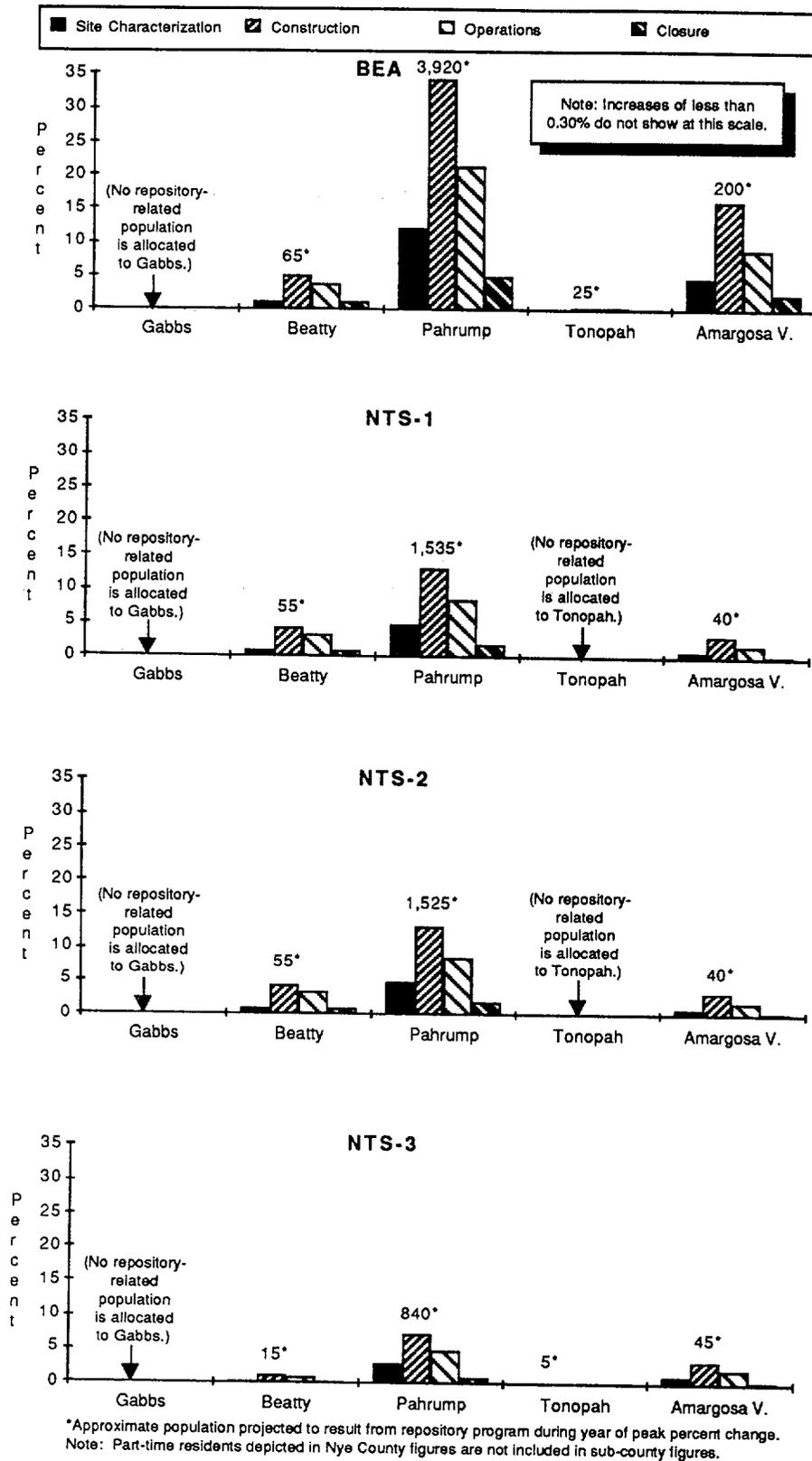
**Figure A3-5. Population and Employment Projected to Result from the Repository Program: Percent Change from Baseline, Nye & Esmeralda Counties, 1987-2060 (See Section A1.2.3.2 for Definition of Scenarios)**



**Figure A3-6. Population and Employment Projected to Result from the Repository Program: Total, Nye & Esmeralda Counties, 1987-2060 (See Section A1.2.3.2 for Definition of Scenarios)**



**Figure A3-7. Total, Direct, and Secondary Employment Projected to Result from the Repository Program: Total Jobs, Nye & Esmeralda, 1987-2060 (See Section A1.2.3.2 for Definition of Scenarios)**

