PHASE I
PRELIMINARY ENVIRONMENTAL ASSESSMENT REPORT

Selection of a Preferred Site
for a
Private Fuel Storage Facility

Skull Valley, Utah

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1.0 EXECUTIVE SUMMARY

This report presents the results of the Phase 1 preliminary field investigations which reviewed the two candidate siting areas within the Skull Valley Indian Reservation. The Phase 1 environmental assessment led to the selection of a preferred site from areas offered by the Tribe for consideration. The individual sites were evaluated with respect to geography/demography, ecology, meteorology, hydrology, geology, historic/archeological/cultural, noise, and radiological criteria and then compared to each other. Site characteristics determined from field work and preliminary contacts with resource agencies are presented for each resource area for both sites A and B.

The results of the geologic, ecological, and cultural/socioeconomic field investigations revealed only minor features favoring the selection of one site over the other. There is a potential for offsite radiation exposure to be greater from Site B than from Site A, due to the closer proximity of Hickman Knolls and the nearest resident. Site A offers a slightly more homogeneous plant community and a greater distance from the habitats associated with Hickman Knolls. Seismicity must be considered identical at the two sites. Geological and soils differences appear to be minimal, based on the borings completed to date. Cultural, recreation, land use, and archeological resources and potential impacts to these resources are essentially the same at Site A and B.

Stone & Webster recommends that Site A be considered the preferred location and Site B be the alternate. Phase 2 will evaluate and characterize the preferred site.

2.0 INTRODUCTION AND PURPOSE

Stone & Webster Engineering Corporation (SWEC) was commissioned to perform preliminary field investigations of two volunteered siting areas within the Skull Valley Indian Reservation. Phase 1 activities include evaluation and comparison of the results of these and previous investigations and the selection of a preferred or primary site.

This report presents the results of the preliminary field investigations of the two candidate siting areas completed in October 1996. The investigation also took into account previous questionnaire data supplied by the Skull Valley Band of Goshute Indians and information collected during the first site visit in June 1996. Geotechnical borings, field surveys, regulatory agency contacts, and other public sources of information were pursued in order to obtain information on the resources of the site areas and their immediate environs. The information is presented for each site separately and then a comparison is made between the two. The data were evaluated using criteria derived from regulatory requirements and guidance for the siting of an Independent Spent Fuel Storage Installation (10 CFR 72; Reg Guide 3.48). Finally, the basis for selection of one site over the other is presented in the determination of a preferred and alternate site. Future Phase 2 site characterization investigations will be focused on the preferred site and ensuing information developed in support of a License Application to the Nuclear Regulatory Commission (NRC).

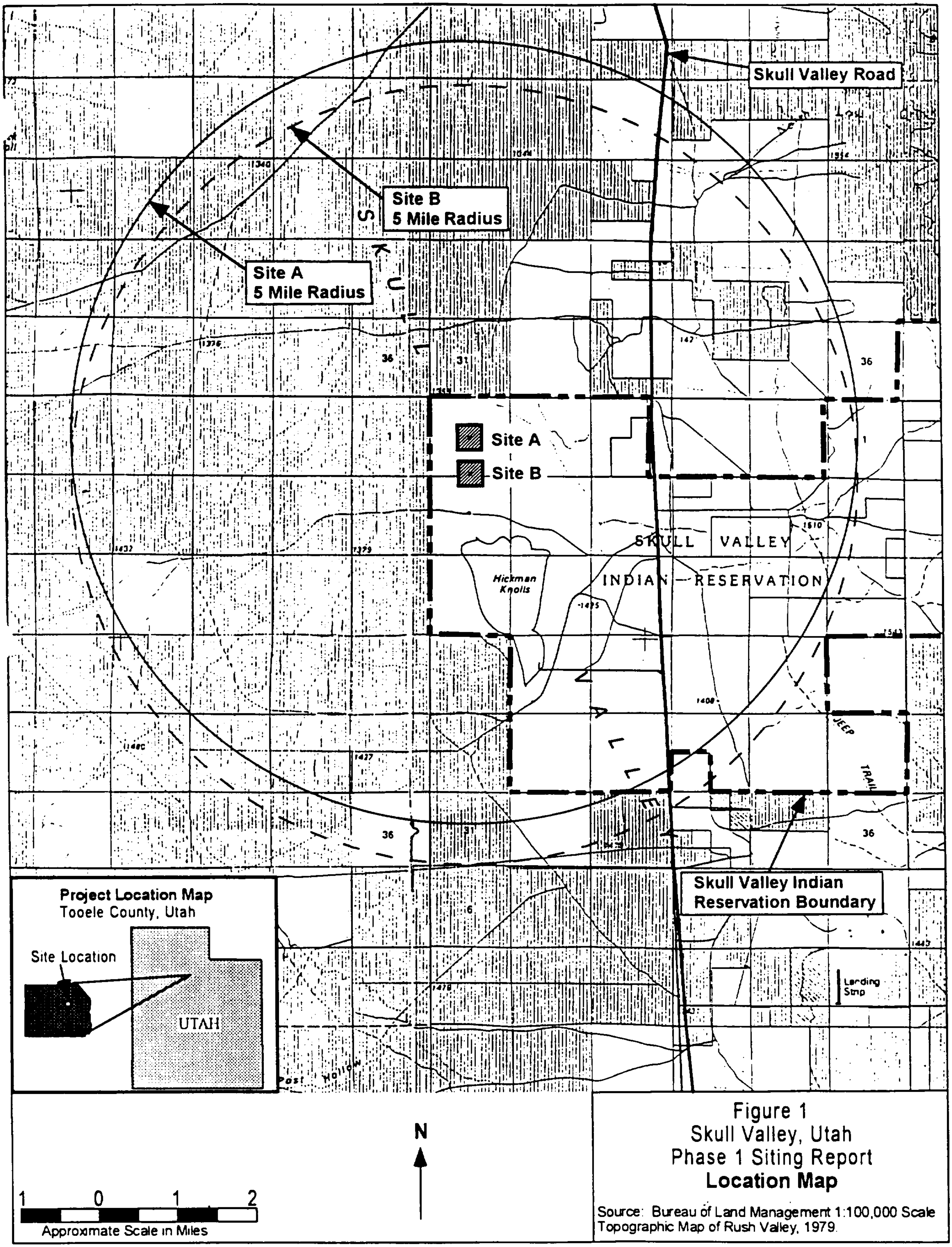

Figure 1
Skull Valley, Utah
Phase 1 Siting Report
Location Map

Source: Bureau of Land Management 1:100,000 Scale Topographic Map of Rush Valley, 1979.

3.0 SITE "A" DESCRIPTION

Site A is located approximately in the middle of Section 6 of T5S/R8W (Hickman Knolls Quadrangle). The cask storage area is a square approximately 2,000 feet on a side. In addition, an administration and operations/maintenance building and appurtenant facilities area (~1,000 ft by 500 ft) is located off the southeast corner of the cask storage area. The new site access road, approximately 2.5 miles in length, will run along the south side of the Sections 4 and 5 to the site from Skull Valley Road.

3.1 Geography and Demography

3.1.1 Land Use

Land owners and administrators of the Skull Valley area include the Bureau of Land Management (BLM), privately owned ranches, the Skull Valley Indian Reservation, the Wasatch National Forest, and the Department of the Army Dugway Proving Ground.. Existing land uses within Skull Valley include sparse residential development, agriculture, and commercial/industrial uses. Land is primarily used for agricultural activities such as ranching, farming, and grazing on public lands. Most of the area in this district is zoned by the county as MU-40 (multiple use district, 40-acre minimum lot size) which allows for varied uses including forestry, grazing, agriculture, mining, and recreation.

Adjacent to Site A, land uses include other undeveloped Reservation lands to the south and east, undeveloped BLM parcels to the west, and private and State lands to the north. The HerculesTekoi Rocket Engine Test Facility, a private industrial facility that leases Reservation land, is located on the south side of Hickman Knolls, approximately 3.2 miles from Site A.

Site A is currently undeveloped and would not be subject to county zoning ordinances because of its location within the Skull Valley Indian Reservation.

3.1.2 Population

Population in Skull Valley is found in the unincorporated town of Terra, English Village at the Dugway Proving Ground, the Skull Valley Reservation village, and scattered ranches located along the Skull Valley Road. According to county utility records, there are approximately 30 households in Terra and 11 in the Valley; using the average household size for Tooele County (3.06 persons), this translates to an estimated population of 125 persons. In addition, the county estimates the population of the military base at Dugway is 522 (Tooele, 1995). Information from the Goshute tribe at the Reservation indicates that there are 29 residents currently living on the Reservation. Therefore, the total population estimate for the Skull Valley area is 676.

Residents within a 5-mile radius of Site A include the population of the Skull Valley Indian Reservation and 2 individual ranches located along Skull Valley Road. The total population within this 5-mile radius is estimated at 35.

