0008

UtahAmerican Energy, Inc.

February 19, 2004

Pam Grubaugh-Littig
Permit Supervisor
1594 West North Temple, Suite 1210
P.O. Box 145801
Salt Lake City, Utah 84114-5801

Incoming
C/007/013

Re: 04-004 Copy of the Kaiser Steel Corporation South Lease Coal Property PAP.

Dear Ms. Grubaugh-Littig,

Enclosed you will find (1) copy of the Kaiser Steel South Lease Coal Property Application. A copy was requested by DOGM to be used as a reference only.

This copy of the Kaiser Application is to be used as a reference by DOGM and is not to be amended to the Lila Canyon Extension Application. All applicable referenced portions of the Kaiser Application have been included in the Lila Canyon Extension Application.

Because the Kaiser Steel information is being submitted for reference only, C1 and C2 forms are not included.

Should you have any questions please call.

Sincerely,

R. Jay Marshall

R. Jay Marshall
Project Engineer

ile in:
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Refer to Record No 0008 Date 02192004
In C0070013, 2004, Incoming
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APPLICATION FOR AN UNDERGROUND COAL MINE PERMIT

KAISER STEEL CORPORATION
SOUTH LEASE COAL PROPERTY
EMERY COUNTY, UTAH

VOLUME 7 OF 7

CHAPTER

X FISH AND WILDLIFE RESOURCES

XI CLIMATOLOGY AND AIR QUALITY

XII GEOTECHNICAL

XIII DESIGNS

XIV CONSULTATION AND COORDINATION

APPLICATION FOR
AN UNDERGROUND COAL MINE PERMIT
FOR
SOUTH LEASE COAL PROPERTY
EMERY COUNTY, UTAH

Submitted to

State of Utah Natural Resources & Energy
Division of Oil, Gas and Mining
4241 State Office Building
Salt Lake City, Utah 44114

by

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10.1 Scope

The contents of this chapter pertain to the requirements under UMC 783.20, 784.21 and 817.97.

This chapter was compiled and authorized by Curt Jansen, Consulting Ecologist of Fort Collins, Colorado, who also did the wildlife field surveys and consultation with regulatory agencies.

Kaiser Steel Corporation plans to develop an underground coal mine in Emery County, Utah. The state and federal coal leases that comprise the Mine Plan Area (MPA) total 8,931 acres. The Permit Area under this initial five-year permit application is approximately 4,000 acres of which about 2,250 acres or 56 percent is located on the bench above the Book Cliffs in an area generally known as Little Park Wash. Approximately 30 acres or 1 percent of this area will be most directly affected by the mine and surface facilities.

The Permit Area below the cliffs contains about 1,500 acres or 38 percent of the total Permit Area. Most of the mine and plant surface facilities will be located here and the area most directly affected will be approximately 355 acres or 23 percent of the bottom area. The Book Cliffs and immediate talus slopes encompass around 250 acres of the Permit Area.

A discussion of wildlife on the Permit Area is influenced by the dominant topographic feature, the Book Cliffs. The cliffs separate two distinct ecological communities and they impose limitations on facility layout and mine design. Consequently, surface development and effects are different for each area; the discussion describes these differences.

10.2 Methodology

The first step in the information gathering process was the consultation procedures outlined in Permanent Program Compliance Consultation Procedures for Fish and Wildlife Studies published by the Division of Oil, Gas and Mining (DOGM) pursuant to 783.20 requirements. Field trips to the site by representatives of Kaiser Steel and state and federal agencies were conducted on 7 November 1980 and 18 February 1981. A third consultation visit on 10 September 1981 became necessary when burrowing owls (scientific names are provided in Appendix 10.8.1) were located near the proposed transportation corridor (Sections 10.3.3.2, 10.4, 10.5 and 10.6). Site specific recommendations were submitted by the Utah Division of Wildlife Resources (DWR), the U.S. Fish and Wildlife Service and the Bureau of Land Management (Appendix 10.8.2).

The site specific recommendations and Fish and Wildlife Information Guidelines for Permanent Program Submissions for Coal Mines (also published by DOGM) were used to design the wildlife studies for the Mine Permit Area. The wildlife studies included raptors, migratory birds of high federal interest, upland game birds, threatened and endangered species, mule deer, and a literature review. The studies were conducted during February, April, May and August of 1981.

Raptor observations were recorded and mapped. Surveys for nesting activity consisted of observation with binoculars from prominent ledges along the upper cliffs and from several positions along the base of the cliffs. The cliffs surveyed were within approximately 0.75 mile of the portal entry site (Plate X-1). In addition, during the past summer the U.S. Fish and

10.2 Cont.

Wildlife Service conducted helicopter-aerial surveys of the first line of the Book Cliffs, including the Permit Area (Plate X-1). The purpose of their surveys was to determine if there was current nesting of cliff-nesting species. Data from their surveys are discussed under Section 10.3.3.2.

The U.S. Fish and Wildlife Service compiled a list of 22 migratory bird species as being of high federal interest. Most of the raptors on the list were included under the raptor survey. Surveys for the remaining species and for upland game birds involved observation in all habitats of the Permit Area. The calls of upland species were noted and approximately located on a field map.

The above surveys also overlapped with efforts to determine the presence of federally listed threatened and endangered species. Endangered species with the highest probability of occurrence on the project site include the black-footed ferret, American peregrine falcon, and the bald eagle.

Prairie dog burrows were examined for signs of ferret activity including plugged burrows, scat, trenches, and prairie dog skulls with tooth punctures. Another technique for determining the presence of ferrets is spotlighting (Martin and Schroeder, 1979). On the evening of 28 August, a spotlight survey was conducted around the perimeter of the prairie dog town (Plate X-1). The survey period was 8:55 to 10:45 p.m. In two areas where burrows were dense, spotlighting was carried out for 5 minutes at 5-minute intervals for 20-30 minutes. Where burrows were less dense, the observation period was 2-3 minutes; there were four of the short duration stops. A 200,000 candle power spotlight was used for the survey.

10.2 Cont.

A literature survey was the primary study method for mule deer. During all field trips, observations of deer and/or sign were recorded.

Although there is no aquatic habitat on the Permit Area, there are stock ponds in the vicinity. A grab sample of water from a pond in the area below the cliffs was chemically analyzed to determine its potential to support aquatic life. The location of the pond sampled is shown in Plates VII-2 and 3. The flow of water from Williams Draw Spring is too variable to support an aquatic ecosystem. During dry summer months water from the spring flows only a short distance before it seeps into the sand and gravel substrate.

10.3 Existing Fish and Wildlife Resources

10.3.1 Wildlife Habitats in the Mine Plan Area

This discussion of habitats will entail a general description of the physiography of the Mine Permit Area. Habitat requirements of particular species will be discussed in later sections.

The Permit Area is located along the eastern side of the Price River Valley and extends East of the Book Cliffs which border the valley. The elevations of facilities to be located at the base of the cliffs and in Little Park Wash above the first line of cliffs are respectively about 5,500 and 6,500 feet.

The abiotic factors operating at the two elevations have contributed to the development of different ecological communities. Annual precipitation accumulations for the South Lease Coal Property range between 8 and 17 inches. Temperature data from similar sites in Utah indicate that the temperature decreases about 3.5 degrees F per thousand foot increase in elevation. The difference in average annual temperature largely accounts for a growing season in the valley 40 days longer than in Little Park Wash (all weather data from Richardson, 1981).

The vegetation types that occur on the bottom area include *Atriplex-Artemisia-Hilaria; Atriplex-Astragalus; Atriplex*-Badland; *Juniperus* Savannah; Pinyon-Juniper (PJ) (Cliffbottom); and Transition (between *Atriplex*-Badland and *Atriplex-Artemisia-Hilaria*). PJ (Clifftop) and Sagebrush occur above the cliffs in Little Park Wash. Cliff-Rockoutcrop-Rubble land includes the cliffs and immediate talus slope. The location of vegetation types in presented in Plate IX-1.

10.3 Cont.

The soils are characterized by badlands and rock outcrop. The largest areal soil type, Rock Outcrop-Sunup Complex (Plate VIII-1), is approximately 70 percent rock outcrop. Ecologically, a climatic climax has evolved on the more stable soils while an edaphic climax has developed on shale and lesser developed soils. The differences in production potential of the vegetation types (Table X-1) are largely due to substrate conditions. The production is highest on relatively stable soils and lowest on eroded, highly mineralized soils.

Wildlife habitat and livestock grazing have been the major land uses of the Permit Area (Section 4.4.2). The range condition (Table X-1) also reflects substrate conditions, i.e. rangeland on eroded soils is generally in poor condition especially around stock ponds. Cattle, horses and sheep comprise the classes of livestock which graze the Permit Area and adjacent areas.

The wildlife community on the Permit Area has evolved in an ecological organization including the above abiotic and biotic components. Generally, the bottom area community has evolved in a cold desert (upper Sonoran life zone) environment and the community in the Little Park Wash area has evolved in a submontane (Transition life zone) environment (DWR, 1981). Habitat components are poorly developed in the bottom area. Water is scarce and cover (for reproductive requirements and escape from predators) is stratified into herb and shrub layers which seldom extend above 2 feet from ground level. Topographic relief (e.g., eroded gullies) provides cover in the absence of the vertical layering. Examples of species that are adapted to these conditions are the side-blotched lizard, midget

Table X-1. Vegetation Types Within the Permit Boundary.

Vegetation Type	Area (Acres)	Above or Below Cliffs	Range Condition[a]	Production Potential[a] (lbs./Acre) Conditions: Poor	Average	Favorable
Atriplex-Artemisia-Hilaria	735	below	poor	300	550	700
Atriplex-Astragalus	1	below	poor	150	300	400
Atriplex-Badland	663	below	poor-good	100	250	400
Juniper Savannah	95	below	fair	400	700	900
PJ (Cliffbottom)	15	below	fair	400	700	900
Transition[b]	12	below	--	--	--	--
Cliff-Rockoutcrop-Rubble land	246	--	--	150	400	600
PJ (Clifftop)	1837	above	--	150	400	600
Sagebrush	396	above	poor	450	500	1400

[a]Bureau of Land Management data

[b]Transition between *Atriplex*-Badland and *Atriplex-Artemisia-Hilaria* vegetation types.

10.3 Cont.

faded rattlesnake, chukar, burrowing owl, savannah sparrow, white-tailed prairie dog, kit fox and pronghorn antelope. Habitat components in the Little Park Wash area are more developed. Water is also scarce but there is more than in the bottom area. Cover is stratified into herb, shrub, and tree layers. Topographic relief also provides cover in the form of rock outcrops. Examples of species that are adapted to these conditions are the sagebrush lizard, striped whipsnake, blue grouse, screech owl, black-throated gray warbler, red squirrel, cougar and mule deer. The cliffs provide reproductive cover for a variety of species that fly such as: the prairie falcon, cliff swallow, canyon wren, and spotted bat.

10.3.2 Wildlife

10.3.2.1 Aquatic Wildlife and Habitat and Value Determination

There is no aquatic habitat on the Permit Area. However, there are 10 small stock ponds in the vicinity (Plate VII-2). To evaluate the potential for aquatic life, the chemical data from the analysis of the pond water were compared with water quality criteria for aquatic life developed by the National Academy of Science (NAS) and National Academy of Engineering (NAE) 1973, and with Environmental Protection Agency (EPA) "Red Book," Quality Criteria for Water (1976). Mercury, selenium and oil and grease concentrations exceeded the limits set by EPA while the concentration of silver exceeded the limit set by NAS and NAE. According to Winget (1980), the sulfate level would be restrictive to many species of aquatic life.

The only source of water for all of the ponds is runoff from precipitation events or snow melt. The ponds are characteristically stagnant, shallow,

10.3 Cont.

lacking in aquatic vegetation and have high evapotranspiration rates, all of which contribute to low levels of dissolved oxygen. This plus the results of the chemical analysis indicate that the stock ponds are not supportive of aquatic life.

10.3.2.2 Terrestrial Wildlife and Habitat and Value Determination

There are potentially 203 vertebrate species of wildlife that could be found in habitats on the Permit Area: 4 are amphibians, 14 reptiles, 121 birds and 64 mammals (DWR, 1978) (Vertebrate Species List, Appendix 10.8.1).

For practical and economic reasons, it is necessary to concentrate on the most "important" species, which can be identified by using a predetermined set of criteria. The DWR has defined high interest wildlife as 1) all game species, 2) any economically important species, 3) any species of special aesthetic, scientific or educational significance, and 4) all federally listed threatened or endangered species. Fifty-eight of the 203 species have been designated high interest by DWR.

The DWR developed a classification system for habitat of high interest species based primarily on two criteria, 1) the dependence of one or more species of wildlife on a habitat and 2) the amount of habitat available. The values from high dependency, limited habitat to low dependency, unlimited habitat are: critical, high-priority, substantial value, and limited value. All of the Permit Area in Little Park Wash has been classified as critical deer winter range as well as Sections 35 and 36 of Township 16 South, Range 14 East and Section 1 of Township 17 South, Range 14 East

10.3 Cont.

(Figure X-1). The importance and protection given a habitat is relative to its assigned value.

There are two categories of species of high federal interest: migratory birds, and threatened and endangered. Migratory birds are protected under the Migratory Bird Treaty Act (PL 93-300, 1974). Through a process of recommendations and screenings by ornithologists, a list of 22 species of high interest was compiled for the Uintah-Southwestern Utah Coal Production Region. Eleven of the species potentially occur on the Permit Area. Some of the raptors on the Migratory Birds of High Federal Interest list are also protected under the Endangered Species Act (PL 93-205, 1973). Of the seven endangered species listed for Utah, four could potentially occur on the Permit Area. Endangered species and raptors are discussed in greater detail under Sections 10.3.3.1 and 10.3.3.2 respectively.

10.3.2.3 Mammals

There are potentially 64 species of mammals that inhabit the Permit Area. Twenty-three have been classified as high interest by DWR. The total is comprised of seven big game, three small game, two endangered, one furbearer, and 10 that are either considered economically important or of special aesthetic, scientific or educational significance.

Mule deer and antelope are two big game species that have been observed on or near the Permit Area. The Permit Area is part of deer herd unit 27B-Range Creek. Herd unit 27B occupies the east half of Carbon County, part of the north side of Emery County, and the south side of Duchesne County for a total land area of 1,169,408 acres (Utah State Department of Fish and Game 1967). The Permit Area is on the southwest side of the unit.

10.3 Cont.

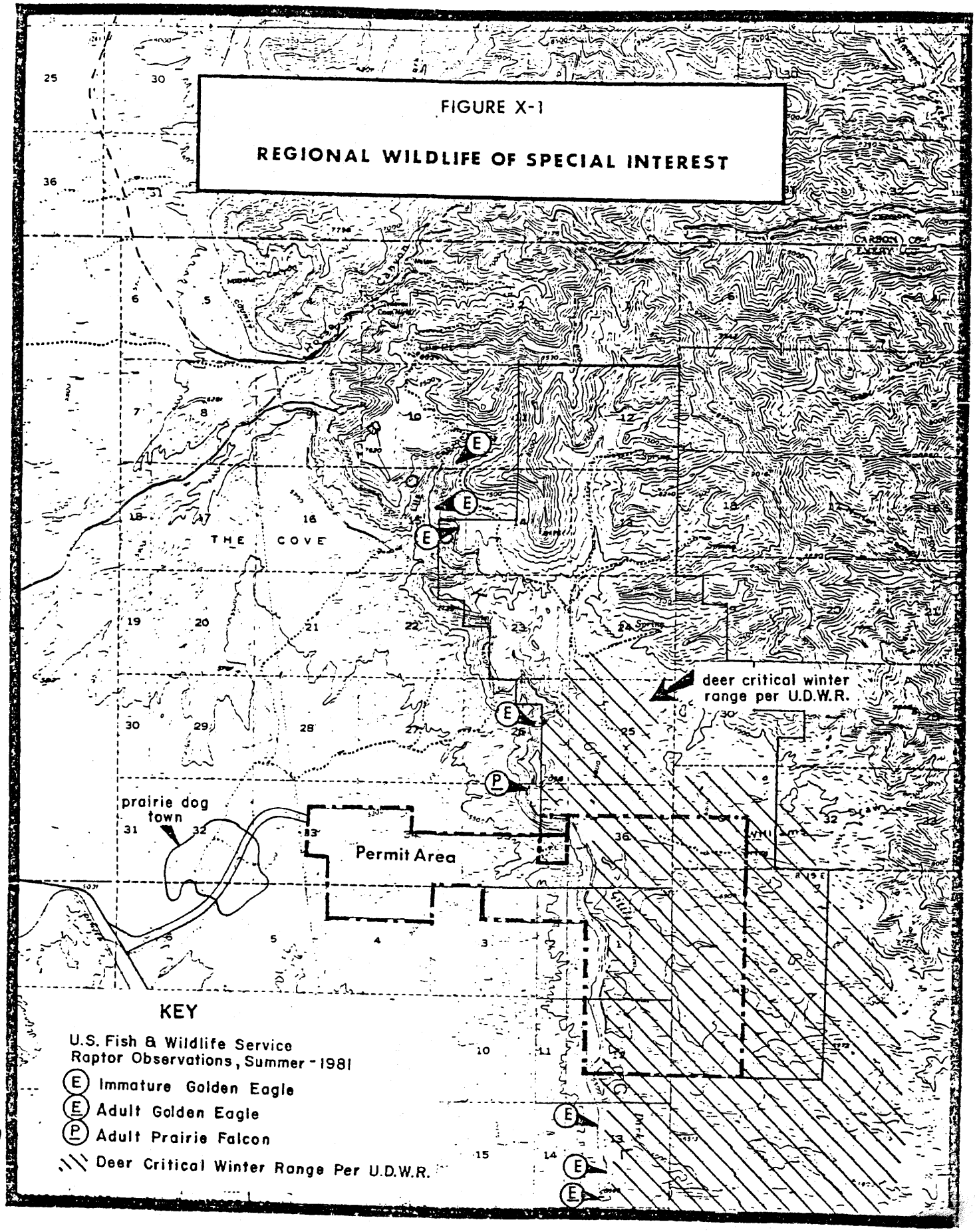


FIGURE X-1
REGIONAL WILDLIFE OF SPECIAL INTEREST
THE COVE
deer critical winter range per U.D.W.R.
prairie dog town
Permit Area
KEY
U.S. Fish & Wildlife Service
Raptor Observations, Summer - 1981
Immature Golden Eagle
Adult Golden Eagle
Adult Prairie Falcon
Deer Critical Winter Range Per U.D.W.R.

10.3 Cont.

Unit 27B was included in range inventory investigations conducted in 1966 by DWR (then the Utah State Department of Fish and Game) to determine winter distribution patterns, range condition information and land ownership status. The distribution pattern observed was summer range on the West Tavaputs Plateau in the center of the unit and winter range at lower outlying elevations. The unit is 19 percent summer range and 49 percent winter range; during severe winters the range decreases to 31 percent. The vegetation types identified for Little Park were Pinyon-Juniper-Mountain Brush-Grass (PJMG) and Sagebrush-Grass (SG). The PJMG comprises 34 percent of the normal winter range of unit 27B and 42 percent of the severe winter range. The SG comprises one percent of the normal winter range and two percent of the severe winter range.

The DWR has classified the Little Park Wash portion of the Permit Area as critical because of its use by deer during severe winters (Figure X-1 and Plate X-1). Summer range is located at higher elevations to the east and northeast of the Permit Area.

Published data are available on big game management units. The Permit Area is less than one percent of unit 27B and it may not be representative of the unit in terms of deer density. However, for the purposes of this discussion, it is assumed that the unit data reflects conditions on the Permit Area.

The trend of fawns per 100 does is an indicator of herd health. During the period 1971 to 1979 the number of fawns per 100 does (preseason) ranged from 31 to 108 with a mean of 75. The 108 were observed in 1976.

10.3 Cont.

For 1977 and 1978 the trend was down, but in 1979 there was an increase to 76. Fawn production and number of bucks harvested in unit 27B was below the all unit mean for these parameters for 1979 (76 vs. 81) (Table X-2). The mean for all units over all years in which data were available (for most units the period was 1970-79) is 81. On a unit-wide basis, 1979 was an average year. Units 27A and 19 are shown because they had respectively the lowest and highest production in 1979. Based on this analysis, on the average, unit 27B produces fewer deer than other units.

Separate observations of deer were recorded for both PJ (Clifftop) and Sagebrush vegetation types during the summer field studies.

On several occasions, a single antelope was observed near the Permit Area. Any antelope in the vicinity of the Permit Area are part of the Icelander Wash herd, antelope unit 11. The Icelander herd was established by an introduction of 150 animals released in 1972 at Icelander Wash. Aerial trend counts indicate that the herd is well established and there has been a limited harvest since 1975. During the period 1972 to 1978, fawns per 100 does ranged from 26 to 103 and averaged 64. On high density ranges, the fawns per 100 does ratio is often 100 and on low density ranges 50 (Yoakum, 1978).

The DWR is planning to transplant antelope to the vicinity, but no date has been set (DWR, 1981). Although cattle grazing occurs on the Permit Area, studies indicate that there is interspecific niche separation between cattle and antelope (Hoover, et al., 1959; Schwartz and Nagy, 1976; Schwartz, et al., 1977; Yoakum, 1978). The Permit Area is located in the

10.3 Cont.

Table X-2. Selected Data from Deer Management Units - 1979[a]

	Fawns Per 100 Does[b]		Bucks Harvested	Hunter Success - %	Range-Acres[c]
	1979	All Years			
All units - $\bar{X}$ [d]	81	81	743	30	401,432
27B	76	75	468	26	793,700
27A	37	57	78	13	267,500
19	93	96	3,673	49	331,100

[a]DWR 1980a, 1980b.

[b]Preseason.

[c]Includes total of winter and summer range available to deer.

[d]Desired data not available for some units.

10.3 Cont.

Cove grazing allotment which allows 750 AUMs (Animal Unit Months) of cattle use; and the Little Park allotment which allows 242 AUMs of cattle and horse use (Section 4.4.2). The grazing period for Cove is 1 March to 31 May, which is when grasses are growing and selectively grazed by cattle. Forbs and shrub species are important food items in the antelope diet.

Rocky Mountain elk, Rocky Mountain bighorn sheep and desert sheep are big game species which prefer habitats similar to those of the Permit Area, but the distance to the nearest known herds preclude their use by any of these species. Winter habitat of the Range Creek elk herd extends from areas east and northeast to about seven miles from the Permit Area (DWR, 1981). Although the terrain is very rugged between the known range boundary and the Permit Area, elk may eventually move into Little Park if the herd approaches carrying capacity of their existing range.

The cougar and black bear are the other big game species that could occur on the Permit Area. Both received protection as game animals on 15 February 1967. Harvest data have been reported by deer management units for both species and unit 27B ranks fourth with a total cougar harvest of 51 animals for the period 1972 to 1979 (DWR, 1980c). The total black bear harvest of 25 animals for the years 1969 to 1979 ranks third among management units (DWR, 1980d). These data indicate that the Permit Area, particularly the Little Park Wash portion, may contain habitat suitable to both species. However, because black bear prefer habitats associated with shrub species (Jonkel, 1978), there is a low probability that they would ever occur on the Permit Area.

10.3 Cont.

Three small game species are listed for the Permit Area: snowshoe hare, and mountain and desert cottontails. Because of the preference of snowshoe hare for spruce-fir habitat, they are not likely to occur on the Permit Area. The bottom desert area is year-round habitat for the desert cottontail, which has been observed. Mountain cottontail generally occur in habitats above 7,000 feet elevation (DWR, 1981), but they may range into the pinyon-juniper and sagebrush habitats in Little Park Wash.

The badger has been classified as a furbearer by the DWR. Its preferred habitat is open grasslands and deserts which characterize the bottom area. Other high interest species that may occur on the Permit Area include the dwarf shrew, red bat, western big-eared bat, spotted bat, northern flying squirrel, red fox, kit fox, wolverine, bobcat, and lynx (DWR, 1981). The dwarf shrew, northern flying squirrel, wolverine, and lynx are not likely to occur on or near the Permit Area because their preferred habitat is absent and, furthermore, the wolverine and lynx are considered extirpated from southeast Utah.

A track thought to be that of a fox was observed in a gully in the lower Permit Area. The kit fox prefers desert habitat while the red fox prefers open grassland interspersed with forest, thus the track may have been a kit fox. The kit fox is uncommon in southeast Utah.

10.3.2.4 Birds

There are potentially 121 species of birds that may use habitats on the Permit Area. Thirty-three are of high interest to the state and 11 are of high federal interest. Raptors (Section 10.3.3.2) are the most numerous high interest species constituting 23 of the state total

10.3 Cont.

and nine of the federal total; two are also on the federal endangered list (Section 10.3.3.1). Three of the species of high interest to Utah are migratory game birds and two are small game birds.

The stock ponds provide habitat for waterfowl. Several mallards and redheads, both migratory game birds, have been observed; however, these were probably transients because there was no evidence of nesting activity. Because of the lack of aquatic vegetation, it is doubtful that any nesting would occur.

The morning dove, also a migratory game bird, typically nests in pinyon-juniper and riparian habitats. The former is present on the Permit Area in several vegetation types. These vegetation types and the stock ponds are important components of mourning dove habitat.

Blue grouse, a small game bird, may use the sagebrush and pinyon-juniper habitats found near Little Park Wash during the spring and summer months. By early fall, females and broods migrate to higher elevations, spruce-fir climax forests, which is their winter habitat. Males migrate to the higher elevations shortly after the breeding season.

The chukar, also a small game bird, prefers the habitats found on the bottom area. Talus slopes provide cover for roosting, while other habitats are used for feeding. The stock ponds are important sources of water especially during hot summer days when chukars make daily trips to water. It is a year-round resident of the Permit Area. The locations of chukar observations are indicated on Plate X-1.

10.3 Cont.

The western bluebird and black swift are species of high state and federal interest. The western bluebird is cosmopolitan in its use of habitats, but its choice of nest sites is limited to tree cavities. It is considered an uncommon summer resident by the State of Utah. Although the black swift could occur on the Permit Area, it is unlikely that it would nest there. The black swift's preferred nesting habitat is cliffs or ledges that are kept moist, e.g., near waterfalls or along ocean beaches. The DWR also considers the black swift an uncommon summer resident.

The mountain bluebird, turkey vulture and grasshopper sparrow are other species of high interest to Utah. The mountain bluebird has been observed on the site and may be a year-round resident. It is similar to the western bluebird in habitat and nesting preference. The turkey vulture is a summer resident and its nest is of simple construction (no nest materials) and located almost anywhere, from the bare floors of caves, to hollow trees, to the ground inside dense shrubbery (Terres, 1980). The Permit Area may be near the southern breeding range of the grasshopper sparrow. According to DWR (1981) it is a rare transient species that occurs in the area during spring and fall migration periods.

10.3.2.5 Reptiles and Amphibians

There is no breeding habitat for amphibians on the Permit Area. The stock ponds near the Permit Area may provide breeding habitat, although no amphibians were observed. According to DWR (1981), four species of amphibians may inhabit the Permit Area, one of which, the tiger salamander, is of high interest.

10.3 Cont.

There are 14 species of reptiles that may inhabit the Permit Area, one of which, the milk snake, is of high interest to the state. The status and population trend of the milk snake is unknown. The reptiles that have been observed on or near the Permit Area are indicated on the Vertebrate Species List (Appendix 10.8.1).

10.3.3 Species of Special Significance

10.3.3.1 Threatened and Endangered Species

There are four species on the U.S. Fish and Wildlife Service list of endangered wildlife (50CFR17.11) that could potentially inhabit the Permit Area: the bald eagle, peregrine falcon, gray wolf and black-footed ferret.

The bald eagle is a winter resident of the biogeographic region in which the Permit Area is located (DWR, 1981). Food supply is probably the most critical feature of the biology of wintering bald eagles (Steenhof, 1978). Eagles prefer fish or fish carrion when it is available. Eagles in the Great Basin rely mostly on avian and mammalian carrion (Murphy, 1975, cited by Steenhof, 1978).

Roost trees are an important part of bald eagle habitat. The nearest known roost tree recorded by Boner et al. (1977, cited in USDI, 1979) is 3 miles southwest of Mounds, which is about 13 miles west of the Permit Area.

The peregrine falcon has been sighted in the region, but no active eyries have been identified (USDI, 1979). The sighting nearest the Permit Area was about 2 miles north of Mounds (Boner et al., 1977, cited in USDI,

10.3 Cont.

1979). The peregrine usually lives in open country around rocky cliffs within 1 mile of streams or rivers; an abundance of birds, which are the falcon's primary source of food, must be within hunting range.

The Permit Area is within the historic range of the gray wolf. The present range of the gray wolf has been reduced to scattered sightings in Montana, Wyoming, and Idaho (Endangered Species Technical Bulletin, 1980).

The historic range of the black-footed ferret corresponded closely with that of the prairie dog, its primary prey species. The most recent sightings of black-footed ferrets have been reported from South Dakota in 1976, Montana in 1978 and in August 1981, a ferret was killed by dogs in Wyoming (personal communication with Dr. Stephen J. Martin, black-footed ferret biologist, U.S. Fish and Wildlife Service, Fort Collins, Colorado). The nearest ferret sighting in relation to the Permit Area was about 2 miles northwest of Woodside about 8 miles southwest of the Permit Area (Scott et al., 1977, cited in USDI, 1979). The date of this sighting is not known.

Because of the association of black-footed ferrets with prairie dogs, prairie dog towns are considered ferret habitat (Martin and Schroeder, 1979, and Fortenbery, 1972). The white-tailed prairie dog town that is bisected by the proposed transportation corridor (Figure X-1) consists of mostly active burrows to the southwest covering approximately 380 acres, and mostly inactive burrows to the northeast covering approximately 200 acres (Plate X-1).

10.3 Cont.

A total of 215 active burrows, about half of the area of the active town, were examined for black-footed ferret sign. Possible sign observed included three prairie dog skulls (none with puncture holes), two plugged holes and two trenches. A photograph of one trench (Photograph X-1) was examined by Dr. Stephen Martin and he concluded that the trench was probably made by a prairie dog.

The eye-shine of one animal was observed during the spotlight survey. The distance was too great for visual identification, but a coyote had barked in the general area just before the observation so the eye-shine was probably a coyote. The area was examined more closely in pre-dawn light and a coyote was observed.

10.3.3.2 Raptors

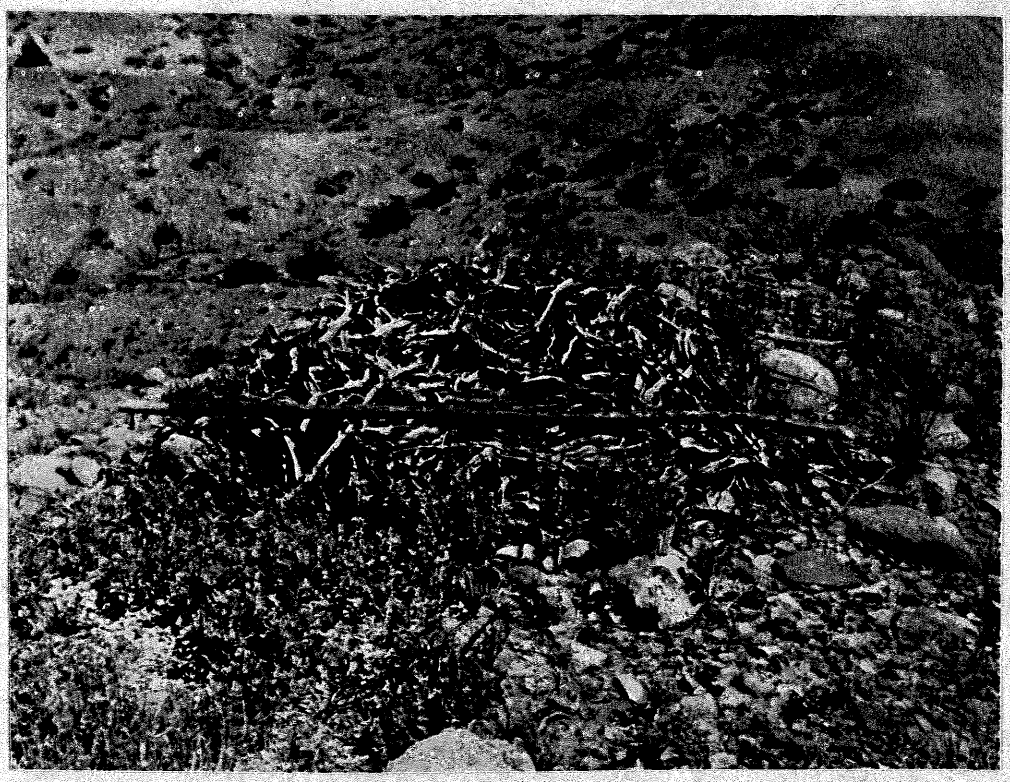
Six of the 24 bird species considered raptors, which potentially occur on the Permit Area (Vertebrate Species List, Appendix 10.8.1), have been observed. All of the six are classified as high interest species by the state and two are classified as migratory species of high federal interest. In addition abandoned nests of the ferruginous hawk (identification confirmed by Bruce Waddell, biologist, U.S. Fish and Wildlife Service, Salt Lake City) were located near the Permit Area (Photographs X-2 and X-3 and Plate X-1). The ferruginous hawk is classified as a high interest species by both state and federal agencies.

American kestrels, two soaring golden eagles and possibly a merlin were observed during surveys of cliff habitat near the portal entry site. Raptors observed during the U.S. Fish and Wildlife helicopter-aerial surveys

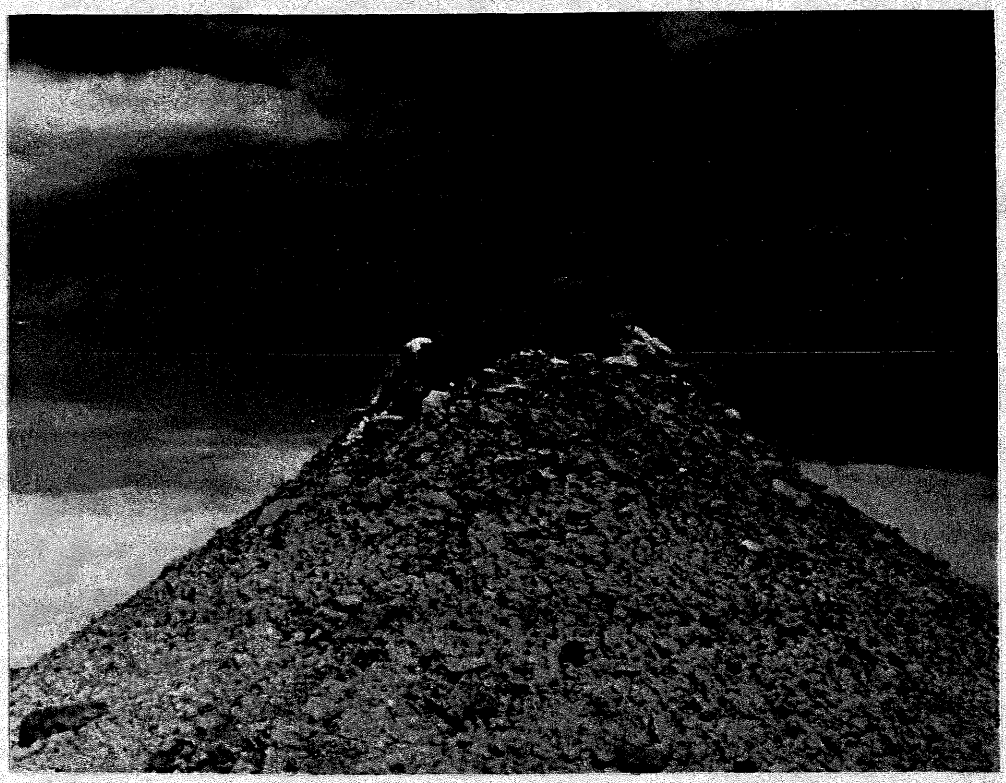
10.3 Cont.