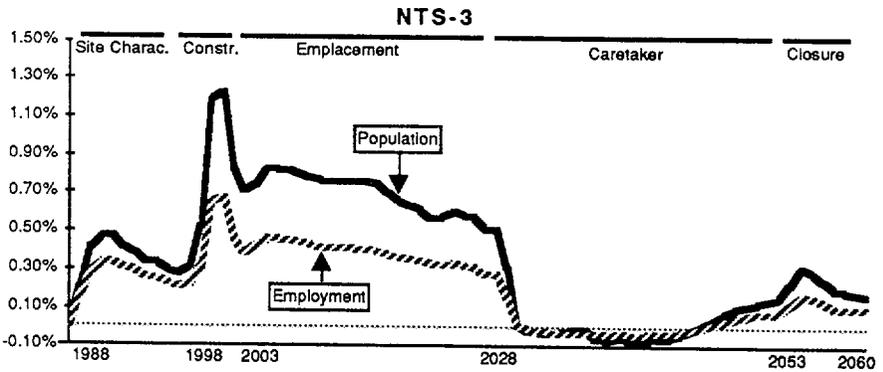
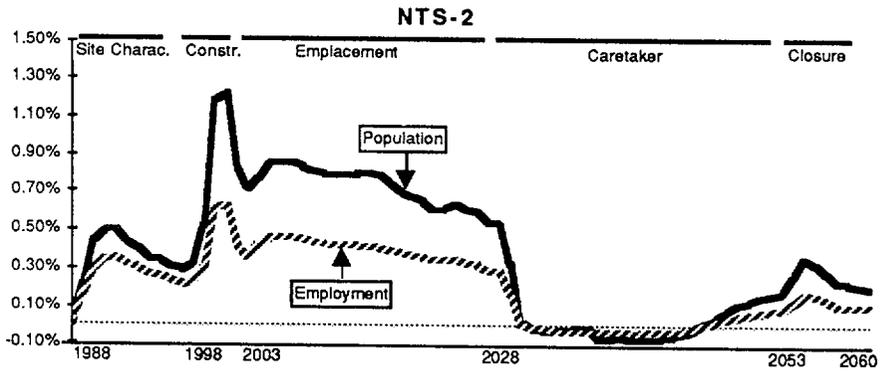
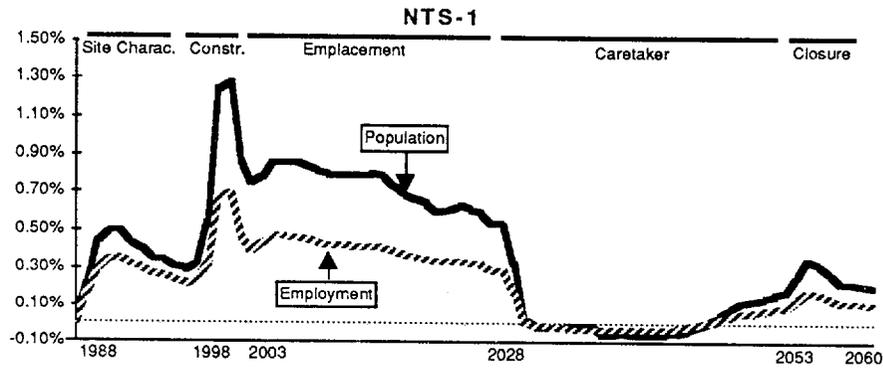
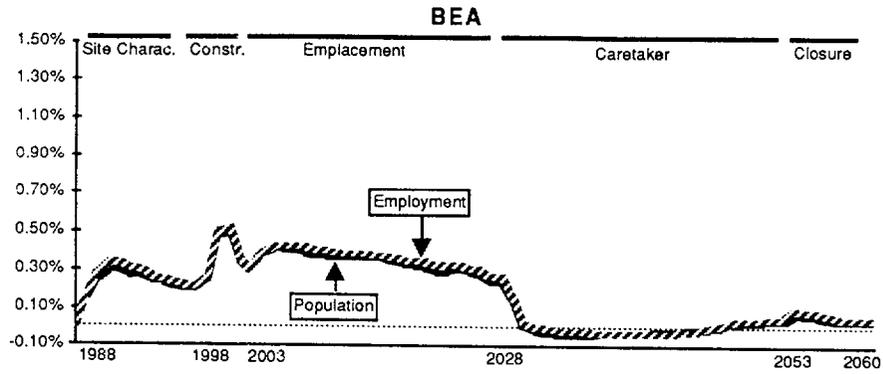


**Figure A3-8. Projected Peak Population Effect for Nye County Communities by Repository Program Phase (See Section A1.2.3.2 for Definition of Scenarios)**