The nearest resident to the site centroid is located within the Reservation boundary on the west side of Skull Valley Road, approximately 2.3 miles from Site A. The Skull Valley Reservation village is located approximately 4 miles from Site A. Two private residences are located northeast of Site A along Skull Valley Road within the 5-mile radius. These residences are located approximately 2.75 and 4.0 miles from Site A.

3.1.3 Recreation

No recreation activities occur within the proposed Site A boundary due to its location on the Reservation and the restricted access to this area.

Recreation opportunities on adjacent lands managed by the BLM include dispersed camping, hunting, and off-road vehicle use. No developed recreation facilities exist within the 5-mile radius of Site A.

3.1.4 Visual Resources

The scenic character of this area is one of isolation, remoteness, and open space with only scattered evidence of human development. The BLM has classified Skull Valley as a Class IV area under the Visual Resource Management program. This classification allows for major modification of the existing landscape character. Activities may dominate views and be the major focus of view attention (BLM, 1988).

Further, no primary viewing locations that included views of the proposed site were identified.

3.2 Ecology

Site A consists of unused high desert/chaparral and open space. There are no known Federal-listed threatened or endangered species in the area. State-listed species may occur and a National Heritage Program database search will be requested. The surrounding land is sparsely populated and is used for some grazing. There are also some agricultural fields, primarily hay and alfalfa, within a five-mile radius of the site. More detailed information on specific resources at Site A is provided below.

3.2.1 Vegetation Resources

Section 6 is nearly flat, sloping gently downward to the north with small, local elevation changes of about 1 foot. Skull Valley is within the area identified by Bailey (1978) as the Bonneville Saltbush-Greasewood section of the Intermountain Sagebrush Province. In addition to sagebrush, other important plants include shadscale, fourwing saltbush, rubber rabbitbush, spiny hopsage, and horsebrush (Bailey, 1978). The vegetation community results from the low precipitation and highly alkaline soils, with a high desert comprising the valley floors and a coniferous forest (pinion/juniper) creeping down the adjacent mountain slopes. Other vegetation observed on the site includes cheat grass, sagebrush, tumbleweed, cacti, greasewood, creosote bush, and freckled milkvetch. Farther north in the valley, particularly in saline lowlands, iodine bush, pickleweed, salt grass, and alkali grass occur.

There are no trees within the site and its 5-mile radius, and the predominant vegetation includes xeric grasses and shrubs. However, cottonwood, juniper and several other tree species may occur in locations around seeps, homesteads, and irrigation outside the 5-mile radius. Vegetative micro-communities were mapped during the October, 1996 site visit. As seen in Figure 2, Site A is homogeneous, predominantly vegetated by grasses (micro-community Code 2).

3.2.2 Wildlife Resources

Information on wildlife species is sparse. Pronghorn antelope, mourning dove, ravens, desert packrat (nests and food cache among rocks of Hickman Knoll), grasshoppers, coyote (scat observed), wild horses, turkey vulture, hawk (large pellet observed), sparrows, vesper sparrow, western meadowlark, and small lizards were observed in the site area during visits in June and October, 1996.

According to the USDA-Natural Resources Conservation Service, soils in the Site A area are poor in terms of supporting vegetation that would provide wildlife habitat. Bailey (1978) states that few large mammals live in the Intermountain Sagebrush Province, but mule deer, mountain lion, bobcat and badger occasionally penetrate it. Small mammals are more common and include ground squirrels, jackrabbits, kangaroo mice, wood rats, and kit fox. Some species, such as the Belding and Townsend ground squirrels, become dormant during the hot dry summer.

In the northern portion of Skull Valley, waterbirds, shorebirds, and wading birds are present, in association with water and wetlands adjacent to and south of Great Salt Lake, about 20 to 26 miles from the site. The wildlife habitat found at Site A is fairly homogeneous, with one dominant vegetative micro-community and level topography.

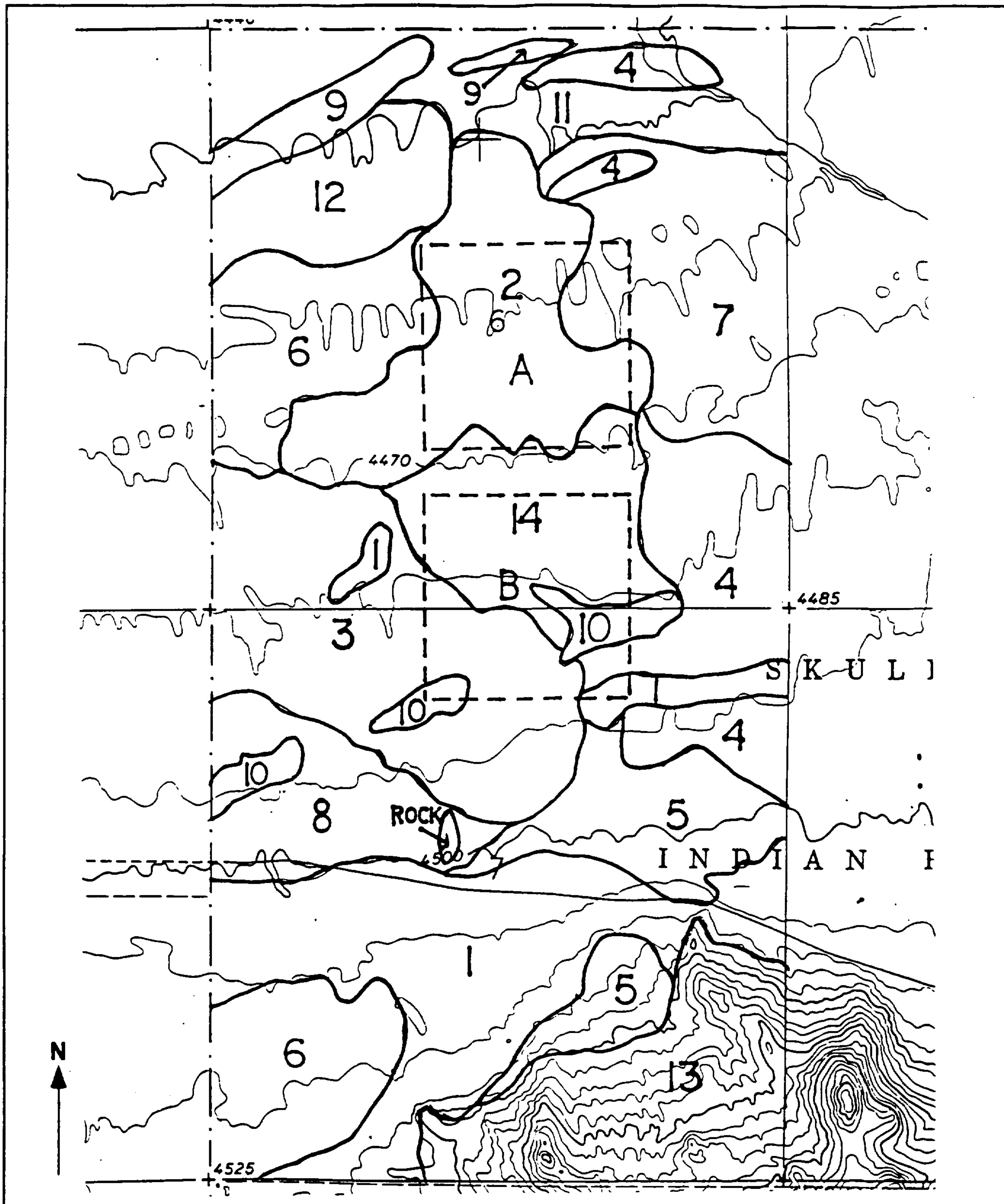

Figure not to scale.

Vegetative Micro-community Codes in Percentages

1. >90 Grass
2. 70 Grass/ 30 Bare
3. >90 Tall Shrub
4. >90 Low Shrub
5. 90 Grass/10 Tall Shrub
6. 50 Tall Shrub/50 Low Shrub
7. 10 Tall Shrub/90 Low Shrub
8. 90 Grass/10 Shrub
9. 50 Tall Herb/10 Shrub/40 Bare
10. Alkali
11. 50 Low Shrub/50 Grass
12. 40 Tall Shrub/40 Low Shrub/20 Grass
13. 10 Rock/60 Grass/30 Tall Herb
14. 33 Grass/33 Tall Shrub/33 Low Shrub

Figure 2
Skull Valley, Utah
Phase 1 Siting Report
Vegetative Communities

Source: USGS Topographic Map, Hickman Knolls, 1993, with modifications.

3.2.3 Aquatic Resources

There are no aquatic resources within Section 6 and there are no wetlands or ponds within the five-mile radius of Site A. However, there are approximately 20 stream channels identified on the USGS quadrangles that include the 5-mile radius. These stream channels are ephemeral or, at best, intermittent and have no features that can be considered aquatic. They are essentially dry washes that probably have short-term flow following local thunderstorms or perhaps during a period of snowmelt. The infrequency and small magnitude of these flows precludes the development of wetlands and prevents the streams from offering aquatic habitat.