Photograph X-1. A possible black-footed ferret trench. Dr. Stephen Martin concluded that the trench was probably made by a prairie dog.

10.3 Cont.



Photograph X-2. An abandoned ferruginous hawk nest. The stick lying on the nest is 4 feet long.



Photograph X-3. A ferruginous hawk nest on top of an erosion pinnacle. According to Call (1978) this is a typical ferruginous nest site.

10.3 Cont.

included adult and immature golden eagles and an adult prairie falcon. The locations of the latter observations are shown on Figure X-1 and Plate X-1. The eyries found nearest the Permit Area were those of prairie falcons, one was 4 miles south and another was 5 miles south. The prairie falcon is of high interest to both state and federal agencies.

Golden eagles were observed on different occasions perched near the prairie dog town (Plate X-1). Prairie dogs are prey of eagles and prairie dog towns are favored hunting grounds. Most eagle eyries are located on cliffs, but they will nest on the ground or in trees (Call, 1978).

Burrowing owls or owl sign (Photograph X-4) were observed in different locations in both active and inactive prairie dog towns (Plate X-1). A minimum of five owls was observed on one occasion.

Owls nest in abandoned prairie dog burrows and in some instances the same nest is used during successive years (Butts, 1973 and Martin, 1973). Butts (1973) cited densities of breeding owls ranging from one per 12.5 acres of prairie dog town to one per 50 acres. For his own study in western Oklahoma, he reported one per 4.8 acres. Hypothetically, the breeding population on the Permit Area prairie dog town could range from 12 to 121 using this range of reported densities.

By the dates owls were observed, 28 and 29 August, some may have left the area. Owls studied near Albuquerque, New Mexico (Martin, 1973) left their study area by this date. The best time to census breeding burrowing owls is during the first 2 weeks of June (Butts, 1973). Other raptor species observed on or near the Permit Area were red-tailed hawk, marsh hawk and great horned owl.

10.3 Cont.

Photograph X-4. Burrowing owl sign observed at the entrance of a prairie dog burrow. A regurgitated pellet is to the right of the lens cover and white excrement to the left.

10.4 Expected Impacts of Mining Operations on Fish and Wildlife

Project impacts are of two kinds: those that occur during construction and those that occur during operation. Construction impacts are relatively short-term but acute in terms of actual loss of wildlife. Also, once construction is underway, the impacts are mostly unavoidable. By comparison, operational impacts are long-term, less destructive and mostly avoidable. Another major difference is that construction impacts begin with an undisturbed environment while operational impacts begin with an environment already disturbed by construction activities.

The degree of impact depends on an animal's mobility (i.e., its ability to escape the impact), its tolerance of the negative stimuli, and the availability of unoccupied habitat. Animals of low mobility or those that seek subterranean cover will be destroyed during the earth moving stage of construction.

Animals of high mobility can avoid the life threatening situations but the impacts of construction and operation can be severe if they have a high dependency on the habitat destroyed or otherwise made unavailable because of their intolerance of the negative stimuli. Mobile animals that are territorial would be impacted if they were unable to establish a new territory in undisturbed habitat. The stress to displaced animals of inter- or intraspecific competition for fewer resources is an indirect impact that is not easily measured or observed.

Both kinds of impacts will occur in Little Park Wash and the bottom area. The initial stage of development consists of the construction of temporary

10.4 Cont.

facilities to access the coal from a site in Little Park Wash. Concurrently, a tunnel will be driven to the coal from the base of the cliffs. Eventually, this will be the primary access route. Permanent surface facilities will be constructed in the bottom area (project construction and operation is described in Chapter III).

Development of the South Lease Coal Property will result in the disturbance of approximately 384 acres comprised of the following vegetation types: 239 acres of *Atriplex-Artemisia-Hilaria*, 9 acres of *Atriplex-Astragalus*, 64 acres of *Atriplex*-Badland, 28 acres of Juniper Savannah, 1 acre of PJ (Cliffbottom), 15 acres of PJ (Clifftop), 14 acres of Sagebrush, and 14 acres of Transition.

The DWR has classified most of Little Park Wash as critical deer winter range. The loss of 14 acres of Sagebrush and 15 acres of PJ (Clifftop) could impact wintering deer. The impact would be exacerbated if a severe winter occurred before deer habituated to the construction activity. Before animals habituate to a stimulus they remain outside a zone of intolerance. All habitat within the zone is unavailable.

Construction activities often result in loud, impulse noises that elicit a startle and avoidance response from animals. High frequency sounds have been shown to repel bats, rabbits, deer and some birds, but there is some adaptation to frequent noise events (USDI, 1978). The effects of chronic exposure to sound levels of low intensity have not been evaluated.

Use of the dirt road for access to the temporary facilities may result in deer (as well as other wildlife species)-vehicular collisons. Again, this

10.4 Cont.

potential impact could be exacerbated during severe winters. The degree of this and the other potential impacts previously discussed depends on actual deer use of Little Park Wash and the facility site during winter months. Winter use data will be obtained during a monitoring study described in Section 10.6.

Construction activities in the bottom area will also destroy less mobile animals or animals in subterranean shelters. Of particular concern is the potential for destruction of burrowing owls and possibly black-footed ferrets during the construction of the transportation corridor through the prairie dog town (Plate X-1). Studies described in Section 10.6 will be conducted to determine the number and location of owl nest burrows. Other studies will be conducted to determine the existence of the black-footed ferret.

The loss of small animals during construction activity will reduce the food base for predator and raptor species. These species will have to hunt adjacent, undisturbed land.

The transportation corridor and overland conveyor entail operational impacts. The combined systems connect Highway 6 with the Book Cliffs and thus are an obstacle to north-south movement. The overland conveyor will be an effective barrier to those animals intolerant of the noise. The transportation corridor will be an effective barrier during periods of heavy use for some animals, e.g. coyotes. Species that inhabit the immediate vicinity of the corridor, e.g. rabbits, will be vulnerable to vehicular collisions.

10.4 Cont.

Dust raised during construction and operation is another impact. Sedimentation will increase as the dust is washed down watersheds. Erosion will also increase because of the exposure of soils.

The proposed project will reduce the antelope carrying capacity of the area below the cliffs. However, antelope adjust well to such development so the proposed transplant should not be jeopardized.

An increase in the human population will increase wildlife-human interactions both on and off the project site. Wildlife will fare the worse as a result of some of these interactions.

10.5 Mitigation and Management Plans

The DWR submitted to Kaiser Steel Corporation (DWR, 1981) recommendations pertaining to mitigation and impact avoidance procedures. They addressed enhancement of wildlife resources and habitats (UMC 783.20); performance standards (UMC 817.97); and plant materials and rates of seed application (UMC 817.97 and UMC 817.111-817.117). Their recommendations have been incorporated in the following discussion.

The value systems described under Section 10.3.2.2, Terrestrial Wildlife and Habitat and Value Determination, will serve to guide mitigation and management planning. Wildlife species of high interest and their habitats will be given the highest priority during the planning process. Species and/or habitats that are currently rated high-priority are mule deer winter range in Little Park Wash and burrowing owl habitat in the proposed transportation corridor.

Kaiser will mitigate the impact to deer wintering in Little Park Wash by ferrying men and material by helicopter from the cliff base to the temporary facility site during the period November through March. The severity of the potential impacts of construction and operation of the facilities is unknown at this time. The results of the winter use monitoring study (Section 10.6) should provide the necessary data for further mitigation planning.

Mitigation planning will also follow the burrowing owl and black-footed ferret studies (Section 10.6). If a ferret or ferret sign is observed, the appropriate authorities will be notified and their recommendations

10.5 Cont.

followed. All burrowing owls and nest burrows will be protected during construction activity. Construction will be delayed until young have fledged or it may be necessary to trap and transplant owls to burrows that will remain undisturbed. The prairie dog town will be posted to inform passersby not to disturb the sensitive area.

Raptors are sensitive to perturbations of the environment. Although raptor nests were not found on the Permit Area and impacts to nesting raptors are not anticipated, Kaiser will avoid other potential impacts. Electrocutions of large birds which perch on power poles is a recognized problem (Marshall, 1940, and Dickinson, 1957, both cited by Olendorff et al., 1980). Utah Power and Light will build the distribution lines to serve the South Lease project (Section 3.2.5). The guidelines they follow, Suggested Practices for Raptor Protection on Powerlines, incorporate design specifications outlined in REA Bulletin 61-10, Powerline Contacts by Eagles and Other Large Birds. Drawings of powerline structures are shown on Plate III-16.

Wildlife habitat is the primary postmine land use (Section 4.5). All disturbed land will be reclaimed according to accepted standards and procedures listed under UMC 817.111-817.117 and as described in Section 3.5. The criteria listed under 817.97(d)(9) will guide the selection of plant species to be used for revegetation.

Temporary structures in Little Park Wash, e.g. the office/bathhouse trailer, will be removed when the permanent facilities in the bottom area

10.5 Cont.

are operational. Permanent facilities will remain for the life of the mine after which they too will be dismantled and removed (Section 3.5.3.2).

Fencing will be used to control access to the permanent facilities. The transportation corridor will not be fenced.

Dust suppression and erosion control measures will be conducted during construction and operation (Section 11.4.2). The amount of airborne dust will be reduced when the access road is paved.

Mitigation of mine impacts will include a wildlife education program to be made available to mine personnel. The basis of the program will be a corporate environmental policy that is being formulated. The program will be developed and implemented under the auspices of mine management and DWR. The focus of the program will be the conservation of wildlife.

10.6 Fish and Wildlife Monitoring

The DWR has classified Little Park Wash as critical deer winter range. The construction of the temporary facilities and increased use of the access road represent an impact to wintering deer, especially if regional winter conditions are severe. Kaiser Steel is committed to mitigate these impacts but there is a need for more data upon which to base a mitigation program. The primary objective of the monitoring study described below is to establish a quantitative database that will serve as a guide for mitigation planning. Only a general description of the study is presented; the specific details of study design will be submitted to DOGM for their review and input.

Secondary objectives are:

1. To locate deer migration corridors into Little Park
2. To quantify deer movement into Little Park
3. To quantify snowpack conditions at selected locations in and outside Little Park.
4. To locate and quantify deer crossings of the road that traverses Little Park.

Existing studies and sources of information will be carefully scrutinized to determine their applicability to the study objectives. When information gaps are found, surveys will be initiated to fill them.

Current plans call for three winter site visits, 1 month apart. Three days are allowed for surveys during each visit. Surveys will be conducted during optimum tracking conditions and soon after snowfall to insure accurate counts of individual deer.

Two days of each winter visit will be devoted to searching for burrowing owls and black-footed ferrets or their sign. During early June 1982, a

10.6 Cont.

burrowing owl breeding survey will be conducted. The primary objective of this study is to locate and quantify pairs of breeding owls. A black-footed ferret survey will be combined with the breeding owl survey. The prairie dog town will be searched in the evening with a spotlight and during the day by walking and close examination of burrows. The study design for these studies will also be submitted to DOGM for their review and input.

No other monitoring studies are contemplated at this time. However, studies will be initiated if potential threats to wildlife become known and the need for information warrants them.

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Chapter XI CLIMATOLOGY AND AIR QUALITY

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11.1 Scope

This chapter on climatology and air quality pertains primarily to requirements under UMC 783.18(a), 784.13(b)(9), and 784.26.

Regional and local climatological data have been compiled by E. Arlo Richardson, Utah State Climatologist. Data was taken from weather stations at Woodside, Price and Sunnyside, Utah, as being representative of the general climate of the area.

Notice of Intent (Appendix 11.7.1) for the proposed underground coal mine on the South Lease Coal Property, Emery County, Utah, has been prepared by Kaiser Steel Corporation and its contractor, North American Weather Consultants, Salt Lake City, and filed with the Utah Bureau of Air Quality. The Notice conforms with specifications provided by the Bureau and includes a complete project description; a summary of the calculated uncontrolled and controlled emissions; and air quality model analysis project impacts, which are necessary as particulate emissions will exceed 100 tons/year. Projected emissions will not exceed the 250 tons/year limit, however, and the project will not be subject to Prevention of Significant Deterioration (PSD) monitoring regulations.

11.2 Methodology

Section 11.3 "Climate Study" was authored by E. Arlo Richardson, State Climatologist of the Utah State Climatology Office.

Section 11.4 "Effects of Mining Operation on Air Quality", was authored by Daniel J. McNaughton, CCM Director of Air Quality Modeling, of North American Weather Consultants.

11.3 Climate Study

Description of the Topography and General Climate

The Mine Plan Area (MPA) under study is located along the eastern side of the Price River valley on the western edge of the Book Cliffs. The Price River valley is in the shape of a large horseshoe which slopes gently toward the southeast. The valley is bounded on the west by the Wasatch Plateau and on the north and east by portions of the West Tavaputs Plateau. The bottom of the valley rises slowly from the river to 4,900 feet above sea level at Woodside and then begins to climb more rapidly toward the base of the Book Cliffs. East of the cliffs, elevations above 9,000 feet can be found with the highest point, north of the MPA, Patmos Head, 9,851 feet above sea level. The cliffs are broken by several small canyons or draws which give access to the higher elevations beyond. The proposed mine office site is located at an elevation nearly 5,600 feet above sea level while the main area of the MPA is nearly 6,500 feet.

The climate in general is continental with hot summers and cold winters and relatively little moisture. The low average humidity combined with a predominance of clear skies and dry air during most seasons of the year results in a wide daily range in temperatures, on the order of 26 degrees during the winter and 35 degrees during the summer. Temperatures exceeding 100 degrees occur during most summers with subzero minimums during the winter. The cold air flowing down the mountain slopes tends to collect in the bottom of the valley which combines with strong radiation to produce a very strong temperature inversion during the winter season. Below this strong inversion, a layer of fog frequently develops in the winter which creates problems for both travel and communications. Ice tends to build up on both

11.3 Cont.

power and telephone lines. The top of this inversion should average a little below the 5,600-foot elevation of the proposed mine offices but will occasionally rise above.

Standard climate summaries for stations representative of the general climate of the area are shown in three tables. Summaries for Woodside, elevation 4,900 feet above sea level, Price 5,560 and Sunnyside 6,716 are listed as Tables XI-1, XI-2 and XI-3. The standard climate summaries contain the following data tabulations:

(a) Average daily maximum temperature by months.

(b) Average daily minimum temperature by months.

(c) Average daily temperature by months.

(d) Highest monthly maximum of record for each month and year of occurrence.

(d) Lowest monthly minimum temperature of record for each month and the year of occurrence.

(e) Average monthly precipitation accumulation.

(f) Greatest daily precipitation for each month and year of occurrence.

(g) Average snowfall for each month (where available).

(h) Greatest monthly snowfall for each month and year of occurrence (where available).

These summaries are quite site specific since the area is quite mountainous. Special care should be exercised in attempting to extrapolate these data over any great distance from the individual stations. However, in general terms, the Sunnyside station is believed to be fairly representative of conditions in upper portions of the MPA.

Table XI-1 Climate Study for Woodside, Utah

Station: Woodside, Utah

Elevation: 4900

Longitude: 110°25'

Latitude: 39°19'

Period of Record: 1911-1916, 1951-1958, 10 years total

Month	TEMPERATURE: MEANS: Daily Maximum	Daily Minimum	Monthly	EXTREMES: Record Highest	Year	Record Lowest	Year	PRECIPITATION TOTALS (Inches): Mean	Greatest Daily	Year	SNOW: Mean*	Maximum Monthly	Year
Jan.	37.0	7.1	22.0	59	1956+	-33	1914	.68			8.6		
Feb.	42.3	11.8	27.1	59	1956	-20	1955	.41			4.9		
Mar.	56.1	23.1	40.0	78	1913	0	1916	.49			1.2		
Apr.	58.8	33.0	51.1	84	1914	14	1911	.52			0		
May	78.1	41.2	59.7	94	1951+	24	1953	.43			0.3		
June	87.3	47.8	67.8	104	1954	34	1954+	.48			0		
July	94.3	57.4	76.0	104	1951+	40	1913	.52			0		
Aug.	92.3	55.1	73.9	104	1914	42	1914	.75			0		
Sept.	83.5	45.3	64.4	99	1955	25	1913+	.76			0		
Oct.	69.2	32.4	50.6	86	1957+	14	1913	.93			0		
Nov.	52.8	21.1	36.0	72	1915	-3	1952	.65			0.8		
Dec.	37.4	10.2	23.8	62	1958	-22	1911	.50			4.2		
Annual	65.8	32.1	47.4					7.12			20.0		

*Based on 6 years of poor data

Table XI-2 Climate Study for Price, Utah

U. S. DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
IN COOPERATION WITH
UTAH COMMITTEE ON INDUSTRIAL AND EMPLOYMENT PLANNING
CLIMATOGRAPHY OF THE UNITED STATES NO. 20 -

LATITUDE 39° 36'
LONGITUDE 110° 48'
ELEV. (GROUND) 5,560 Ft.

CLIMATOLOGICAL SUMMARY

STATION **PRICE**

East side of town in Warehouses

MEANS AND EXTREMES FOR PERIOD 1936 - 1965

Month	Temperature (°F) Means: Daily maximum	Daily minimum	Monthly	Extremes: Record highest	Year	Record lowest	Year	** Mean degree days	Precipitation Totals (Inches): Mean	Greatest daily	Year	Snow, Sleet: Mean	Maximum monthly	Year	Greatest daily	Year	Mean number of days: Precip. .10 inch or more	Temperatures: Max. 90° and above	Max. 32° and below	Min. 32° and below	Min. 0° and below	Month
(a)	30	30	30	30		30		#	30	30		30	30		30		30	30	30	30	30	
Jan.	37.1	11.0	24.1	58	1961	-29	1937	1274	.68	.67	1956	9.2	21.5	1944	8.5	1956	2	0	8	31	4	Jan.
Feb.	42.3	17.4	29.8	68	1958	-17	1963/	986	.68	.80	1962	7.0	27.0	1939	13.0	1939	2	0	4	27	3	Feb.
Mar.	51.6	25.2	38.4	75	1956	- 7	1964	797	.78	.97	1938	3.9	26.0	1952	6.0	1963	3	0	*	27	*	Mar.
Apr.	63.8	34.2	49.0	86	1946	8	1945	471	.57	.66	1944	0.1	2.0	1944	2.0	1944	2	0	0	12	0	Apr.
May	74.1	42.9	58.5	94	1962	20	1959	239	.68	1.45	1937	0.4	10.0	1964	8.0	1964	2	1	0	2	0	May
June	83.6	50.0	66.9	101	1954	29	1939	75	.80	1.47	1941	0.0	T	1955	0.0		2	7	0	*	0	June
July	90.6	56.7	73.7	106	1938	40	1962/	0	.82	1.05	1954	0.0	T	1954/	0.0		2	20	0	0	0	July
Aug.	88.2	55.3	71.7	102	1940	32	1960	0	1.19	1.03	1949	0.0	0.0		0.0		3	12	0	*	0	Aug.
Sept.	80.0	47.2	63.6	96	1950	23	1938	81	1.13	1.67	1962	0.1	2.5	1965	2.5	1965	3	2	0	6	0	Sept.
Oct.	67.7	36.6	52.2	87	1963	15	1960	403	.99	1.75	1960	0.2	4.5	1949	3.5	1949	3	0	0	8	0	Oct.
Nov.	50.5	23.7	37.1	73	1962	0	1959/	843	.56	1.97	1957	2.4	12.5	1951	8.0	1951	2	0	*	26	*	Nov.
Dec.	40.6	15.9	28.2	60	1962	-10	1948/	1141	.89	1.07	1964	8.8	42.0	1951	13.0	1951	3	0	6	28	2	Dec.
Year	64.2	34.7	49.4	106	July 1938	-29	Jan. 1937	6280	9.77	1.97	Nov. 1957	32.1	42.0	Dec. 1951	13.0	Dec. 1951/	29	42	18	167	9	Year

(a) Average length of record, years.

T Trace, an amount too small to measure.

** Base 65°F

+ Also on earlier dates, months, or years.

* Less than one half.

Normal 1931-1960

CLIMATE OF PRICE, UTAH

Price, county seat of Carbon County, is located in the northwestern portion of the Price River Valley in eastern Utah. Situated near the Price River in a rather broad plain which slopes gently to the southeast, the station is almost completely surrounded by mountains. To the east and north lies the West Tavaputs Plateau with peaks ranging from 9,000 to over 10,000 feet. The Wasatch Plateau with numerous peaks to above 10,000 feet, is 15-20 miles to the west. Highest mountain in the area is South Tent about 35 miles southwest, which rises to 12,300 feet above sea level.

The nearby mountains have a marked influence on the weather at Price, acting as a barrier to storms approaching from every direction except south. The preponderance of clear days with abundant sunshine enjoyed by residents of the area and the relatively low annual precipitation of ten inches are due, in part, to the proximity of these mountains. Also, cold arctic air masses seldom move into Price Valley because of the protecting influence exerted by the mountain ranges to the north and east.

The climate is continental and dry. Due to the elevation (5,560 feet), and a predominance of clear skies and dry air, daily temperature ranges are rather large, averaging 26 degrees in winter and 33 degrees in summer. Temperatures 100 degrees or higher during summer, or 15 degrees below zero or colder during winter, are likely to occur one season out of three.

Winters are cold and uncomfortable, but usually not severe. Snowfall is generally light, averaging less than 33 inches annually, but as much as 95 inches has been reported during a single winter season.

Summers are characterized by hot days and cool nights. The high temperatures during this season are not oppressive since the relative humidity is usually low. July is the hottest month with maximum temperatures on most days near 90 degrees and lows in the upper 50's. The principal rainfall period is in late summer when the area is occasionally subjected to thunderstorm activity associated with moisture-laden air masses moving in from the Gulf of Mexico.

The growing season, or freeze-free period, averages about five months in length, extending from early May to early October.

Following are tables of miscellaneous phenomena, not included in the climatological summary table.

Average Dates of Occurrences of Various Temperature Values:

Temperature Equal to or Lower Than:	Average Dates of Occurrence: Last in Spring	First in Fall	Length of Period
32°	May 3	October 3	153
28°	April 27	October 15	171
24°	April 11	October 25	197
20°	March 29	November 7	223
16°	March 17	November 16	244

Extremes of Temperature and Precipitation which have occurred prior to 1926 and which exceed those appearing in the table include:

Maximum Temperature:
108° in July 1925

Minimum Temperature:
28 in June 1923
31 in July 1921
21 in September 1924
-31 in December 1924

Greatest Daily Precipitation
0.85 inches in January 1921
0.98 inches in March 1929
2.00 inches in August 1921
1.65 inches in October 1925

Extremes from autographic records 1941-1965 (with break)
1 hour 0.93 inch in August 1954
2 hours 1.00 inch in August 1954
3 hours 1.01 inches in August 1954
6 hours 1.02 inches in August 1954
12 hours 1.34 inches in June 1949
24 hours 1.58 inches in November 1957

Greatest and least monthly precipitation totals for the full period of record are as follows: The first column contains median precipitation values by months for the 30-year period 1936-1965. The median value is such that more precipitation was recorded half of the time, and less the other half.

Month	Median	Greatest	Year	Least	Year
January	0.60	2.31	1914	0	1948/
February	0.61	2.44	1919	T	1954
March	0.83	2.58	1912	0	1934/
April	0.47	2.22	1941	0	1948/
May	0.46	2.19	1964	0	1927/
June	0.54	3.69	1927	0	1950/
July	0.73	3.84	1914	0.05	1963
August	1.05	4.32	1921	0	1911
September	0.60	5.91	1927	0	1934
October	0.90	3.24	1941	0	1952
November	0.38	2.84	1957	0	1932/
December	0.60	2.80	1951	0	1930
Annual	9.47	19.55	192[illegible]	4.47	1942

Table XI-3 Climate Summary for Sunnyside, Utah

Station: Sunnyside, Utah Longitude: 110° 22'

Elevation: 6750 Latitude: 39° 34' Period of Record: 1958-1980*

	TEMPERATURE							PRECIPITATION TOTALS (Inches)					
	MEANS			EXTREMES							SNOW		
Month	Daily Maximum	Daily Minimum	Monthly	Record Highest	Year	Record Lowest	Year	Mean	Greatest Daily	Year	Mean	Maximum Monthly	Year
Jan.	34.3	13.1	23.7	60	1971	-16	1963	.80	1.46	1969	11.3	30.5	1978
Feb.	41.3	19.3	30.3	59	1963	-11	1962	.90	1.63	1969	11.3	41.0	1969
Mar.	45.4	22.1	33.8	65	1978+	0	1971	1.08	.85	1968	6.8	18.1	1979
Apr.	55.0	29.7	42.4	81	1962	4	1975	.94	1.09	1969	2.6	17.0	1979
May	65.7	39.6	52.7	88	1967	20	1975	1.07	1.10	1969	0.2	2.7	1978
June	77.6	48.4	63.0	95	1968	28	1976	.84	1.60	1970	0	0	
July	85.5	56.3	70.9	95	1969	32	1968	1.08	.89	1980	0	0	
Aug.	82.7	53.6	68.2	98	1969	35	1968	1.27	1.20	1968	0	0	
Sept.	73.5	45.7	59.6	92	1967	28	1978+	1.34	1.24	1980	T	T	1978
Oct.	60.9	35.6	48.3	80	1960	10	1975	1.26	1.25	1972	0.6	4.0	1970
Nov.	47.0	24.6	35.8	67	1960	-1	1976	.76	.91	1980	2.0	13.0	1961
Dec.	37.3	16.2	26.8	62	1966	-12	1978	.64	.84	1978	5.3	24.0	1959
Annual	58.9	33.7	46.3	98	Aug. 1969	-16	Jan. 1963	11.98	1.63	Feb. 1969	40.1	#	

*The records at this station are very erratic, especially snowfall.
#Insufficient annual snowfall information available.

11.3 Cont.

11.3.1 Precipitation Patterns

Precipitation during any given period of time varies considerably in the MPA. While one of the primary causes of this variability is the diversity of topography, there are three general synoptic situations which tend to compound conditions. These general synoptic situations are: (a) Pacific storm fronts (b) Summer thunderstorms and (c) Upper level low pressure systems, sometimes called lows aloft. The lows aloft which affect the area are classified according to the portion of the intermountain area where they develop. The general categories are Nevada lows, Southern Utah lows and the more northern development area Great Basin lows.

Pacific storm fronts originate in the Pacific Ocean and move eastward across the coast into the Utah area. These fronts may move from the northwest toward the southeast, from the west to east or from the southwest toward the northeast across the state depending upon the direction of the winds in the upper atmosphere. Frontal activity dominates the weather picture over the intermountain area during the winter and early spring but may also produce some precipitation during other seasons of the year.

Lows aloft are most frequent during the month of October in the fall, and late April and May during the spring. These lows aloft may move very erratically and often produce very heavy precipitation over extended periods of time. The general topography of the Price River valley modifies the impact of both fronts and lows aloft and these systems are not as potent in this section of the state as they are in other areas.

11.3 Cont.

11.3.1.1 Precipitation Probabilities

Thunderstorms are most frequent during the summer months. Thunderstorms can be triggered either by the lifting action of winds moving moist tropical air up the slopes of the mountains from the south or southeast or through the lifting action produced by the intense heating of the surface of the earth by the direct rays of the summer sun on this dry desert soil. When the heating occurs in the moist air moving in from the Gulf of Mexico, which, contrary to popular belief, is the major source of moisture for the intermountain area, or from the Gulf of California, condensation occurs in the rising air which often triggers intense thunderstorm activity with some damaging hail. The wettest month in the lower Price River valley is normally in the summer and is associated with this thunderstorm activity. Figures XI-1, XI-2 and XI-3 show the probability of occurrence of selected accumulations of moisture during any one week at three representative stations surrounding the MPA. While the amounts indicated will be somewhat different with different elevations on the MPA, the general seasonal distribution pattern will be similar.

11.3.1.2 Seasonal Precipitation

Figures XI-4, XI-5 and XI-6 have been extracted from isohyetal maps prepared several years ago by the State Climatologist and the Hydrologist then of the National Weather Service. These figures show the distribution of estimated normal precipitation for the period 1931-1960. Figure XI-4 covers the May-September or, roughly, the expected growing season accumulations; Figure XI-5 shows the normal accumulations for the period October-April which is the normal snowfall season; and Figure XI-6

Figure XI-1 Probabilities of selected accumulations of precipitation during any one week period of the year at EMERY, UTAH

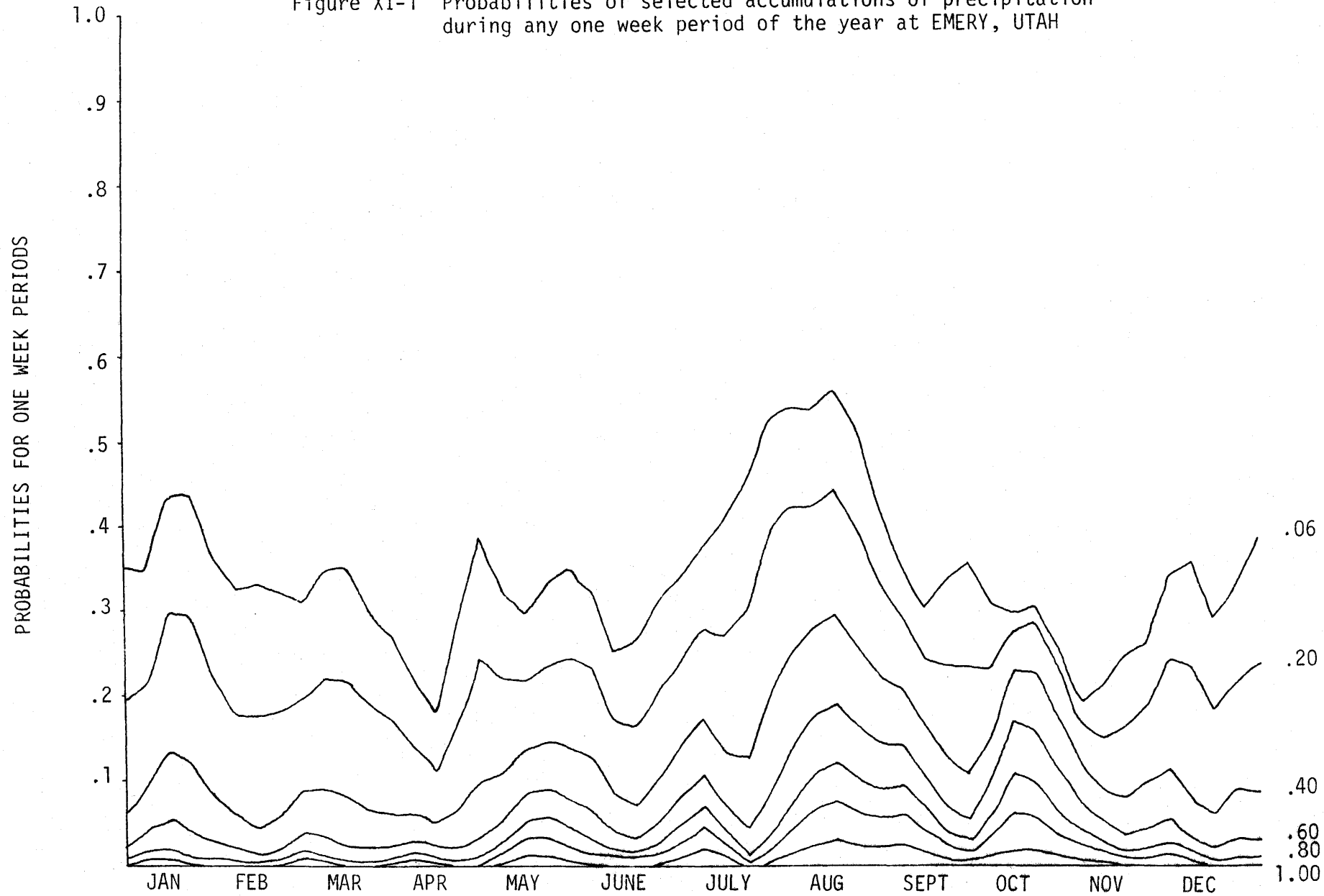


Figure XI-2 Probabilities of selected accumulations of precipitation during any one week period of the year at HIAWATHA, UTAH