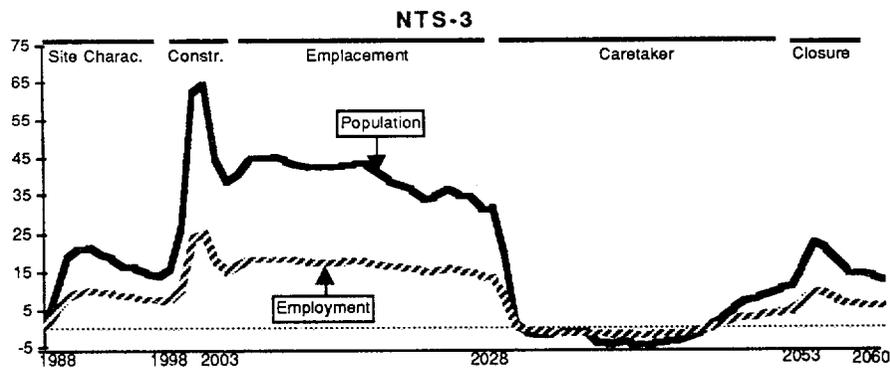
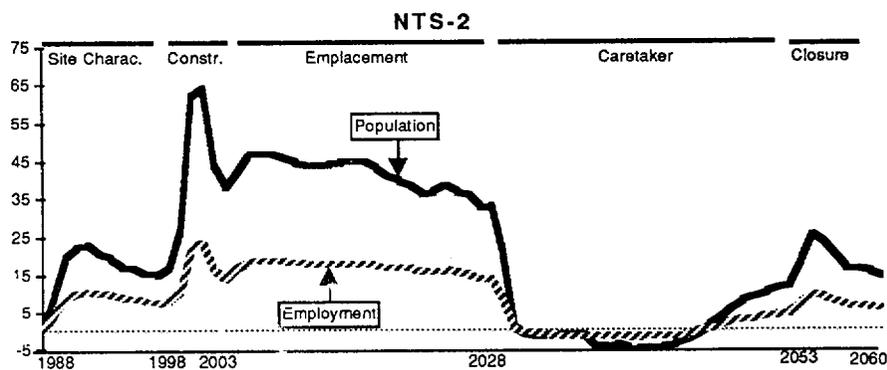
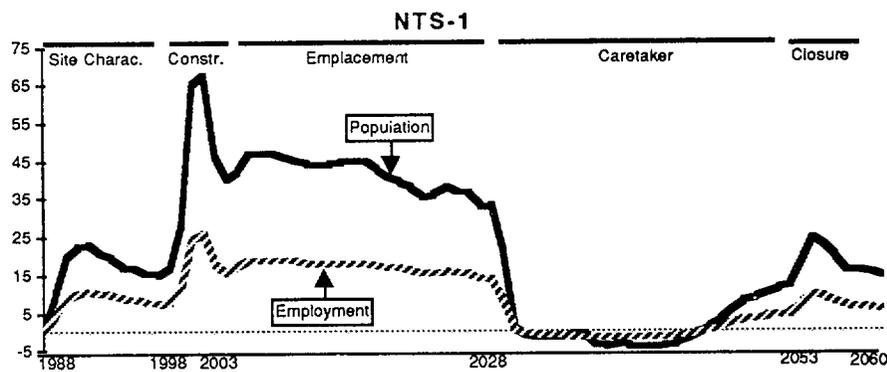
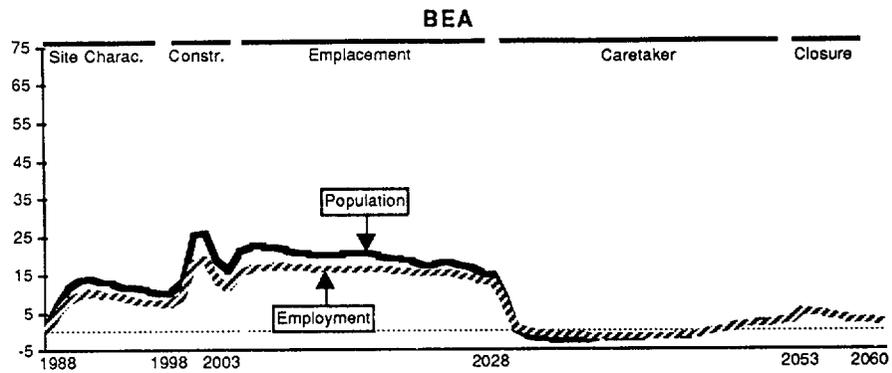
### A3.3 Lincoln County

There will be no direct employment with the repository program created in Lincoln County, based upon estimates of the location of jobs that were discussed in Chapter 2; however, depending on the residential adjustment scenario, some Lincoln County residents may work for the program in Nye County. Some secondary jobs may be generated in Lincoln County, but the number is projected to be small because few of the repository's purchases of goods and services are projected to occur in Lincoln County, and because a small proportion of the repository-generated income in the four-county area and the State is projected to be spent on Lincoln County's goods and services. These projections are the result of analysis of historical inter-county trade flows, as discussed in this appendix. Because of the small secondary employment effects in Lincoln County, the largest repository-induced population increase for any of the residential location scenarios is 65 new residents.