3.2.4 Threatened and Endangered Species

Based on personal communications with personnel of the Utah Natural Heritage Program (UNHP) (June 24, 1996), there are not likely to be any State-listed threatened or endangered plant or animal species in the site area. Actual field surveys by UNHP staff would be required to confirm this.

U.S. Forest Service or BLM sensitive species on nearby lands are unknown but could include golden eagle, burrowing owl, and great horned owl. These species are unlikely to be present or adversely affected by the project given either the distance to Forest Service land or the lack of unique habitat that may support these species present at the site and near vicinity.

Transient bald eagles may forage in the site area for small mammals, but nesting does not occur. Federal candidate species in the region include ferruginous and Swainson's hawks, western snowy plover, long-billed curlew, and white-faced ibis. The US Fish and Wildlife Service (USFWS) is currently removing many candidate species from listing and some of those listed above may be dropped from future consideration.

3.3 Meteorology

3.3.1 Regional Climatology

The climate of Skull Valley, Tooele County, Utah can best be described as "semi-arid continental" marked with four well-defined seasons. Summers are characterized by hot, dry weather, but the high temperatures are usually not oppressive since the relative humidity is generally low and the nights usually cool. July is the hottest month with temperature readings commonly above 90 degrees F. The mean diurnal temperature range is about 30° F in the summer and 18° F during the winter. Temperatures above 100° F in the summer or colder than 0° F in the winter occur occasionally. Winters are cold, but usually not severe. Mountains to the north and east act as a barrier to frequent invasions of cold continental air. Heavy fog can develop under temperature inversions in the winter and may persist for several days. Precipitation is generally light with the driest months being in summer and early fall and the wetter months in the spring when storms from the Pacific Ocean are moving through the area more frequently than at any other season of the year. Winds are usually light, although occasional high winds have occurred in every month of the year, particularly in March.

Utah's climate is the result of several factors. These factors include its latitude, elevation above sea level, location with respect to the average storm track over the Intermountain Region, and its distance from the principal moisture sources of the Pacific Ocean and Gulf of Mexico. The mountain ranges in the western United States also have a significant impact on the climate of the region, particularly the Cascade and Sierra Nevada Ranges along with the Rocky Mountains. Pacific storms must cross the Cascades and Sierras before reaching Utah resulting in much of the moisture being removed by precipitation as the moist air rises over the high mountains. As a result, the prevailing westerly air flow reaching Utah is relatively dry resulting in light precipitation.

Besides the mountain ranges, the most influential natural feature affecting the climate of the area is the Great Salt Lake. This large inland body of water, which never freezes over due to its high salt content, can moderate the temperatures of cold winter winds blowing from the northwest and north and helps drive a lake/valley wind system. The warmer lake water during the winter and spring also contributes to increased precipitation in the valleys downwind from the lake.

3.3.2 Local Meteorology

The meteorology of the Site A area can be partially characterized using long-term meteorological data collected by the National Weather Service at the Salt Lake City International Airport, as summarized by the National Climatic Data Center. This climatological data set is the most comprehensive available for this area. The Salt Lake City International Airport is located approximately 50 miles northeast of the site at an elevation of approximately 4,220 feet AMSL. With Site A being located at an elevation of approximately 4,500 feet AMSL, meteorological data collected at Salt Lake City International Airport, within 50 miles of the site, can be considered representative of the general climate of the site, but not necessarily of local conditions.

The valley location of the site has an influence on the local meteorology relative to that of Salt Lake City International Airport with the Stansbury and Oquirrh Mountains rising to elevations of above 10,000 feet AMSL in between the two locations. The location of the Great Salt Lake to the north of Skull Valley, as opposed to west and northwest of Salt Lake City International Airport, also causes some meteorological differences between the two locations. Therefore, meteorological data collected in Skull Valley is also needed to characterize the local conditions. Temperature and precipitation data collected at various locations in Skull Valley have been published by the U. S. Weather Bureau at various times (1937, 1957, 1965, and 1966) along with more recent data collected at Dugway (1951 -1980). These data are useful in understanding the differences in meteorological conditions between Skull Valley and Salt Lake City.

Normal monthly precipitation tends to be concentrated in the winter and spring months with the larger amounts occurring between December and May and the least amounts in the summer and early fall. The annual average rainfall rate at Salt Lake City is 15.3 inches per year with a record 24-hour rainfall of 2.4 inches. Precipitation occurs an average of 90 days per year (0.01 inches or more). Long term precipitation data collected in Skull Valley indicate a range of annual precipitation of from 7 to 12 inches per year with increasing amounts at higher elevations in the Stansbury Mountains, maximizing at Deseret Peak with approximately 40 inches per year. A 30-year record (1951 - 1980) of precipitation data at Dugway, approximately 12 miles south of the site, indicates an annual average precipitation rate of 6.9 inches per year. Therefore, the valley location of Site A tends toward the lowest precipitation amounts in the area. Monthly precipitation amounts for Salt Lake City, Skull Valley locations, and Dugway are summarized in Table 1.

The long term average annual snowfall (1963 - 1992) at Salt Lake City is 57.6 inches per year, occurring mostly between November and April and ranging from a low of 30.2 inches in 1979-1980 to 110.8 inches in 1973-1974. The maximum recorded monthly snowfall is 41.9 inches in March, 1977 along with a maximum 24-hour snowfall of 18.4 inches in October, 1984. Information on snowfall amounts specifically in Skull Valley is not available but amounts are likely to be less than experienced in Salt Lake City due to the general trend of lower precipitation amounts in the valley.

The range of temperatures in the area is rather large from winter to summer. Summers are relatively hot with temperatures reaching 90° F or higher approximately 56 days per year on average at Salt Lake City. The average daily maximum temperature at Salt Lake City in July is 93.2° F and mean maximum temperatures in Skull Valley and at Dugway exceed 90° F during July and August. The record high temperature at Salt Lake City is 107° F occurring in July, 1960 with record high temperatures ranging from 105 to 107° F in Skull Valley. Winters are moderately cold with an average monthly temperature of 28.6° F in January at Salt Lake City along with a daily minimum temperature of 19.7° F. The lowest recorded temperature at Salt Lake City -30° F occurring in February, 1933. Similar winter temperatures are experienced in Skull Valley with average monthly values near 30° F in December and January and record low temperatures from -11 to -35° F. The average number of days with temperatures reaching 32° F or below at Salt Lake City is 125 days with the first freeze normally occurring in October and the last freeze occurring in April. The annual average temperatures at Salt Lake City and Dugway are both approximately 52° F for the period 1951 - 1980 with Skull Valley average temperatures ranging from 48 to 52° F for various periods from 1900 to 1964. Normal monthly, daily maximum, and daily minimum temperatures for the period 1951 to 1980 for Salt Lake City and Dugway are provided in Table 2.

Winds at Salt Lake City are moderate and are fairly uniform over the year with the highest average speed (9.7 mph) occurring in August and the lightest average wind speed (7.4 mph) occurring in December. The long term mean wind speed for the year is 8.8 mph. The prevailing wind direction at Salt Lake City is from the southeast or south-southeast throughout the year. Mean wind speeds by month for a 62-year period of record and prevailing wind directions by month are provided in Table 3. Wind information is not available specifically for the Skull Valley area.

On an annual average basis, relative humidities at Salt Lake City range from a high of 67 percent in the early morning hours to 43 percent in the afternoon. On a seasonal basis, the highest relative humidities tend to occur in late fall and winter while summer relative humidities are generally the lowest.

Salt Lake City also has a mean of 36.7 thunderstorm days per year and approximately 5 to 8 thunderstorm days per month from May through August.