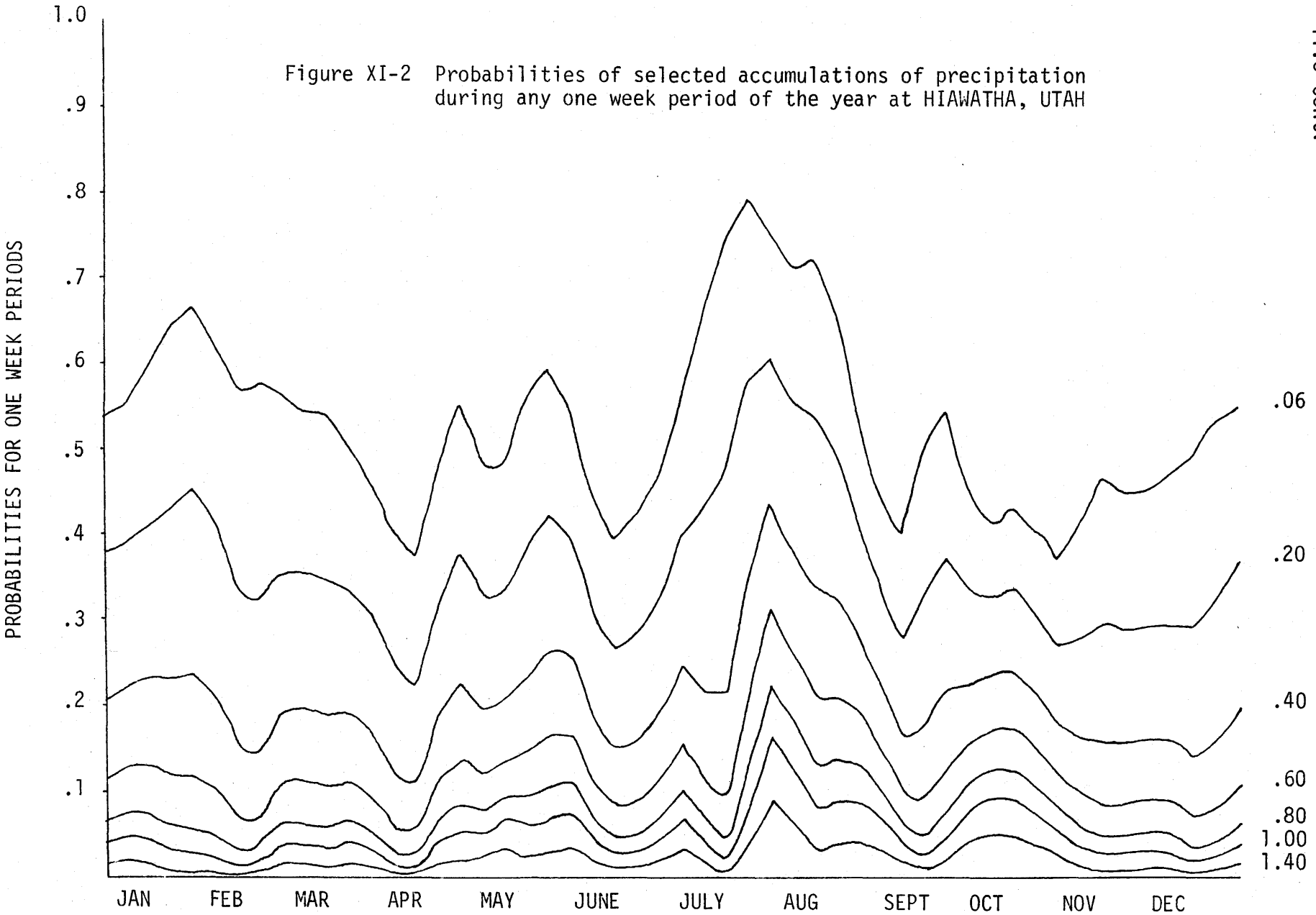
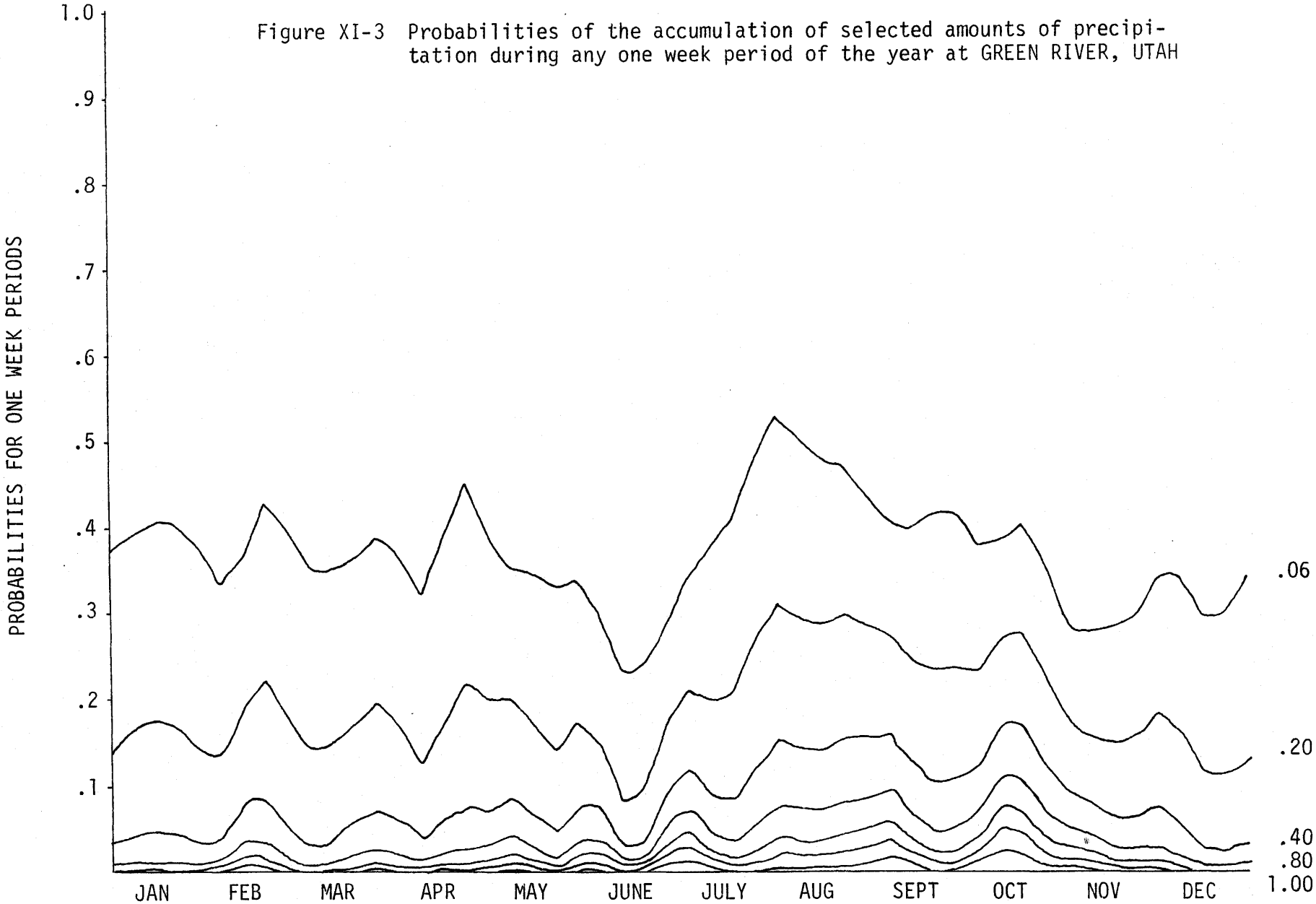


Figure XI-3 Probabilities of the accumulation of selected amounts of precipitation during any one week period of the year at GREEN RIVER, UTAH



11.3 Cont.

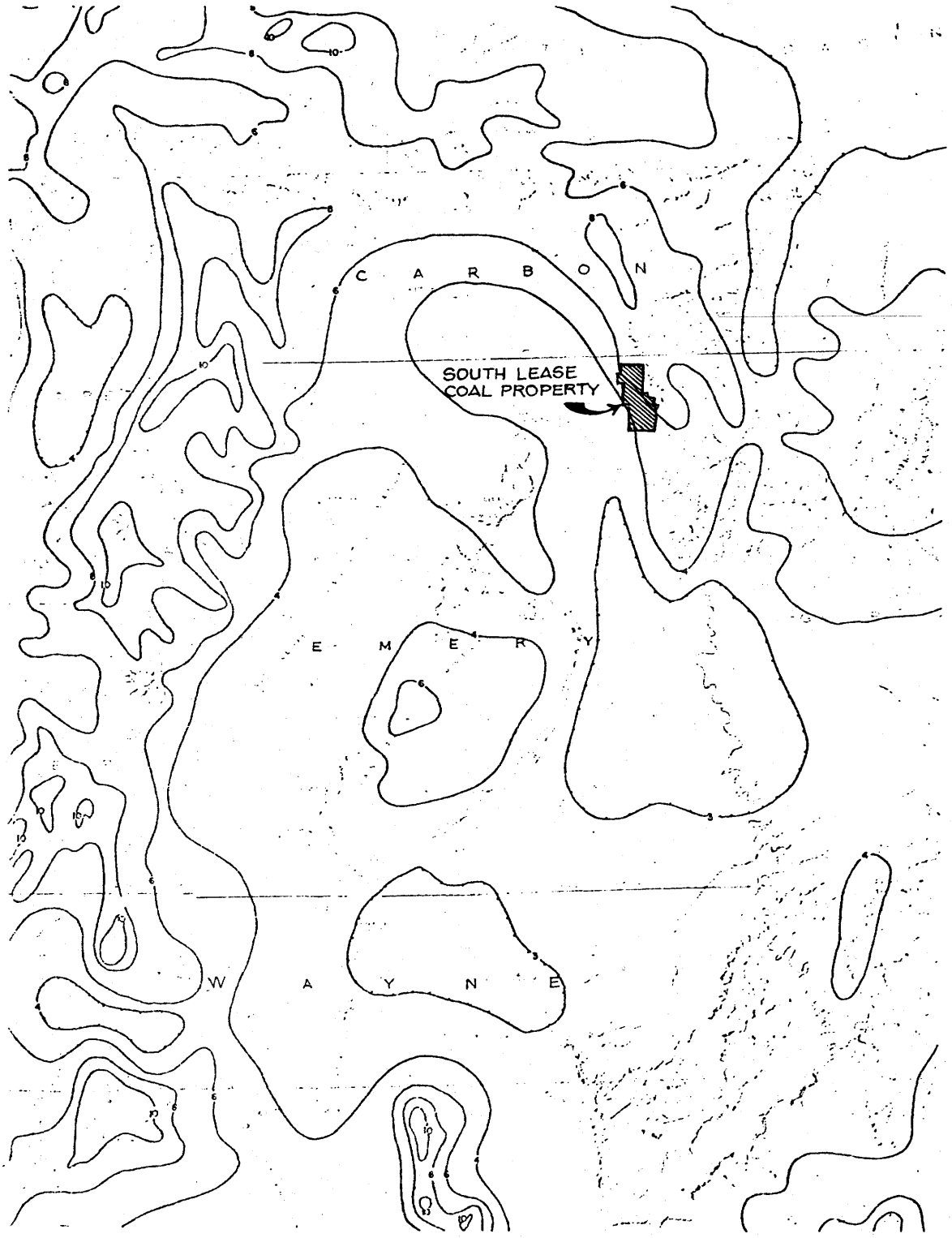


Figure XI-4 NORMAL MAY-SEPTEMBER PRECIPITATION ACCUMULATION
Based on 1931-1960 Period

11.3 Cont.

Figure XI-5 NORMAL OCTOBER-APRIL PRECIPITATION ACCUMULATION
Based on 1931-1960 Period

11.3 Cont.

Figure XI-6 NORMAL ANNUAL PRECIPITATION ACCUMULATION
Based on 1931-1960 Period

11.3 Cont.

shows normal annual accumulations. Precipitation accumulations for the MPA range between 4 and 7 inches during the growing season, 5 to 10 inches during the winter season and 8 to 17 inches normal annual accumulations.

11.3.1.3 Return Periods for Short Duration Precipitation

Another type of hydrologic data of considerable importance is the "return periods of selected amounts of short duration precipitation." Table XI-4 gives tabulations of the estimated return periods for short duration precipitation based upon an extended analysis of maps published by the National Weather Service Office of Hydrology. Two sites were selected for this analysis, Price and Hill Creek No. 5. These stations cover more than the range of elevations of the MPA. These tables were extracted from Bulletin No. 1, "Estimated Return Periods for Short Duration Precipitation" published by the Department of Soils and Meteorology (Richardson, 1971). Most of the intense precipitation accumulations during short periods is associated with the summer thunderstorms.

11.3.2 Temperature

Temperature is among the more important weather factors that influence man and all other living organisms. All temperatures reported in official National Weather Service publications are measured under prescribed conditions which include standardized thermometers that are checked regularly for accuracy and exposed in specially constructed radiation shields called shelters. These shelters protect the thermometers against errors in measurement that are introduced by stray direct and reflected radiation from the sun. Many of the newer types of instruments are not compatible with these older instruments and one must be careful when attempting to relate

11.3 Cont.

Table XI-4

ESTIMATED RETURN PERIODS FOR SHORT DURATION PRECIPITATION
(inches)

Station: Price
Latitude: 39° 37'

Elevation: 5680
Longitude: 110° 50'

Original site West side of town in Canyon; now closed

RETURN PERIOD (years)	DURATION 5 Min	10 Min	15 Min	30 Min	1 Hr	2 Hr	3 Hr	6 Hr	12 Hr	24 Hr
1	.08	.13	.17	.23	.29	.37	.44	.62	.78	.95
2	.12	.18	.23	.32	.40	.49	.58	.80	1.00	1.20
5	.16	.25	.32	.44	.56	.68	.79	1.07	1.32	1.58
10	.20	.31	.39	.54	.68	.81	.94	1.25	1.53	1.82
25	.24	.37	.47	.65	.82	.98	1.13	1.50	1.83	2.18
50	.28	.43	.54	.75	.95	1.12	1.29	1.71	2.08	2.47
100	.31	.49	.62	.85	1.08	1.27	1.45	1.91	2.32	2.74

Station: Hill Creek No. 5
Latitude: 39° 17'

Elevation: 8900
Longitude: 109° 51'

RETURN PERIOD (years)	DURATION 5 Min	10 Min	15 Min	30 Min	1 Hr	2 Hr	3 Hr	6 Hr	12 Hr	24 Hr
1	.15	.23	.29	.40	.50	.55	.60	.72	.83	.94
2	.17	.27	.34	.47	.60	.67	.74	.90	1.05	1.20
5	.22	.34	.43	.59	.75	.85	.94	1.17	1.38	1.59
10	.24	.37	.47	.65	.82	.94	1.05	1.34	1.59	1.86
25	.28	.44	.56	.77	.98	1.12	1.26	1.60	1.90	2.22
50	.32	.49	.62	.86	1.09	1.25	1.41	1.80	2.15	2.51
100	.35	.54	.68	.95	1.20	1.38	1.56	2.00	2.39	2.80

11.3 Cont.

measurements made with many commercially available instruments to the long-term trends obtained by the official instruments of the National Weather Service.

Copies of portions of four temperature maps extracted from a publication entitled "Climate of the States - Utah" prepared by the Environmental Data Service have been included as Figures XI-7, XI-8, XI-9 and XI-10. These maps are entitled: Average Maximum Temperatures for January, Average Minimum Temperatures for January, Average Maximum Temperatures for July and Average Minimum Temperatures for July. The isolines on these maps have been drawn to equivalent data points and no attempt was made to incorporate the influence of local topography. In mountainous terrain, wide variations in temperature in relatively short distances can be experienced due to the influence of slope, aspect and elevation along with other topographic features.

11.3.2.1 Winter Temperatures

The winter temperature regime is represented by the two January maps. There are two major synoptic features that combine with the local topographic influences to control winter temperatures, both maximum and minimum. The first of these is a large high pressure system which often dominates the weather picture for several weeks at a time during the winter season. This high pressure produces a stable airmass which tends to serve as a blanket over the area. Beneath this mass the cold air drains down into the bottom of the valley and collects there. This situation produces a very strong temperature inversion.

11.3 Cont.

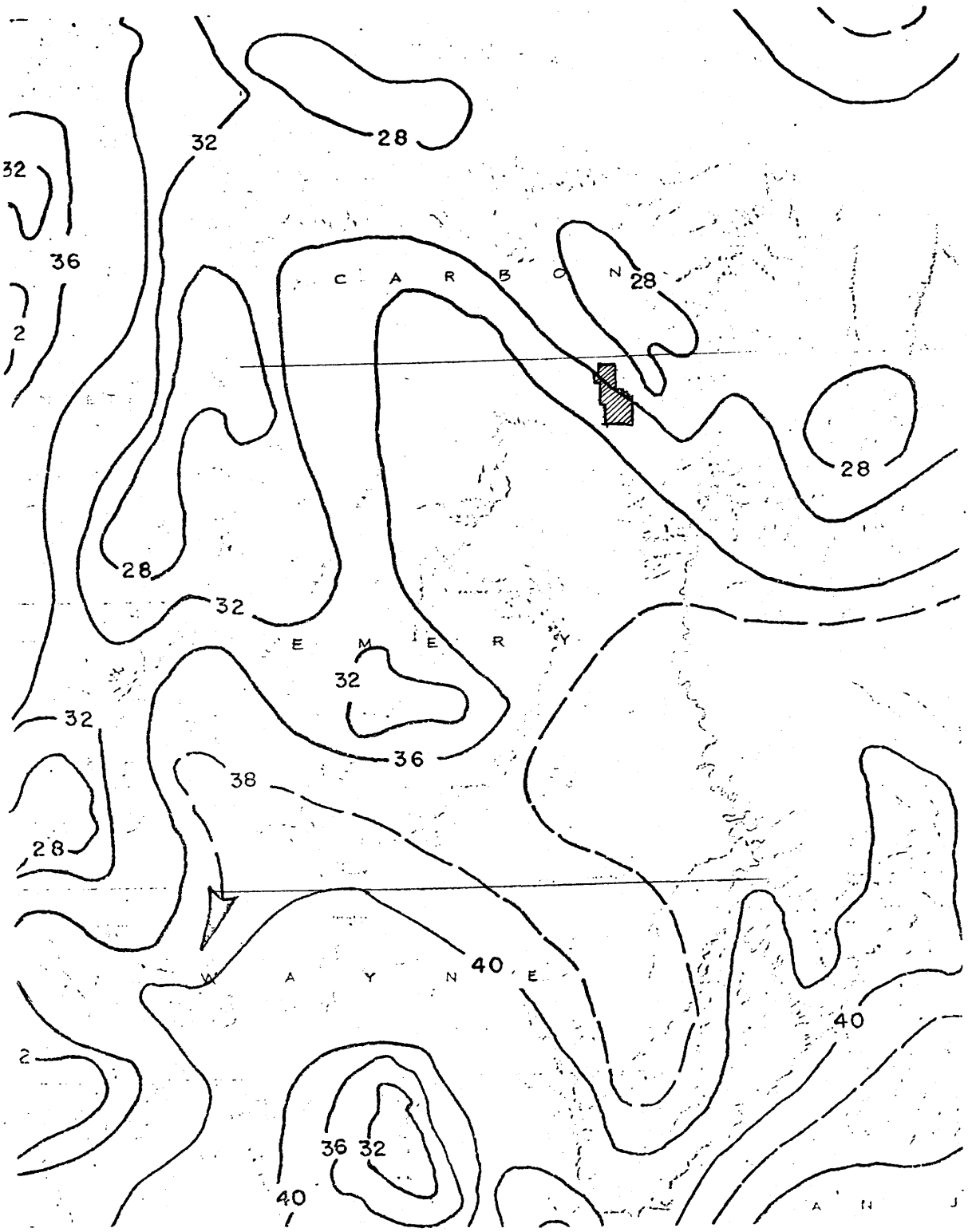


Figure XI-7 AVERAGE JANUARY MAXIMUM TEMPERATURE
Extracted from Climate of the States--Utah

11.3 Cont.

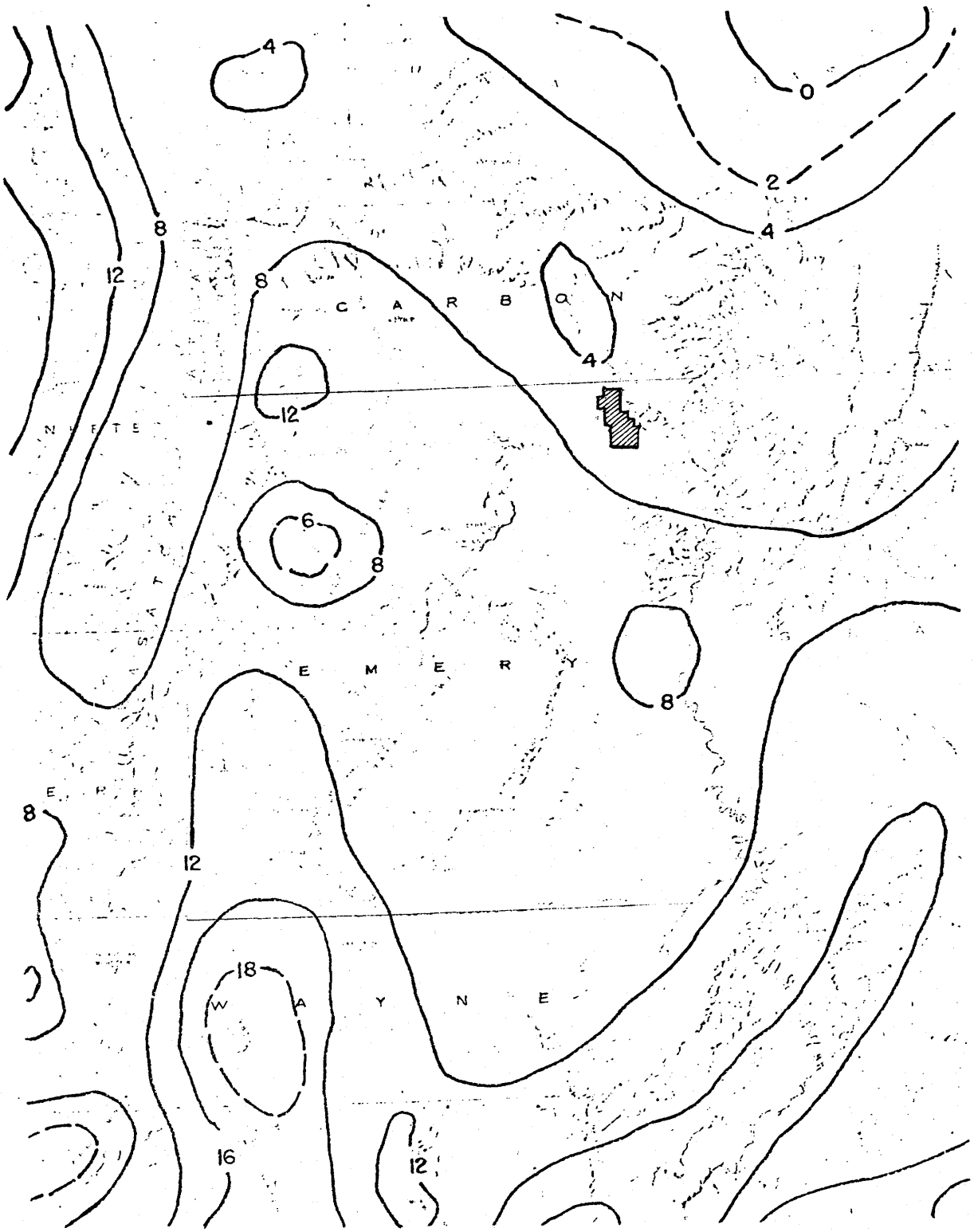


Figure XI-8 AVERAGE JANUARY MINIMUM TEMPERATURE
Extracted from Climate of the States--Utah

11.3 Cont.

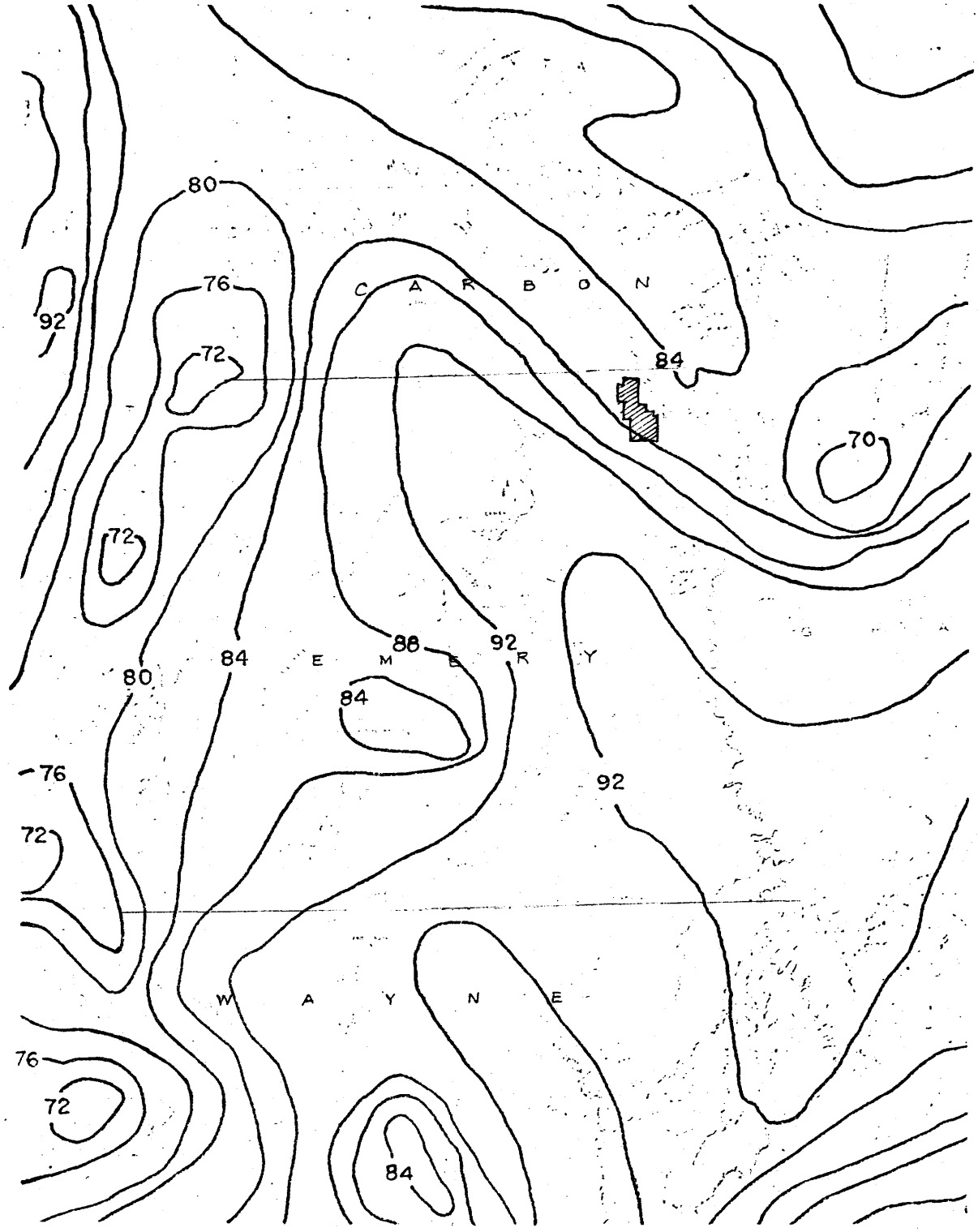


Figure XI-9 AVERAGE JULY MAXIMUM TEMPERATURE
Extracted from Climate of the States--Utah

11.3 Cont.

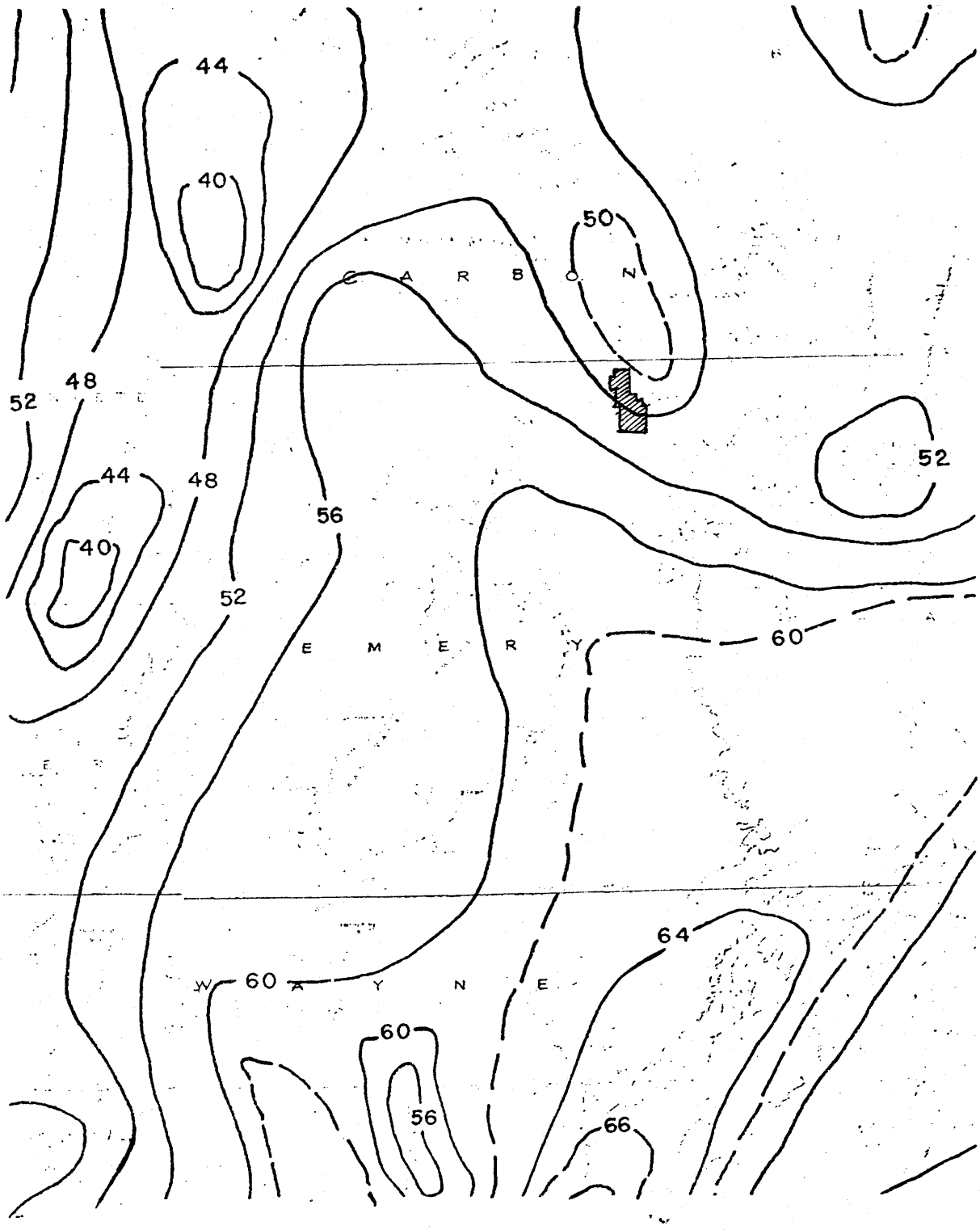


Figure XI-10 AVERAGE JULY MINIMUM TEMPERATURE
Extracted from Climate of the States--Utah

11.3 Cont.

Due to the dominant nature of this strong inversion during the winter season, winters at lower elevations in the valley are cold and uncomfortable but usually not severe. This pooling of cold air traps moisture and industrial pollutants in the low valley and forms a blanket of fog that may persist for several weeks. Temperatures in this inversion zone remain quite uniform while above the inversion at the MPA fairly large variations will continue to occur.

The second synoptic feature which influences winter temperatures is the Pacific Frontal activity previously mentioned. The coldest minimum temperatures of the year usually occur as skies clear following the passage of a strong, active cold front which deposited a covering of snow on the ground. Strong radiation from the snow-covered surface intensifies the inversion and produces a marked cooling of the already cold air which forms the inversion zone.

11.3.2.2 Summer Temperatures

The July temperature maps are quite representative of the temperature distribution about the valley but are not as representative of conditions in some portions of the MPA. Summer temperatures show a distinct contrast to those recorded during the middle of the winter season due to the marked weakening of the temperature inversion in the lower valley. In the MPA the density of the air is small due to the high elevation; the moisture content is usually low and the sun is nearly overhead. The combination of rarefied atmosphere, decreased moisture content and more vertical elevation of the sun results in a high-incident daytime radiation load at the surface of the ground during the summer season. The low humidity also allows maximum radiative losses at night.

11.3 Cont.

Although the sun reaches its most northern declination about June 22, there is a lag between this date and the date when the normal summer temperatures are recorded. On the average, the highest maximums in the area occur about the 24th of July, nearly a month later than the date of maximum solar insolation.

Although, as previously mentioned, summer temperature inversions are much weaker than those which form in the winter, they are, nonetheless, an important contributing factor to summer minimums.

11.3.2.3 Average Annual Temperature Estimates

Analysis of temperatures in the state of Utah that have similar topographic exposures indicate that the temperature decreases about 3.5°F per thousand-foot increase in elevation. As a first approximation of the average annual temperature at any site this relationship can be used. The accuracy of this method depends upon the availability of weather stations with similar exposure conditions. When exposure conditions of slope aspect, elevation and air drainage are similar, this method is quite accurate.

Another approach to estimating the average annual temperature is to use the Freeze-Free Season map (Figure XI-11). About 76 percent of the variability in the length of the freeze-free season can be explained by variations in the average annual temperature. Again, it is very important to properly analyze the topographic conditions at each desired site.