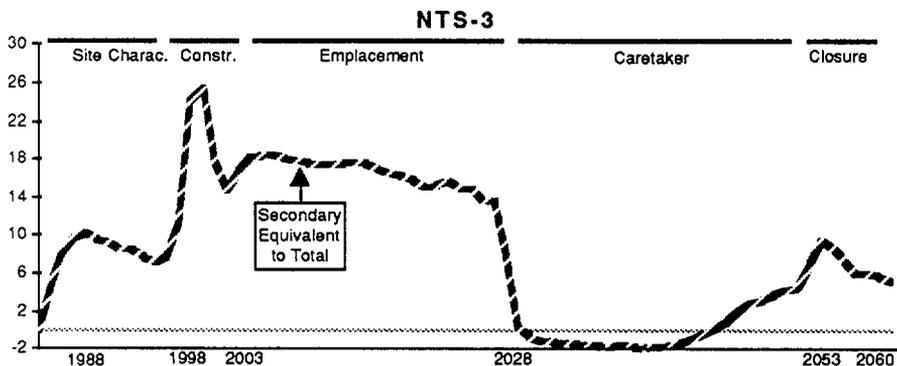
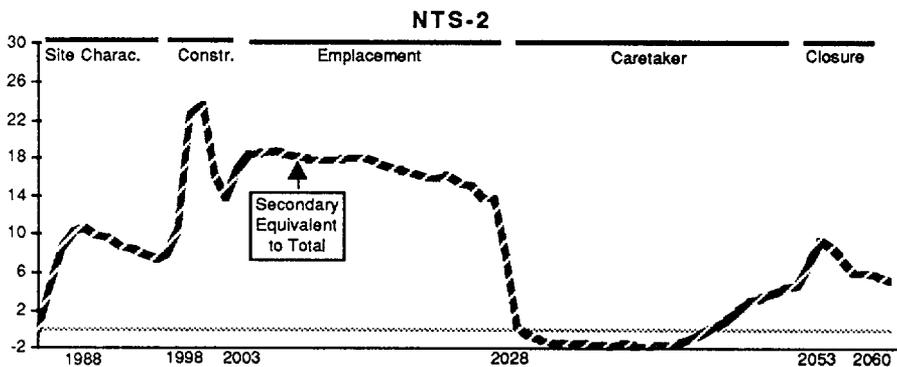
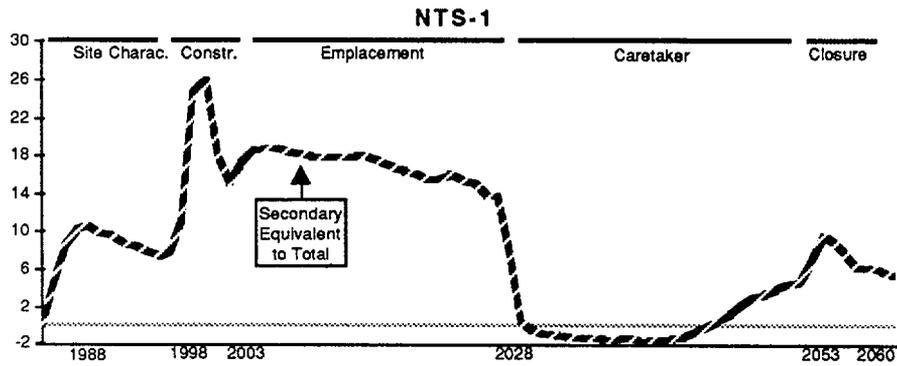
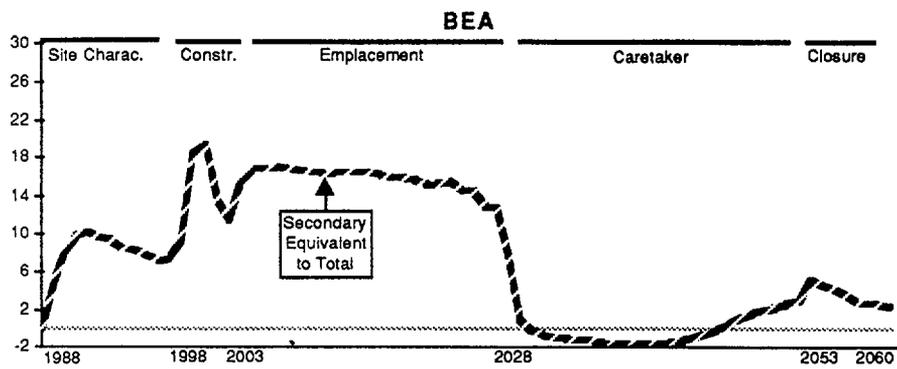
Figure A3-9 indicates the percent change from baseline employment and population forecasts represented by employment and population that may result in Lincoln County from the repository program under each residential location scenario. Figure A3-10 indicates the numbers of jobs and the change in population in Lincoln County that may result from the program. Figure A3-11 indicates the number of secondary jobs that may be generated by the program. Figure A3-12 indicates the peak population effects that may occur in Caliente and the rest of Lincoln County under each residential location scenario.



**Figure A3-9. Population and Employment Projected to Result from the Repository Program: Percent Change from Baseline, Lincoln County, 1987-2060 (See Section A1.2.3.2 for Definition of Scenarios)**