Table 1

Normal Monthly Precipitation for Salt Lake City and Dugway(NOAA,82)

Month	Precipitation (inches) Skull Valley	Salt Lake City	Dugway
January	0.62	1.35	0.51
February	0.88	1.33	0.59
March	0.87	1.72	0.63
April	0.91	2.21	0.76
May	1.03	1.47	0.83
June	0.51	0.97	0.59
July	0.50	0.72	0.44
August	0.74	0.92	0.47
September	0.50	0.89	0.48
October	0.99	1.14	0.55
November	0.69	1.22	0.52
December	0.81	1.37	0.54
Annual	9.05	15.3	6.91

Notes:

1. Skull Valley location is Orr's Ranch

2. Period of record for Salt Lake City and Dugway is 1951 - 1980

Table 2

Normal Monthly Temperatures for Salt Lake City and Dugway[(NOAA,82)]

Month	Daily Maximum (°F)		Daily Minimum (°F)		Average (°F)	
	SLC	Dugway	SLC	Dugway	SLC	Dugway
January	37	38	20	17	28.5	27.5
February	44	45	24	24	34.0	34.5
March	52	52	30	28	41.0	40.0
April	61	62	37	36	49.0	49.0
May	72	73	45	45	58.5	59.0
June	83	84	53	54	68.0	69.0
July	93	94	62	63	77.5	78.5
August	90	91	60	60	75.0	75.5
September	80	81	50	49	65.0	65.0
October	67	67	39	37	53.0	52.0
November	50	50	29	26	39.5	38.0
December	39	39	22	19	30.5	29.0

1. Period of record is 1951 - 1980

Table 3

Mean Wind Speeds and Prevailing Directions for Salt Lake City(NOAA,92)

Month	Wind Speed (mph)	Prevailing Direction
January	7.6	SSE
February	8.2	SE
March	9.4	SSE
April	9.6	SE
May	9.5	SE
June	9.4	SSE
July	9.6	SSE
August	9.7	SSE
September	9.1	SE
October	8.5	SE
November	8.0	SSE
December	7.4	SSE

1. Period of record is 1951 - 1980

3.4 Hydrology

3.4.1 Groundwater

The main groundwater reservoir in Skull Valley is the unconsolidated sediments underlying the central part of the valley. The source of this water is precipitation which falls on the adjacent Stansbury and Cedar Mountains and enters the reservoir by way of the alluvial fans along the edges of these ranges. The best quality water is from springs or streams in the mountains, but good quality water can be found in the alluvial fan developments. Toward the center and northern parts of the valley, the water quality is generally poor due to saline or alkaline conditions in the soils. The water well drilled near the Reservation village was completed to a depth of 651 feet in clay, sand, and gravel. The static water level in the well after completion was 519.5 feet below ground surface, indicating a very deep water table in the alluvial fan. Another well drilled for the Hercules Tekoi Rocket Engine Test Facility southeast of Hickman Knolls was completed at 401 feet, in apparent unconsolidated materials. The static water level is only 77.5 feet below ground surface at this location, possibly indicating an artesian condition. Information gathered from tribal members indicates some wells yield good water and others yield poor quality water.

3.4.2 Surface Hydrology

The floor of Skull Valley slopes gently northward to the Great Salt Lake. High gradient streams originating in the mountains are mainly ephemeral by the time they reach the main valley bottom, having disappeared into the coarse soils of the bordering alluvial fans. Drainage in the immediate Site A area appears to be developed strictly as a result of local topographic and meteorological conditions, superimposed on the ancient lake bottom features. A minor exception is a dry stream channel in the northeast corner of Section 6 that appears to originate in the Stansbury Mountains. It may carry water more frequently than the dry washes or arroyos at the site proper but has been dry from June to November. As discussed previously in Topography and indicated on the topographic map, the washes trend northerly and appear to be spaced at somewhat regular intervals across Sections 6 and 7. Incision is minimal due to the near-desert conditions, low gradient of the old lake bottom, and small watershed area. Little or none of the flow in these washes reaches the groundwater table because of the small volumes and because the presence of near surface clay and silt inhibits infiltration. A few locations indicate that shallow ponding of water may occur for a few days from time to time. There are no wetlands within Site A or along the prospective access road to the highway. However, as described under Aquatic Resources, there are a number of springs and wetlands west of the existing county road in the northern portion of Skull Valley.

3.5 Geology

3.5.1 Topography

Site A on the Skull Valley Reservation is situated in the central portion of Section 6 of T5S, R8W. The land surface slopes gently to the north at about 30 feet per mile. A series of shallow (1 to 3 ft.), north-trending, dry washes, marked by more dense shrub vegetation, drains the area during infrequent thunderstorms or spring runoff. Several low (1 to 3 ft.) linear soil ridges rise above the valley bottom in the southeastern part of Section 6 and adjacent Sections 7 and 8, also trending northward. These types of features provide the main topographic relief on the valley bottom in this area. East of the site, the land surface rises more steeply along the surface of large alluvial fans at the western edge of the Stansbury Mountains.

3.5.2 Regional Geology

Site A is situated near the east side of Skull Valley, a north-south trending structural basin, between the Stansbury Mountains on the east and the Cedar Mountains on the west. The area is within the Basin and Range Physiographic Province, characterized by north-south trending, fault-bound mountain ranges separated by valleys occupying the down-dropped end of the fault-block or graben between the tilted ranges. Unconsolidated sediment derived from the adjacent ranges fills the valley floor and may be several thousand feet thick near the western edge of the valley. Development of this physiography has occurred during the last 30 million years, and continues today as evidenced by the seismic activity in the region and by the numerous locations where Quaternary (1.6 million years) soils and geomorphic features are disturbed or offset along fault traces. The Stansbury Fault along the west side of the Stansbury Mountains is a good example of this relationship. Ground surface dislocations of this type have been mapped about 6 miles east of the Site A location at the base of the Stansbury Mountains (Helm, 1995).

3.5.3 Bedrock

The Hickman Knolls is a large bedrock exposure about 1.5 miles south of Site A. It is believed to be composed of the Fish Haven Dolomite of Late Ordovician age (440 to 450 million years) (Hintze, 1980). It is described as a dark gray to black dolomite (magnesian limestone) with some interbeds of very light to medium gray dolomite (Rigby, 1958). A few fossils, thin beds of siltstone, thin sandstone, and masses of intra-formational conglomerate were noted at the Knolls. The rock is massive but does show some enlargement of joints due to dissolution. Small caves and openings (1 to 4 ft deep) can be seen on the steep faces of Hickman Knolls. Differential erosion has produced a very rough and irregular rock surface (mesoscopic scale). Karst conditions are not believed to exist due to the arid climate.

3.5.4 Soils and Geotechnical Engineering

Surficial soils at Site A are mainly fine grained sand, silt, and clay deposited in and by Lake Bonneville which occupied the valley during the late Pleistocene and early Holocene (30,000 to 10,000 years ago). These soils are typically calcareous and saline and may be reworked by wind or alluvial processes. They can be corrosive to steel and concrete and have severe limitations for leach fields, as roadfill, and in embankments. However, limitations for shallow foundations are slight (USDA-SCS, unpublished data). The dry conditions existing in the valley bottom (<7 inches of rain per year) will tend to minimize the corrosive nature of the soil. Storm drains and granular structural fill will preclude conditions necessary for corrosion to develop.

A total of eighteen borings were drilled at Site A to a maximum depth of 100 feet for Phase 1 investigations. The generalized soil profile consists of three layers. At the top is a stiff, clayey silt/silty clay that extends to about 20 feet in depth in the northeast corner and to about 35 feet in depth in the southwest corner of the site. Below this layer is very dense, dry fine sand to a depth of at least 50 feet, where most borings terminated. Minor gravel layers occurred in the deeper parts of these borings. A very dense silt with some clay is present below about 55 feet in the two borings that were drilled to 100 feet. Bedrock was not encountered in any of the borings, nor was the water table intersected.

Based on preliminary analyses of material from the upper layer, it is anticipated that shallow, conventional foundations may be used at the site. The high density of site materials, the cohesive nature of the upper soil layer, and the great depth to the water table essentially preclude the possibility of liquefaction of soils during seismic vibrations.

3.5.5 Faulting and Seismicity

The Skull Valley area is located in the Intermountain Seismic Belt (Wasatch Front region) of the continental United States extending from New Mexico to Idaho. Earthquakes up to magnitude 7.5 can be expected in this region and a magnitude 5.0 earthquake has an estimated average return period of about 10 years (Helm, 1995).

Active faults or "capable faults" (as the NRC identifies them) are defined as those that have shown movement at least once in the past 35,000 years, recurring movement within the past 500,000 years, or macroseismicity (seismic activity correlatable to a specific structure). A large body of evidence indicates that the mountain ranges adjacent to the Skull Valley site and parallel ranges to the east and west are the result of movements on faults during the last 30 million years. Many of these faults show evidence of movement history that the NRC would consider as "capable." Numerous studies of various ranges have been performed in attempts to determine the frequency of movements, the amount of displacements, and the lengths of rupture in order to estimate probable maximum earthquake magnitude and a recurrence interval. Using this information, a probable maximum acceleration for design purposes is determined.

Two other projects have been proposed or implemented in the vicinity of the proposed siting area that have published numerical estimates of the accelerations anticipated from earthquakes: the low-level radioactive waste disposal facility at Clive, Utah and the DOE preliminary MRS site assessment of the Skull Valley Goshute siting area.

In 1994, the NRC issued a Final Safety Evaluation Report on a license application to store and dispose of low-level radioactive waste at Clive, UT, about 25 miles northwest of the Reservation, west of the Cedar Mountains. The applicant completed a detailed analysis of the regional and local seismicity, as well as a hypothetical "random event" earthquake. They submitted, and the NRC accepted, a maximum ground acceleration of 0.37g (mean plus 1 standard deviation) for design purposes at the Clive site. This value results from the hypothetical random local earthquake occurring 6 miles from the Clive Site (USNRC, 1994). However, the Skull Valley site is only 6 miles (10 km) from the surface trace of the Stansbury Mountain fault and 4.2 miles (6.8 km) from the downdip (45°) projection of the fault beneath the site. This fault is capable of a maximum 7.3 magnitude earthquake (Helm, 1995).