Figure XI-12 contains three reference lines which relate the length of the freeze-free season to the average annual temperature. The center line is for average conditions. The two outer lines represent boundaries of

11.3 Cont.

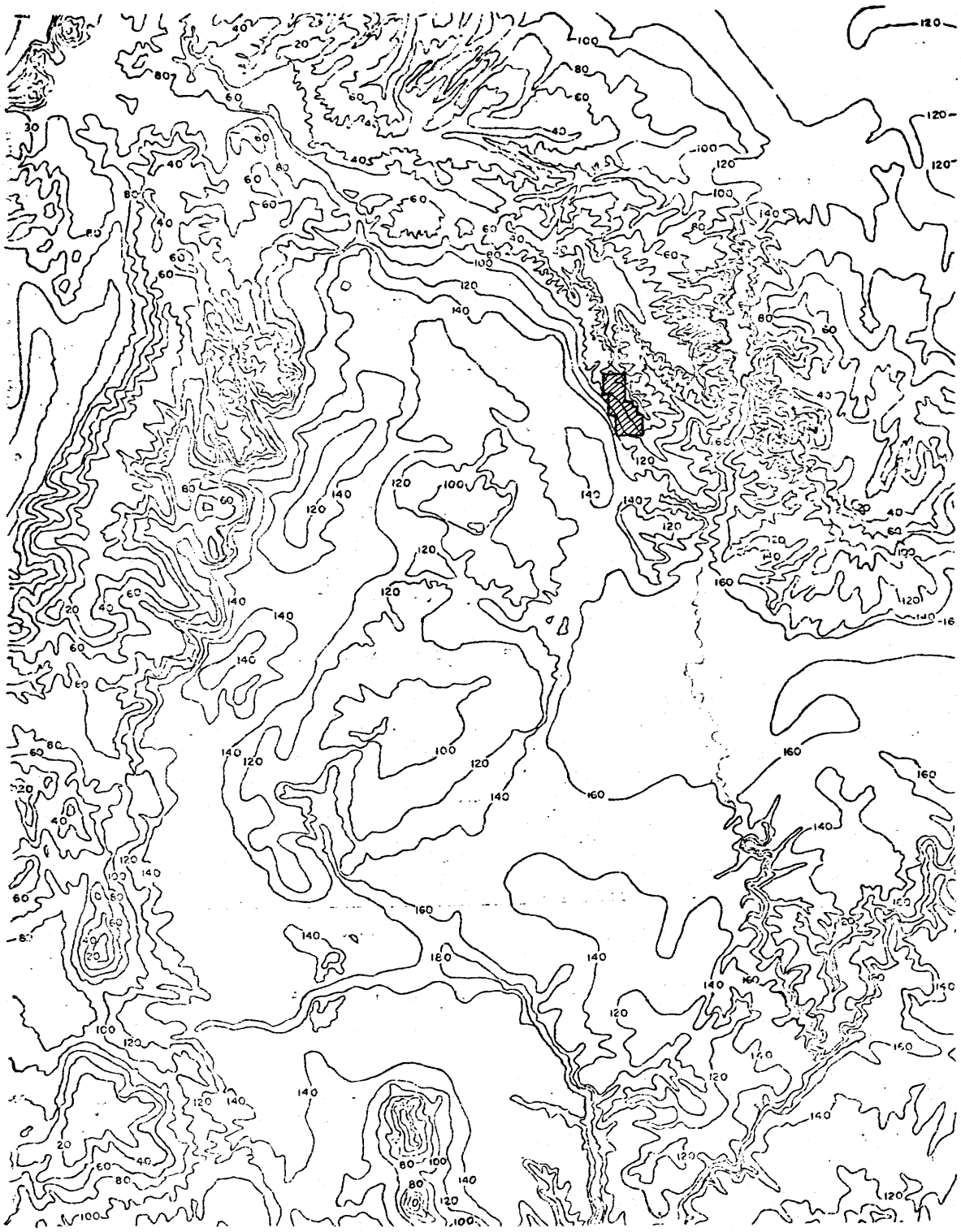
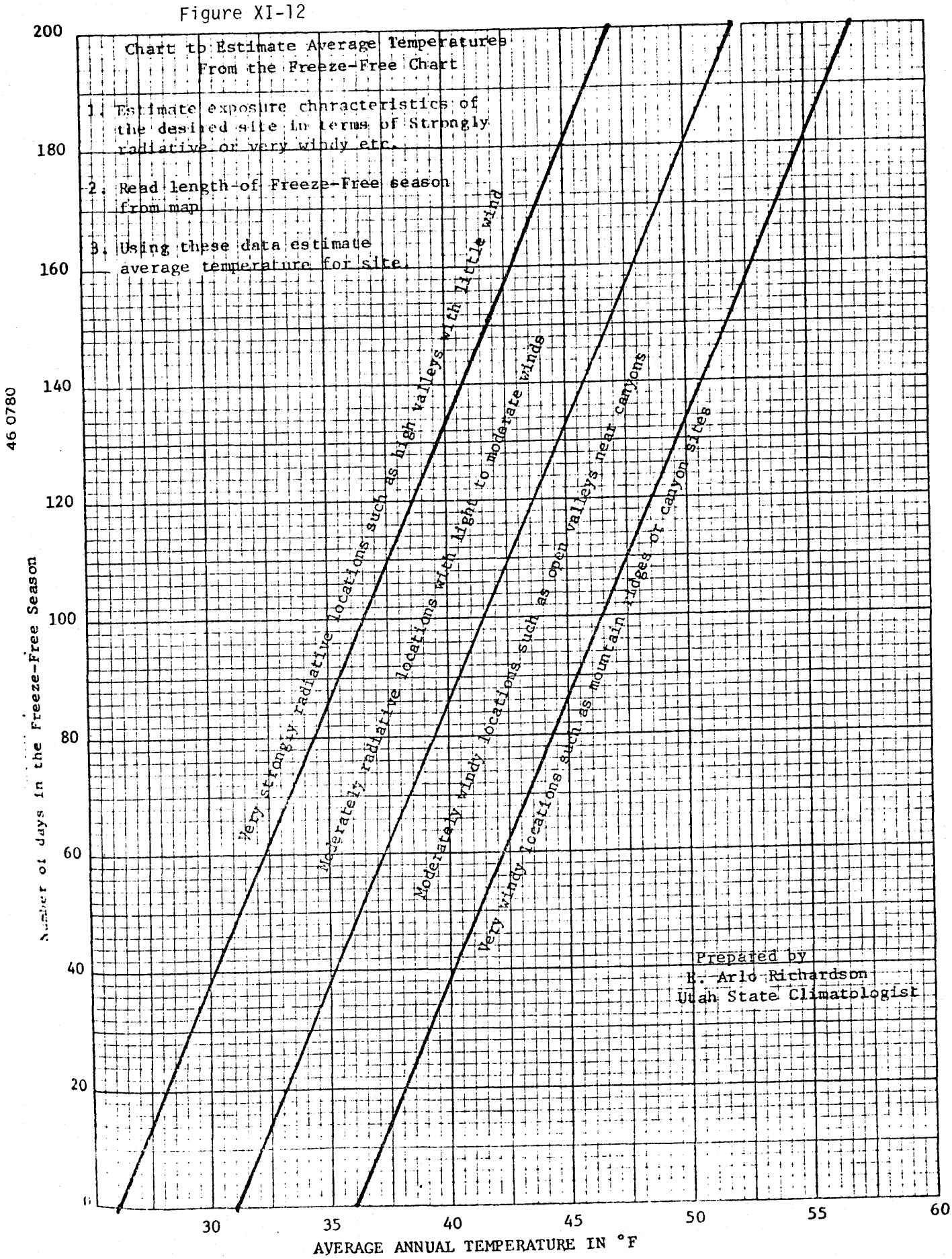


Figure XI-11 NORMAL LENGTH OF GROWING SEASON BASE 32°F
Based on Period 1931-1960

11.3 Cont.

Figure XI-12



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11.3 Cont.

extreme conditions. The left line, as indicated on the graph, represents average annual temperatures at a strongly radiative site such as those located in small valleys where inversions readily form and average winds are light. The line on the right corresponds to locations where the winds are strong and inversions rarely form, such as mountain ridges or canyon sites with strong drainage winds. With good estimates of the exposure characteristics at a site, estimates of the average annual temperatures will usually be accurate to within plus or minus 1 and 1/2 to 2°F.

11.3.2.4 Freeze-Free Season

Freezing is commonly associated with a temperature of 32°F, the normal freezing temperature of pure water. Temperatures other than 32 degrees may, however, be critical under many circumstances. Freeze damage depends upon the type of plant involved and the stage of development, e.g. tomatoes are damaged at higher temperatures than wheat, and wheat is more readily injured in the milk stage than at the hard dough stage of development. Most native plants in the MPA are more hardy than the common field crops, but their sensitivity to damage from cold temperatures will still vary with the phenological stage of development.

Most official temperatures are measured at about five feet above the surface of the ground in a standard instrument shelter. Readings at this elevation above the surface may be representative of temperatures about the middle of some trees and the tops of shrubs but are not necessarily a good estimate of the temperature in the plant canopy of low growing grasses and forbs. A nighttime temperature of 32 degrees in an instrument shelter is normally

11.3 Cont.

associated with a colder temperature in the zone of plant growth unless winds are blowing. Under some conditions air temperatures near the soil surface may be as much as 10 to 15 degrees colder than those measured at the five-foot height.

The Freeze-Free Season map in Figure XI-11 is based on the length of season between the last 32 degrees in the spring and the first 32 degrees in the fall. In general, the freezing conditions near the proposed mine office site will be less severe than conditions above and below this site.

11.3.3 Evaporation-Transpiration

In desert and semi-desert regions such as Price River valley and the MPA, soil moisture is frequently a limiting factor in determining plant growth and development. Losses through evaporation of a portion of the limited rainfall from soil and plant surfaces combined with transpiration from plants is a limitation on the local hydrologic cycle as it relates to potential revegetation.

The water which falls as precipitation on the land may travel any of several paths. One of these pathways is water movement through the soil and the associated water storage. Soil acts as a large permeable sponge and has a large capacity to hold water but this capacity varies greatly with different soil types. When precipitation rates are low or when snow is melting slowly, the water percolates into the soil where it is stored. When the soil reaches its water holding capacity, any additional precipitation or snowmelt will proceed deeper into the soil or will run off overland into local streams.

11.3 Cont.

Another pathway is the combination of surface evaporation and transpiration from plants commonly called evapotranspiration. The ratio of evaporation water losses to losses by transpiration varies with the season of the year. Early in the growing season when plant cover is very small most of the water losses from the surface area are due to evaporation; but as the growing season progresses, evaporative losses decrease and transpiration losses increase. In areas where the soil surface is completely shaded by vegetation, evaporation from the soil becomes minimal. In such a case, large amounts of water are lost from the plant surfaces by transpiration. Because transpired water is extracted throughout the plant's root zone, the transpiration rate is not reduced until considerable water has been extracted from the soil or until the plants have nearly completed their growth cycle.

Another use of the evaporation information is in the design of self-contained lagoons where the only water losses are due to evaporation or slight infiltration into the soil. In many forms of industrial use of water the water becomes so polluted that such lagoons are mandatory to prevent pollution of nearby streams or the underground water aquifers. The rate of evaporation from a lake or a reservoir depends not only on the size of the reservoir but the temperature of the water, the humidity of the air and the amount of wind movement across the water surface.

11.3.3.1 Potential Evapotranspiration

Water loss through evapotranspiration is dependent upon several factors. The first of these is available energy. Conversion of liquid water to water vapor requires large amounts of energy and can be thus limited by the available heat. Available heat can be calculated from climate

11.3 Cont.

data by use of various formulas (Thornthwaite, Blaney-Criddle, Papadakis, Penman, etc.) Most of these formulas estimate the maximum evapotranspiration or the potential that could occur if other factors than climate were not limiting.

A standard measurement made by the National Weather Service which is frequently used as an estimate of potential evapotranspiration is pan evaporation. A summary of estimated pan evaporation for three selected sites based on climatological data is included in Table XI-5. The stations selected as being most representative of conditions on and near the MPA are: (a) Price, (b) Sunnyside and (c) Hiawatha. These estimates have been obtained by use of regression equations developed for Utah conditions by the State Climatologist and use only standard climatological information. These stations cover a wide range in elevations and care must again be exercised in extrapolating to other sites because of the influence of local exposure conditions.

11.3.3.2 Actual Evapotranspiration

The actual evapotranspiration from any given area is almost always less than the potential. For many irrigated agricultural field crops such as corn, alfalfa, sugar beets, etc., crop coefficients have been developed which are used to estimate the actual evapotranspiration from the potential. Such coefficients are not available for native range species with their nonuniform plant coverage and their greater capability of handling moisture stress. However, we are now working on several range studies which may give us this information for selected species within the next few years.

Table XI-5 Estimated Normal Months Pan Evaporation Totals

	Elevation	Jan.	Feb.	Mar.	Apr.	May	June	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Price(Warehouse)	5500	0.8	1.7	3.3	6.0	9.4	10.9	12.3	10.9	8.2	5.0	1.7	1.0	71.2
Sunnyside	6750	0.7	1.5	2.9	5.2	8.1	9.4	11.1	9.4	7.1	4.3	1.5	0.9	62.1
Hiawatha	7230	0.6	1.4	2.7	4.9	7.6	8.8	9.9	8.8	6.6	4.0	1.4	0.8	57.5

*The pan coefficient in this area to convert pan evaporation to lake as extracted from Technical Paper #37 of The National Weather Service is .69.

11.3 Cont.

11.3.4 Humidity

Humidity measurements again are not part of the standard climatological program of the National Weather Service. There are no measurements available for the MPA in the Office of the State Climatologist. In general, however, humidities in the Price River valley are very low at times during the summer season; minimum on the order of 5 to 7 percent can be expected but the average minimum will be on the order of 20 percent. As the elevation increases and temperatures decrease the relative humidity will tend to increase. Estimates are that minimum relative humidities in the MPA will probably range on the average of 25 to 30 percent during the evaporation season but extreme minimums will again drop to near 10 percent at times during the year.

Relative humidity is the least conservative of the atmospheric moisture measurements but is the one with which most people are familiar. Better measurements are the dewpoint or the specific humidity, each of which is more conservative since these do not vary with the diurnal temperature changes, while the relative humidity may cover a range of 70 percent or more during any one day.

11.3.5 Wind

The winds at any given location can be characterized by both wind speed and direction. Most common summaries are formed by analyzing the percent of time that the wind blows from a specific direction. In Utah such summaries are available for only a very few locations. Wind data has been accumulated only near a few of the major airports. In many areas of the state, records for only a few months have been accumulated and these are

11.3 Cont.

usually not sufficient for an accurate assessment of the wind pattern. In mountainous terrain both speed and direction are so variable that measurements are very site specific. Summaries of 6-hourly wind measurements from the station at Green River have been included in Tables XI-6 and XI-7.

Winds high in the atmosphere tend to be strong but decrease toward the surface where obstructions and surface friction come into play. Thus, in the MPA winds will tend to increase with increasing elevation. High ridges and plateaus will generally have stronger winds than the valleys and desert areas. Upper level winds generally have a westerly component in this area as indicated by the streamlines on the 700 millibar chart in Figure XI-15. Figures XI-13 and XI-14 indicate the seasonal changes that tend to occur at these elevations. The streamlines at the 700 millibar level have been included for the months of January and June. The (X) indicates the approximate position of the MPA in reference to the height contours. The prevailing wind direction still has a westerly component but shifts from a more northwesterly direction in January to a more southwesterly direction in June.

As the effects of these winds drop toward the surface of the ground, the influence of friction or the roughness of the ground surface reduces the speed of the wind and the direction tends to move across the isopleths. This frictional effect is further modified by local topography. Hence the prevailing direction will vary considerably within relatively short distances.

11.3 Cont.

Table XI-6

Surface Wind Summary for Green River, Utah

For Period 1957-1961

(Taken from Air Force Summaries)

Direction	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
N	15	24	34	34	27	27	21	8	23	17	24	18	272
NNE	14	10	18	25	16	12	14	8	5	12	15	10	159
NE	15	17	31	30	16	19	23	14	12	13	12	8	210
ENE	4	2	4	6	5	5	8	7	5	4	2	2	54
E	5	9	14	10	8	4	9	7	6	2	2	2	78
ESE	6	15	12	11	7	8	15	11	8	5	5	4	107
SE	15	26	28	36	30	10	13	13	16	5	10	7	209
SSE	9	25	30	41	35	9	20	10	15	13	8	1	216
S	10	15	18	25	22	34	23	21	14	10	12	5	209
SSW	5	18	22	39	54	55	24	30	20	20	13	2	302
SW	11	15	25	20	32	27	27	29	19	20	4	6	235
WSW	7	21	13	12	12	7	13	11	11	7	6	5	125
W	17	27	27	19	25	14	19	24	14	11	14	14	225
WNW	10	13	25	15	10	9	9	4	8	7	3	8	121
NW	21	33	43	38	23	20	17	13	17	7	30	10	272
NNW	5	10	17	28	5	11	2	6	5	2	4	4	99

Note: Number of hours with given directions at six hourly observations.

11.3 Cont.

Table XI-7

Surface Wind Summary for Green River, Utah

For Period 1957-1961

(Taken from Air Force Summaries)

Time	Speed	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1630M	Calm	93	40	18	16	19	24	117	56	76	57	87	97	700
	1-10K	54	85	114	98	108	108	101	83	61	52	44	32	940
	11-20K	1	10	14	17	18	5	5	2	5	4	5	3	89
	21-30K		1	4	12	6	2	1	3	1	1	1	0	32
	30K plus				1	1								
2230M	Calm	111	73	64	51	72	74	81	98	90	81	107	116	1018
	1-10K	34	54	62	80	61	54	58	45	43	28	23	19	561
	11-20K	1	3	8	11	3	2		2	1	3	2	2	38
	21-30K		1	1								2	0	4
	30K plus													
0430M	Calm	102	90	92	79	107	123	119	105	108	90	101	112	1228
	1-10K	35	36	36	46	22	14	18	24	19	15	22	17	304
	11-20K	1	1	7	2	2			1		1	2	0	17
	21-30K	1			1									2
	30K plus													
1030M	Calm	104	45	30	29	40	59	71	88	66	67	83	105	787
	1-10K	42	84	102	116	101	86	73	54	67	46	58	29	848
	11-20K		5	9	15	4		1	2	1	5	4	1	47
	21-30K			4		2						1	1	8
	30K plus													
Average Speed		1.9	3.1	4.2	4.9	3.7	2.7	2.4	2.2	2.0	2.1	1.9	1.8	

Note: Number of cases at six hourly observations falling in velocity bracket.

The two cases over 30 knots were reported as 32 and 42 knots respectively.

11.3 Cont.

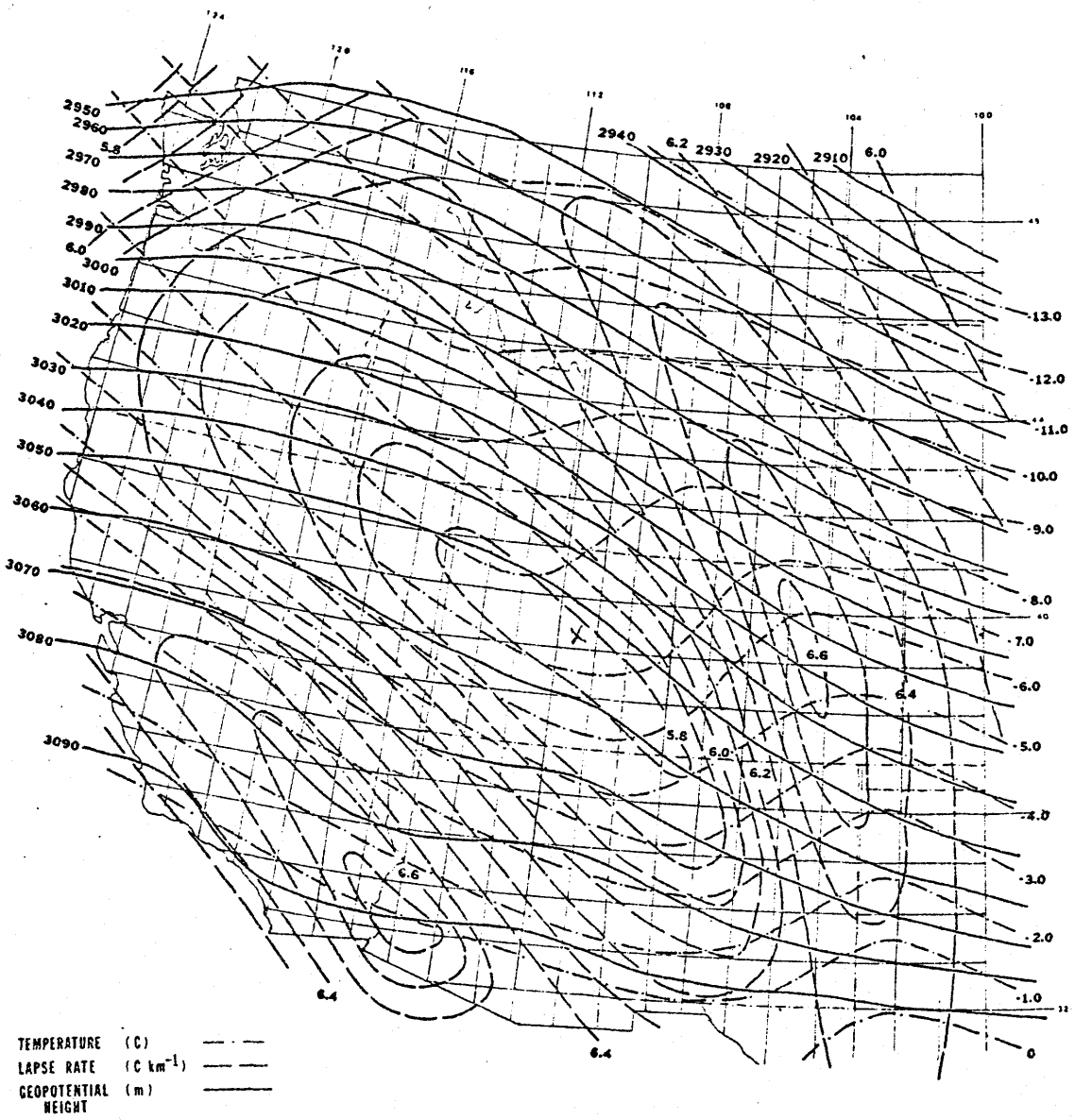

Figure XI-13 Normal (1946-75) January 700 mb temperatures, 700 mb geopotential heights, and 700-500 mb lapse rates.

11.3 Cont.

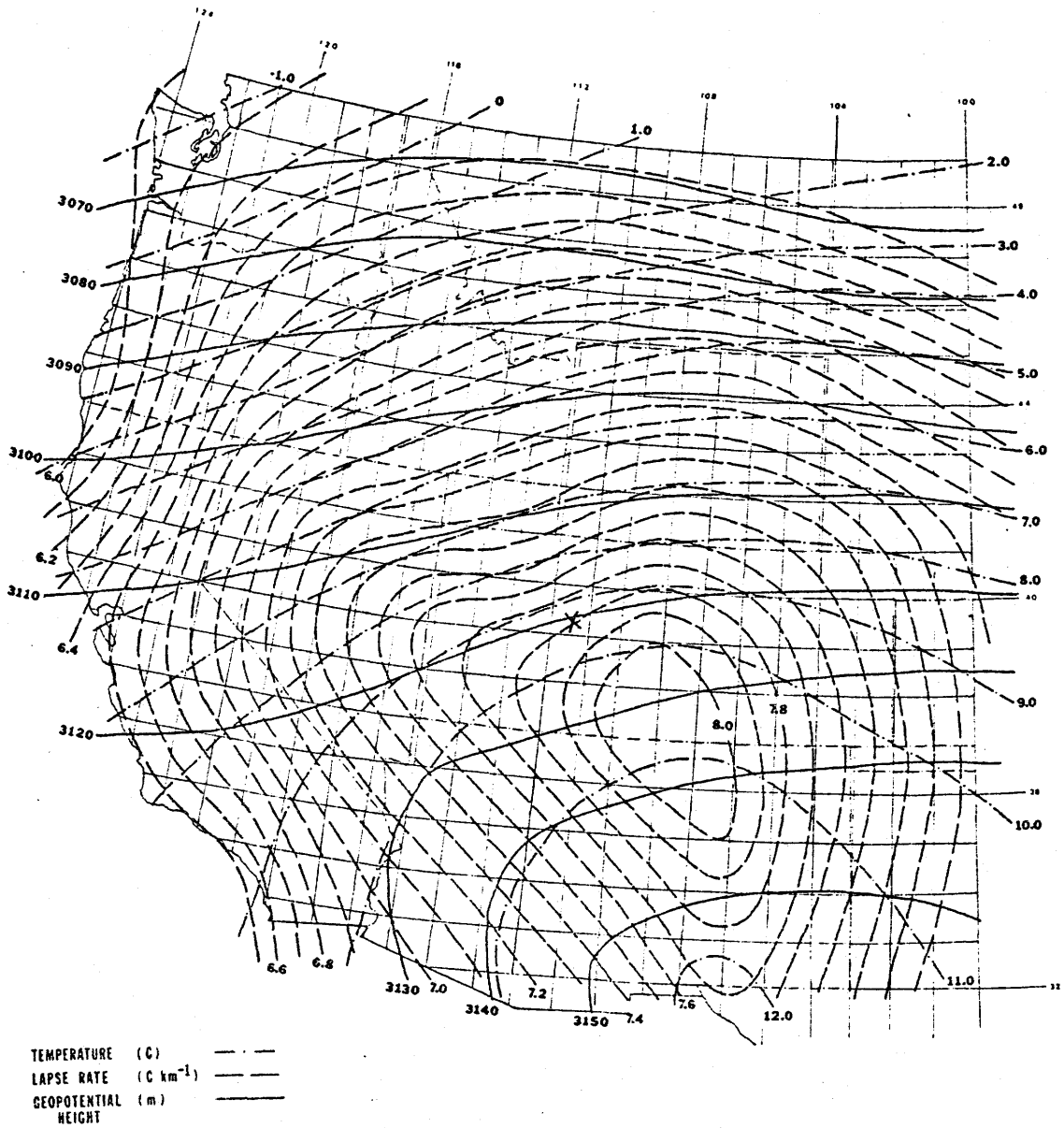

Figure XI-14 Normal (1946-75) June 700 mb temperatures, 700 mb geopotential heights, and 700-500 mb lapse rates.

11.3 Cont.

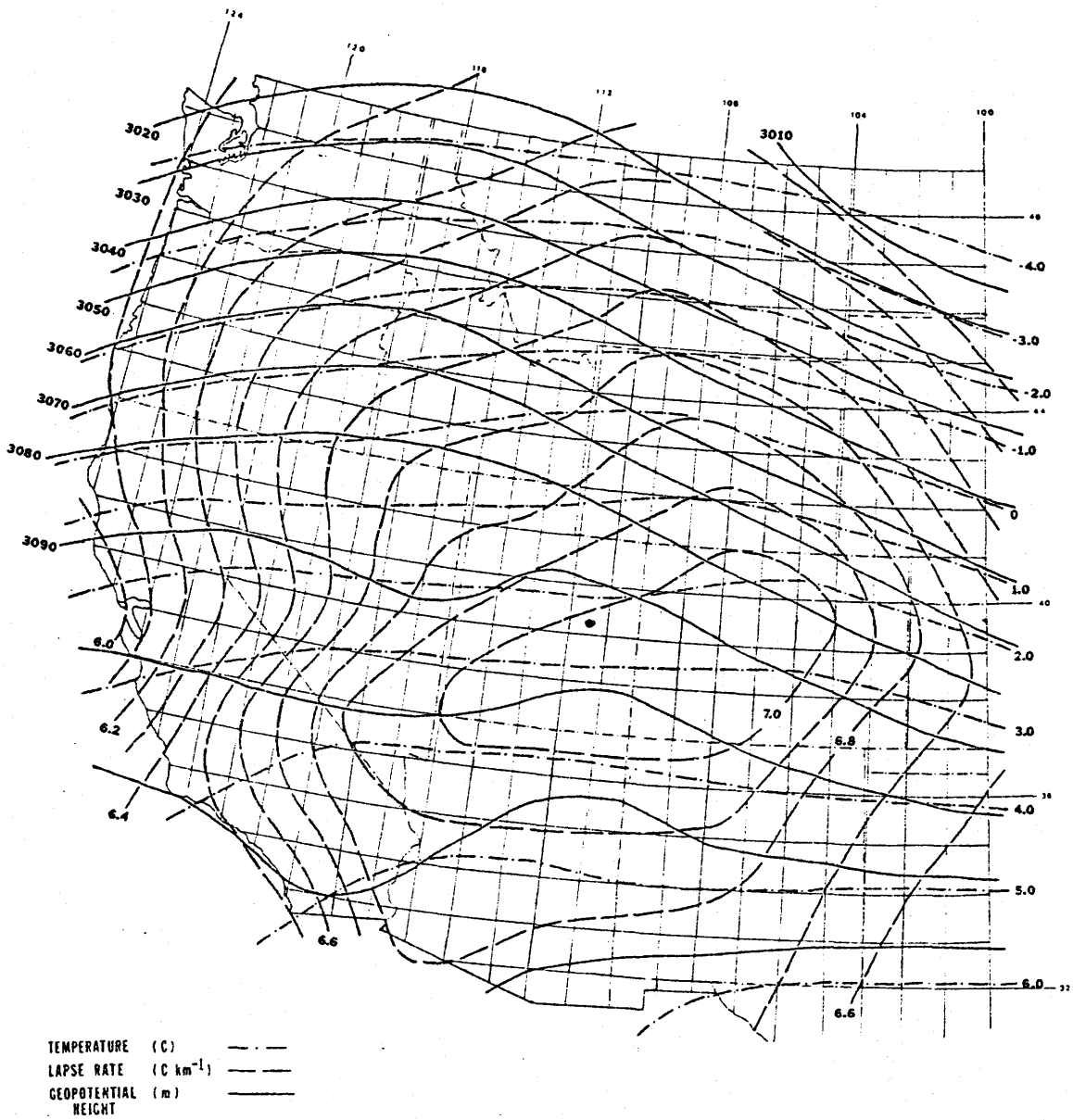

Figure XI-15 Normal (1946-75) annual 700 mb temperatures, 700 mb geopotential heights, and 700-500 mb lapse rates.

11.4 Effects of Mining Operation on Air Quality

11.4.1 Estimate of Uncontrolled Emissions

Estimates of emissions were made for three different phases of the project. Phase I emissions were considered to be primarily particles resulting from the transfer and storage of coal in a temporary pile. This phase covers a time period including the last three months of the first year of the project and the first five months of the second year. A total of approximately 37,000 tons of coal would be handled during this period.

The second phase would be in effect from the seventh month of the third year through the fifth month of the sixth year. Emissions from two different years were considered because the sources of the emissions will differ. During the first year of Phase II, mined coal will be conveyed to a surge pile, processed through the breaker, and then hauled by truck to an offsite rail loading facility. This haul road will be gravelled, resulting in significant amounts of fugitive particulate matter. During the last year, the haul road will be paved. The amount of coal handled during that year will be approximately 787,000 tons, as compared to 108,000 tons during the first year of this phase.

Phase III emissions will be essentially the same as Phase II except that the coal will be conveyed from the breaker to an onsite rail loop where it will be loaded on a unit train. This phase will last from the fifth month of year six to the end of the eighth year. During the peak production year of this phase, 2,144,000 tons of coal will be produced.

Emissions were calculated using a number of factors from several different sources. The calculations are explained in detail in the Notice of Intent sub-

11.4 Cont.

mitted to the Utah Bureau of Air Quality and appended to this permit application (Appendix 11.7.1). Estimates of emissions from each source and/or operation for the three phases (and including the two years in Phase II) are summarized in Tables XI-8 through XI-11. The highest uncontrolled emissions were estimated to be 1530.6 tons/year of particulates during Phase III.

11.4.2 Description of Control Measures

The control measures to be used at this facility conform to Best Available Technology (BACT) specifications. As can be seen in Table XI-11, the major uncontrolled sources of particulate matter will be from conveying, train loading, pile loading, and traffic to maintain the piles. Conveying emissions will be controlled by using covered conveyors. The train loading will be accomplished in an underground tunnel using a gravity feed mechanism which is estimated to reduce fugitive dust by 90%. Pile loading emissions will be controlled primarily by using stacking silos or telescoping chutes. These techniques replace pile traffic involved in loading or unloading activities, effectively reducing traffic emissions by 80%. A complete description of the control measures proposed for all sources and all phases is given in Table XI-12.

11.4.3 Estimate of Controlled Emissions

Estimated controlled emissions for each phase are summarized in Tables XI-13 through XI-16. Uncontrolled emissions are repeated for comparison.

Table XI-13 indicates that no Phase I emissions will be greater than 250 tons/year, and only NO_x emissions will exceed 100 tons/year. The important pollut-

11.4 Cont.

Table XI-8 Summary of Phase I Uncontrolled Emissions

Source	Uncontrolled Emissions (T/yr)
Generator	8.6 (P)
	26.1 (CO)
	9.7 (HC)
	8.0 (SO_x)
	121.0 (NO_x)[a]
Conveying	3.8 (P)
Pile Loading	0.4 (P)
Pile Erosion	1.1 (P)
Maintenance Traffic	1.3 (P)
Vehicle Emissions	neg
TOTAL	15.2 (P)
	26.1 (CO)
	9.7 (HC)
	8.0 (SO_X)
	121.0 (NO_X)[a]

P = PARTICLES
CO= CARBON MONOXIDE
HC= HYDROCARBONS
SO_X= SULFUR OXIDES
NO_X= NITROGEN OXIDES

a = NO_2 emissions estimated at 18.2 T/yr

11.4 Cont.

Table XI-9 Summary of Phase II Uncontrolled Emissions (First Year)

Source	Uncontrolled Emissions (T/yr)
Conveying	36.2 (P)
Breaker	1.1 (P)
Pile Loading	1.1 (P)
Pile Erosion	3.2 (P)
Maintenance Traffic	4.0 (P)
Pile Loadout	1.9 (P)
Truck Loading	23.8 (P)
Truck Unloading	2.2 (P)
Light Vehicles Fug. Dust[a]	211.8 (P)
Haul Vehicles Fug. Dust[a]	220.2 (P)
Haul Vehicles Emissions[a]	0.04 (P) 0.08 (SO_x) 0.4 (CO) 0.04 (HC) 0.2 (NO_x)
Light Vehicle Emissions[a]	.003 (P) .001 (SO_x) .13 (CO) .009 (HC) .004 (NO_x)
TOTAL	503.3 (P) 0.5 (CO) 0.05 (HC) 0.08 (SO_x) 0.2 (NO_x)

a = Ten mile trip on gravel road for first 8 months at 35 mph, and on paved road thereafter (55 mph).

P = PARTICLES
CO= CARBON MONOXIDE
HC= HYDROCARBONS
SO_X= SULFUR OXIDES
NO_X= NITROGEN OXIDES

11.4 Cont.

Table XI-10 Summary of Phase II Uncontrolled Emissions (Maximum Production Year)

Source	Uncontrolled Emissions (T/yr)
Conveying	236.4 (P)
Breaker	7.9 (P)
Pile Loading	7.9 (P)
Pile Erosion	26.3 (P)
Maintenance Traffic	28.2 (P)
Pile Loadout	10.4 (P)
Truck Loading	173.2 (P)
Truck Unloading	15.7 (P)
Light Vehicles Fug. Dust[a]	1.1 (P)
Haul Vehicles Fug. Dust[a]	4.2 (P)
Haul Vehicles Emissions[a]	0.3 (P)
	0.6 (SO_x)
	2.2 (CO)
	0.2 (HC)
	2.0 (NO_x)
Light Vehicle Emissions[a]	0.09 (P)
	0.001 (SO_x)
	0.1 (CO)
	0.01 (HC)
	0.004 (NO_x)
TOTAL	511.7 (P)
	2.3 (CO)
	0.2 (HC)
	0.6 (SO_x)
	2.0 (NO_x)

a = Ten mile trip over paved road (55 mph).

P = PARTICLES
CO= CARBON MONOXIDE
HC= HYDROCARBONS
SO_X= SULFUR OXIDES
NO_X= NITROGEN OXIDES

11.4 Cont.

Table XI-11 Summary of Phase III Uncontrolled Emissions.