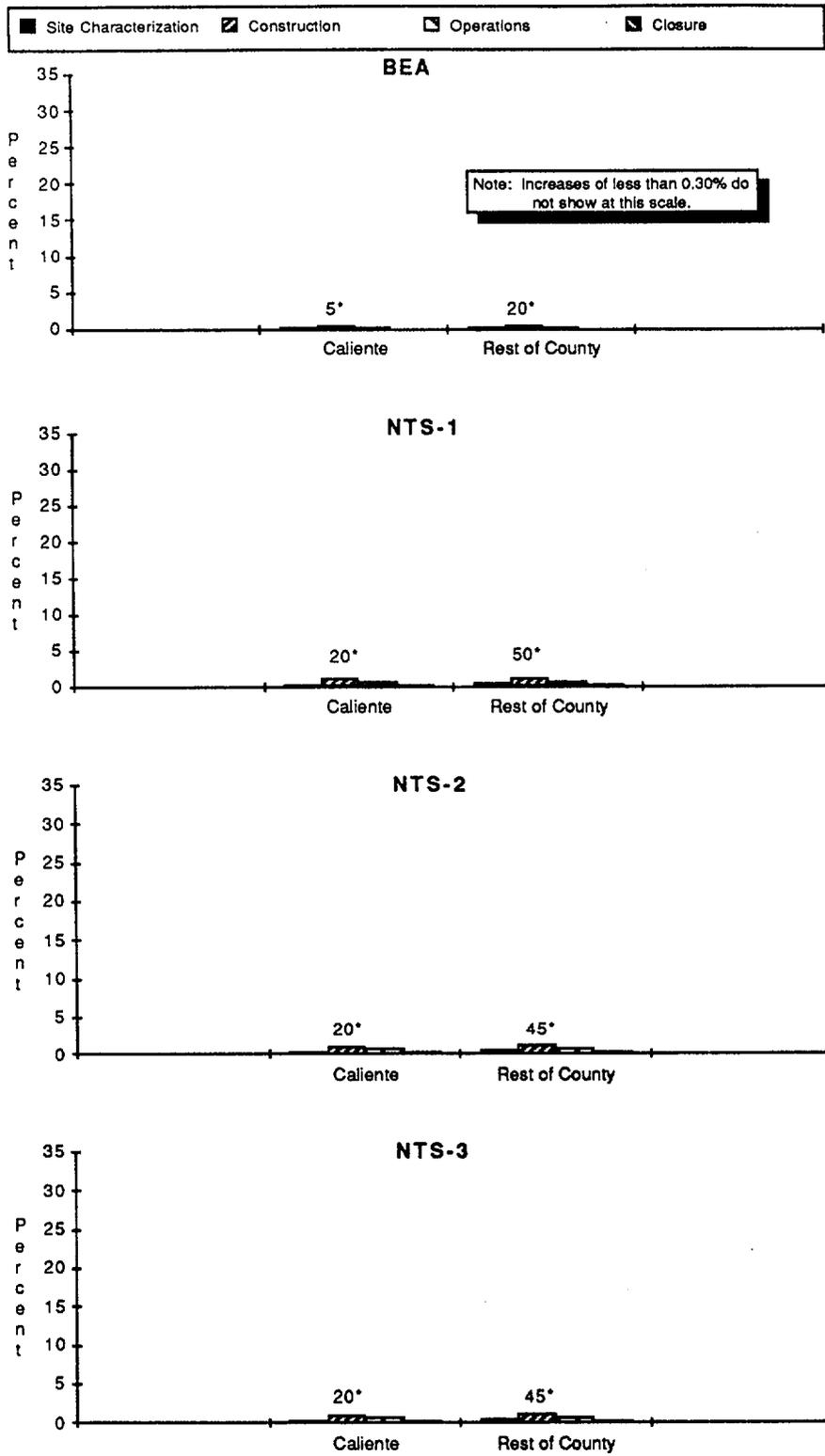


**Figure A3-10. Population and Employment Projected to Result from the Repository Program: Total, Lincoln County, 1987-2060 (See Section A1.2.3.2 for Definition of Scenarios)**



Note: No direct employment (i.e., place of work basis) is projected for Lincoln County.

Figure A3-11. Total, Direct, and Secondary Employment Projected to Result from the Repository Program: Total Jobs, Lincoln County, 1987-2060 (See Section A1.2.3.2 for Definition of Scenarios)



\*Approximate population projected to result from repository program during year of peak percent change.

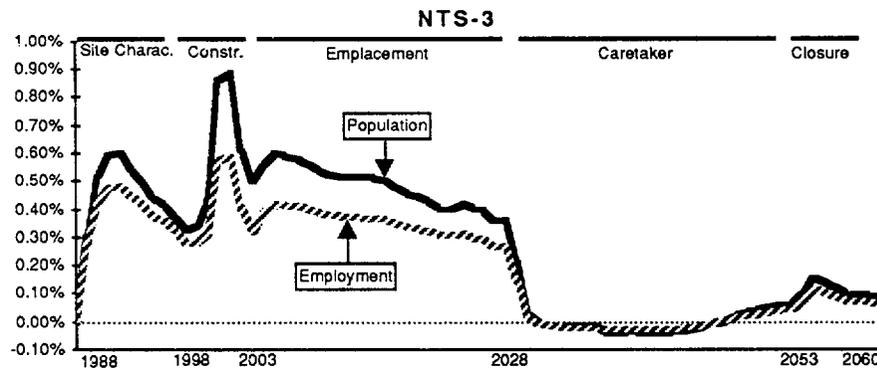
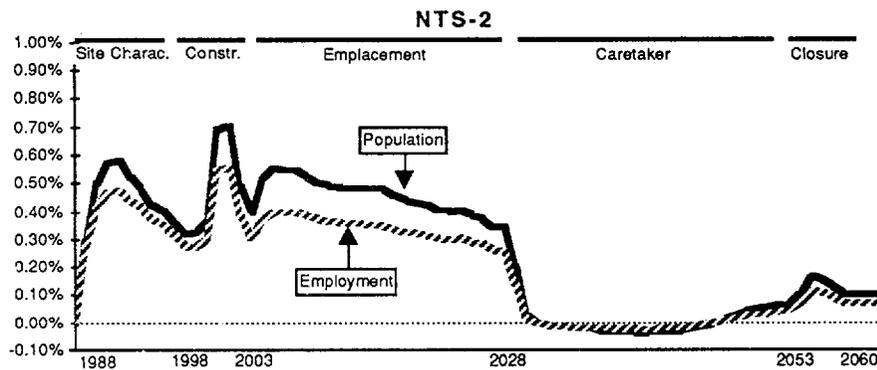
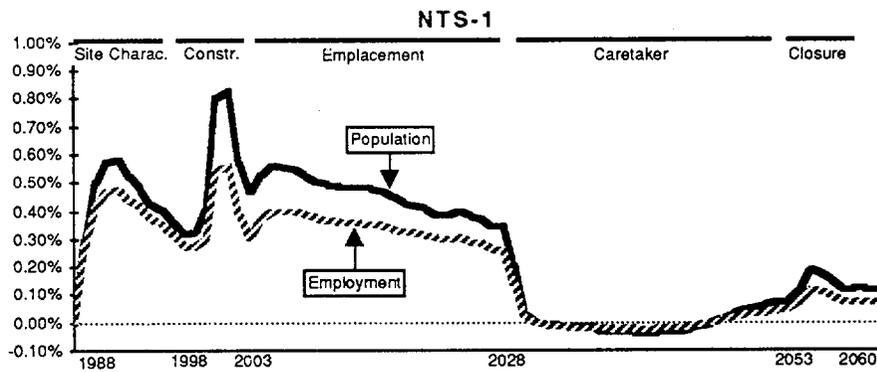
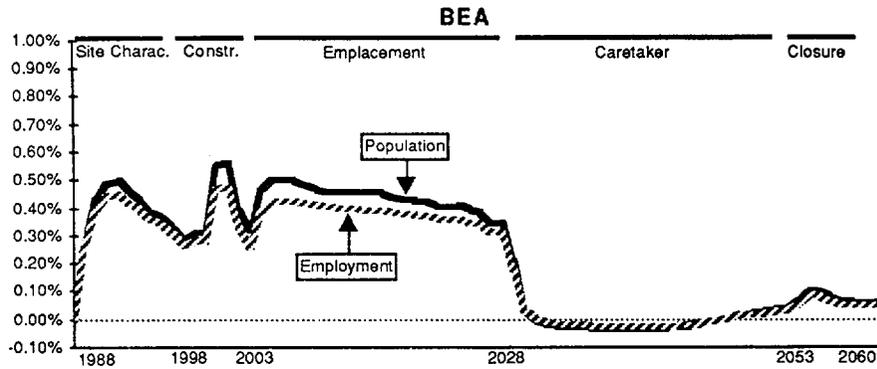
**Figure A3-12. Projected Peak Population Effect for Lincoln County Communities by Repository Program Phase (See Section A1.2.3.2 for Definition of Scenarios)**