A DOE-sponsored preliminary site assessment of the same land area offered by the Skull Valley Goshute Tribe for this project was issued in October, 1993 (TRW, 1993). In this document, TRW Environmental Safety Systems concluded that the estimated bedrock acceleration was approximately 0.3 g from the Stansbury Fault. The basis for this value is unknown but appears to be unrealistically low considering the proximity of the Stansbury Fault.

Geomatrix (unpublished preliminary report, 1996) has initially determined a peak ground acceleration (PGA) of 0.8 g for the site design. Site-specific data, such as actual depth to bedrock, nature of the soil profile, and shear wave velocities, were not available as input to their determination. As a result, this value is believed to be conservative. These parameters will be determined and included in the Phase 2 evaluation and may result in a lower PGA.

Sack (1993), on the basis of aerial photograph interpretation, has mapped a "Hickman Knolls fault and lineament zone" north of Hickman Knolls in Sections 5,6,7, and 8. The features occur mainly in the old lake bottom deposits but one is shown extending through the colluvium at the base of Hickman Knolls into the bedrock outcrop. At the ground surface these features appear to be flat-topped, grassy ridges about 2 to 3 feet higher than the surrounding ground. They consist of silty sand or sandy silt, being distinctly different in composition from the adjacent soil. Dr. Donald Currey, director of the Limneotectonics Laboratory at the University of Utah has recently examined these features and conclude no evidence of faulting in the bedrock of Hickman Knolls could be found near the mapped location. They were not of tectonic origin or related to faulting in any way. Rather, they appear to be beach ridges probably developed during transgressions of Lake Bonneville about 23,000 years B.P. (Currey, 1996).

3.6 Regional Historic, Archeological, Architectural, Scenic, Cultural and Natural Features

Tooele County has both historic and prehistoric cultural resources. Seventeen sites are listed on the National Register of Historic Places. However, there are no historic structures located on or near Site A. Further, representatives of the Skull Valley tribe have stated that the areas being considered for development of this project do not contain any "cultural or historic resources or areas of religious significance". Likewise, the areas proposed for construction of any required access roads do not contain any cultural or historic resources (Bear, 1996).

3.7 Noise

There are no federal, state, or local noise regulations which limit the sound from the site. The nearest noise sensitive residential receptor to the site is 2.3 miles east of the center of the site on Skull Valley Road. The nearest settlement is the Skull Valley Reservation village 3.9 miles east of Site A. The primary sources of noise in the area are local traffic, aircraft, and wildlife. The ambient sound levels are expected to be similar to the EPA measured rural L_{90} ambient sound levels of 30 dBA or less for both daytime and nighttime (EPA, 1971). The L_{90} is the sound level exceeded 90 percent of the time.

3.7.1 Construction Noise

The facilities to be constructed include a private access road and storage pad, as well as security and garage/warehouse buildings. Construction is expected to be limited to daytime hours. The equipment typical of this type of construction includes diesel powered backhoes, cranes, front-end loaders, dozers, dump trucks, scrapers, and paving machines.

The average sound level of modest size construction equipment is typically 80 dBA at 50 ft, with peak sound levels of 85 dBA. The construction tasks will include site preparation, pouring concrete building foundations and the cask slab, and building erection.

The construction and operational sound level predictions are for downwind sound propagation conditions, that is with the wind blowing from the source to the receptor. The sound levels for clear calm days, cross-wind and up-wind conditions will be 10-20 dBA lower.

The construction sound decreases rapidly with distance, giving a sound level at the nearest residential receptor from on-site construction of 28 dBA. This sound may occasionally be just audible under extremely quiet conditions. Construction is expected to be limited primarily to daytime hours. The maximum sound levels for access road construction would be approximately 48 dBA at the nearest neighbor. This sound will be audible at the nearest residential receptor during receptor downwind conditions.

3.7.2 Operational Noise

The potential noise impacts from operation of the storage facility result from cask delivery and on-site placement, and employees commuting to work. There will be approximately 40 to 50 day-shift employees, and 5 to 10 employees on each of the night-shifts. Commuter vehicles are expected to arrive at the access road from both the north and the south.

It is anticipated that casks will be delivered twice per week from the north along Skull Valley Road during daytime hours. On-site operational noise will include the unloading and transport of the casks by diesel powered equipment with sound levels similar to conventional construction equipment. These vehicles are expected to operate periodically during the day-shift, but not at night.

The maximum sound levels from this periodic operation at the nearest residential receptor is expected to be 28 dBA. This sound will generally not be audible from the nearest residential receptor. The operation of the facility will be inaudible at the Skull Valley Reservation village.

3.8 Radiological Considerations

Radiological considerations include assessment of potential radiation doses from the cask storage area to persons offsite. The Code of Federal Regulations, Chapter 10, Part 72 mandates that the annual dose equivalent to any individual beyond the controlled area must not exceed 25 mrems as a result of normal facility operations. Increasing the distance between the casks and the individuals lowers the dose beyond the site boundary. As described in Section 3.3.2, Site A is 2.3 miles from the nearest residence. Site A is about 2 miles from Hickman Knolls, considered as a potential "overlook" of the site outside the owner controlled area. Dose rates from the PSFS at these distances are very small - on the order of 3E-5 mrem/year (SNC, 1996).

4.0 SITE "B" DESCRIPTION

Site B is located approximately in the center of the boundary line between Section 6 and 7 of T5S/R8W. The main cask storage area is roughly an area, approximately 2,000 feet on a side. In addition, an office, maintenance facility and appurtenant facilities area (~1,000 ft by 500 ft) is located off the southeast corner of the cask area. The new site access road, approximately 2 miles in length, will extend along the Section line to the site from Skull Valley Road.

4.1 Geography and Demography

4.1.1 Land Use

Land owners and administrators of the Skull Valley area include the Bureau of Land Management (BLM), privately owned ranches, the Skull Valley Indian Reservation, the Wasatch National Forest, and the Department of the Army Dugway Proving Ground. Existing land uses within Skull Valley include sparse residential development, agriculture, and commercial/industrial uses. Land is primarily used for agricultural activities such as ranching, farming, and grazing on public lands. Most of the area in this district is zoned by the County as MU-40 (multiple use district, 40-acre minimum lot size) which allows for varied uses including forestry, grazing, agriculture, mining, and recreation.

Adjacent to Site B land uses include other undeveloped Reservation lands to the south and east, undeveloped BLM parcels to the west, and private, and State lands to the north. The Hercules Tekoi Rocket Engine Test Facility, a private industrial facility that leases Reservation land, is located on the south side of Hickman Knolls, approximately 2.8 miles from Site B.

Site B is currently undeveloped and would not be subject to county zoning ordinances because of its location within the Skull Valley Indian Reservation.

4.1.2 Population

Population in Skull Valley is found in the unincorporated town of Terra, English Village at the Dugway Proving Ground, the Skull Valley Reservation village, and scattered ranches located along Skull Valley Road. According to county utility records, there are approximately 30 households in Terra and 11 in the Valley; using the average household size for Tooele County (3.06 persons), this translates to an estimated population of 125 persons (4 persons per household). In addition, the county estimates the population of the military base at Dugway is 522 (Tooele, 1995). Information from the Goshute tribe at the Reservation indicates that there are 29 residents currently living on the Reservation. Therefore, the total population estimate for the Skull Valley area is 676.

Residents within a 5-mile radius of Site B include the population of the Skull Valley Indian Reservation and 2 individual ranches located along Skull Valley Road. The total population within this 5-mile radius is estimated at 35.

The nearest residents to the site centroid are located within the Reservation boundary on the west side of the Skull Valley Road, approximately 2.1 miles from Site B. The Skull Valley Reservation village is located approximately 3.9 miles from Site B. Two private residences are located northeast of Site B along Skull Valley Road within the 5-mile radius. These residences are located approximately 3.0 and 4.5 miles from Site B.

4.1.3 Recreation

No recreation activities occur within the proposed Site B boundary due to its location on the Reservation and the restricted access to this area.

Recreation opportunities on adjacent lands managed by the BLM include dispersed camping, hunting, and off-road vehicle use. No developed recreation facilities occur within a 5-mile radius of Site B.

4.1.4 Visual Resources

The scenic character of this area is one of isolation, remoteness, and open space with only scattered evidence of human development. The BLM has classified Skull Valley as a Class IV area under the Visual Resource Management program. This classification allows for major modification of the existing landscape character. Activities may dominate views and be the major focus of view attention (BLM, 1988).