Source	Uncontrolled Emissions (T/yr)
Conveying	643.2 (P)
Breaker	21.4 (P)
Loading Pile	42.8 (P)
Pile Erosion	132.1 (P)
Maintenance Traffic	146.4 (P)
Pile Unloading	26.8 (P)
Truck Loading/Unloading	85.8 (P)
Loading Trains	428.9 (P)
Paved Roads	
Fug. Dust	3.0 (P)
Light Vehicle Emissions	0.2 (P)
	0.09 (SO_x)
	9.1 (CO)
	0.6 (HC)
	0.3 (NO_x)
TOTAL	1530.6 (P)
	0.09 (CO)
	9.1 (HC)
	0.6 (SO_x)
	0.3 (NO_x)

P = Particles
CO = Carbon monoxide
HC = Hydrocarbons
SO_x = Sulfur oxides
NO_x = Nitrogen oxides

Table XI-12 Summary of Control Measures

Emission Point	Control Method (Efficiency in %)	References
Wind erosion (refuse pile)	Compacted and revegetated (60%)	PEDCo 1977 and NAWC estimates, PEDCo (1974)
Loading (storage piles)	Stacking silos and telescoping chutes (75%)	PEDCo (1977)
Loading (refuse pile)	Gravity feed (80%) damp material (5%)	PEDCo (1977)
Unloading (storage piles)	Gravity feed (80%)	PEDCo (1977)
Vehicular traffic (piles)	Use of vehicles for maintenance only (80%)	NAWC estimates
Unpaved gravel road	Chemical stabilizer (50%)	PEDCo (1977), PEDCo (1974)
Conveying	Fully covered conveyors (100%)	PEDCo
Breaker	Baghouse (99%)	Manufacturer's estimate
Loading trucks	Enclosed bin, gravity feed (90%)	PEDCc (1977), NAWC estimate
Loading trains	Gravity feed tunnel (90%)	PEDCo (1977), NAWC estimate
Generator	None	
Paved Road	None	
Vehicular emissions	None	
Wind erosion (storage piles)	None	

11.4 Cont.

Table IX-13 Summary of Phase I Emissions - Controlled and Uncontrolled

Source	Uncontrolled Emissions (T/yr)	Controlled Emissions (T/yr)
Generator	8.6 (P)	8.6 (P)
	26.1 (CO)	26.1 (CO)
	9.7 (HC)	9.7 (HC)
	8.0 (SO_x)	8.0 (SO_x)
	121.0 (NO_x)[a]	121.0 (NO_x)[a]
Conveying	3.8 (P)	0 (P)
Pile Loading	0.4 (P)	0.1 (P)
Pile Erosion	1.1 (P)	0.6 (P)
Maintenance Traffic	1.3 (P)	0.1 (P)
Vehicle Emissions	neg	neg
TOTAL	15.2 (P)	9.4 (P)
	26.1 (CO)	26.1 (CO)
	9.7 (HC)	9.7 (HC)
	8.0 (SO_X)	8.0 (SO_X)
	121.0 (NO_X)[a]	121.0 (NO_X)[a]

P = PARTICLES
CO= CARBON MONOXIDE
HC= HYDROCARBONS
SO_X= SULFUR OXIDES
NO_X= NITROGEN OXIDES

a = NO_2 emissions estimated at 18.2 T/yr

11.4 Cont.

Table XI-14 Summary of Phase II Emissions (First Year) Controlled and Uncontrolled

Source	Uncontrolled Emissions (T/yr)	Controlled Emissions (T/yr)
Conveying	36.2 (P)	0 (P)
Breaker	1.1 (P)	.01 (P)
Pile Loading	1.1 (P)	0.3 (P)
Pile Erosion	3.2 (P)	3.2 (P)
Maintenance Traffic	4.0 (P)	0.9 (P)
Pile Loadout	1.9 (P)	0.9 (P)
Truck Loading	23.8 (P)	2.6 (P)
Truck Unloading	2.2 (P)	0.3 (P)
Light Vehicles Fug. Dust[a]	211.8 (P)	106.0 (P)
Haul Vehicles Fug. Dust[a]	220.2 (P)	110.2 (P)
Haul Vehicles Emissions[a]	0.04 (P)	0.04 (P)
	0.08 (SO_x)	0.08 (SO_x)
	0.4 (CO)	0.4 (CO)
	0.04 (HC)	0.04 (HC)
	0.2 (NO_x)	0.2 (NO_x)
Light Vehicle Emissions[a]	.003 (P)	.003 (P)
	.001 (SO_x)	.001 (SO_x)
	.13 (CO)	.13 (CO)
	.009 (HC)	.009 (HC)
	.004 (NO_x)	.004 (NO_x)
TOTAL	503.3 (P)	224.5 (P)
	0.5 (CO)	0.5 (CO)
	0.05 (HC)	0.05 (HC)
	0.08 (SO_x)	0.8 (SO_x)
	0.2 (NO_x)	0.2 (NO_x)

a = Ten mile trip on gravel road for first 8 months at 35 mph, and on paved road thereafter (55 mph).

P = PARTICLES
CO= CARBON MONOXIDE
HC= HYDROCARBONS
SO_X= SULFUR OXIDES
NO_X= NITROGEN OXIDES

11.4 Cont.

Table XI-15 Summary of Phase II Emissions (Maximum Production Year) Controlled and Uncontrolled

Source	Uncontrolled Emissions (T/yr)	Controlled Emissions (T/yr)
Conveying	236.4 (P)	0 (P)
Breaker	7.9 (P)	0.08 (P)
Pile Loading	7.9 (P)	2.0 (P)
Pile Erosion	26.3 (P)	26.7 (P)
Maintenance Traffic	28.2 (P)	6.1 (P)
Pile Loadout	10.4 (P)	2.6 (P)
Truck Loading	173.2 (P)	18.2 (P)
Truck Unloading	15.7 (P)	2.4 (P)
Light Vehicles Fug. Dust[a]	1.1 (P)	1.1 (P)
Haul Vehicles Fug. Dust[a]	4.2 (P)	4.2 (P)
Haul Vehicles Emissions[a]	0.3 (P)	0.3 (P)
	0.6 (SO_x)	0.6 (SO_x)
	2.2 (CO)	2.2 (CO)
	0.2 (HC)	0.2 (HC)
	2.0 (NO_x)	2.0 (NO_x)
Light Vehicle Emissions[a]	0.09 (P)	0.09 (P)
	0.001 (SO_x)	0.001 (SO_x)
	0.1 (CO)	0.1 (CO)
	0.01 (HC)	0.01 (HC)
	0.004 (NO_x)	0.004 (NO_x)
TOTAL	511.7 (P)	63.8 (P)
	2.3 (CO)	2.3 (CO)
	0.2 (HC)	0.2 (HC)
	0.6 (SO_x)	0.6 (SO_x)
	2.0 (NO_x)	2.0 (NO_x)

a = Ten mile trip over paved road (55 mph).

P = PARTICLES
CO= CARBON MONOXIDE
HC= HYDROCARBONS
SO_X= SULFUR OXIDES
NO_X= NITROGEN OXIDES

11.4 Cont.

Table XI-16 Summary of Phase III Emissions Controlled and Uncontrolled

Source	Uncontrolled Emissions (T/yr)	Controlled Emissions (T/yr)
Conveying	643.2 (P)	0 (P)
Breaker	21.4 (P)	0.2 (P)
Loading Pile	42.8 (P)	10.8 (P)
Pile Erosion	132.1 (P)	122.2 (P)
Maintenance Traffic	146.4 (P)	29.2 (P)
Pile Unloading	26.8 (P)	5.4 (P)
Truck Loading/Unloading	85.8 (P)	12.9 (P)
Loading Trains	428.9 (P)	42.9 (P)
Paved Roads		
Fug. Dust	3.0 (P)	3.0 (P)
Light Vehicle Emissions	0.2 (P)	0.2(P)
	0.09(SO_x)	0.09(SO_x)
	9.1 (CO)	9.1 (CO)
	0.6 (HC)	0.6 (HC)
	0.3 (NO_x)	0.3 (NO_x)
TOTAL	1530.6 (P)	226.8 (P)
	0.09 (CO)	0.09 (CO)
	9.1 (HC)	9.1 (HC)
	0.6 (SO_x)	0.6 (SO_x)
	0.3 (NO_x)	0.3 (NO_x)

P = Particles
CO = Carbon monoxide
HC = Hydrocarbons
SO_x = Sulfur oxides
NO_x = Nitrogen oxides

11.4 Cont.

ant, however, would be the NO_2 portion of the total NO_x, which is estimated at 18.2 tons/year.

Phase II particulate emissions (Table XI-14) will exceed 100 tons/year for the first year when the gravel road is used, but not in the peak production year (Table XI-15). The first year emissions will be below the 250 tons/year PSD limitation.

The highest expected particulate emissions are expected to occur in Phase III when coal production reaches a maximum (Table XI-16). Consequently, this was the limiting case modeled for evaluation of potential impacts, as described in Section 3.4.7.

11.4.4 Estimated Cost of Emission Control

Most of the equipment to be used has built-in air pollution controls. Additional costs will be approximately $20,000 for a baghouse on the rotary breaker or other means of controlling the rotary breaker dust as approved by the Bureau of Air Quality.

11.5 Climatological and Air Quality Monitoring

Because no projected emissions will exceed the 250 tons/year limit, above which PSD monitoring is required, no air quality monitoring will be performed. Climatological monitoring is being conducted and consists of precipitation measurements, using a weighing bucket recording precipitation gage, and temperature and relative humidity measurements, using a hygrothermograph. The data is being collected at a site near the proposed breaker refuse pile.

11.6 Bibliography

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11.7 Appendix

11.7.1 Notice of Intent Submitted to the Utah Bureau of Air Quality

11.7.1

NOTICE OF INTENT
KAISER STEEL CORPORATION
SOUTH LEASE MINE
EMERY COUNTY, UTAH
NAWC REPORT SLAQ 81-15

PREPARED BY

DANIEL J. MCNAUGHTON AND VICTORIA C. SUTHERLAND

NORTH AMERICAN WEATHER CONSULTANTS

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DOUGLAS C. PEARCE

KAISER STEEL CORPORATION

DECEMBER 1981

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APPENDICES

Appendix A Emissions Calculations

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1. INTRODUCTION

Kaiser Steel Corporation and its contractor, North American Weather Consultants, have prepared this Notice of Intent for a proposed underground coal mine to be located near Sunnyside, Utah. The notice conforms with specifications provided by the Utah Bureau of Air Quality, and includes a complete project description (Section 2), a summary of the calculated uncontrolled and controlled emissions (Section 3), and an air quality model analysis of project impacts (Section 4). The simulation of impacts is necessary because the proposed facility will be considered a major source with potential emissions in excess of 100 T/yr for particulates. Emissions are not, however, expected to exceed 250 T/yr and therefore the project will not be subject to PSD requirements as an EPA defined major stationary source.

2. PROJECT DESCRIPTION

The life of the mine has been divided into three phases. The first phase involves preliminary access and initial mining in the coal seam. Phase two is active coal mining and truck haulage off the mine site. Phase three is active mining at two million tons a year and haulage by conveyor to a unit train loadout. Coal production for each year of the eight year buildup period is given in a table accompanying this report.

In Phase one, the coal seam is approached from the base of the Book Cliffs by two 5000 ft long rock tunnels and from the top of the cliffs by a 600 ft long rock tunnel. Approaching the coal seam from the cliff top will provide bulk coal samples, prove mining conditions, and establish the mine ventilation. Coal from the mine will be stacked in a temporary pile on the cliff top. After the rock tunnels from the cliff base have intersected the established mine works, coal in the temporary stock pile will be transferred back into the mine and then down the rock tunnels to the base of the cliff.

In Phase two, the mining of coal will proceed. Coal from the mine will be moved by conveyor down the rock tunnels to the cliff base. At the cliff base the coal will be stored in a run of mine surge pile. Coal from the surge pile will be moved by conveyor to a rotary breaker station where waste rock will be removed and the coal size reduced. Coal from the breaker will be transferred by covered conveyor to truck loading bins and then off the mine site by trucks. Waste from the breaker will be taken by truck to a disposal site.

In Phase three, the trucking of coal will be eliminated and replaced by a covered conveyor going to a unit train loadout.

3. EFFLUENT CHARACTERISTICS AND EMISSIONS ESTIMATES

This section is divided into four parts. The first is a description of the effluents expected. The second is a discussion of the emission factors used in the calculations, followed by a description of the control techniques and their efficiencies. The emissions estimates are summarized in the last section. Additionally, Appendix A contains more detailed information on the calculations for each step in the project.

From an air quality point of view, growth in mining production is marked by three main milestones which serve to divide the project into three phases for estimating potential emissions. The maximum coal production schedules and time frames for each phase are given in Table 3-1. Phase I represents the exploratory mining operations, during which mined coal will be stored in a temporary pile near the mine mouth until it can be moved during Phase II for offsite hauling. During Phase II, coal will be processed through a rotary breaker and then hauled by truck to an offsite rail loading facility. Phase III differs from Phase II in that the coal will go from the breaker to a storage pile at an onsite rail siding. It will then be loaded on trains for final transport. The emission points and control measures to be used are graphically depicted in Figures 3-1 through 3-3.

3.1 Effluent Characteristics

Phase 1 emissions will consist primarily of particles from coal transfer and storage. In addition, a large generator will provide power to the mine until the middle of the third year of production. This will produce particulate, CO, HC, NO_x, and SO_2 emissions. Emissions from workers' vehicles

Table 3-1. Summary of production levels for the three phases of Sunnyside Coal Mine.

	Time Frame	Max. Coal Output (T/yr)	Cumulative Coal Output (T)
Phase I	Month 10(A+1)* to month 5(A+2)	28,400	37,600
Phase II	Month 7(A+3) to month 5(A+6)	737,600	1,778,433
Phase III	Month 5(A+6) to month 12(A+8)	2,144,400	6,137,100

* Year from project start, A

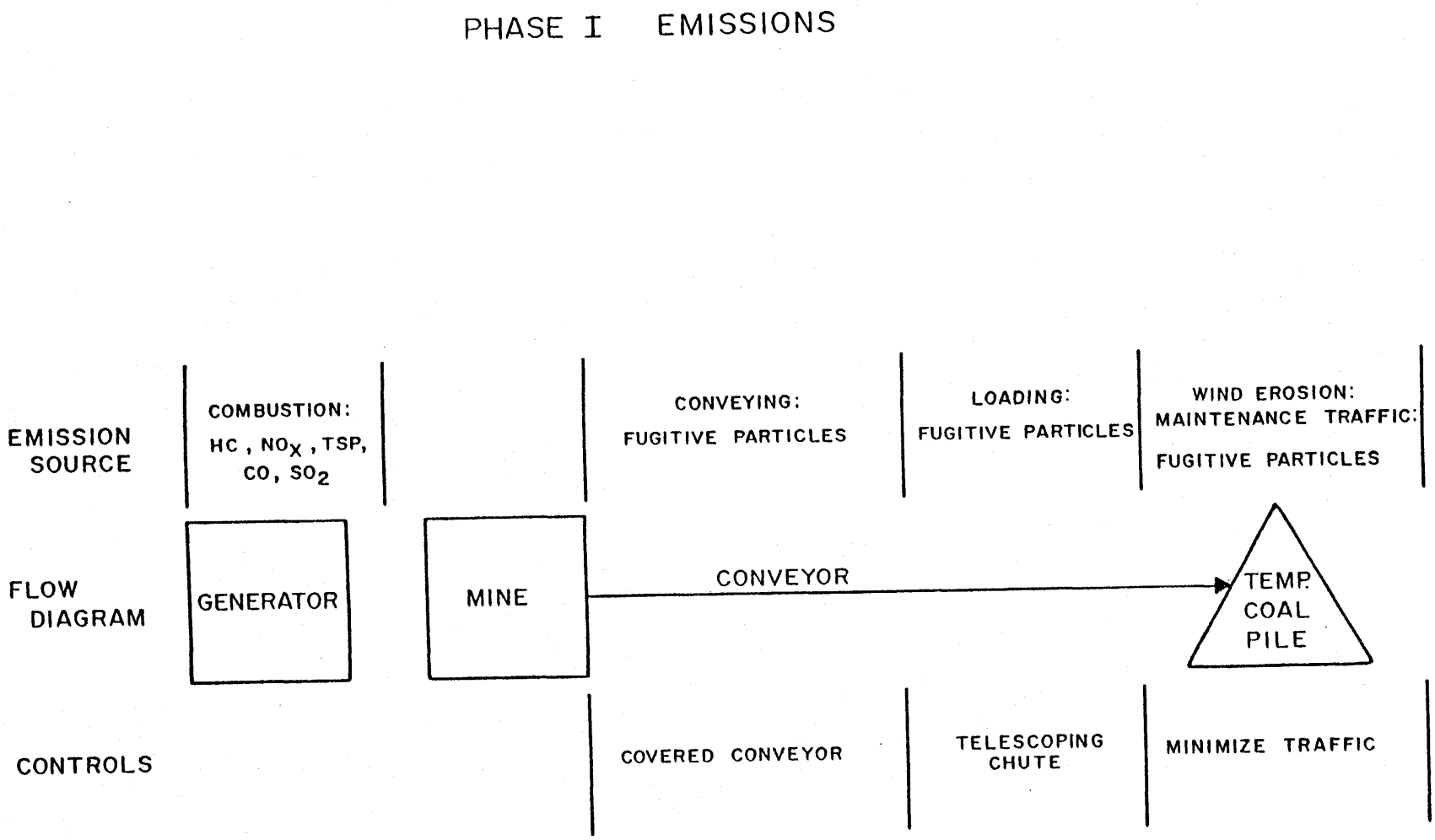

Fig. 3-1 Phase I Emissions

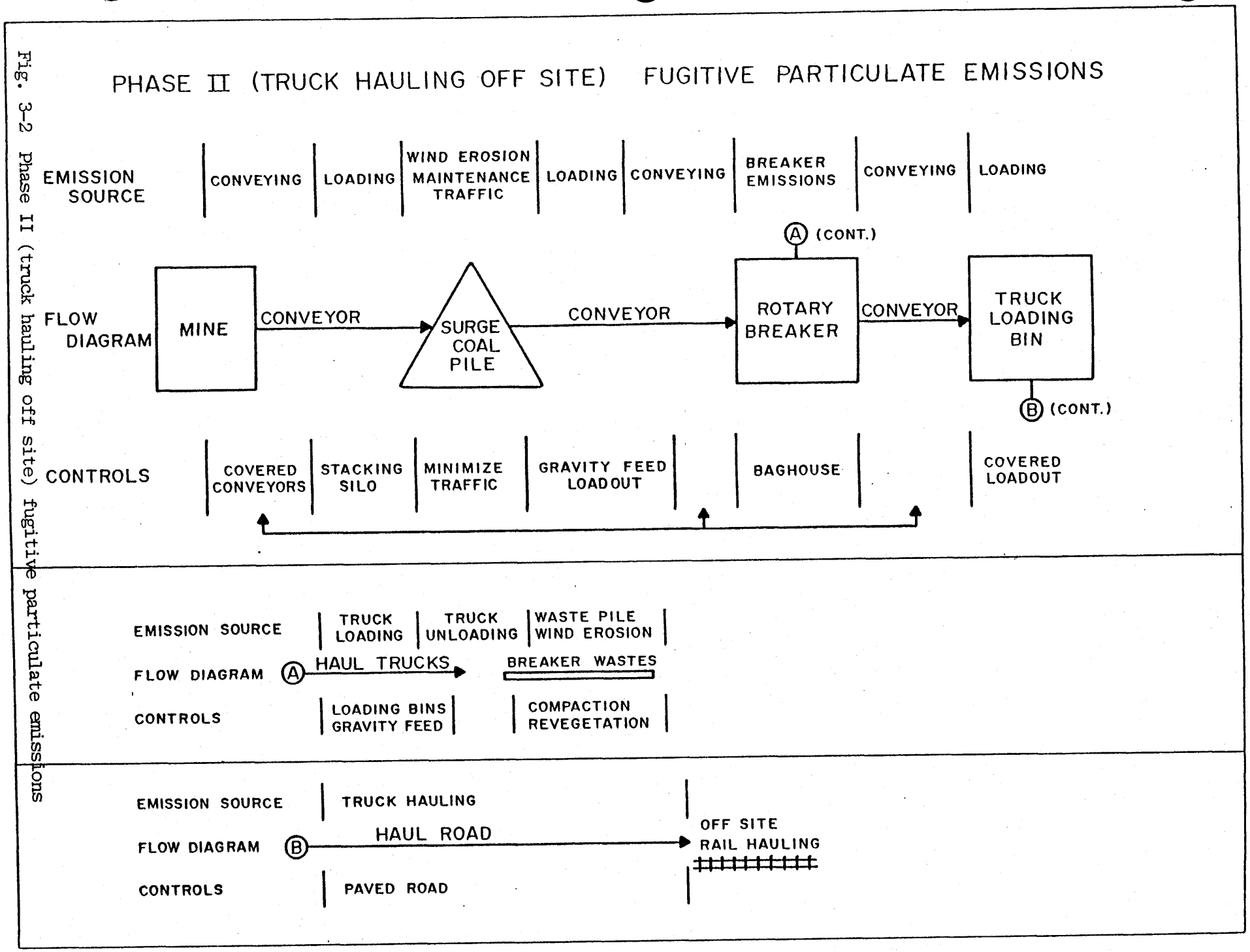

Fig. 3-2 Phase II (truck hauling off site) fugitive particulate emissions

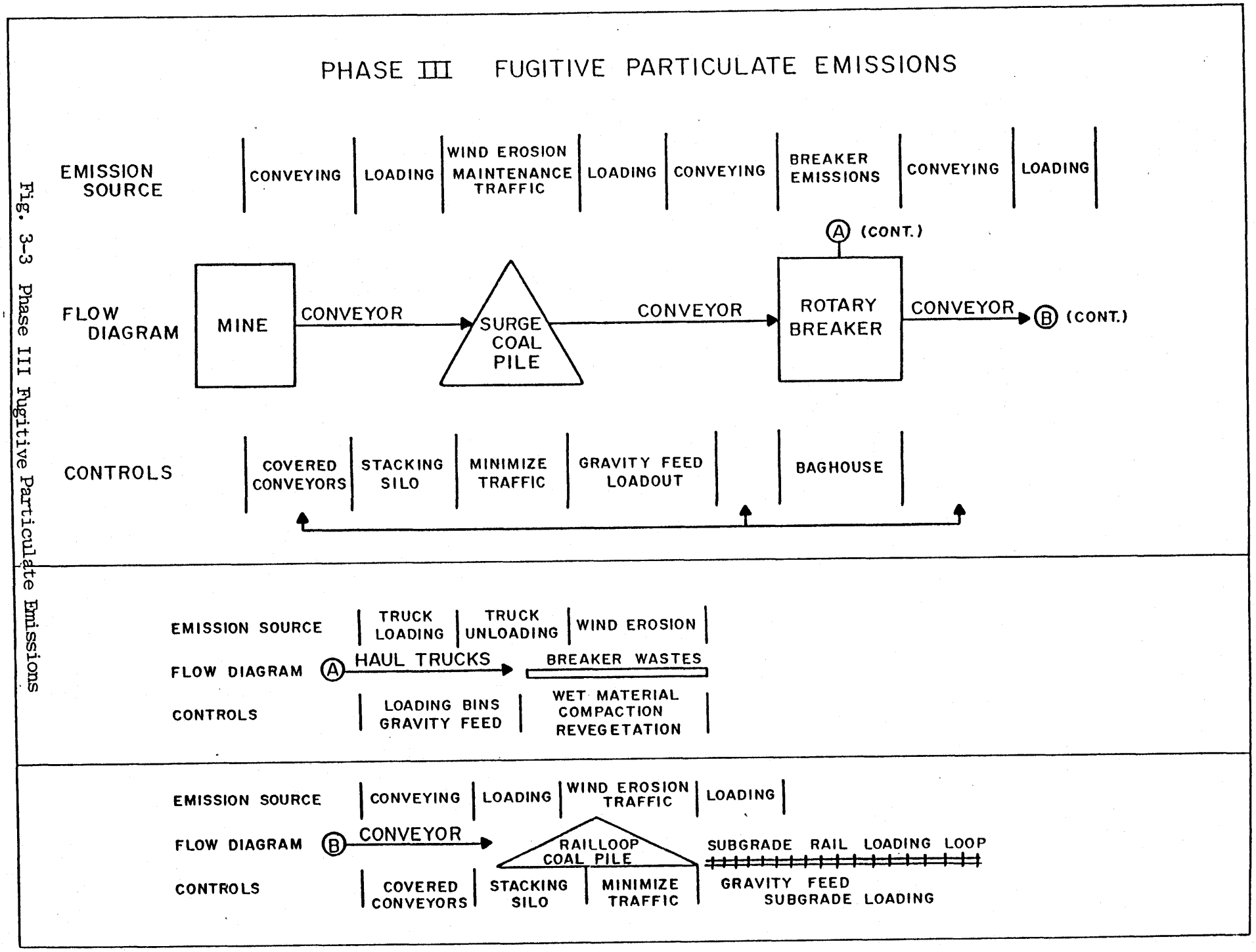

Fig. 3-3 Phase III Fugitive Particulate Emissions

are assumed to be negligible because the work force will total less than 25 workers who will be ferried to the site by helicopter.

Phase II emissions will consist of particles from the coal transfer, storage, and hauling functions. During the first eight months of this phase, the haul access road will be gravelled resulting in a significant amount of fugitive dust. Other emissions will include combustion-related CO, HC, NO_x, particles, and SO_x from the haul trucks and the workers' vehicles.

The emission characteristics of Phase III will be virtually the same as Phase II. Changes will be made in particular emission sources and controls as truck hauling is terminated, but the effluents will consist mostly of TSP with smaller contributions of CO, HC, NO_x and SO_x.

Questions remain in all phases as to the composition of particulate and NO_x emissions. Fugitive particulate emissions will be the largest pollutant source at the mine facility. Most of the mass of fugitive particles will be in large particle size ranges. Emissions estimates provided in the following sections assume that particles are less than 30 μm in diameter. Size distributions for particles from the various sources considered in the proposed project were not estimated due to the lack of adequate data. In a like manner, the breakdown of NO_x emissions estimates into NO_2 and NO is not practical, although initial emissions of NO_2 are expected to be 15% of the NO_x total. Emissions presented are for total oxides of nitrogen rather than NO_2, thereby providing an overly conservative emissions estimate.

3.2 Emission Factors Summary

Emission factors for more general activities can usually be found in the EPA's Compilation of Air Pollutant Emission Factors (commonly referred to as AP42). However, factors for those processes specific to underground coal mining are not readily obtainable, necessitating an extensive literature review. In some cases, several different factors for the same process were discovered, requiring a decision on which to use. In other cases modifications were necessary when an emission factor was not directly applicable. All emission factors used, and their sources, are summarized in Table 3-2. A discussion of how they were applied to each phase follows.

3.2.1 Phase I Emissions

Generator Emissions: The emission factors obtained from the tables in AP42 were derived from data collected from generators smaller than the 1000-kva one planned for this project. To scale the emissions for the larger generator, the emissions given in units of g/KWhr for diesel generators were used. Emissions of SO_2, CO, HC, and particulate matter were calculated directly. The NO_2 portion of the calculated NO_x emissions is assumed to be 15%.

Emissions were calculated on the basis of operation at full capacity for 8 hours per day and half capacity for 16 hours per day.

Wind Erosion Estimates From Coal Piles: A particulate emission factor of .054 pounds per ton was recommended for use by the Utah Bureau of Air Quality as cited in an EPA reference

Table 3-2 Summary of emissions sources and emission factors

Emission Point	Emission Factor	Reference
Wind erosion (storage and waste piles)	.054 lb./T	PEDCo (1974
Loading (storage piles)	.02 lb./T	AP42 (Sec. 11.2.3-1), 12% of emissions
Unloading	.025 lb./T	AP42 (Sec. 11.2.3-1), 15% of emissions
Vehicular traffic (around piles)	.065 lb./T	AP42 (Sec. 11.2.3-1), 40% of emissions
Unpaved gravel road	$.6\ (.81)s\ \frac{S}{30}\ (\frac{365-w}{365})$	AP42 (sec. 11.2.1-1), EPA (1977), EPA Region VIII(1979
Paved road	.012 lb./T	AP42 (Sec. 11.2.5-1)
Conveying	.2 lb./T	EPA Region VIII (1979), PEDCo (1980)
Generator	1.34 g/kwhr (particulates)[a]	AP42 (Sec. 3.3.3-1)
Vehicular emissions (heavy duty)	1.3 g/VMT (particulates)[a]	EPA (1978)
Vehicular emissions (light duty)	.34 g/VMT (particulates)[a]	EPA (1978)
Loading, unloading trucks/trains	.4 lb./T	PEDCo (1978)
Breaker	.02 lb./T	EPA Region VIII (1979)

a) Factors used for other emissions also came from reference cited

(Pedco, 1974). No other factor was seen as being more appropriate. The entire throughput of 37,600 T was used for the calculations,rather than an annual coal production amount, in order to show the maximum emissions while the pile is in storage.

Coal Pile Loading Emissions: The contribution of this activity to total fugitive dust emissions associated with storing material in piles is estimated at 12% of the total emissions (AP42). Calculating the emission factor requires an estimate of total coal pile emissions from wind erosion, loading, unloading and traffic on the coal pile. To compute this emission factor, an estimate of the fraction of total emissions attributed to wind erosion can be used. Typically 33% of total coal pile fugitive emissions result from wind erosion (AP42). To find the total emissions factor for all activities, the wind erosion emission factor was divided by 0.33 and X, the pile loading factor, was obtained from:

$$\frac{.054(\text{lb/T})}{33\%} = \frac{X\ (\text{lb/T})}{12\%}$$

Emissions from Traffic at the Coal Pile: This emission factor was calculated in the same manner as the pile loading factor. Emissions from this activity account for 40% of the total fugitive particles associated with storage piles.

Vehicular Emissions: Since the work force is projected to be so small, emissions were neglected.

Coal Pile Unloading: The coal pile will be used only for storage during Phase I and no emissions will result from unloading.

3.2.2 Phase II Emissions. Most of the factors discussed under Phase I were also used to calculate Phase II emissions. Other calculations are discussed below.

Haul Road Fugitive Dust Emissions: During the first eight months of Phase II, the haul trucks and workers' vehicles will travel over a five-mile long, gravelled access road. After that time, the road will be paved. Because of the large dust emissions expected prior to paving, emissions were calculated for both the first year and the last year when production will be at a peak for this phase. The vehicle miles travelled were calculated for all vehicles during the two years, and the emission factors given in AP42 were used for the estimates.

Emissions from Unloading Piles: This emission factor was calculated in the same manner as the one for loading piles, which was discussed in the previous subsection. These emissions estimates assume that 15% of storage piles emissions result from unloading (AP42), and the resultant factor was calculated to be .025 lb/T.

Breaker Waste Dumping Emissions: No discussions of emissions from waste dumping areas were suitable for use. It is unlikely that emissions will be large because the material will consist of large waste pieces (2 to 6 inches). Emissions will result from loading the waste into trucks, unloading, spreading and compacting and wind erosion. Although the waste will be placed in a 600,000 $ft.^2$ area, rather than a pile, the same factor used for storage piles was employed for the wind erosion estimate. An estimated 10% of the mined material will be waste, and the wind erosion calculation was performed for the cumulative waste material at the end of Phase II.

Similarly, the cumulative waste material at the end of Phase III was used as input for calculations for that phase.

Conveying: The references which provided the estimate for the conveying emission factor include transfer emissions by uncovered conveyors (EPA Region VIII, 1979; PEDCo, 1980). However, none of the references defined exactly what was meant by transfer (i.e., are loading and unloading emissions included?). For the purposes of this work, a distinction was made between the fugitive dust produced by conveying and the dust from loading or unloading the conveyors. Those latter emission factors were calculated from the percentage contributions, as already discussed.

Vehicle Emissions: The emissions of pollutants from operation of haul trucks and light duty workers' vehicles were estimated from the EPA Moble Source Emission Factors Guideline (EPA, 1978). Haul truck emissions were calculated assuming that they will be new in 1984. Emission factors selected were for diesel trucks operative at high altitudes. Speed corrections to the published emissions factors were also applied to reflect haul road speeds of 35 mph on gravel roads and 55 mph on paved roads.

Emissions from workers' light duty vehicles were difficult to estimate since the age mix of vehicles is difficult to project. To provide conservative estimates of emissions, all vehicles were assumed to be 1980 models with deterioration over 30,000 miles. High altitude emission factors for gasoline powered light duty vehicles were used with no corrections for air conditioning, starts, temperature, humidity, or load.

Coal Throughput Values: The coal tonnages used for calculations were taken from the estimate of the level of production during the first year of Phase II when the gravel road will be a main source (108,100 T) and for the maximum year (787,600 T).

3.2.3 Phase III Emissions. Preceding discussions also apply to the calculations made for Phase III, with the following additions.

Emissions from Train Loadout: The main difference between Phase II and Phase III, excluding increased production, is that the truck loadout facility will be eliminated and the coal will go directly from the breaker (by conveyor) to an onsite rail loop. The trains will be loaded in a tunnel constructed underneath the pile. It is more than a question of semantics as to whether this last activity should be considered train loading (emission factor = .4 lb/T) or pile unloading (.025 lb/T). While we feel the higher emission factor may be excessive, it was used for the calculations in order to be conservative.

Vehicular Emissions: Vehicular emissions calculations for Phase III were calculated using the techniques and assumptions discussed in Section 3.2.2.

Coal Throughput Values: Coal tonnage used for calculations is the amount produced during the peak production year (2,144,400 T).

3.3 Control Techniques and Efficiencies

A summary of the control methods proposed for each emission source is given in Table 3-3 with its references and the estimated efficiencies. The application of some of these efficiencies

Table 3-3 Summary of control measures

Emission Point	Control Method (Efficiency in %)	References
Wind erosion (refuse pile)	Compacted and revegetated (60%)	EPA 1977 and NAWC estimates, EPA (1974)
Loading (storage piles)	Stacking silos and telescoping chutes (75%)	EPA (1977)
Loading (refuse pile)	Gravity feed (80%), damp material (5%)	EPA (1977)
Unloading (storage piles)	Gravity feed (80%)	EPA (1977)
Vehicular traffic (piles)	Use of vehicles for maintenance only (80%)	NAWC estimate
Unpaved gravel road	Chemical stabilizer (50%)	EPA (1977), EPA (1974)
Conveying	Fully covered conveyors (100%)	EPA Region VIII (1979)
Breaker	Baghouse (99%)	Manufacturer's estimate
Loading trucks	Enclosed bin, gravity feed (90%)	EPA (1977), NAWC estimate
Loading trains	Gravity feed,tunnel (90%)	EPA (1977), NAWC estimate
Generator	None	
Paved Road	None	
Vehicular emissions	None	
Wind erosion (storage piles)	None	

was not always straightforward. The rest of this section is a discussion of how some of the efficiencies were modified to represent the particular circumstances of this project.

3.3.1 Conveying Emissions. Fully covered conveyors were reported in the document produced by Region VIII of the EPA (1979) as being 100% efficient. While this may seem optimistic, that value was used because the end points of the conveying systems used by Kaiser Steel will almost always be enclosed. For example the conveyor from the mine to the breaker surge pile will begin inside the mine and will terminate within the stacking silo. As mentioned before, loading and unloading emissions were considered separately from the conveying emissions to improve the accuracy of the calculations.

3.3.2 Vehicle Traffic during Pile Maintenance. The emission factor cited in Table 3-2 for this activity is assumed to include dust disturbed while trucks load and unload piles, as well as during pile maintenance operations. At the Kaiser Steel facility other means will be used for loading, such as conveyors, telescoping chutes, etc. Only one vehicle will be required for maintaining each pile. We estimate that the effective reduction in emissions would be about 80%.