### A3.4 Clark County

Because Clark County is the regional economic center of southern Nevada, it directly supplies a large proportion of the goods and services sold in the region. Its resident work force is the source of much of the temporary labor and some of the permanent labor in nearby counties. Thus, it is not surprising that much of the secondary employment that may result from the program will accrue to Clark County under any of the residential location scenarios.

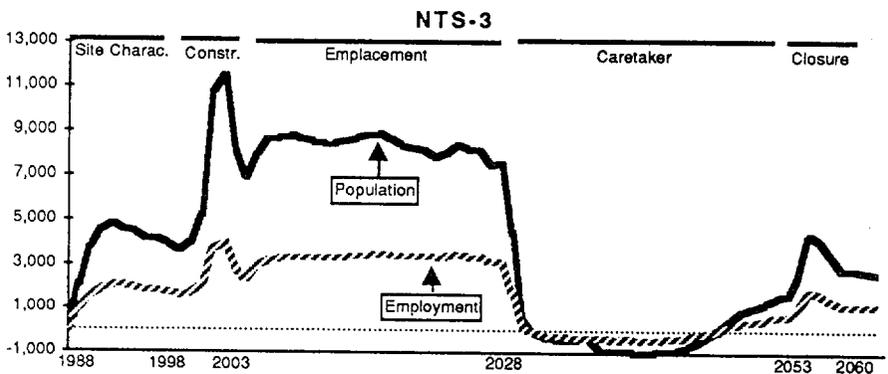
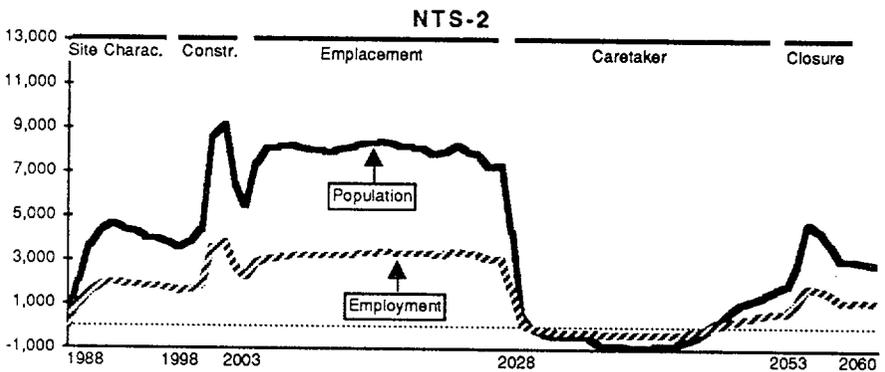
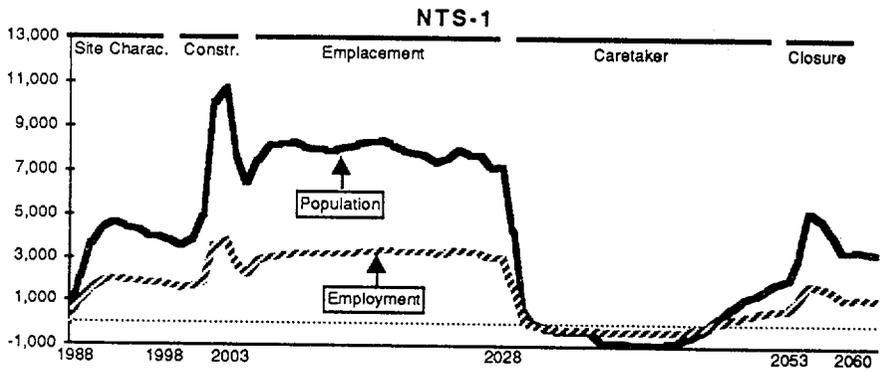
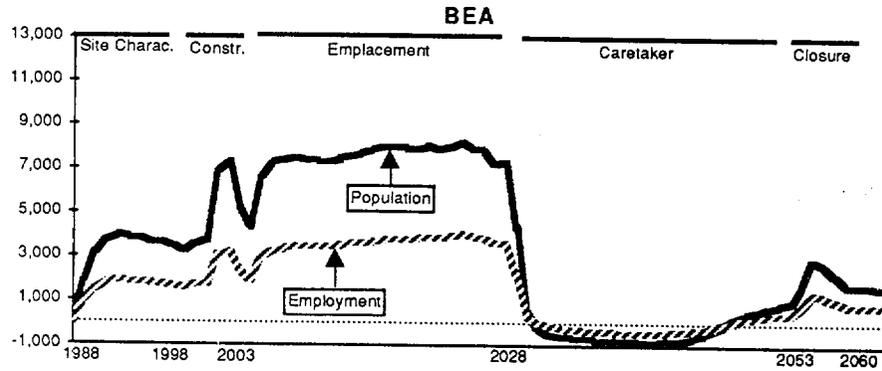
Under all of the residential location scenarios, the increased demand for labor due to the repository program is expected to draw workers and their families to Clark County, thereby increasing its population. Also, many repository workers may live in Clark County, even though they will work in Nye County. Proportionately, however, the population increases in subcounty areas of Clark County may be small relative to their baseline population, except in Indian Springs. Depending on the residential location scenario, Indian Springs may experience a population increase from 10 percent to 35 percent as a result of the repository program.