Further, primary viewing locations that included views of the proposed site were identified.

4.2 Ecology

Site B consists of unused high desert/chaparral and open space. There are no known Federal-listed threatened or endangered species in the area. State-listed species may occur and a National Heritage Program database search will be requested. The surrounding land is sparsely populated and is used for some grazing. There are also some agricultural fields, primarily hay and alfalfa, within a five-mile radius of the site. More detailed information on specific resources at Site B is provided below.

4.2.1 Vegetation

Section 7 has an overall gentle downward slope to the north with small, local elevation changes of 1 to 3 feet. The southeast corner of Section 7 contains lower portions of Hickman Knolls, a rocky outcrop that juts about four hundred feet above the valley floor. The area has been identified by Bailey (1978) as within the Bonneville Saltbush-Greasewood section of the Intermountain Sagebrush Province. In addition to sagebrush, other important plants include shadscale, fourwing saltbush, rubber rabbitbush, spiny hopsage, and horsebrush (Bailey, 1978). The vegetation community results from the low precipitation and highly alkaline soils, with a high desert comprising the valley floors and a coniferous forest (pinion/juniper) creeping down the adjacent mountain slopes. Other vegetation observed on the site includes cheat grass, sagebrush, tumbleweed, cacti, greasewood, creosote bush, and freckled milkvetch. Farther north in the valley, particularly in saline lowlands, iodine bush, pickleweed, salt grass, and alkali grass occur.

There are no trees within the site and its 5-mile radius, and the predominant vegetation includes xeric grasses and shrubs. However, cottonwood, juniper and several other tree species may occur in locations around seeps, homesteads, and irrigation outside the 5-mile radius. Vegetative micro-communities were mapped during the October, 1996 site visit. As seen in Figure 2, Site B has a diversity of micro-communities, including areas dominated by grasses, tall shrubs, nearly barren alkali areas, and an even mixture of grass, tall shrubs and low shrubs (Codes 1, 3, 10, and 14).

4.2.2 Wildlife Resources

Information on wildlife species is sparse. Pronghorn antelope, mourning dove, ravens, desert packrat (nests and food cache among rocks of Hickman Knoll), grasshoppers, coyote (scat observed), wild horses, turkey vulture, hawk (large pellet observed), sparrows, vesper sparrow, western meadowlark, and small lizards were observed in the site area during visits in June and October, 1996.

According to the USDA-Soil Conservation Service soils are poor in terms of supporting vegetation that would provide wildlife habitat. Bailey (1978) states that few large mammals live in the Intermountain Sagebrush Province, but mule deer, mountain lion, bobcat and badger occasionally penetrate it. Small mammals are more common and include ground squirrels, jackrabbits, kangaroo mice, wood rats, and kit fox. Some species, such as the Belding and Townsend ground squirrels, become dormant during the hot dry summer.

In the northern portion of Skull Valley, waterbirds, shorebirds, and wading birds are present, in association with water and wetlands adjacent to Great Salt Lake, about 26 miles from the site.

The wildlife habitat found at Site B has some diversity due to the multiple vegetation micro-communities, 1-3 foot relief difference, and close vicinity of Hickman Knolls. The Knolls are likely to provide habitat for small mammals and perching raptors, as one of the only places in the immediate valley (within 5 miles) that is not fairly level and the rocky outcrops provide habitat heterogeneity. However, technically the Knolls do not fall within the Site B boundary and are approximately 2000 feet south.

4.2.3 Aquatic Resources

There are no aquatic resources within Section 7 and Section 6 as described in Section 3.2.3. There are no wetlands or ponds within the five-mile radius of site B; however, there are approximately 20 stream channels identified on the USGS quadrangles that include the 5-mile radius. These stream channels are ephemeral or, at best, intermittent and have no features that can be considered aquatic. They are essentially dry washes that probably have short-term flow following local thunderstorms or perhaps during a period of snowmelt. The infrequency and small magnitude of these flows precludes the development of wetlands and prevents the streams from offering aquatic habitat. Site B does have a couple of small areas (alkali areas on Figure 2) that could pond water during rain events, but that probably last from no more than a few days to a week or two before drying out.

4.2.4 Threatened and Endangered Species

Based on personal communications with personnel of the UNHP (June 24, 1996), there are not likely to be any State-listed threatened or endangered plant or animal species in the site area. Actual field surveys by the UNHP staff would be required to confirm this.

U.S. Forest Service or BLM sensitive species on nearby lands are unknown but could include golden eagle, burrowing owl, and great horned owl. These species are unlikely to be present or adversely affected by the project given either the distance to Forest Service land or the lack of unique habitat that may support these species present at the site and near vicinity.

Transient bald eagles may forage in the site area for small mammals, but nesting does not occur. Federal candidate species in the region include ferruginous and Swainson's hawks, western snowy plover, long-billed curlew, and white-faced ibis. The US Fish and Wildlife Service (USFWS) is currently removing many candidate species from listing and some of those listed above may be dropped from future consideration.

4.3 Meteorology

4.3.1 Regional Climatology

The climate of Skull Valley, Tooele County, Utah can best be described as "semi-arid continental" marked with four well-defined seasons. Summers are characterized by hot, dry weather, but the high temperatures are usually not oppressive since the relative humidity is generally low and the nights usually cool. July is the hottest month with temperature readings above 90 degrees F. The mean diurnal temperature range is about 30° F in the summer and 18° F during the winter. Temperatures above 100° F in the summer or colder than 0° F in the winter occur occasionally. Winters are cold, but usually not severe. Mountains to the north and east act as a barrier to frequent invasions of cold continental air. Heavy fog can develop under temperature inversions in the winter and may persist for several days. Precipitation is generally light with the driest months being in summer and early fall and the wetter months in the spring when storms from the Pacific Ocean are moving through the area more frequently than at any other season of the year. Winds are usually light, although occasional high winds have occurred in every month of the year, particularly in March.

Utah's climate is the result of several factors. These factors include its latitude, elevation above sea level, location with respect to the average storm track over the Intermountain Region, and its distance from the principal moisture sources of the Pacific Ocean and Gulf of Mexico. The mountain ranges in the western United States also have a significant impact on the climate of the region, particularly the Cascade and Sierra Nevada Ranges along with the Rocky Mountains. Pacific storms must cross the Cascades and Sierras before reaching Utah resulting in much of the moisture being removed by precipitation as the moist air rises over the high mountains. As a result, the prevailing westerly air flow reaching Utah is relatively dry resulting in light precipitation.

Besides the mountain ranges, the most influential natural feature affecting the climate of the area is the Great Salt Lake. This large inland body of water, which never freezes over due to its high salt content, can moderate the temperatures of cold winter winds blowing from the northwest and north and helps drive a lake/valley wind system. The warmer lake water during the winter and spring also contributes to increased precipitation in the valleys downwind from the lake.

4.3.2 Local Meteorology

The meteorology of the Site B area can be partially characterized using long-term meteorological data collected by the National Weather Service at the Salt Lake City International Airport, as summarized by the National Climatic Data Center. This climatological data set is the most comprehensive available for this area. The Salt Lake City International Airport is located approximately 50 miles northeast of the site at an elevation of approximately 4,220 feet AMSL. With Site B being located at an elevation of approximately 4,500 feet AMSL, meteorological data collected at Salt Lake City International Airport, within 50 miles of the site, can be considered representative of the general climate of the site, but not necessarily of local conditions.

The valley location of the site has an influence on the local meteorology relative to that of Salt Lake City International Airport with the Stansbury and Oquirrh Mountains rising to elevations of above 10,000 feet AMSL in between the two locations. The location of the Great Salt Lake to the north of Skull Valley, as opposed to west and northwest of Salt Lake City International Airport, also causes some meteorological differences between the two locations. Therefore, meteorological data collected in Skull Valley is also needed to characterize the local conditions. Temperature and precipitation data collected at various locations in Skull Valley have been published by the U. S. Weather Bureau at various times (1937, 1957, 1965, and 1966) along with more recent data collected at Dugway (1951 -1980). These data are useful in understanding the differences in meteorological conditions between Skull Valley and Salt Lake City.

Normal monthly precipitation tends to be concentrated in the winter and spring months with the larger amounts occurring between December and May and the least amounts in the summer and early fall. The annual average rainfall rate at Salt Lake City is 15.3 inches per year with a record 24-hour rainfall of 2.4 inches. Precipitation occurs an average of 90 days per year (0.01 inches or more). Long term precipitation data collected in Skull Valley indicate a range of annual precipitation of from 7 to 12 inches per year with increasing amounts at higher elevations in the Stansbury Mountains, maximizing at Deseret Peak with approximately 40 inches per year. A 30-year record (1951 - 1980) of precipitation data at Dugway, approximately 12 miles south of the site, indicates an annual average precipitation rate of 6.9 inches per year. Therefore, the valley location of Site B tends toward the lowest precipitation amounts in the area. Monthly precipitation amounts for Salt Lake City, Skull Valley locations, and Dugway are summarized in Table 1.