3.3.3 Wind Erosion at Breaker Dump. Emissions will be reduced by compacting the material and revegetating inactive areas. It should also be noted that the material will be large and will be transported and spread while damp. Since there are no estimates of the efficiency of these activities, a 60% reduction in wind erosion emission was assumed.

3.3.4 Truck Loading at Bins. No source provided a control efficiency for enclosed loading bins. The Kaiser Steel system

used will employ a gravity feed mechanism for transferring the material, which has an efficiency of 80% (EPA, 1977). An additional 10% efficiency was added for the effect of the enclosure.

3.3.5 Haul Roads. While the emission factors for paved and unpaved roads are different, it should be noted that the paving to be done in the third month of year A+4 constitutes a control measure.

3.4 Summary of Emissions

Tables 3-4, 3-5a, 3-5b, and 3-6 are an overview of the calculated emissions for each phase, including those for both the first and last years of Phase II.

Table 3-4 indicates that no Phase I emissions will be greater than 250 T/yr, and only NO_x emissions exceed 100 T/yr. The important pollutant, however, would be the NO_2 portion of the total NO_x, which is estimated at 18.2 T/yr.

Phase II particulate emissions (Table 3-5a) will exceed the 100 T/yr limit for the first year when the gravel road is used, but not in the peak production year (Table 3-5b). The first year emissions will be below the 250 T/yr PSD limitation.

The highest expected particulate emissions are expected to occur in Phase III when coal production reaches a maximum (Table 3-6). Consequently, this was the limiting case modeled for this Notice of Intent.

Table 3-4. Summary of Phase I emissions.

Source	Uncontrolled Emissions (T/yr)	Controlled Emissions (T/yr)
Generator	8.6 (P)	8.6 (P)
	26.1 (CO)	26.1 (CO)
	9.7 (HC)	9.7 (HC)
	8.0 (SO_x)	8.0 (SO_x)
	121.0 (NO_x)[a]	121.0 (NO_x)[a]
Conveying	3.8 (P)	0 (P)
Pile Loading	0.4 (P)	0.1 (P)
Pile Erosion	1.1 (P)	0.6 (P)
Maintenance Traffic	1.3 (P)	0.1 (P)
Vehicle Emissions	neg	neg
TOTAL	15.2 (P)	9.4 (P)
	26.1 (CO)	26.1 (CO)
	9.7 (HC)	9.7 (HC)
	8.0 (SO_X)	8.0 (SO_X)
	121.0 (NO_X)[a]	121.0 (NO_X)[a]

P = PARTICLES
CO= CARBON MONOXIDE
HC= HYDROCARBONS
SO_X= SULFUR OXIDES
NO_X= NITROGEN OXIDES

a = NO_2 emissions estimated at 18.2 T/yr

Table 3-5a. Summary of Phase II emissions (1st year).

Source	Uncontrolled Emissions (T/yr)	Controlled Emissions (T/yr)
Conveying	36.2 (P)	0 (P)
Breaker	1.1 (P)	.01 (P)
Pile Loading	1.1 (P)	0.3 (P)
Pile Erosion	3.2 (P)	3.2 (P)
Maintenance Traffic	4.0 (P)	0.9 (P)
Pile Loadout	1.9 (P)	0.9 (P)
Truck Loading	23.8 (P)	2.6 (P)
Truck Unloading	2.2 (P)	0.3 (P)
Light Vehicles Fug. Dust[a]	211.8 (P)	106.0 (P)
Haul Vehicles Fug. Dust[a]	220.2 (P)	110.2 (P)
Haul Vehicles Emissions[a]	0.04 (P) 0.08 (SO_x) 0.4 (CO) 0.04 (HC) 0.2 (NO_x)	0.04 (P) 0.08 (SO_x) 0.4 (CO) 0.04 (HC) 0.2 (NO_x)
Light Vehicle Emissions[a]	.003 (P) .001 (SO_x) .13 (CO) .009 (HC) .004 (NO_x)	.003 (P) .001 (SO_x) .13 (CO) .009 (HC) .004 (NO_x)
TOTAL	503.3 (P) 0.5 (CO) 0.05 (HC) 0.08 (SO_x) 0.2 (NO_x)	224.5 (P) 0.5 (CO) 0.05 (HC) 0.8 (SO_x) 0.2 (NO_x)

a = Ten mile trip on gravel road for first 8 months at 35 mph, and on paved road thereafter (55 mph).

P = PARTICLES
CO= CARBON MONOXIDE
HC= HYDROCARBONS
SO_X= SULFUR OXIDES
NO_X= NITROGEN OXIDES

Table 3-5b. Summary of Phase II emissions (maximum production year).

Source	Uncontrolled Emissions (T/yr)	Controlled Emissions (T/yr)
Conveying	236.4 (P)	0 (P)
Breaker	7.9 (P)	0.08 (P)
Pile Loading	7.9 (P)	2.0 (P)
Pile Erosion	26.3 (P)	26.7 (P)
Maintenance Traffic	28.2 (P)	6.1 (P)
Pile Loadout	10.4 (P)	2.6 (P)
Truck Loading	173.2 (P)	18.2 (P)
Truck Unloading	15.7 (P)	2.4 (P)
Light Vehicles Fug. Dust[a]	1.1 (P)	1.1 (P)
Haul Vehicles Fug. Dust[a]	4.2 (P)	4.2 (P)
Haul Vehicles Emissions[a]	0.3 (P)	0.3 (P)
	0.6 (SO_x)	0.6 (SO_x)
	2.2 (CO)	2.2 (CO)
	0.2 (HC)	0.2 (HC)
	2.0 (NO_x)	2.0 (NO_x)
Light Vehicle Emissions[a]	0.09 (P)	0.09 (P)
	0.001 (SO_x)	0.001 (SO_x)
	0.1 (CO)	0.1 (CO)
	0.01 (HC)	0.01 (HC)
	0.004 (NO_x)	0.004 (NO_x)
TOTAL	511.7 (P)	63.8 (P)
	2.3 (CO)	2.3 (CO)
	0.2 (HC)	0.2 (HC)
	0.6 (SO_x)	0.6 (SO_x)
	2.0 (NO_x)	2.0 (NO_x)

a = Ten mile trip over paved road (55 mph).

P = PARTICLES
CO= CARBON MONOXIDE
HC= HYDROCARBONS
SO_x= SULFUR OXIDES
NO_x= NITROGEN OXIDES

Table 3-6. Summary of Phase III emissions.

Source	Uncontrolled Emissions (T/yr)	Controlled Emissions (T/yr)
Conveying	643.2 (P)	0 (P)
Breaker	21.4 (P)	0.2 (P)
Loading Pile	42.8 (P)	10.8 (P)
Pile Erosion	132.1 (P)	122.2 (P)
Maintenance Traffic	146.4 (P)	29.2 (P)
Pile Unloading	26.8 (P)	5.4 (P)
Truck Loading/Unloading	85.8 (P)	12.9 (P)
Loading Trains	428.9 (P)	42.9 (P)
Paved Roads		
Fug. Dust	3.0 (P)	3.0 (P)
Light Vehicle Emissions	0.2 (P)	0.2(P)
	0.09(SO_x)	0.09(SO_x)
	9.1 (CO)	9.1 (CO)
	0.6 (HC)	0.6 (HC)
	0.3 (NO_x)	0.3 (NO_x)
TOTAL	1530.6 (P)	226.8 (P)
	0.09 (CO)	0.09 (CO)
	9.1 (HC)	9.1 (HC)
	0.6 (SO_x)	0.6 (SO_x)
	0.3 (NO_x)	0.3 (NO_x)

P = Particles
CO = Carbon monoxide
HC = Hydrocarbons
SO_x = Sulfur oxides
NO_x = Nitrogen oxides

4. AIR CONCENTRATION ESTIMATES

Emissions estimates summarized in Section 3 indicate that the proposed Kaiser Mine may be considered a major source of particles and oxides of nitrogen with annual emissions of over 100 T/yr. Since it is highly unlikely the nitrogen dioxide component of the total NO_x emissions is in excess of 100 T/yr at the source or within a reasonable distance, NO_2 emissions are not simulated. Results provided in this section are for air concentrations of total suspended particles primarily from fugitive sources during the maximum production years of the proposed project.

Following subsections describe techniques and inputs used in the simulations as well as resultant impact estimates.

4.1 Techniques

PAL, a multisource Gaussian dispersion model, was used for all concentration estimates. Concentrations are calculated using a user-specified grid of receptors. Point sources are simulated with a standard Gaussian point source equation and Pasquill-Gifford dispersion parameters. Line source computations are calculated by numerical integration of the point source equations accounting for all wind orientations to the line source. Area source concentrations are calculated by integration along the wind vector of concentrations resulting from cross wind finite line sources. Edge effects due to integration of finite line sources is considered so that the area source model provides a better predictor than virtual point source type computations.

Recommended screening techniques for air quality assessments in complex terrain settings such as the Kaiser site (Fig. 4-1) include use of the EPA VALLEY model for air concentration estimates. The VALLEY model could not be used for this assessment due to the large spatial scale of the emission source configuration, the wide diversity of source types, and the large number of ground level or near ground level sources. To overcome these difficulties, an alternate screening model PAL (Point, Area, Line) was selected for use as from the EPA UNAMAP series (EPA, 1978).

Particulate emission sources for the Kaiser Mine are distributed over a region of approximately two by seven kilometers and are in the form of point, area, and line type sources. PAL explicitly handles each of these source types by techniques described below. PAL is essentially a flat terrain modeling technique, but for low level sources, it actually provides more conservative concentration estimates than the VALLEY model. To understand this, a brief review of critical VALLEY model assumptions is necessary. VALLEY calculates 24-hour average air pollutant concentrations by assuming that the worst case concentrations occur if a plume in a low wind speed, stable air flow impacts terrain for 6 of 24 hours. In the model which was developed primarily for elevated point sources, this is calculated by assuming that if the local terrain height is in excess of initial plume height, then the plume will impact the terrain. Impaction appears in the model as a calculation with a flat terrain, sector averaged Gaussian model and a plume height of 10 m. PAL calculations for this assessment were all made with source heights of less than 10 m, thus providing equivalent impaction estimates.

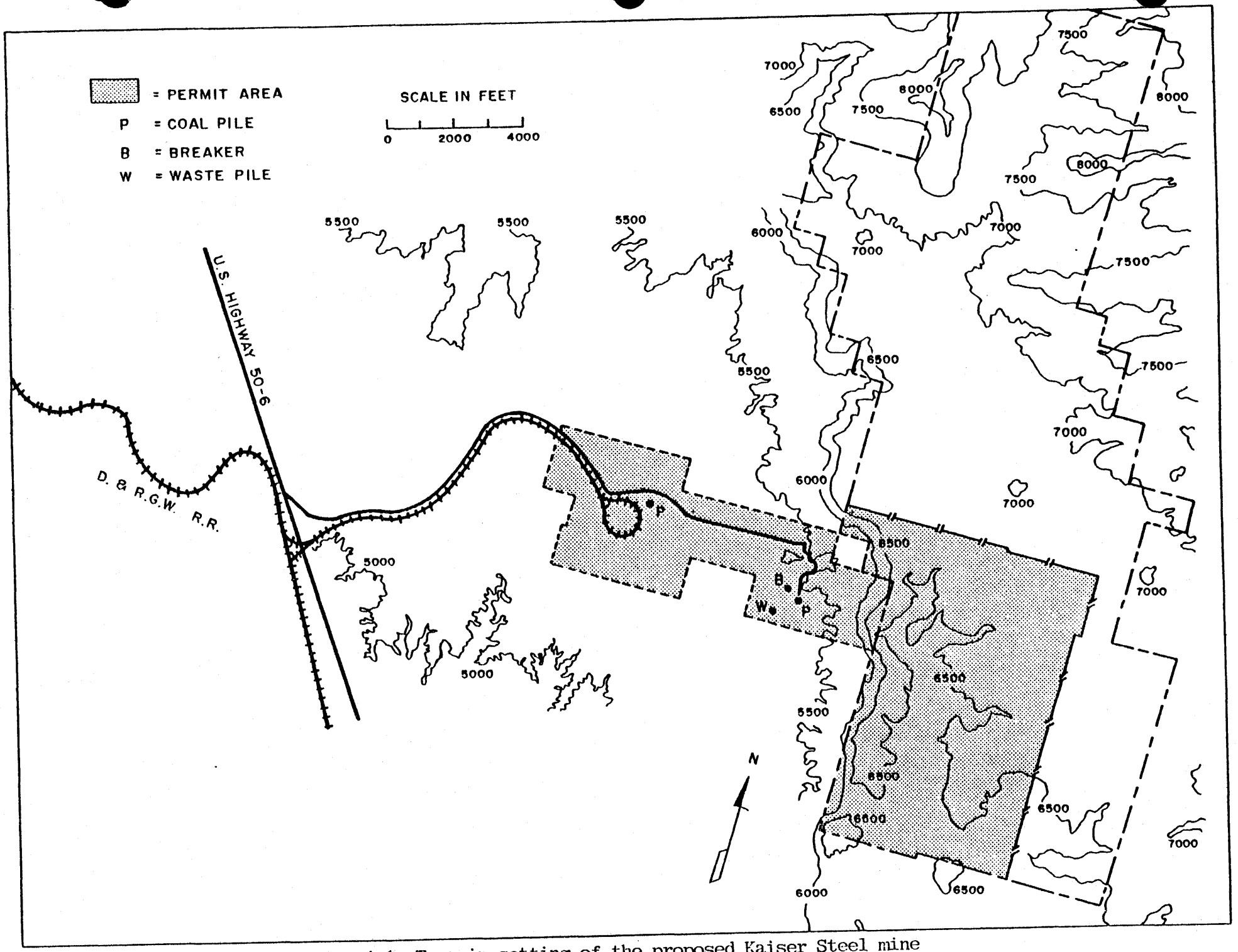

Fig. 4-1 Terrain setting of the proposed Kaiser Steel mine

4.2 Input Data

Emission estimates for all sources active in the peak production year were converted to forms acceptable as model inputs. In addition, meteorological conditions typical of the VALLEY model worst case calculation were prepared. Simulations were made assuming stable atmospheric conditions (F) and light wind speed (2 ms^{-1}) for all wind directions. A receptor grid was established to provide concentration estimates at one kilometer increments in the mine vicinity.

Proper preparation of emission source inputs is essential to producing conservative model estimates. A listing of model inputs is provided in Appendix B. Details of input preparation and assumptions follow:

1) Operating Schedule - Annual emissions given in Section 3 were distributed to provide an accurate correspondence of emissions to operating schedule. Emissions caused by wind erosion were uniformly distributed over the year. All other emissions were distributed assuming operations 260 days per year over 16 hours per day to provide a best estimation of daily emissions. This rate provided a very conservative concentration estimate since stable, low wind speed conditions typical of worst case meteorology most likely occur at night when mine operations are at a minimum.

2) Area Sources - The only area source modeled was the breaker waste refuse pile. This source was modeled as a ground level source with average emissions made up of wind erosion and operational components.

3) Line Sources - Fugitive emissions for workers' automobiles and related combustion particulate emissions were represented by straight line or curved line sources with zero emission height and no initial mixing from vehicle wakes.

4) Point Sources - Point sources were used to represent breaker emissions and emissions from coal piles. Breaker emissions were given an initial height of 10 m. Coal piles were assumed to be ground level point sources due to their relatively small size and the point nature of loading, unloading, and pile maintenance activity emissions. Initial dispersion parameters in the vertical and cross wind directions were assumed to be 15 m representing a conservative estimate of the wake zone caused by the coal piles. Coal pile dimensions are expected to be approximately 60 m in diameter and 15 m high.

4) Simulation of 24 Hour Averages - Twenty-four hour average concentrations were simulated by calculating sector average concentrations and dividing by 24/6 to represent 6 hour persistence for each wind direction. Model inputs listed in Appendix B are divided by 4 and multiplied by 10^6 μg/g to provide direct and convenient model output as 24-hour average particulate concentrations in $\mu g/m^3$.

4.3 Results

Worst case particulate concentration estimates were calculated for the proposed mine over the twenty-four hour averaging period. Results should be compared to the following particulate concentration limits:

	Concentration (μgm^{-3})	
	24 h	Annual
PSD Class II Increments	37	19
National Ambient Air Quality Standards	260	75

Since the proposed mine is in a complex terrain setting (Fig. 4-1), representative meteorological data were not available for simulation and only worst case TSP concentrations could be calculated. Annual average concentrations were inferred from these short term air concentrations.

Peak 24 hour average concentrations will occur when the wind becomes aligned with major project sources. The effects of this alignment are demonstrated with model results in east or west winds in Figures 4-2 to 4-7 In easterly winds (Figure 4-2), worst case conditions (stability 6; wind speed 2 ms^{-1}) result in concentrations of greater than 10 μgm^{-3} at approximately 2 kilometers west of Highway 6, while concentrations of greater than 20 μgm^{-3} occur only within the immediate vicinity of the mine. Areas of predicted concentrations in excess of 37 μgm^{-3} are indicated for areas of approximately 1 kilometer in length due to calculations either in or near the coal piles. Peaks of this type are typical of ground level sources since the models predict concentrations approaching the emission rate as distance from the source decreases.

Figure 4-3 shows a slightly more extensive area of concentrations in excess of 10 μgm^{-3} with westerly winds of 2 ms^{-1} under stable conditions. Since this is a highly unlikely condition in westerly winds (i.e., light wind speeds; uphill stable airflow) due to the Book Cliffs (Fig. 4-1), it is expected that actual maximum concentrations in westerly winds may occur in neutral flows. Air concentrations for low wind speed neutral

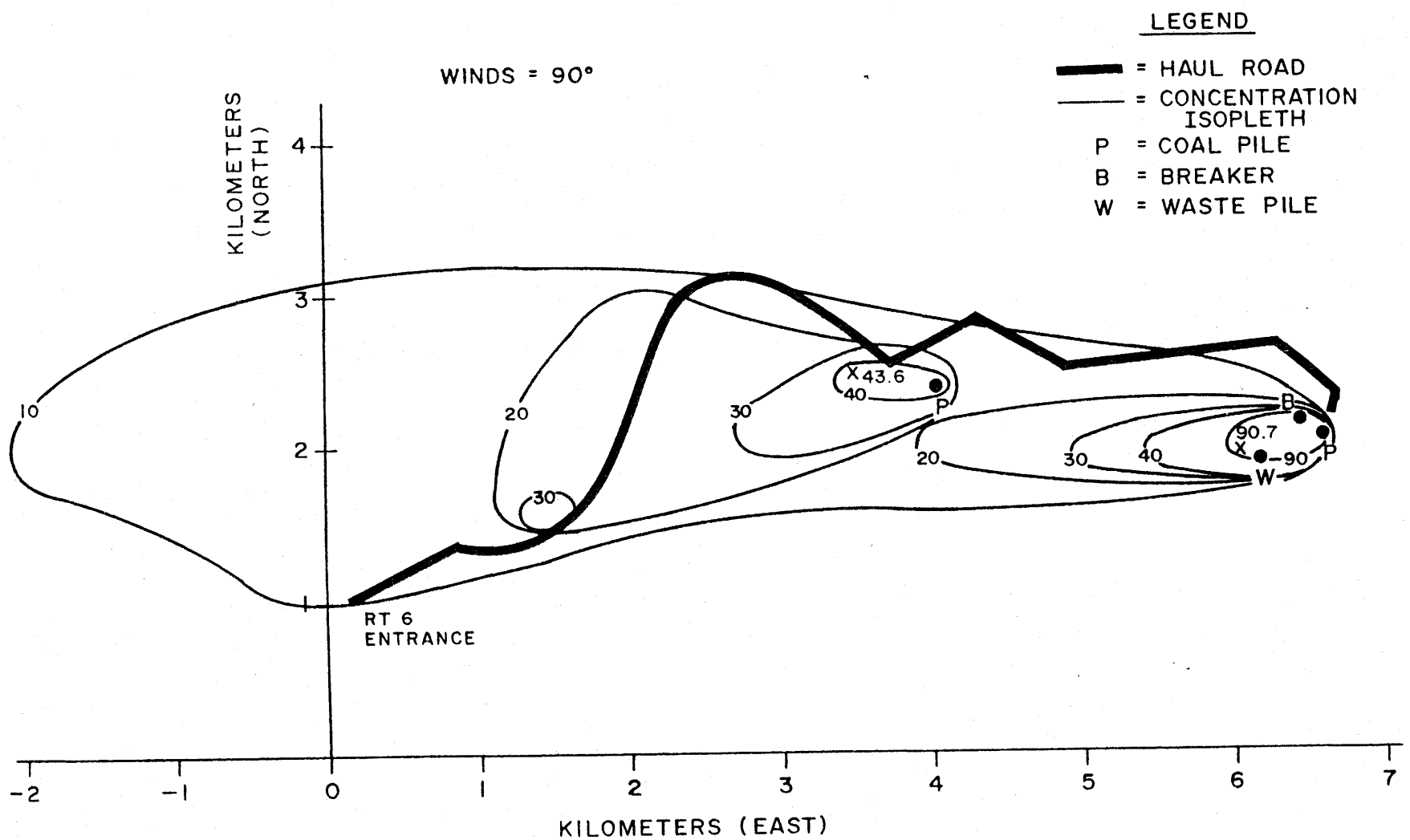

Fig. 4-2 24 hour average TSP concentration (μgm^{-3})
(stability 6, windspeed 2 ms^{-1}, wind direction 90°

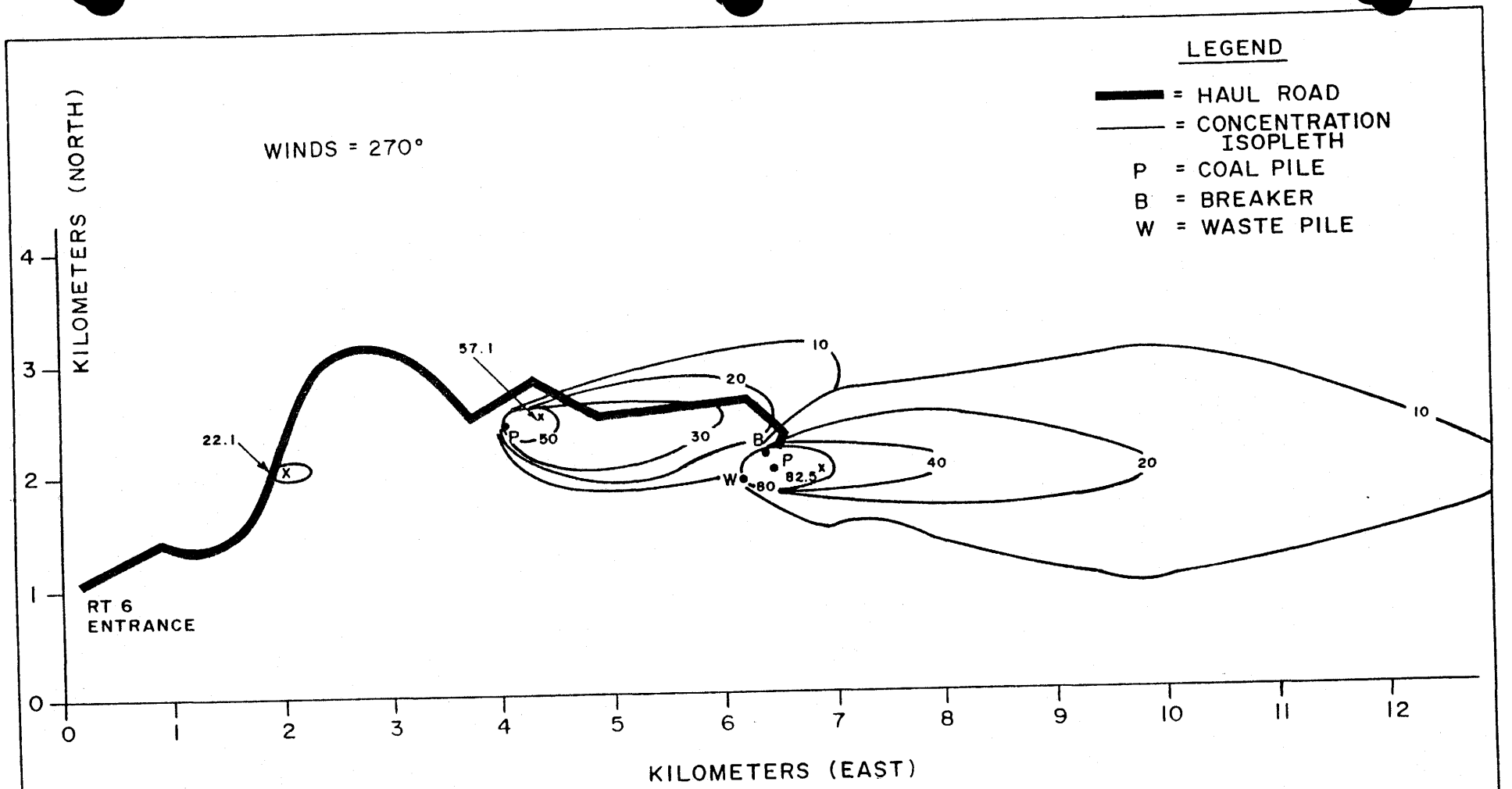

Fig. 4-3 24 hour average TSP concentrations (μgm^{-3})
(stability 6, windspeed 2 ms^{-1}, wind direction 270°)

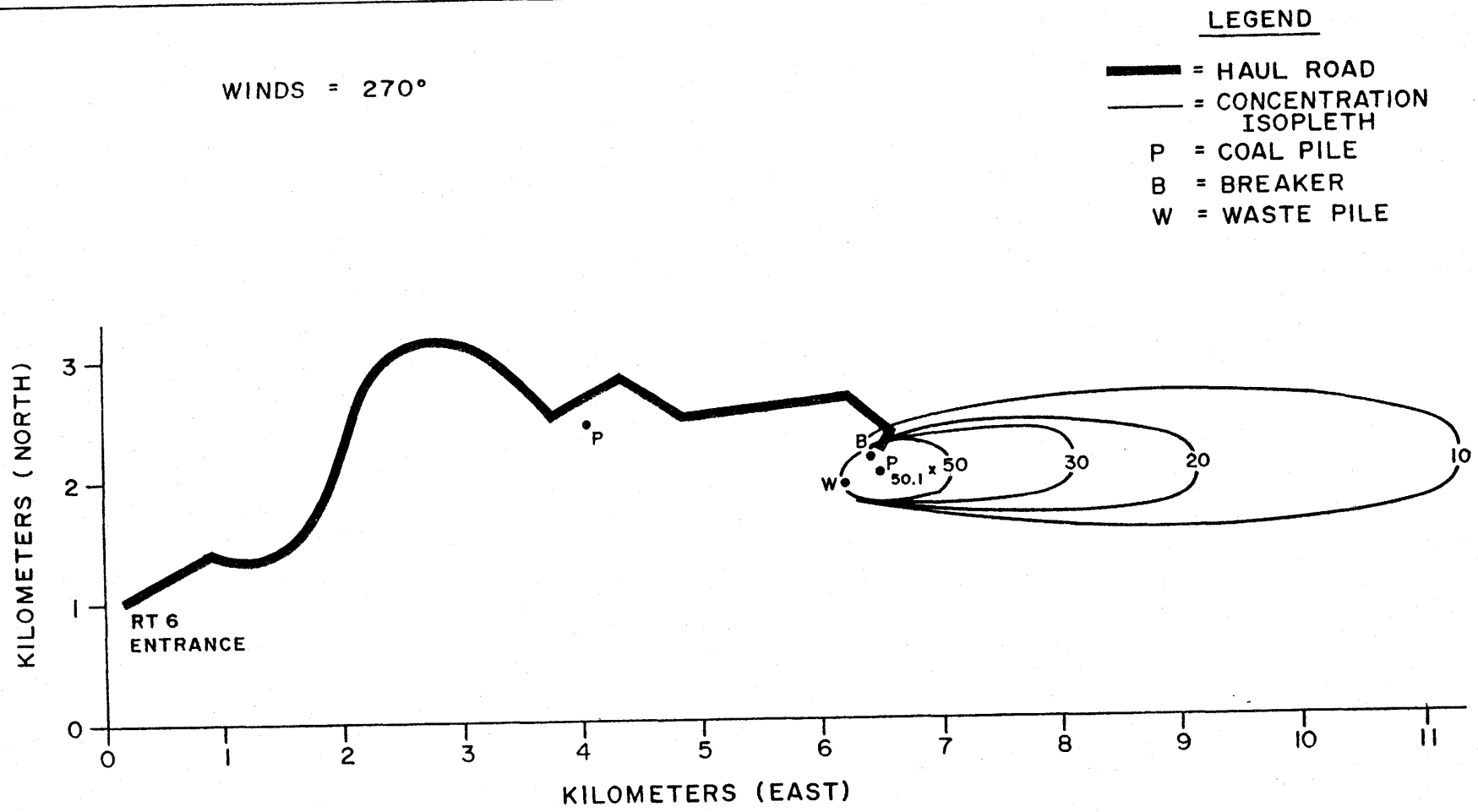

Fig. 4-4 24 hour average TSP concentrations (μgm^{-3}) stability 4, windspeed 2 ms^{-1}, wind direction 270°)

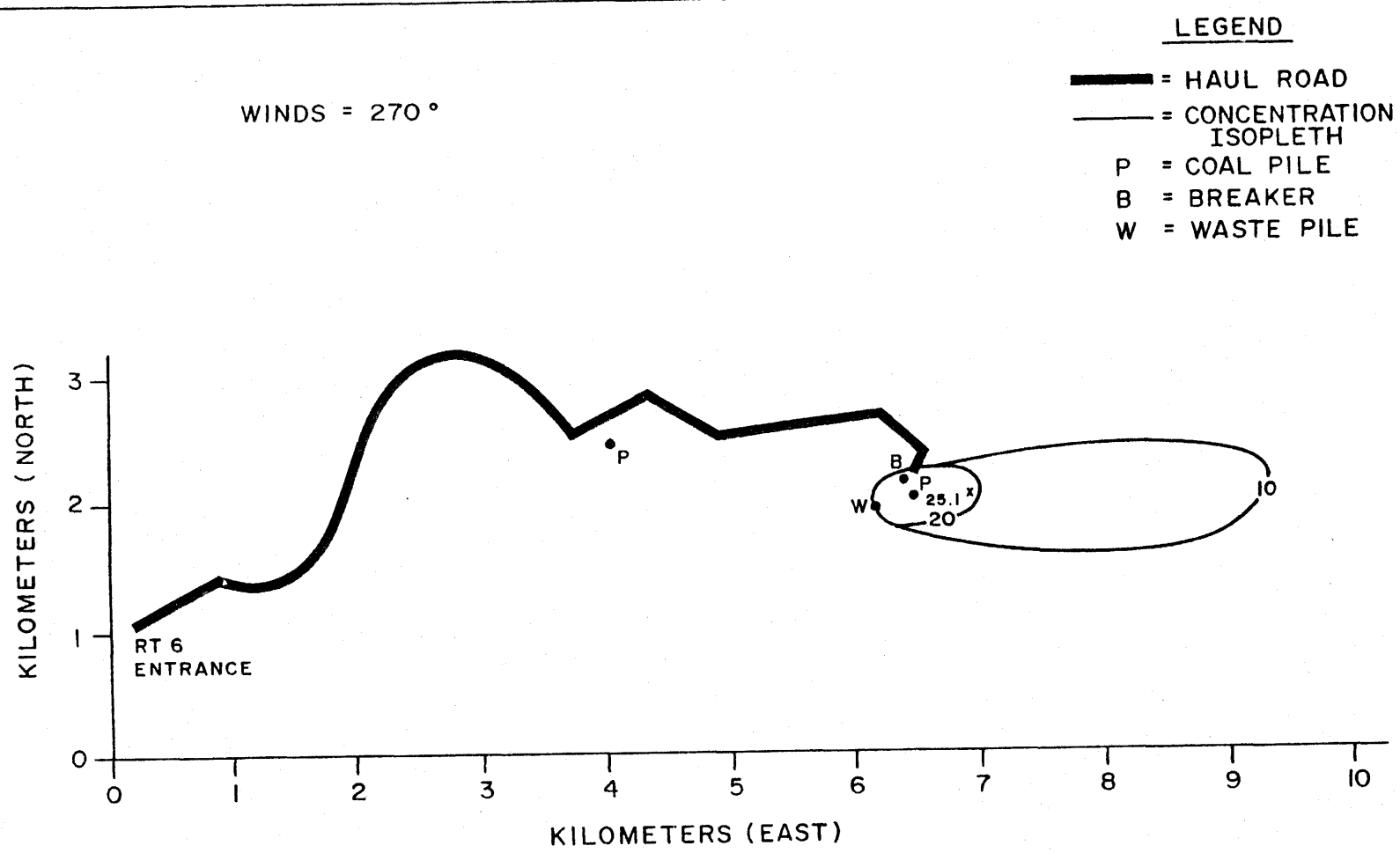

Fig. 4-5 24 hour average TSP concentrations (μgm^{-3})
(stability 4, windspeed 4 ms^{-1}, wind direction 270°)