Figure A3-13 indicates the percent change from baseline employment and population forecasts represented by employment and population that may result in Clark County from the repository program under each residential location scenario. Figure A3-14 indicates the numbers of jobs and the change in population in Clark County that may result from the program. Figure A3-15 indicates the number of direct and secondary jobs that may be generated by the program. Figure A3-16 indicates the peak population effects that may occur in the different subcounty areas of Clark County under each residential location scenario.

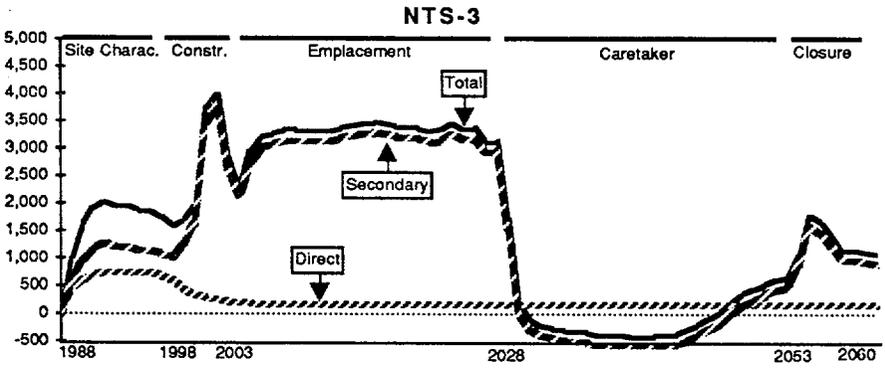
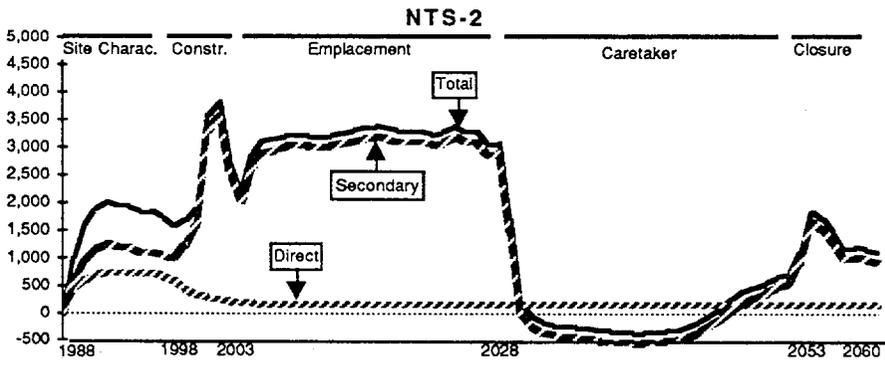
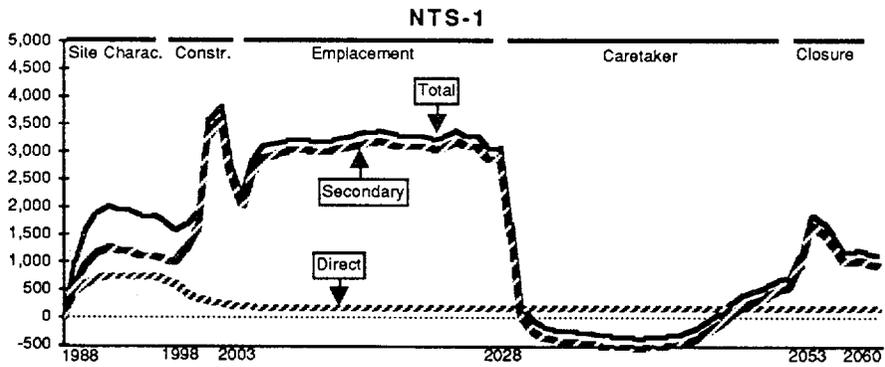
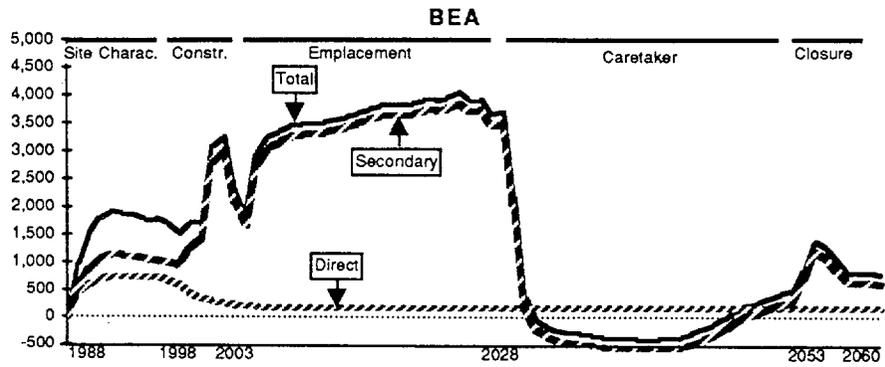