The long term average annual snowfall (1963 - 1992) at Salt Lake City is 57.6 inches per year occurring mostly between November and April and ranging from a low of 30.2 inches in 1979-1980 to 110.8 inches in 1973-1974. The maximum recorded monthly snowfall is 41.9 inches in March, 1977 along with a maximum 24-hour snowfall of 18.4 inches in October, 1984. Information on snowfall amounts specifically in Skull Valley is not available but is likely to be less than the amounts experienced in Salt Lake City due to the general trend of lower precipitation amounts in the valley.

The range of temperatures in the area is rather large from winter to summer. Summers are relatively hot with temperatures reaching 90° F or higher approximately 56 days per year on average at Salt Lake City. The average daily maximum temperature at Salt Lake City in July is 93.2° F and mean maximum temperatures in Skull Valley and at Dugway exceed 90° F during July and August. The record high temperature at Salt Lake City is 107° F occurring in July, 1960 with record high temperatures ranging from 105 to 107° F in Skull Valley. Winters are moderately cold with an average monthly temperature of 28.6° F in January at Salt Lake City along with a daily minimum temperature of 19.7° F. The lowest recorded temperature at Salt Lake City -30° F occurring in February, 1933. Similar winter temperatures are experienced in Skull Valley with average monthly values near 30° F in December and January and record low temperatures from -11 to -35° F. The average number of days with temperatures reaching 32° F or below at Salt Lake City is 125 days with the first freeze normally occurring in October and the last freeze occurring in April. The annual average temperatures at Salt Lake City and Dugway are both approximately 52° F for the period 1951 - 1980 with Skull Valley average temperatures ranging from 48 to 52° F for various periods from 1900 to 1964. Normal monthly, daily maximum, and daily minimum temperatures for the period 1951 to 1980 for Salt Lake City and Dugway are provided in Table 2.

Winds at Salt Lake City are moderate and are fairly uniform over the year with the highest average speed (9.7 mph) occurring in August and the lightest average wind speed (7.4 mph) occurring in December. The long term mean wind speed for the year is 8.8 mph. The prevailing wind direction at Salt Lake City is from the southeast or south-southeast throughout the year. Mean wind speeds by month for a 62-year period of record and prevailing wind directions by month are provided in Table 3. Wind information is not available specifically for the Skull Valley area.

On an annual average basis, relative humidities at Salt Lake City range from a high of 67 percent in the early morning hours to 43 percent in the afternoon. On a seasonal basis, the highest relative humidities tend to occur in late fall and winter while summer relative humidities are generally the lowest.

Salt Lake City also has a mean of 36.7 thunderstorm days per year and approximately 5 to 8 thunderstorm days per month from May through August.

4.4 Hydrology

4.4.1 Groundwater

The main groundwater reservoir in Skull Valley is the unconsolidated sediments underlying the central part of the valley. The source of this water is precipitation which falls on the adjacent Stansbury and Cedar Mountains and enters the reservoir by way of the alluvial fans along the edges of these ranges. The best quality water is from springs or streams in the mountains, but good quality water can be found in the alluvial fan developments. Toward the center and northern parts of the valley, the water quality is generally poor due to saline or alkaline conditions in the soils. The water well drilled near the Reservation village was completed to a depth of 651 feet in clay, sand, and gravel. The static water level in the well after completion was 519.5 feet below ground surface, indicating a very deep water table in the alluvial fan. Another well drilled for the Hercules Tekoi Rocket Engine Test Facility southeast of Hickman Knolls was completed at 401 feet, in apparent unconsolidated materials. The static water level is only 77.5 feet below ground surface at this location, possibly indicating an artesian condition. Information gathered from tribal members indicates some wells yield good water and others yield poor quality water.

4.4.2 Surface Hydrology

The floor of Skull Valley slopes gently northward to the Great Salt Lake. High gradient streams originating in the mountains are mainly ephemeral by the time they reach the main valley bottom, having disappeared into the coarse soils of the bordering alluvial fans. Drainage in the immediate Site B area appears to be developed strictly as a result of local topographic and meteorological conditions, superimposed on the ancient lake bottom features. A minor exception is a dry stream channel in the northeast corner of Section 6 that appears to originate in the Stansbury Mountains. It may carry water more frequently than the dry washes or arroyos at the site proper but has been dry from June to November. As discussed previously in Section 3.5.1 and indicated on the topographic map, the washes trend northerly and appear to be spaced at somewhat regular intervals across Sections 6 and 7. Incision is minimal due to the near-desert conditions, low gradient of the old lake bottom, and small watershed area. Little or none of the flow in these washes reaches the groundwater table because of the small volumes and because the presence of near surface clay and silt inhibits infiltration. A few locations indicate that shallow ponding of water may occur for a few days from time to time. There are no wetlands within Site B or along the prospective access road to the highway. However, as described under Aquatic Resources, there are a number of springs and wetlands west of the existing county road in the northern portion of Skull Valley.

4.5 Geology

4.5.1 Topography

Site B on the Skull Valley Reservation is centered on the E-W section between Sections 6 and 7, of T5S, R8W. The land surface slopes gently to the north at about 30 feet per mile in this area. A series of shallow (1 to 3 ft.), north-trending, dry washes, marked by more dense shrub vegetation, drains the area during infrequent thunderstorms or spring runoff. Several low (1 to 3 ft.) linear soil ridges rise above the valley bottom in the southeastern part of Section 6 and adjacent Sections 7 and 8, also trending northward. These types of features provide the main topographic relief on the valley bottom in this area. East of the site, the land surface rises more steeply along the surface of large alluvial fans at the western edge of the Stansbury Mountains.

4.5.2 Regional Geology

Site B is situated near the east side of Skull Valley, a north-south trending structural basin, between the Stansbury Mountains on the east and the Cedar Mountains on the west. The area is within the Basin and Range Physiographic Province, characterized by north-south trending, fault-bound mountain ranges separated by valleys occupying the down-dropped end of the fault-block or graben between the tilted ranges. Unconsolidated sediment derived from the adjacent ranges fills the valley floor and may be several thousand feet thick near the western edge of the valley. Development of this physiography has occurred during the last 30 million years, and continues today as evidenced by the seismic activity in the region and by the numerous locations where Quaternary (1.6 million years) soils and geomorphic features are disturbed or offset along fault traces. The Stansbury Fault along the west side of the Stansbury Mountains is a good example of this relationship. Ground surface dislocations of this type have been mapped about 6 miles east of the Site B location at the base of the Stansbury Mountains (Helm, 1995).

4.5.3 Bedrock

The Hickman Knolls is a large bedrock exposure about 1 mile south of Site B. It is believed to be composed of the Fish Haven Dolomite of Late Ordovician age (440 to 450 million years) (Hintze, 1980). It is described as a dark gray to black dolomite (magnesian limestone) with some interbeds of very light to medium gray dolomite (Rigby, 1958). A few fossils, thin beds of siltstone, thin sandstone, and masses of intra-formational conglomerate were noted at the Knolls. The rock is massive but does show some enlargement of joints due to dissolution. Small caves and openings (1 to 4 ft deep) can be seen on the steep faces of Hickman Knolls. Differential erosion has produced a very rough and irregular rock surface (mesoscopic scale). Karst conditions are not believed to exist due to the arid climate.

4.5.4 Soils and Geotechnical Engineering

Surficial soils at Site B are mainly fine grained sand, silt, and clay deposited in and by Lake Bonneville which occupied the valley during the late Pleistocene and early Holocene (30,000 to 10,000 years ago). These soils are typically calcareous and saline and may be reworked by wind or alluvial processes. They can be corrosive to steel and concrete and have severe limitations for leach fields, as roadfill, and in embankments. However, limitations for shallow foundations are slight (USDA-SCS, unpublished data). The dry conditions existing in the valley bottom (<7 inches of rain per year) will tend to minimize the corrosive nature of the soil. Storm drains and granular structural fill will preclude conditions necessary for corrosion to develop.

Two borings were drilled at Site B to a maximum depth of 50 feet during Phase 1 investigations. The generalized soil profile consists of three layers. At the top is a stiff silty clay or compact silt that extends to about 25 feet in depth. Below this layer is very dense, dry silt to a depth of about 35 feet. Below 35 feet is a mix of very dense silty or clayey gravel, gravelly silt and clayey silt/silty clay. Bedrock was not encountered in any of the borings, nor was the water table intersected.

Based on preliminary analyses of material from the upper layer, it is anticipated that shallow, conventional foundations may be utilized at the site. The high density of site materials, the cohesive nature of the upper soil layer, and the great depth to the water table effectively precludes the possibility of liquefaction during a seismic event.