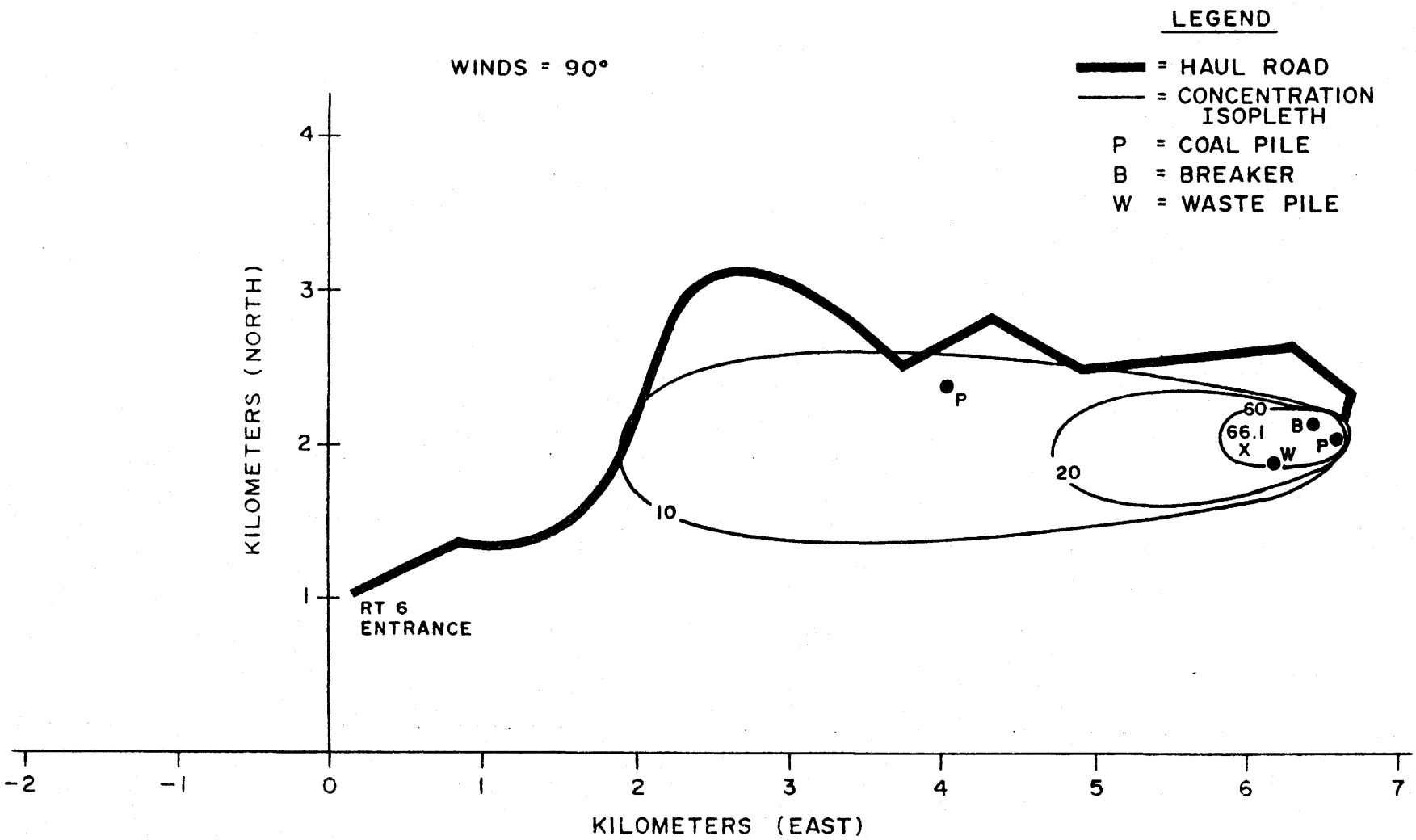

Fig. 4-6 24 hour average TSP concentrations (μgm^{-3})
(stability 4, windspeed 2 ms^{-1}, wind direction 90°)

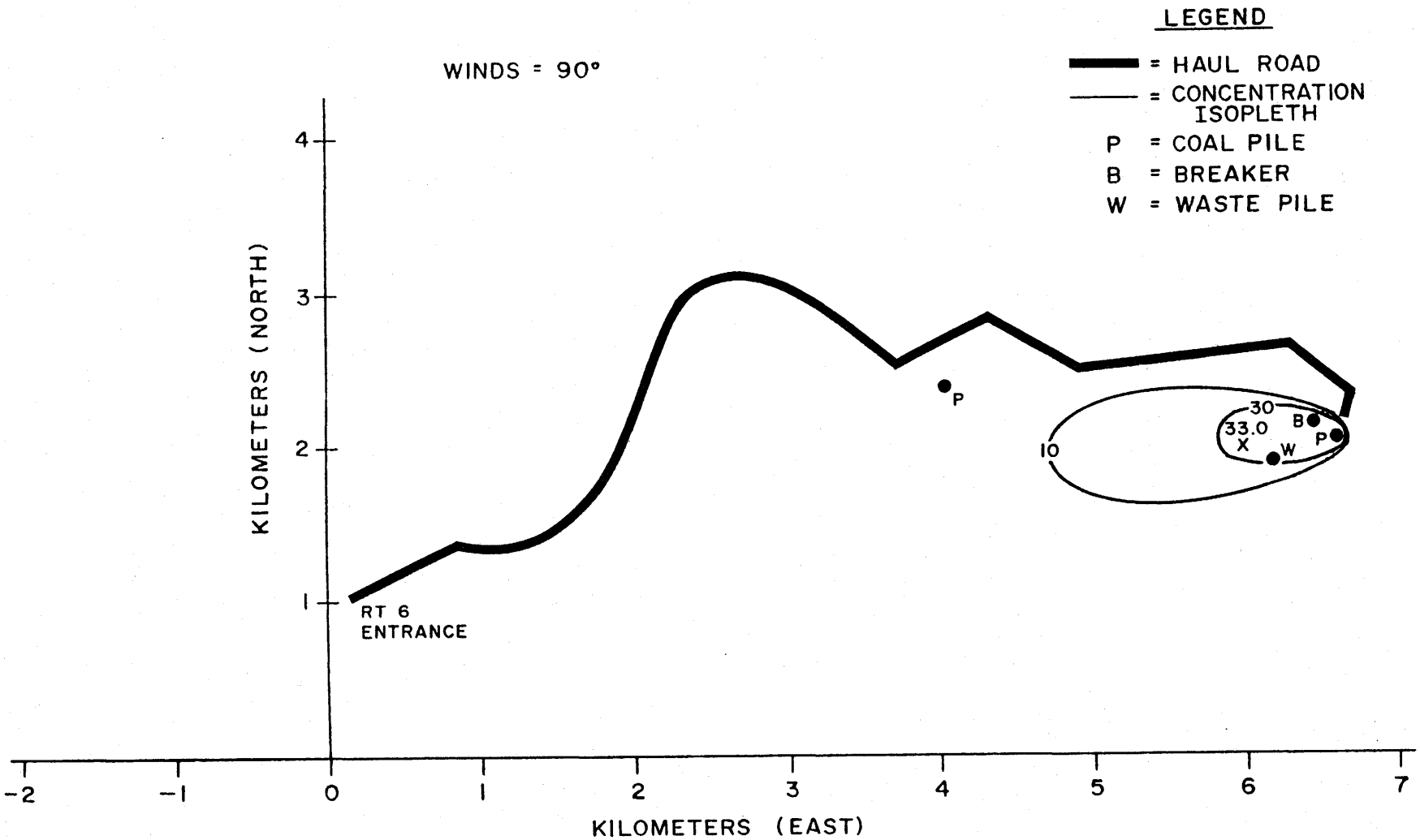

Fig. 4-7 24 hour average TSP concentrations (μgm^{-3}) stability 4, windspeed 4 ms^{-1}, wind direction 90°)

conditions are given in Figure 4-4 and 4-5. In these figures, concentrations are shown to decrease sharply with distance when stability decreases and/or wind speed increases. Comparable decreases are indicated in Figure 4-6 and 4-7 in easterly winds.

The twenty-four hour average simulations suggest that onsite TSP concentrations will be less than the National Ambient Air Quality Standard while concentrations off site should fall below the PSD Class II increments. Simulated onsite concentrations may be in excess of 37 μgm^{-3} but this is typical of receptors near ground level source boundaries. In general it is expected that the proposed Kaiser mine will only have significant impacts within a few kilometers of its component sources.

Annual simulations were not performed due to the lack of representative meteorological data. However, worst case 24 hour average concentrations can provide some guidance in this area, and the EPA suggests in its VALLEY model guide that for an isolated source in VALLEY model worst case conditions, compliance with 24-hour standards implies compliance with annual standards. The annual PSD Class II increment is 19 μgm^{-3}. Worst case 24-hour concentrations estimated in excess of 20 μgm^{-3} never extended more than 3 km from major mine emissions sources. The peak modeled 24 hour concentration of approximately 90 μgm^{-3} was estimated at a receptor in the breaker waste area when winds aligned this source and the surge coal pile. Assuming that the annual frequency of wind from any one direction is on the order of 10-20% of the time, an estimate of a maximum annual average concentrations would be at most 9-18 μgm^{-3} at the peak receptor. In summary, since peak 24-hour average concentrations were estimated to be less than 20 μgm^{-3} within

three kilometers of the source, the annual PSD increment will be preserved. Within three kilometers, the maximum predicted concentration of 90 gm^{-3} within the maximum emissions area suggests that the annual PSD increment will not be exceeded on the proposed Kaiser site.

REFERENCES

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Compilation of Past Practices and Interpretations by EPA on Air Quality Review of Surface Mining Operations, U. S. Env. Protection Agency Region VIII, 1979.

Compilation of Air Pollutant Emission Factors, EPA Report No. AP42, last update Oct. 1980.

Investigation of Fugitive Dust, VOl. I - Sources, Emissions and Control, PEDCo Environmental Inc., Report No. EPA-45-0/3-74-036a, 1974.

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Technical Guidance for Control of Industrial Process Fugitive Particulate Emissions, PEDCo Environmental Inc. Report No. EPA-450/3-77-010, 1977.

Environmental Assessment of Coal Transportation, PEDCo Environmental Inc. Report No. EPA-600/7-78-08, 1978.

Environmental Protection Agency, 1978: Users Guide for PAL. A Gaussian plume algorithm for Point, Area, and Line Sources, EPA-600/4-78-013.

APPENDIX A

The emissions calculated for this project, using the factors in Table 3-2 and the control efficiencies of Table 3-3, are detailed in this section. Assumptions used in the calculations are also described. Diagrams of the processes, emission sources and control methods of each phase are provided in Figures 3-1, 3-2, and 3-3.

A.1 Phase I Uncontrolled and Controlled Emissions

A.1.1 Generator:

Uncontrolled Particulates		= 8.6 T/yr
Uncontrolled	CO	=26.1 T/yr
Uncontrolled	HC	= 9.7 T/yr
Uncontrolled	SO_x	= 8.0 T/yr
Uncontrolled	NO_x	= 121 T/yr

No control measures.

It is estimated that no more than 15% (18.2 T/yr) of the NO_x emissions will be in the form of NO_2.

A.1.2 Conveying coal from mine to pile: (37,600 T throughput).

Uncontrolled Particulates = 3.8 T/yr

Control measure: fully covered conveyor (100% efficiency).

Controlled Particulates = 0 T/yr

A.1.3 Loading pile from conveyor: (37,600 T throughput).

Uncontrolled Particulates = **.4 T/yr.**

Control measure: telescoping chute (75% efficiency).

Controlled Particulates = **0.1 T/yr.**

A.1.4 Coal pile wind erosion: (37,600 T pile).

Uncontrolled Particulates = **1.1 T/yr**

No control measures are assumed although some compacting and watering will take place.

A.1.5 Vehicular traffic to maintain pile: (37,600 T throughput).

Uncontrolled Particulates = **1.3 T/yr**

In this case, the control measure is to load the pile with the conveyor. The pile will not be unloaded during this phase (80% efficiency).

Controlled Particulates = **0.3 T/yr**

A.1.6 Vehicular emissions: Assumed to be negligible because of small work force.

A.2 Phase II Uncontrolled and Controlled Emissions

A.2.1 Loadout of temporary Coal pile: (37,600 T)

Uncontrolled Particulates = 0.6 T/yr (1st year)

No control measures.

A.2.2 Conveying from temporary coal pile to mine: (37,600 T throughput).

Uncontrolled Particulates = 3.8 T/yr (1st year)

Control measure: partially covered conveyor (100% efficiency)

Controlled Particulates = 0 T/yr (1st year)

A.2.3 Conveying from mine to pile: (1st year = 108,100 T throughput, max year = 787,600 T throughput)

Uncontrolled Particulates = 10.8 T/yr (1st year)
Uncontrolled Particulates = 78.8 T/yr (max.year)

Control measure: fully covered conveyor (100% efficiency)

Controlled Particulates = 0 T/yr (1st year)
Controlled Particulates = 0 T/yr (max year)

A.2.4 Loading breaker surge pile: (1st year = 108,100 T throughput, max year = 787,600 T throughput)

Uncontrolled Particulates = 1.1 T/yr (1st year)
Uncontrolled Particulates = 7.9 T/yr (max year)

Control measure: stacking silo (75% efficiency)

Controlled Particulates = 0.3 T/yr (1st year)
Controlled Particulates = 2.0 T/yr (max year)

A.2.5 Wind erosion at breaker pile: (1st year = 108,100 T throughput, max year = 787,600 T throughput)

Uncontrolled Particulates = 3.0 T/yr (1st year)
Uncontrolled Particulates = 21.5 T/yr (max year)

No control measures

A.2.6 Vehicular traffic to maintain pile: (1st year = 108,100 T throughput, max year = 787,600 T throughput)

Uncontrolled Particulates = 3.6 T/yr (1st year)
Uncontrolled Particulates = 25.6 T/yr (max year)

Control measure: use conveyors for loading and unloading (80% efficiency)

Controlled Particulates = 0.7 T/yr (1st year)
Controlled Particulates = 5.1 T/yr (max year)

A.2.7 Conveying from breaker pile to breaker: (1st year = 108,100 T throughput, max year = 787,600 T throughput)

Uncontrolled Particulates = 10.8 T/yr (1st year)
Uncontrolled Particulates = 78.8 T/yr (max year)

Control measure: fully covered conveyors (100% efficiency)

Controlled Particulates = 0 T/yr (1st year)
Controlled Particulates = 0 T/yr (max year)

A.2.8 Load out of breaker pile: (1st year = 108,100 T throughput, max year = 787,600 T throughput)

Uncontrolled Particulates = **1.3 T/yr** (1st year)
Uncontrolled Particulates = **9.8 T/yr** (max year)

Control measure: gravity feed (80% efficiency)

Controlled Particulates = **0.3 T/yr** (1st year)
Controlled Particulates = **2.0 T/yr** (max year)

A.2.9 Breaker emissions: (1st year = 108,100 T throughput, max year = 787,600 T throughput)

Uncontrolled Particulates = **1.1 T/yr** (1st year)
Uncontrolled Particulates = **7.9 T/yr** (max year)

Control measure: baghouse (99% efficiency)

Controlled Particulates = **0.01 T/yr** (1st year)
Controlled Particulates = **0.08 T/yr** (max year)

A.2.10 Truck loading and unloading of breaker waste: (1st year = 10,810 T throughput, max year = 78,760 T throughput)

Uncontrolled Particulates = **4.4 T/yr** (1st year)
Uncontrolled Particulates = **31.4 T/yr** (max year)

Control measure: gravity feed (80% efficiency) and damp

material (5% efficiency)

Controlled Particulates: **0.7 T/yr** (1st year)
Controlled Particulates: **4.7 T/yr** (max year)

A.2.11 Breaker waste pile erosion: (1st year = 10,810 T) of waste, last year = 177,843 T of waste)

Uncontrolled Particulates = **0.2 T/y** (1st year)
Uncontrolled Particulates = **4.8 T/yr** (max year)

Control measure: compact and revegetate (60% efficiency)

Controlled Particulates = **0.1 T/yr** (1st year)
Controlled Particulates = **1.9 T/yr** (max year)

A.2.12 Vehicular traffic to maintain waste pile: (1st year = 10,810 T waste, last year = 78,760 T of waste)

Uncontrolled Particulates = **0.4 T/yr**
Uncontrolled Particulates = **2.6 T/yr** (last year)

Control measure: vehicular activity limited to spreading and compacting the material (60% efficiency).

Controlled Particulates = **0.2 T/yr** (1st year)
Controlled Particulates = **1.0 T/yr** (last year)

A.2.13 Conveying to truck load out (1st year = 108,100 T throughput, max year = 787,600 T throughput)

Uncontrolled Particulates = **10.8 T/yr** (1st/year)
Uncontrolled Particulates = **78.8 T/yr** (max year)

Control measure: fully covered conveyor (100% efficiency)

Controlled Particulates = 0 T/yr (1st year)
Controlled Particulates = 0 T/yr (max year)

A.2.14 Loading trucks (1st year = 108,100 T throughput, max year = 787,600 T throughput)

Uncontrolled Particulates = 21.6 T/yr (1st year)
Uncontrolled Particulates = 157.5 T/yr (max year)

Control measure: gravity feed and bins (90% efficiency)

Controlled Particulates = 2.2 T/yr (1st year)
Controlled Particulates = 15.8 T/yr (max year)

A.2.15 Fugitive dust from haul trucks:
Haul is 10 miles (round trip) to highway. First 8 months are on gravel road. Max year is on paved road (27025 VMT/yr).

Uncontrolled Particulates = 220.2 T/yr (1st year)
Paved Road Particulates = 4.2 T/yr (max year)

Control measure: chemical stabilizer on gravel (50% efficiency) no additional control measures on paved surface.

Controlled Particulates = 110.2 T/yr (1st year)
Paved Road Particulates = 4.2 T/yr (max year)

A.2.16 Light duty vehicle fugitive dust emissions:
Assumes first 8 months are on gravel road. Max year

is on paved road. (117,000 VMT/yr)

Uncontrolled Particulates = 211.8 T/yr (1st year)
Paved Road Particulates = 1.1 T/yr (max year)

Control measure: chemical stabilizer on gravel road (50% efficiency)

Controlled Particulates = 106.0 T/yr (1st year)
Paved Road Particulates = 1.1 T/yr (max year)

A.2.17 Haul vehicle emissions:

Ten mile haul (round trip). During first year, 8 months are on unpaved road at 35 mph. Remainder is at 55 mph. Max year emissions are at 55 mph.

Uncontrolled Particulates = 0.04 T/yr (1st year)
Uncontrolled SO_x = 0.08 T/yr (1st year)
Uncontrolled CO = 0.4 T/yr (1st year)
Uncontrolled HC = 0.04 T/yr (1st year)
Uncontrolled NO_x = 0.2 T/yr (1st year)

Uncontrolled Particulates = 2.8 T/yr (max year)
Uncontrolled SO_x = 6.1 T/yr (max year)
Uncontrolled CO = 22.4 T/yr (max year)
Uncontrolled HC = 2.4 T/yr (max year)
Uncontrolled NO_x = 20.4 T/yr (max year)

No control measures

A.2.18 Light duty vehicle emissions: (assumes 45 cars/day in first year, 90 cars/day in max. year)

Uncontrolled Particulates =	0.003 (1st year)
Uncontrolled SO_x =	0.001 (1st year)
Uncontrolled CO =	0.13 (1st year)
Uncontrolled HC =	0.01 (1st year)
Uncontrolled NO_x =	0.004 (1st year)

Uncontrolled Particulates =	0.09 (max year)
Uncontrolled SO_x =	0.03 (max year)
Uncontrolled CO =	03.37 (max year)
Uncontrolled HC =	0.23 (max year)
Uncontrolled NO_x =	0.12 (max year)

A.3 Phase III Uncontrolled and Controlled Emissions

A.3.1 Conveying from mine to breaker pile: (2,144,400 T throughput).

Uncontrolled Particulates = **214.4 T/yr**

Control measure: fully covered conveyors (100% efficient).

Controlled Particulates = **0 T/yr**

A.3.2 Loading breaker surge pile: (2,144,400 T throughput).

Uncontrolled Particulates = **21.4 T/yr**

Control measure: stacking silo (75% efficiency).

Controlled Particulates = **5.4 T/yr**

A.3.3 Wind erosion at breaker pile: (2,144,400 T throughput).

Uncontrolled Particulates = **57.8 T/yr**

No control measures

A.3.4 Vehicular traffic to maintain pile:

Uncontrolled Particulates = **69.7 T/yr**

Control measure: use conveyors for loading and unloading (80% efficiency)

Controlled Particulates = **13.9 T/yr**

A.3.5 Conveying from breaker pile to breaker: (2,144,400 T throughput).

Uncontrolled Particulates = **214.4 T/yr**

Control measure: fully covered conveyors (100% efficiency)

Controlled Particulates = **0 T/yr**

A.3.6 Load out of breaker pile (2,144,400 T throughput).

Uncontrolled Particulate = **26.8 T/yr**

Control measure: gravity feed (80% efficient)

Controlled Particulates = **5.4 T/yr**

A.3.7 Breaker emissions: (2,144,400 T throughput).

Uncontrolled Particulates = **21.4 T/yr**

Control measure: baghouse (99% efficiency).

Controlled Particulates = **0.2 T/yr**

A.3.8 Truck loading and unloading of breaker waste: (214,440 T throughput)

Uncontrolled Particulates = **85.8 T/yr**

Control measure: gravity feed (80% efficiency), damp material (5% efficiency).

Controlled Particulates = **12.9 T/yr**

A.3.9 Breaker waste pile erosion: (613,710 T of waste)

Uncontrolled Particulates = **16.5 T/yr**

Control measure: compact and revegetate (60% efficiency)

Controlled Particulates = **6.6 T/yr**

A.3.10 Vehicular traffic to maintain waste pile: (214,440 T tnroughput).

Uncontrolled Particulates = **7.0 T/yr**

Control measure: vehicular activity limited to spreading and compacting the material (60% efficiency)

Controlled Particulates = **2.8 T/yr**

A.3.11 Conveying from breaker to rail loop: (2,144,400 T throughput).

Uncontrolled Particulates = **214.4 T/yr**

Control measure: fully covered conveyors (100% efficiency)

Controlled Particulates = **0 T/yr**

A.3.12 Loading railroad pile: (2,144,400 T throughput).

Uncontrolled Particulates = **21.4 T/yr**

Control measure: stacking silo (75% efficiency)

Controlled Particulates = **5.4 T/yr**

A.3.13 Loading trains: (2,144,400 T throughput)

Uncontrolled Particulates = **428.9 T/yr**

Control measure: loading in tunnel using gravity feed (90% efficiency)

Controlled Particulates = **42.9 T/yr**

A.3.14 Rail pile wind erosion: (2,144,400 T throughput)

Uncontrolled Particulates = **57.8 T/yr**

No control measures

A.3.15 Vehicular traffic to maintain pile: (2,144,400 T throughput).

Uncontrolled Particulates = **69.7 T/yr**

Control measure: conveyor and gravity feed used for loading and unloading, and vehicles for pile maintenance only (80% efficiency).

Controlled Particulates = **13.9 T/yr**

A.3.16 Emissions from paved road: Assumes traffic is light duty vehicles (629,200 VMT/yr)

Uncontrolled Particulates = **3.0 T/yr**

No control measures

A.3.17 Light duty vehicle emissions: Assumes 242 vehicles per day.

Uncontrolled Particulates	=	**0.2 T/yr**
Uncontrolled CO	=	**9.1 T/yr**
Uncontrolled HC	=	**0.6 T/yr**
Uncontrolled SO_x	=	**0.1 T/yr**
Uncontrolled NO_x	=	**0.3 T/yr**

No control measures

APPENDIX B

MODEL INPUTS AND RESULTS

Model inputs are summarized in a PAL model listings. Emission rates were dividied by four and multiplied by 10^{-6} $\mu g/g$ to provide results in μgm^{-3} for six hours persistence in a 24 hour period. Results are provided for the most significant receptors simulated in the wind directions of 0°, 90°, 180°, and 270°. Other receptors and wind directions have been excluded to reduce the report size but are available to the state on request.

An example of a PAL input file is given on page B-2. Pages B-3 through B-11 are output files for the wind directions resulting in maximum impact. The output using 90° winds is presented in pages B-3 through B-6, and the remainder of Appendix B shows the output for 270° winds.

```
KAISER STEEL TEST
0.02,0.02,2,1,2,1,2,1,2,1,1,1,1,1,1,1,10.
1,9.00E05,05.,283.,0.,0.,0.,5.62,2.07,15.,15.
1,1.285E06,05.,283.,0.,0.,0.,4.27,2.35,15.,15.
2,3.00E03,10.,283.,0.,0.,13.,6.58,2.10,0.,0.
2,4.13,0.,6.22,1.92,0.24,0.24
1,0.,1,4.68,2.44,6.40,2.50,0.00,0.00,10.,0.,12.2
1,0.,1,5.40,2.50,6.71,2.29,0.00,0.00,10.,0.,12.2
1,0.,1,6.71,2.29,6.65,2.16,0.00,0.00,10.,0.,12.2
1,0.,1,4.42,2.71,4.68,2.44,0.00,0.00,10.,0.,12.2
1,0.,1,3.75,2.47,4.42,2.71,0.00,0.00,10.,0.,12.2
1,0.,1,1.92,1.63,2.29,2.63,0.00,0.00,10.,0.,12.2
2,0.,1,0.21,1.07,1.07,1.43,0.00,0.00,10.,0.,12.2
1,0.,1,3.75,2.47,3.29,2.93,2.66,3.11,0.0,0.0,10.0,0.0,12.2
1,0.,1,2.68,3.11,2.44,3.05,2.29,2.83,0.0,0.0,10.0,0.0,12.2
2,0.,1,1.92,1.63,1.53,1.52,1.07,1.43,0.0,0.0,10.0,0.0,12.2
1,01.0,4.00,0.0
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1,01.0,6.00,0.0
1,01.0,7.00,0.0
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1,01.0,9.00,0.0
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1,02.0,11.00,0.0
1,02.0,12.00,0.0
2,02.0,13.00,0.0
2,270.0,2.,6.300.,283.
4
```

Point Sources

Area Sources

Line Sources

Curved Path Sources

Receptors

Meteorology

VERSION 78124.

KAISER STEEL TEST

PINA = .02000 PINL = .02000

	SOURCE INCLUDED	WIND INCREASE WITH HEIGHT
POINT	YES	NO
AREA	YES	NO
HORIZONTAL LINE SOURCE	YES	NO
CURVE PATH SOURCE	YES	NO
SPECIAL LINE SOURCE	NO	NO
SPECIAL PATH SOURCE	NO	NO

AVERAGE NO DIURNAL NO HEIGHT AT WIND SPEED 10.0 METERS

B-3

* * * P O I N T S O U R C E S * * *

NO.	POINT SOURCE STRENGTH (G/SEC)	PHYSICAL HEIGHT (METERS)	STACK TEMP (DEG-K)	STACK GAS VELOCITY (M/SEC)	STACK DIAMETER (METERS)	VOLUME FLOW (CU M/SEC)	COORDINATES EAST (KM)	COORDINATES NORTH (KM)	INITIAL SIGMAS Y (M)	INITIAL SIGMAS Z (M)
1	900000.00	5.0	283.0	.00	.00	.00	6.620	2.070	15.0	15.0
2	1285000.00	5.0	283.0	.00	.00	.00	4.270	2.350	15.0	15.0
3	3000.00	10.0	283.0	.00	.00	14.00	6.580	2.100	.0	.0

* * A R E A S O U R C E S * * *

NO.	AREA SOURCE STRENGTH (G/SEC-M**2)	AREA SOURCE HEIGHT (METERS)	COORDINATES SW-CORNER EAST (KM)	COORDINATES SW-CORNER NORTH (KM)	AREA SIZE EAST-WEST (KM)	AREA SIZE NORTH-SOUTH (KM)
1	4.13000000	.0	6.220	1.920	.240	.240

****HORIZONTAL LINE SOURCES*****

NO.	LINE SOURCE STRENGTH (G/SEC-M)	LINE SOURCE HEIGHT (METERS)	COORDINATES POINT A EAST (KM)	POINT A NORTH (KM)	POINT B EAST (KM)	POINT B NORTH (KM)	INITIAL SIGMAS Y (M)	INITIAL SIGMAS Z (M)	NO. OF LANES	TOTAL WIDTH (METERS)	MEDIAN WIDTH (METERS)
1	12.20000	.0	4.880	2.440	6.400	2.500	.00	.00			
2	12.20000	.0	6.400	2.500	6.710	2.290	.00	.00			
3	12.20000	.0	6.710	2.290	6.680	2.160	.00	.00			
4	12.20000	.0	4.420	2.710	4.880	2.440	.00	.00			
5	12.20000	.0	3.750	2.470	4.420	2.710	.00	.00			
6	12.20000	.0	1.920	1.830	2.290	2.830	.00	.00			
7	12.20000	.0	.210	1.070	1.070	1.430	.00	.00			

****CURVED HORIZONAL PATH SOURCES*****

NO.	PATH SOURCE STRENGTH (G/SEC-M)	PATH SOURCE HEIGHT (METERS)	COORDINATES POINT A EAST (KM)	POINT A NORTH (KM)	POINT B EAST (KM)	POINT B NORTH (KM)	POINT C EAST (KM)	POINT C NORTH (KM)	INITIAL SIGMAS Y (M)	INITIAL SIGMAS Z (M)	NO. OF LANES	TOTAL WIDTHWIDTH (METERS)	MEDIAN WIDTH (METERS
1	12.20000	.000	3.750	2.470	3.290	2.930	2.680	3.110	.00	.00	1	10.00	.00
2	12.20000	.000	2.680	3.110	2.440	3.050	2.290	2.830	.00	.00	1	10.00	.00
3	12.20000	.000	1.920	1.830	1.580	1.520	1.070	1.430	.00	.00	1	10.00	.00

****RECEPTORS*****

NO.	RREC(KM)	SREC(KM)	Z (M)
1	-2.000	1.000	.0
2	-1.000	1.000	.0
3	.000	1.000	.0
4	1.000	1.000	.0
5	2.000	1.000	.0
6	3.000	1.000	.0
7	4.000	1.000	.0
8	5.000	1.000	.0
9	6.000	1.000	.0
10	7.000	1.000	.0
11	-2.000	2.000	.0
12	-1.000	2.000	.0
13	.000	2.000	.0
14	1.000	2.000	.0
15	2.000	2.000	.0
16	3.000	2.000	.0
17	4.000	2.000	.0
18	5.000	2.000	.0
19	6.000	2.000	.0
20	7.000	2.000	.0

* * R E C E P T O R S * * *

NO.	RREC(KM)	SREC(KM)	Z (M)
1	-2.000	3.000	.0
2	-1.000	3.000	.0
3	.000	3.000	.0
4	1.000	3.000	.0
5	2.000	3.000	.0
6	3.000	3.000	.0
7	4.000	3.000	.0
8	5.000	3.000	.0
9	6.000	3.000	.0
10	7.000	3.000	.0
11	3.500	2.500	.0

* * M E T E O R O L O G Y * * *

NO.	THETA(DEG)	U (M/SEC)	KST	HL (M)	T (DEG-K)
1.	90.	2.0	6	300.	283.

DIURNAL VARIATIONS (FRACTIONS OF GIVEN Q)

POINT	AREA	HORIZONAL LINE	CURVED PATH	SPECIAL LINE	SPECIAL PATH
1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

* * C O N C E N T R A T I O N S A T R E C E P T O R S * * *

CONCENTRATIONS IN GRAMS PER CUBIC METER

HOUR	RECEPTOR NO.	RECEPTOR COORDINATES EAST	NORTH	HEIGHT	FROM POINTS	FROM AREAS	FROM HORIZONAL LINES	FROM CURVED PATHS	FROM SPECIAL LINES	FROM SPECIAL PATHS	TOTAL
1	1	-2.000	1.000	.00	6.320E 00	0.000E-01	3.580E-01	1.320E-01	0.000E-01	0.000E-01	6.310
1	2	-1.000	1.000	.00	7.653E 00	0.000E-01	5.150E-01	2.010E-01	0.000E-01	0.000E-01	8.369
1	3	.000	1.000	.00	9.581E 00	0.000E-01	1.510E 00	1.264E-01	0.000E-01	0.000E-01	11.22
1	4	1.000	1.000	.00	3.434E 00	0.000E-01	4.990E-02	0.000E-01	0.000E-01	0.000E-01	3.484
1	5	2.000	1.000	.00	4.340E 00	0.000E-01	1.984E-02	0.000E-01	0.000E-01	0.000E-01	4.360
1	6	3.000	1.000	.00	5.710E 00	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	5.709
1	7	4.000	1.000	.00	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	.0000
1	8	5.000	1.000	.00	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	.0000
1	9	6.000	1.000	.00	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	.0000
1	10	7.000	1.000	.00	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	.0000
1	11	-2.000	2.000	.00	6.320E 00	3.560E 00	3.430E-01	2.533E-01	0.000E-01	0.000E-01	10.47
1	12	-1.000	2.000	.00	7.653E 00	4.143E 00	3.692E-01	3.511E-01	0.000E-01	0.000E-01	12.52
1	13	.000	2.000	.00	9.581E 00	4.943E 00	4.814E-01	2.780E-01	0.000E-01	0.000E-01	15.28
1	14	1.000	2.000	.00	1.254E 01	6.060E 00	8.290E-01	2.353E-01	0.000E-01	0.000E-01	19.67
1	15	2.000	2.000	.00	1.760E 01	7.643E 00	5.160E-01	3.460E-02	0.000E-01	0.000E-01	25.80
1	16	3.000	2.000	.00	2.811E 01	1.002E 01	4.340E-01	0.000E-01	0.000E-01	0.000E-01	38.57
1	17	4.000	2.000	.00	8.100E 00	1.404E 01	4.290E-01	0.000E-01	0.000E-01	0.000E-01	22.57
1	18	5.000	2.000	.00	1.282E 01	2.244E 01	1.880E-01	0.000E-01	0.000E-01	0.000E-01	35.45
1	19	6.000	2.000	.00	2.600E 01	6.460E 01	1.454E-01	0.000E-01	0.000E-01	0.000E-01	90.71
1	20	7.000	2.000	.00	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	.0000

* * C O N C E N T R A T I O N S A T R E C E P T O R S * * *

CONCENTRATIONS IN GRAMS PER CUBIC METER

HOUR	RECEPTOR NO.	RECEPTOR COORDINATES EAST	NORTH	HEIGHT	FROM POINTS	FROM AREAS	FROM HORIZONAL LINES	FROM CURVED PATHS	FROM SPECIAL LINES	FROM SPECIAL PATHS	TOTAL
1	1	-2.000	3.000	.00	6.320E 00	1.390E-03	2.440E-01	1.330E-01	0.000E-01	0.000E-01	6.699
1	2	-1.000	3.000	.00	7.653E 00	0.000E-01	2.900E-01	1.854E-01	0.000E-01	0.000E-01	8.129
1	3	.000	3.000	.00	9.581E 00	0.000E-01	3.610E-01	2.891E-01	0.000E-01	0.000E-01	10.23
1	4	1.000	3.000	.00	1.254E 01	0.000E-01	4.754E-01	5.774E-01	0.000E-01	0.000E-01	13.60
1	5	2.000	3.000	.00	1.760E 01	0.000E-01	5.160E-01	2.710E 00	0.000E-01	0.000E-01	20.83
1	6	3.000	3.000	.00	5.740E 00	0.000E-01	7.390E-01	6.793E 00	0.000E-01	0.000E-01	13.27
1	7	4.000	3.000	.00	0.000E-01	0.000E-01	3.210E-01	0.000E-01	0.000E-01	0.000E-01	.3206
1	8	5.000	3.000	.00	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	.0000
1	9	6.000	3.000	.00	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	.0000
1	10	7.000	3.000	.00	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	.0000
1	11	3.500	2.500	.00	3.884E 01	3.013E-04	3.103E 00	1.594E 00	0.000E-01	0.000E-01	43.55

KAISER STEEL TEST VERSION 78124.