Note: Percent change depicted in these figures is less than one percent.

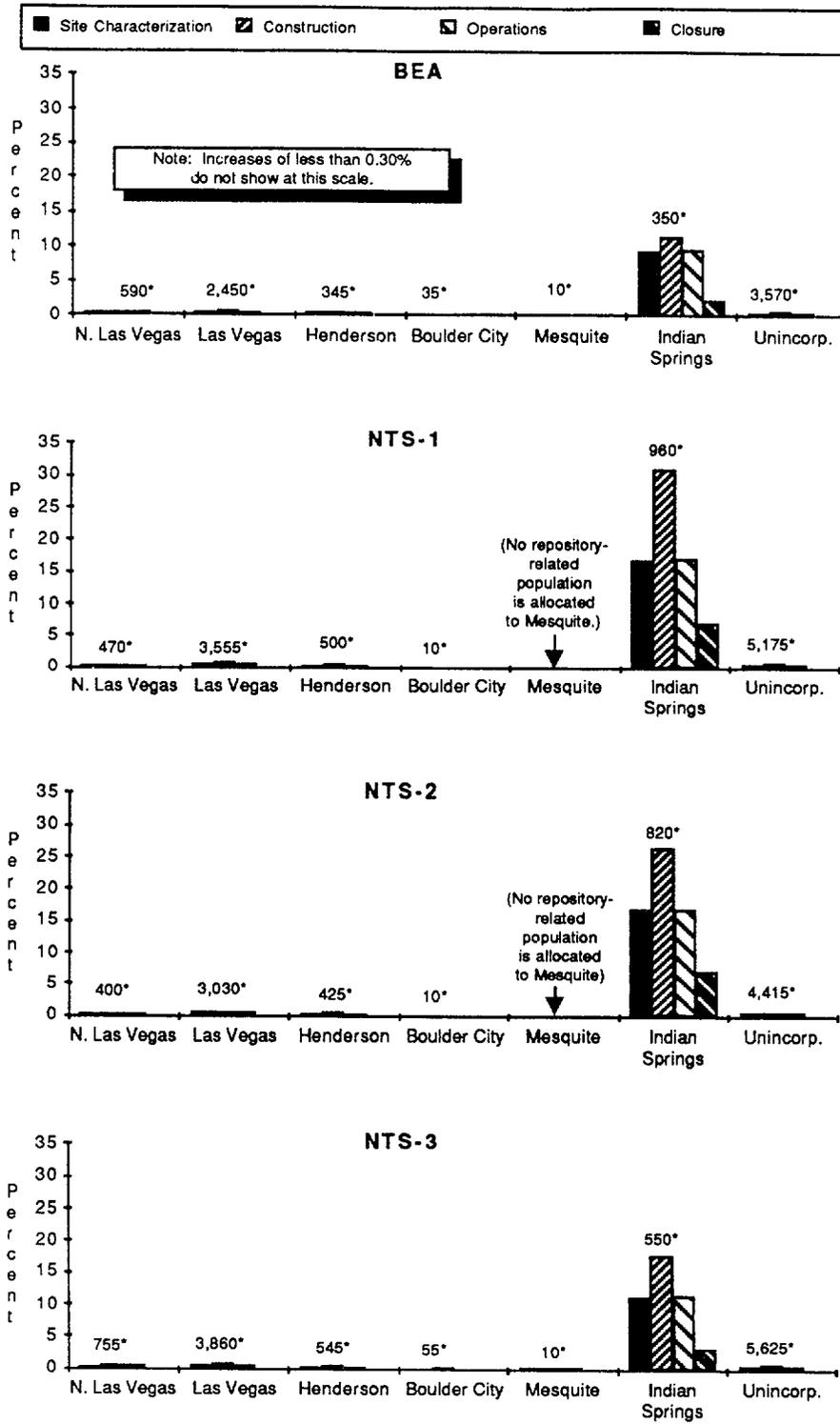
**Figure A3-13. Population and Employment Projected to Result from the Repository Program: Percent Change from Baseline, Clark County, 1987-2060 (See Section A1.2.3.2 for Definition of Scenarios)**



**Figure A3-14. Population and Employment Projected to Result from the Repository Program: Total, Clark County, 1987-2060 (See Section A1.2.3.2 for Definition of Scenarios)**



**Figure A3-15. Total, Direct, and Secondary Employment Projected to Result from the Repository Program: Total Jobs, Clark County, 1987-2060 (See Section A1.2.3.2 for Definition of Scenarios)**



\*Approximate population projected to result from repository program during year of peak percent change.

**Figure A3-16. Projected Peak Population Effect for Clark County Communities by Repository Program Phase (See Section A1.2.3.2 for Definition of Scenarios)**

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