4.5.5 Faulting and Seismicity

The Skull Valley area is located in the Intermountain Seismic Belt (Wasatch Front region) of the continental United States extending from New Mexico to Idaho. Earthquakes up to magnitude 7.5 can be expected in this region and a magnitude 5.0 earthquake has an estimated average return period of about 10 years (Helm, 1995).

Active faults or "capable faults" (as the NRC identifies them) are defined as those that have shown movement at least once in the past 35,000 years, recurring movement within the past 500,000 years, or macroseismicity (seismic activity correlatable to a specific structure). A large body of evidence indicates that the mountain ranges adjacent to the Skull Valley site and parallel ranges to the east and west are the result of movements on faults during the last 30 million years. Many of these faults show evidence of movement history that the NRC would consider as "capable." Numerous studies of various ranges have been performed in attempts to determine the frequency of movements, the amount of displacements, and the lengths of rupture in order to estimate probable maximum earthquake magnitude and a recurrence interval. Using this information, a probable maximum acceleration for design purposes is determined.

Two other projects have been proposed or implemented in the vicinity of the proposed siting area that have published numerical estimates of the accelerations anticipated from earthquakes: the low-level radioactive waste disposal facility at Clive, Utah and the DOE preliminary MRS site assessment of the Skull Valley Goshute siting area.

In 1994, the NRC issued a Final Safety Evaluation Report on a license application to store and dispose of low-level radioactive waste at Clive, UT, about 25 miles northwest of the Reservation, west of the Cedar Mountains. The applicant completed a detailed analysis of the regional and local seismicity, as well as a hypothetical "random event" earthquake. They submitted, and the NRC accepted, a maximum ground acceleration of 0.37g (mean plus 1 standard deviation) for design purposes at the Clive site. This value results from the hypothetical random local earthquake occurring 6 miles from the Clive Site (USNRC, 1994). However, the Skull Valley site is only 6 miles (10 km) from the surface trace of the Stansbury Mountain fault and 4.2 miles (6.8 km) from the downdip (45°) projection of the fault beneath the site. This fault is capable of a maximum 7.3 magnitude earthquake (Helm, 1995).

A DOE-sponsored preliminary site assessment of the same land area offered by the Skull Valley Goshute tribe for this project was issued in October, 1993 (TRW, 1993). In this document, TRW Environmental Safety Systems concluded that the estimated bedrock acceleration was approximately 0.3 g from the Stansbury Fault. The basis for this value is unknown but appears to be unrealistically low considering the proximity of the Stansbury Fault.

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4.6 Regional Historic, Archeological, Architectural, Scenic, Cultural and Natural Features

Tooele County has both historic and prehistoric cultural resources. Seventeen sites are listed on the National Register of Historic Places. However, there are no historic structures located on or near Site B. Further, representatives of the Tribe have stated that the areas being considered for development of this project do not contain any "cultural or historic resources or areas of religious significance". Likewise, the areas proposed for construction of any required access roads do not contain any cultural or historic resources (Bear, 1996).

4.7 Noise

There are no federal, state, or local noise regulations which limit the sound from the site. The nearest noise sensitive residential receptor to the site is 2.1 miles east of the center of the site on Skull Valley Road. The nearest settlement is the Skull Valley Reservation village 3.8 miles east of Site B. The primary sources of noise in the area are local traffic, aircraft, and wildlife. The ambient sound levels are expected to be similar to the EPA measured rural L_{90} ambient sound levels of 30 dBA or less for both daytime and nighttime (EPA, 1971). The L_{90} is the sound level exceeded 90 percent of the time.

4.7.1 Construction Noise

The facilities to be constructed include a private access road and storage pad, as well as security and garage/warehouse buildings. Construction is expected to be limited to daytime hours. The equipment typical of this type of construction includes diesel powered backhoes, cranes, front-end loaders, dozers, dump trucks, scrapers, and paving machines.

The average sound level of modest size construction equipment is typically 80 dBA at 50 ft, with peak sound levels of 85 dBA. The construction tasks will include site preparation, pouring concrete building foundations and the cask slab, and building erection.

The construction and operational sound level predictions are for downwind sound propagation conditions, that is with the wind blowing from the source to the receptor. The sound levels for clear calm days, cross-wind and up-wind conditions will be 10-20 dBA lower.

The construction sound decreases rapidly with distance, giving a sound level at the nearest residential receptor from on-site construction of 30 dBA. This sound may occasionally be just audible under extremely quiet conditions. Construction is expected to be limited primarily to daytime hours. The maximum sound levels for access road construction would be approximately 48 dBA at the nearest neighbor. This sound will be audible at the nearest residential receptor during receptor downwind conditions.

4.7.2 Operational Noise

The potential noise impacts from operation of the storage facility result from cask delivery and on-site placement, and employees commuting to work. There will be 40 to 50 day-shift employees, and five to ten employees on each of the night-shifts. Commuter vehicles are expected to arrive at the access road from both the north and the south.

It is assumed that casks will be delivered twice per week from the north along Skull Valley Road during daytime hours. On-site operational noise will include the unloading and transport of the casks by diesel powered equipment with sound levels similar to conventional construction equipment. These vehicles are expected to operate periodically during the day-shift, but not at night.

The maximum sound levels from this periodic operation at the nearest residential receptor is expected to be 30. This sound will generally not be audible from the nearest residential receptor. The operation of the facility will be inaudible at the Skull Valley Reservation village.

4.8 Radiological Considerations

Radiological considerations include assessment of potential radiation doses from the storage facility to persons offsite. The Code of Federal Regulations, Chapter 10, Part 72 mandates that the annual dose equivalent to any individual beyond the controlled area must not exceed 25 mrems as a result of normal facility operations. Increasing the distance between the casks and the individuals lowers the dose beyond the site boundary. As described in Section 4.1.2, Site B is 2.1 miles from the nearest residence. Site B is also about 1.7 miles from Hickman Knolls, considered as a potential "overlook" of the site outside the owner-controlled area. Dose rates from the PSFS at these distances are very small - on the order of 3E-5 mrem/year (SNC, 1996)

5.0 SITE COMPARISON AND RECOMMENDATIONS

5.1 Comparative Analysis

Development of either Site A or B would not conflict with existing land use, use of adjacent properties, or county zoning regulations.

The location of area populations and the proximity to the nearest residences are substantially similar for both sites.

No impacts to on- or off-site recreation activities are anticipated from the development of either Site A or B.

While development of this facility in either location would alter the existing visual environment, there is no difference in level of impact at either site.

Development of Site B would result in a very minor increased loss of vegetation diversity compared to Site A. This difference essentially has no ecological significance, given the small scale, minimal species differences, and abundance of these micro-communities within Skull Valley.

Section 18 and about the southern 1/3 of Section 7 include exposures of elevated bedrock known as the Hickman Knolls, standing 100 ft to 500 ft above the floor of Skull Valley. It is unlikely that the exposed bedrock portions of these sections will be utilized by the facility except as a natural screen. However, the closer proximity of Site B to the Knolls may result in slightly greater disturbance impacts to more sensitive wildlife species from the development of Site B. Wildlife present in either Site A or Site B are probably essentially the same species and the loss of this habitat has negligible ecological significance.

There is no apparent difference between Site A and Site B with regards to threatened and endangered species.

There are no differences in groundwater or surface hydrology conditions between the sites, except for the presence of a couple shallow, temporary ponding areas in Site B.

There are no differences between the sites regarding meteorological conditions.

Based on available information, the development of either site would not impact known historic or cultural resources.

Based on the initial results of the drilling program and previous geologic research, no discriminating factors were identified that would favor one site over the other in the areas of geology, seismology, and soils.

Development of an access road to either site would follow the same route for the most part, and therefore, cannot be used as a basis of comparison.

The potential radiation dose to individuals offsite is slightly greater from Site B than Site A due to the slightly shorter distance to the nearest offsite resident and the closer proximity of Hickman Knolls outside the controlled area. However, the potential doses in either case are a very small fraction of NRC limits and the absolute dose values can be considered insignificant from either site.

5.2 Selection of Preferred Site

Based on the comparison of potential impacts from the development of Site A versus Site B, in regards to human populations, land use, recreation, visual resources, ecological resources, meteorology, hydrology, geologic resources, historic and cultural resources, and noise, as presented above, it is possible to assign a very small distinct advantage to Site A . When radiological issues are considered, Site A is found to be marginally preferable to Site B as a result of its greater distance from the nearest residence and Hickman Knolls. Cost differences between the two sites in developing and operating a PSFS are likely to be negligible and are therefore ignored in selecting the preferred site.

This evaluation concludes that additional investigative efforts on the northernmost site (Site A) were warranted. A total of eighteen borings were drilled in this site area with an additional five borings drilled along the proposed access road between Skull Valley Road and the site area. Results of these investigations, as well as additional characterization activities, will be discussed in the Phase 2 Final Environmental Assessment Report.

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Attachment 9-2

EIS RAI 9-2 (a) & (b)

Tooele County General Plan