PIMA = .02000 PIML = .02000

	SOURCE INCLUDED	WIND INCREASE WITH HEIGHT
POINT	YES	NO
AREA	YES	NO
HORIZONTAL LINE SOURCE	YES	NO
CURVE PATH SOURCE	YES	NO
SPECIAL LINE SOURCE	NO	NO
SPECIAL PATH SOURCE	NO	NO

AVERAGE NO DIURNAL NO HEIGHT AT WIND SPEED 10.0 METERS

* * * POINT SOURCES * * *

NO.	POINT SOURCE STRENGTH (G/SEC)	PHYSICAL HEIGHT (METERS)	STACK TEMP (DEG-K)	STACK GAS VELOCITY (M/SEC)	STACK DIAMETER (METERS)	VOLUME FLOW (CU M/SEC)	COORDINATES EAST (KM)	COORDINATES NORTH (KM)	INITIAL SIGMAS Y (M)	INITIAL SIGMAS Z (M)
1	960000.00	5.0	283.0	.00	.00	.00	6.620	2.070	15.0	15.0
2	1285000.00	5.0	283.0	.00	.00	.00	4.270	2.350	15.0	15.0
3	3000.00	10.0	283.0	.00	.00	14.00	6.560	2.100	.0	.0

* * AREA SOURCES * * *

NO.	AREA SOURCE STRENGTH (G/SEC- **2)	AREA SOURCE HEIGHT (METERS)	COORDINATES SW-CORNER EAST (KM)	COORDINATES SW-CORNER NORTH (KM)	AREA SIZE EAST-WEST (KM)	AREA SIZE NORTH-SOUTH (KM)
1	4.13000000	.0	6.220	1.920	.240	.240

* * H O R I Z O N T A L L I N E S O U R C E S * * *

NO.	LINE SOURCE STRENGTH (G/SEC-M)	LINE SOURCE HEIGHT (METERS)	COORDINATES POINT A EAST (KM)	POINT A NORTH (KM)	POINT B EAST (KM)	POINT B NORTH (KM)	INITIAL SIGMAS Y (M)	INITIAL SIGMAS Z (M)	NO. OF LANES	TOTAL WIDTH (METERS)	MEDIAN WIDTH (METERS)
1	12.20000	.0	4.880	2.440	6.400	2.500	.00	.00			
2	12.20000	.0	6.400	2.500	6.710	2.290	.00	.00			
3	12.20000	.0	6.710	2.290	6.680	2.160	.00	.00			
4	12.20000	.0	4.420	2.710	4.880	2.440	.00	.00			
5	12.20000	.0	3.750	2.470	4.420	2.710	.00	.00			
6	12.20000	.0	1.920	1.830	2.290	2.830	.00	.00			
7	12.20000	.0	.210	1.070	1.070	1.430	.00	.00			

* * C U R V E D H O R I Z O N T A L P A T H S O U R C E S * * *

NO.	PATH SOURCE STRENGTH (G/SEC-M)	PATH SOURCE HEIGHT (METERS)	COORDINATES POINT A EAST (KM)	POINT A NORTH (KM)	POINT B EAST (KM)	POINT B NORTH (KM)	POINT C EAST (KM)	POINT C NORTH (KM)	INITIAL SIGMAS Y (M)	INITIAL SIGMAS Z (M)	NO. OF LANES	TOTAL WIDTH (METERS)	MEDIAN WIDTH (METERS)
1	12.20000	.000	3.750	2.470	3.290	2.930	2.680	3.110	.00	.00	1	10.00	.00
2	12.20000	.000	2.680	3.110	2.440	3.050	2.290	2.830	.00	.00	1	10.00	.00
3	12.20000	.000	1.920	1.830	1.580	1.520	1.070	1.430	.00	.00	1	10.00	.00

* * R E C E P T O R S * * *

NO.	RREC(KM)	SREC(KM)	Z (M)
1	4.000	1.000	.0
2	5.000	1.000	.0
3	6.000	1.000	.0
4	7.000	1.000	.0
5	8.000	1.000	.0
6	9.000	1.000	.0
7	10.000	1.000	.0
8	11.000	1.000	.0
9	12.000	1.000	.0
10	13.000	1.000	.0
11	4.000	2.000	.0
12	5.000	2.000	.0
13	6.000	2.000	.0
14	7.000	2.000	.0
15	8.000	2.000	.0
16	9.000	2.000	.0
17	10.000	2.000	.0
18	11.000	2.000	.0
19	12.000	2.000	.0
20	13.000	2.000	.0

* * R E C E P T O R S * * *

NO.	RREC(KM)	SREC(KM)	Z (M)
1	4.000	3.000	.0
2	5.000	3.000	.0
3	6.000	3.000	.0
4	7.000	3.000	.0
5	8.000	3.000	.0
6	9.000	3.000	.0
7	10.000	3.000	.0
8	11.000	3.000	.0
9	12.000	3.000	.0
10	13.000	3.000	.0
11	4.000	2.500	.0
12	6.500	2.000	.0

* * M E T E O R O L O G Y * * *

NO.	THETA(DEG)	U (M/SEC)	KST	HL (M)	T (DEG-K)
1.	270.	2.0	6	300.	283.

DIURNAL VARIATIONS (FRACTIONS OF GIVEN Q)

POINT	AREA	HORIZONAL LINE	CURVED PATH	SPECIAL LINE	SPECIAL PATH
1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

* * C O N C E N T R A T I O N S A T R E C E P T O R S * * *

CONCENTRATIONS IN GRAMS PER CUBIC METER

HOUR	RECEPTOR NO.	RECEPTOR COORDINATES EAST	NORTH	HEIGHT	FROM POINTS	FROM AREAS	FROM HORIZONAL LINES	FROM CURVED PATHS	FROM SPECIAL LINES	FROM SPECIAL PATHS	TOTAL
1	1	4.000	1.000	.00	0.000E-01	0.000E-01	1.220E-01	1.634E-01	0.000E-01	0.000E-01	.2855
1	2	5.000	1.000	.00	0.000E-01	0.000E-01	9.902E-02	1.240E-01	0.000E-01	0.000E-01	.2229
1	3	6.000	1.000	.00	0.000E-01	0.000E-01	9.810E-02	8.514E-02	0.000E-01	0.000E-01	.1832
1	4	7.000	1.000	.00	0.000E-01	0.000E-01	9.373E-02	6.321E-02	0.000E-01	0.000E-01	.1569
1	5	8.000	1.000	.00	0.000E-01	0.000E-01	8.790E-02	4.940E-02	0.000E-01	0.000E-01	.1373
1	6	9.000	1.000	.00	6.001E 00	0.000E-01	8.040E-02	3.810E-02	0.000E-01	0.000E-01	6.136
1	7	10.000	1.000	.00	1.092E 01	0.000E-01	1.200E-01	7.603E-02	0.000E-01	0.000E-01	11.12
1	8	11.000	1.000	.00	8.550E 00	0.000E-01	1.900E-01	9.622E-02	0.000E-01	0.000E-01	8.836
1	9	12.000	1.000	.00	6.941E 00	0.000E-01	2.090E-01	8.194E-02	0.000E-01	0.000E-01	7.232
1	10	13.000	1.000	.00	5.803E 00	0.000E-01	1.730E-01	7.100E-02	0.000E-01	0.000E-01	6.048
1	11	4.000	2.000	.00	0.000E-01	0.000E-01	3.611E-01	2.094E-01	0.000E-01	0.000E-01	.5706
1	12	5.000	2.000	.00	3.321E 01	0.000E-01	2.560E-01	1.253E-01	0.000E-01	0.000E-01	33.60
1	13	6.000	2.000	.00	1.712E 01	0.000E-01	2.793E-01	2.090E-01	0.000E-01	0.000E-01	17.61
1	14	7.000	2.000	.00	4.390E 01	3.774E 01	6.110E-01	2.533E-01	0.000E-01	0.000E-01	82.48
1	15	8.000	2.000	.00	2.262E 01	1.690E 01	8.670E-01	1.850E-01	0.000E-01	0.000E-01	42.57
1	16	9.000	2.000	.00	1.491E 01	1.250E 01	4.941E-01	1.431E-01	0.000E-01	0.000E-01	28.04
1	17	10.000	2.000	.00	1.100E 01	9.150E 00	3.442E-01	1.160E-01	0.000E-01	0.000E-01	20.56
1	18	11.000	2.000	.00	8.550E 00	7.070E 00	2.620E-01	9.622E-02	0.000E-01	0.000E-01	15.98
1	19	12.000	2.000	.00	6.941E 00	5.660E 00	2.090E-01	8.194E-02	0.000E-01	0.000E-01	12.89
1	20	13.000	2.000	.00	5.803E 00	4.660E 00	1.730E-01	7.100E-02	0.000E-01	0.000E-01	10.70

* * M E T E O R O L O G Y * * *

NO.	THETA(DEG)	U (M/SEC)	KST	HL (M)	T (DEG-K)
1.	270.	2.0	6	300.	283.

DIURNAL VARIATIONS (FRACTIONS OF GIVEN G)

POINT	AREA	HORIZONAL LINE	CURVED PATH	SPECIAL LINE	SPECIAL PATH
1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

* * C O N C E N T R A T I O N S A T R E C E P T O R S * * *

CONCENTRATIONS IN GRAMS PER CUBIC METER

HOUR	RECEPTOR NO.	RECEPTOR COORDINATES EAST	NORTH	HEIGHT	FROM POINTS	FROM AREAS	FROM HORIZONAL LINES	FROM CURVED PATHS	FROM SPECIAL LINES	FROM SPECIAL PATHS	TOTAL
1	1	4.000	3.000	.00	0.000E-01	0.000E-01	1.590E-01	1.273E 00	0.000E-01	0.000E-01	1.432
1	2	5.000	3.000	.00	0.000E-01	0.000E-01	1.330E-01	5.460E-01	0.000E-01	0.000E-01	.6785
1	3	6.000	3.000	.00	1.712E 01	0.000E-01	4.770E-01	3.054E-01	0.000E-01	0.000E-01	17.90
1	4	7.000	3.000	.00	1.102E 01	0.000E-01	4.962E-01	2.532E-01	0.000E-01	0.000E-01	11.78
1	5	8.000	3.000	.00	7.883E 00	0.000E-01	6.170E-01	1.850E-01	0.000E-01	0.000E-01	8.685
1	6	9.000	3.000	.00	6.001E 00	0.000E-01	4.660E-01	1.431E-01	0.000E-01	0.000E-01	6.611
1	7	10.000	3.000	.00	1.100E 01	0.000E-01	3.442E-01	1.160E-01	0.000E-01	0.000E-01	11.41
1	8	11.000	3.000	.00	8.550E 00	0.000E-01	2.620E-01	9.622E-02	0.000E-01	0.000E-01	8.908
1	9	12.000	3.000	.00	6.941E 00	0.000E-01	2.090E-01	8.194E-02	0.000E-01	0.000E-01	7.232
1	10	13.000	3.000	.00	5.803E 00	0.000E-01	1.730E-01	7.100E-02	0.000E-01	0.000E-01	6.048
1	11	4.000	2.500	.00	0.000E-01	0.000E-01	5.674E 00	1.560E 00	0.000E-01	0.000E-01	7.232
1	12	6.500	2.000	.00	1.350E 01	1.380E 02	5.200E-01	2.850E-01	0.000E-01	0.000E-01	151.8

** C O N C E N T R A T I O N S A T R E C E P T O R S **

CONCENTRATIONS IN GRAMS PER CUBIC METER

HOUR	RECEPTOR NO.	RECEPTOR COORDINATES EAST	NORTH	HEIGHT	FROM POINTS	FROM AREAS	FROM HORIZONAL LINES	FROM CURVED PATHS	FROM SPECIAL LINES	FROM SPECIAL PATHS	TOTAL
1	1	4.000	3.000	.00	0.000E-01	0.000E-01	1.590E-01	1.273E 00	0.000E-01	0.000E-01	1.432
1	2	5.000	3.000	.00	0.000E-01	0.000E-01	1.330E-01	5.460E-01	0.000E-01	0.000E-01	.6785
1	3	6.000	3.000	.00	1.712E 01	0.000E-01	4.770E-01	3.054E-01	0.000E-01	0.000E-01	17.90
1	4	7.000	3.000	.00	1.102E 01	0.000E-01	4.962E-01	2.532E-01	0.000E-01	0.000E-01	11.78
1	5	8.000	3.000	.00	7.883E 00	0.000E-01	6.170E-01	1.850E-01	0.000E-01	0.000E-01	8.685
1	6	9.000	3.000	.00	6.001E 00	0.000E-01	4.660E-01	1.431E-01	0.000E-01	0.000E-01	6.611
1	7	10.000	3.000	.00	1.100E 01	0.000E-01	3.442E-01	1.160E-01	0.000E-01	0.000E-01	11.41
1	8	11.000	3.000	.00	8.550E 00	0.000E-01	2.620E-01	9.622E-02	0.000E-01	0.000E-01	8.908
1	9	12.000	3.000	.00	6.941E 00	0.000E-01	2.090E-01	8.194E-02	0.000E-01	0.000E-01	7.232
1	10	13.000	3.000	.00	5.803E 00	0.000E-01	1.730E-01	7.100E-02	0.000E-01	0.000E-01	6.048
1	11	4.000	2.500	.00	0.000E-01	0.000E-01	5.674E 00	1.560E 00	0.000E-01	0.000E-01	7.232
1	12	6.500	2.000	.00	1.350E 01	1.380E 02	5.200E-01	2.850E-01	0.000E-01	0.000E-01	151.8

Chapter XII GEOTECHNICAL

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12.1 Scope

This chapter covers the requirements specified by UMC 784.20, Subsidence Control Plan and UMC 784.19, Underground Development Waste.

There are no buildings or structures in the permit area that could be affected by any subsidence which may occur. However, the mine plan has been designed to protect the Little Park Wash. Within the barrier protecting the wash, no pillar extraction will occur (Plate III-2).

Mining during the first 5-year permit term will range from depths of 100 feet to 825 feet. During this time entries will be driven to develop the mine. Full extraction room and pillar mining will also occur.

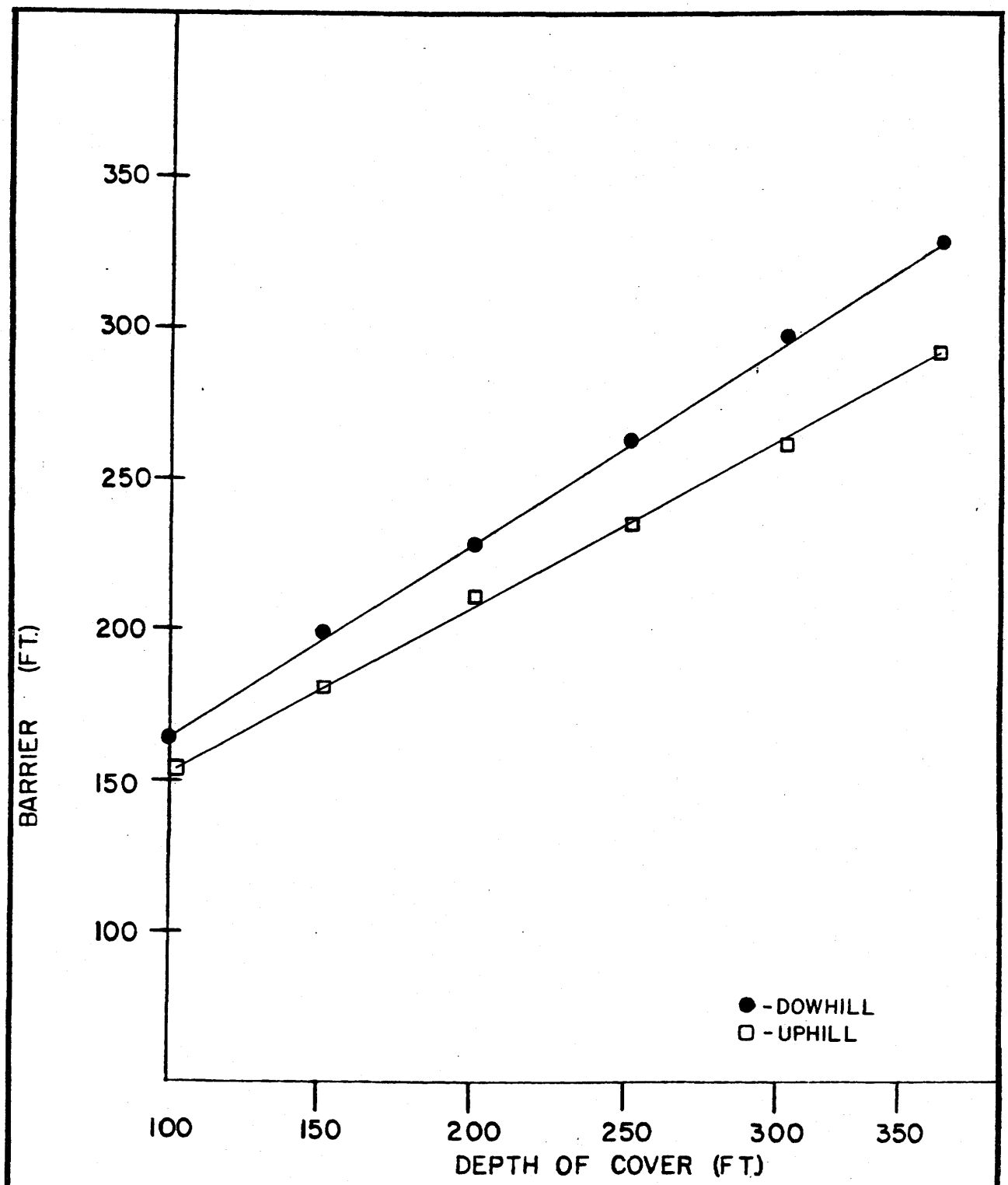
After the first permit term, retreat longwall mining will account for approximately 70 percent of the production.

The rotary breaker refuse pile is the only earthen structure proposed during the initial permit term.

12.2 Methodology

This underground mine design is based on over 30 years of successful coal mining experience in Utah. The operational plans such as roof control and ventilation have been submitted to MSHA who enforce safety and health regulations in coal mines.

The barriers to protect the Little Park Wash were designed according to the State of Pennsylvania Coal Mining Regulations. At this time there are no State of Utah or federal regulations addressing this situation. Figure XII-1 shows the relationship between cover depth and the size of the barrier.



NOTE:
25 feet channel width assumed with a buffer zone of 12 1/2 feet on either side.

KAISER STEEL CORPORATION
SOUTH LEASE COAL PROPERTY
EMERY COUNTY, UTAH

BARRIER DESIGN
LITTLE PARK WASH

SCALE: 1" = 50'
DATE: 9/30/81

FIGURE XII - 1

12.3 Underground Mine Design

The mine layout is shown on Plate III-4. The design is discussed in Chapter III and the following section.

12.3.1 Geotechnical Tests and Analysis

Geotechnical tests have been performed on some roof rock. The results of these tests were used for roof span and pillar design.

12.3.2 Coal Pillar Design

The slope bottom will be developed by continuous miners. During the first permit term three to seven entry developments will be developed on 50-100 foot centers with crosscuts every 75 to 110 feet. Barrier pillars 300 feet wide will be left on both sides of the mains to protect the entries.

Longwall gates and crosscuts will also be developed during the first permit term. These will be driven 20 feet wide on 50 or 60 foot centers with crosscuts every 100 feet.

Full extraction room and pillar mining will be done on the 40 foot by 80 foot centers. A minimum of 80 percent of these pillars will be removed, if possible, yielding an approximate recovery of 75 percent.

Plate III-19 shows typical continuous miner and longwall panels.

A barrier where only first mining will occur is provided to protect the Little Park Wash. Mining under the barrier will be rooms driven on the 60 foot by 80 foot centers (Plate III-4). The size of the barrier was discussed in Section 12.2.

12.3 Cont.

Barriers will be provided to protect the outcrop and property boundary except where entries daylight. To comply with the Utah State Laws and Regulations and 30 CFR 211, mining will not occur within 50 feet of any outside boundary of the leased lands except where reserves may otherwise be lost. After this first permit term, mining is projected 150 feet outside of the western lease boundary for approximately 600 feet in Section 1, T17S, R14E (Plate III-3). The lease in this area will be applied for.

12.3.3 Roof Span Design

Mine openings will be supported as specified in the roof control plan submitted to MSHA.

Roof span pillar recovery is a function of the roof conditions and may be less than 20 feet as necessary.

12.4 Surface Subsidence Effects of Mining

Subsidence occuring as a result of full extraction mining is expected and is necessary for safe mining to occur. Full extraction will be limited to areas away from the coal outcrops, property boundaries and the Little Park Wash.

12.4.1 Subsidence Mechanisms

The subsidence at the surface is a function of the thickness of the coal seam extracted and the depth of cover. In deeper cover, less subsidence is to be expected due to the swell of caved material. Cover depths during the first permit term will range from 100 feet to approximately 825 feet with a seam of 5 to 7 feet of coal.

The rocks overlaying the coal seam are sandstones and mudstones with some thin bands of coal. Due to the strength of the overburden, full seam height subsidence can be expected in areas of shallow cover but subsidence will decrease as cover depth increases.

The continuous miner panels have been designed and sequenced to provide controlled caving. It is expected in time the caved area will reach an equilibrium condition. At this time, no additional surface disturbance from subsidence is expected.

After the first permit term, longwall mining is planned. The depth of cover over the proposed longwall panels for the projected life of the mine ranges from 400 feet to 3,000 feet and the coal seam thickness ranges from 6½ feet to 13½ feet. In longwall mining the coal seam is removed as the face advances, and the immediate roof sags away from the stronger, high strata. Caving occurs as the face continues to advance.

12.4 Cont.

The caved material fills the area where the coal was removed. Most of the roof pressure must be taken by the solid coal face and the gob.

12.4.2 Projected Subsidence Effects

There are no anticipated major effects due to subsidence during the permit term.

12.4.3 Subsidence Control and Mitigation

No surface structures, powerlines, pipelines or oil and gas wells occur within the area to be mined during the first permit term. Therefore, no methods are needed for the mitigation of effects due to subsidence.

Subsidence will be controlled and monitored at the Little Park Wash.

12.4.4 Subsidence Monitoring Plan

A visual survey will be conducted on a yearly basis over the projected underground mine workings to locate and describe any tension cracks, fissures or potholes.

Subsidence will be monitored along the Little Park Wash. This subsidence monitoring program will be established to provide information for the determination of the angle of draw, the amount of subsidence and the location of the subsidence. A subsidence detector grid will be established on the surface for the panels which may have an effect on these areas one year prior to mining. The grids will consist of three stations per panel. The geometry of the grids may be adjusted as mining progresses in order to obtain a more accurate assessment of any subsidence effects.

12.4 Cont.

A map will be provided to the regulatory authority showing the vertical and horizontal location of the survey points. Monitoring at these survey points will occur every six months or until subsidence is complete. The regulatory authority will be provided with this information.

12.5 Stability of Earthen Structures

The proposed rotary breaker refuse pile is shown in plan view on Plates III-1 and III-2. It will consist primarily of fragments of shale, sandstone and siltstone. It will be a nonimpounding mound on an inclined surface. Cross sections for the proposed refuse pile are shown on Plate III-10.

This refuse pile is designed and will be maintained in accordance with 30 CFR 77 and UMC 817.71 - 817.74.

12.6 Bibliography

State of Pennsylvania, Department of Environmental Resources, Division of Mine Subsidence. Coal Mining Regulations. Personal communication from S. E. Corliss, (412) 941-7100.

Chapter XIII DESIGNS

Detailed designs relative to compliance with performance standards have been covered in the individual chapters from III through XII. Therefore, they will not be separately presented in this chapter.

Chapter XIV CONSULTATION AND COORDINATION

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14.1 Scope

In putting together the permit application for the South Lease Coal Property, the primary consultation and coordination has been with the Utah Division of Oil, Gas and Mining and the U. S. Bureau of Land Management.

Additionally, consultation has been made with various Federal, State and County agencies to develop the necessary information.

Private consultants and one State consulting service have been engaged to help with field studies, write-ups and designs in disciplines where Kaiser Steel does not have in-depth in-house expertise or sufficient staffing to accomplish the work.

14.2 Federal Consultation and Coordination

Agricultural Stabilization & Conservation Service
Photography Laboratory (ASCS)
222 West 23rd South
Salt Lake City, Utah 84103

Aerial photography.

Bureau of Land Management
U. S. Department of the Interior
University Club Building
136 East South Temple
Salt Lake City, Utah 84111

Charles Stout, Cartographic Technician
Ed Harne

Consultations on land surveys and ownership, coal and oil and gas leases, rights-of-way, and grazing leases in the subject Mine Plan Area and vicinity; plat supply; also right-of-way appraisals.

Bureau of Land Management
U. S. Department of the Interior
900 North 700 East
Price, Utah 84501

Michelle Abbey, Range Conservationist
David Mills, Wildlife Biologist
Mark Mackiewicz, Realty Specialist
Jesse Purvis

Consultations on land-use, soils and vegetation, wildlife, rights-of-way applications, road improvements, range site descriptions, grazing allotments.

Cadastral Survey Examination
Denver Service Center
Denver Federal Center
U. S. Department of the Interior
Denver, Colorado 80225

Environmental Protection Agency
1860 Lincoln Street
Denver, Colorado 80295

Rob Walline

Water and air quality permit requirements.

14.2 Cont.

Eros Data Center
U. S. Geological Survey
Sioux Falls, South Dakota 57198

Tom Nagelmire

Landsat Satellite, NASA Aircraft color infrared, and other color and color infrared geographic computer searches; supply of NASA Aircraft and BLM color infrared aerial photographs used in relation to vegetation, wildlife; archeological, hydrological and geological studies for subject application.

Fish and Wildlife Service
U. S. Department of the Interior
125 South State Street
Salt Lake City, Utah 84111

Clark Johnson, Wildlife Biologist
Bruce Waddell, Raptor Biologist

Field survey of proposed Mine Plan Area and consultation on fish and wildlife at this site.

Great Basin Exploration Station
Ephraim, Utah 84627

Kent Jorgensen

Elymus salina.

Montana Plant Materials Center
Route 1, Box 119
Bridger, Montana 59014

Mr. Majerus

Elymus salina.

National Cartigraphic Information Center
USGS Topographic Division
Mail Stop 510, Box 25046
Denver Federal Center
Denver, Colorado 80225

14.2 Cont.

National Oceanic & Atmospheric Administration
U. S. Department of Commerce
125 South State Street
Salt Lake City, Utah 84111

Dean Hershey

Weather and precipitation.

Office of Surface Mining
U. S. Department of the Interior
1020 15th Street
Denver, Colorado 80202

Larry Larson, Statistician

Regulation interpretation, vegetation; vegetation survey methods.

Soil Conservation Service
U. S. Department of Agriculture
P. O. Box 17107
Denver, Colorado 80211

Wendell Hassel, Plant Materials Specialist

Plant materials research.

Soil Conservation Service
U. S. Department of Agriculture
Box 1168
Tucumcari, New Mexico 88401

Steve Sellnow, Soil Classification Specialist

Third order soil survey/federal coal mining regulations.

Soil Conservation Service
U. S. Department of Agriculture
Walker Bank Building
Price, Utah 84501

Earl Jensen, Soil Classification Specialist
George Cook, District Range Conservationist
Gary Moreau, Area Soil Conservationist

Consultation on soils and vegetation resources; soils mapping in the subject Mine Plan Area; Soils third order survey and regulation requirements.

14.2 Cont.

Soil Conservation Service
U. S. Department of Agriculture
Room 345
304 N. 8th Street
Boise, Idaho 83702

George James, Plant Materials Specialist

Plant materials research at South Lease.

Soil Conservation Service
U. S. Department of Agriculture
P.O. Box 11350
Salt Lake City, Utah 84147

Joe Downs, Utah State Soil Classification Coordinator

Soil suitability.

Southern Plains Range Research Station
Woodward, Oklahoma 73801

W. A. Berg, Research Soil Scientist

Soil fertility, calibrations and correlations for native plants.

Upper Colorado Plant Material
Center for Mine Reclamation
Meeker, Colorado 81641

Sam Strahanathan

Plant materials availability.

U. S. Geological Survey
U. S. Department of the Interior
2040 Administration Building
1700 South 1745 West
Salt Lake City, Utah 84104

Jackson W. Moffitt, Area Mining Supervisor

Field surveys and consultations on field programs in the proposed Mine Plan Area; consultations regarding the proposed mining plan and reporting requirements under 30 CFR 211.

14.3 State Consultation and Coordination

Brigham Young University
Herbarium
Provo, Utah 84601

Stanley Welsh

Plant taxonomy problems.

Bureau of Surface Mining
Mining and Minerals Division
Energy and Minerals Department
State of New Mexico
P. O. Box 2860
Santa Fe, New Mexico 87501

Dr. Edward Kelly, Chief

Consultation re. vegetation and the interpretation of the regulations.

Colorado State University
Botany Department
Fort Collins, Colorado 80523

Dieter Wilkin, Plant Taxonomist, Curator, Herbarium

Taxonomy of *Artemisia* species.

Health Division
Utah State Social Services Department
73 East 400 South
Salt Lake City, Utah 84111

Consultations on water supply and water quality in the Price River drainage.

Montana State University
Reclamation Department
Bozeman, Montana 59717

Dr. Richard L. Hodder, Reclamation Researcher

Soil fertility, calibration tests.

14.3 Cont.

University of New Mexico
Department of Biology
Albuquerque, New Mexico 87131

Dr. Ligon, Department of Biology

Burrowing owls and effects of human disturbance.

University of Utah
Archeological Center
Department of Anthropology
Stewart Building
Salt Lake City, Utah 84112

Dr. Richard Holmer, Contract Archeologist
Ms. Rebecca Rauch, Project Director

Field surveys re. archeological, historic and ethnographic cultural resource evaluations, consultation with regulatory agencies and compilation and authoring of Chapter V, Historical and Cultural Resources, of the subject application.

Utah Division of Highways, District 4
Price, Utah 84501

Archie Hamilton
Frank Ularich

Consultation and plans review of proposed highway overpass over rail line.

State of Utah Natural Resources & Energy
Division of Oil, Gas & Mining
4241 State Office Building
Salt Lake City, Utah 84114

James W. Smith, Jr.
Mary Ann Wright
Sally Keefer
Joe Helfrich
Susan Linear
D. Wayne Hedberg
Sandy Pruitt
Antonia Torrence
Tom Portle

Field trips and consultations relative to applicable regulations, regulation interpretations, mine permitting procedures, inter-agency coordination and responsibility, wildlife, soils, vegetation, hydrology, geology, planned surface facilities and mine plan.

14.3 Cont.

Utah Division of State Lands
231 East 400 South, Room 411
Salt Lake City, Utah 84111

Mr. Lou Brown

Consultations, public hearings and public notices on state special use leases applied for; land-use of state land.

Utah Division of Water Rights
200 Empire Building
231 East 400 South
Salt Lake City, Utah 84111

Earl Stoker, Deputy State Engineer

Water rights.

Utah Division of Wildlife Resources
State of Utah
445 West Railroad Avenue
Price, Utah 84501

Larry Dalton

Field surveys and consultations on fish and wildlife resources on the subject Mine Plan Area.

Utah State Historic Preservation Office
300 Rio Grande, Room 210
Salt Lake City, Utah 84101

Melvin T. Smith, Director
Amy Pringle

Regulations.

14.3 Cont.

Utah State Department of Health
Bureau of Air Quality
Division of Environmental Health
150 West North Temple
Salt Lake City, Utah 84110

Dennis Dalley, Division of Environmental Health
Richard A. Sweet, Bureau of General Sanitation
Steven McNeal, Bureau of Water Pollution Control
Connie Miller, Solid & Hazardous Waste
Jerry Jackson, Solid & Hazardous Waste
Montie R. Keller, Bureau of Air Quality
Michael Georgeson, Bureau of Public Water Supplies
Wanless Southwick, Division of Environmental Health/Administration
Russell N. Hinshaw, Environmental Health Specialist
Bureau of Water Pollution Control

Consultations on emissions, water and solid waste disposal and air quality at the subject Mine Plan Area.

Utah State University
Logan, Utah 84321

Dr. Kay Asay, Grass Geneticist
Dr. Doug Dewey, Grass Geneticist

Elymus salina.

Utah State University
Logan, Utah 84321

E. Arlo Richardson, Utah State Climatologist

Consultations on the climatology of the Mine Plan Area; compilation and authoring by the State Climatologist of Section 11.3, Existing Environment, of the subject application.

14.4 Local Consultation and Coordination

Emery County Planning Board
P. O. Drawer 457
Castle Dale, Utah 84513

Don Almond

County zoning and land-use of Mine Plan Area.

Emery County Recorder
Emery County Court House
Castle Dale, Utah 84513

Re: filing a copy of the subject permit application for public inspection.

Emery County Supervisors
Emery County Court House
Castle Dale, Utah 84513

A public hearing on the South Lease Coal Property project; consultation with the County Supervisors and the County Attorney relative to approval by Emery County of the State Special Use Leases applied for.

14.5 Other Consultation and Coordination

Bamert Seed Company
Muleshoe, Texas 79347

Mr. Bamert

Hilaria jamesii and contract seed growing

John T. Boyd Company
Mining and Geological Engineers
1860 Lincoln Street, Suite 1028
Denver, Colorado 80295

David J. Morris, Vice President
William P. Balaz, Mining Engineer
Marcie A. Greenberg, Geological Engineer

Field surveys and design engineering re. the planned surface facilities and underground mine; compilation and authoring of the principal portions of Sections3.0 through 3.3.8.1, 3.4.8 through 3.4.8.3, 7.2.3.2 and Chapter XII in cooperation with Kaiser Steel.

John P. Davidson
Erwin and Davidson, P.C.
Attorneys at Law
243 Cook Avenue
Raton, New Mexico 87740

Compliance. Notice of Violations in New Mexico review and interpretation.

Denise Dragoo
Law Offices of Fabian and Clendenin
8th Floor, Continental Bank Building
Salt Lake City, Utah 84101-2097

Compliance, socioeconomic review.

Denver and Rio Grande Western Railroad Company
P. O. Box 5482
Denver, Colorado 80217

E. W. Wopitka

Consultation on land ownership and rights-of-way, railroad spur and loading loop criteria and design, highway overpass criteria and design.

14.5 Cont.

Jacklin Seed Co.
W. 5300 Jacklin Avenue
Post Falls, Idaho 83854

Availability of *Poa* species.

Curt D. Jansen, Consulting Wildlife Ecologist
1130 McHugh Street
Fort Collins, Colorado 80524

Wildlife field surveys, consultation with regulatory agencies and compilation and authoring of Chapter X, Fish and Wildlife Resources, of the subject application.

Native Plants
400 Wakara Way
Salt Lake City, Utah 84108

Claire Gabriel, Seed Specialist

Contract seed picking and growing.

Mountain States Telephone and Telegraph Company
80 South 3rd East
P. O. Box 30960
Salt Lake City, Utah 84125

Ray Goodrich
Ron Brown
Pat Bird

Consultation re. telephone service to permit application area and rights-of-way.

North American Weather Consultants
1141 East 3900 South, Suite A-130
Salt Lake City, Utah 84117

Daniel J. McNaughton, Director of Air Quality Modeling
Victoria C. Sutherland

Prepared The Notice of Intent submitted to the Utah Bureau of Air Quality for a state air quality permit; consultation with regulatory agencies; prepared Section 11.4 of this permit application, Effects of Mining Operation on Air Quality; coordinated the establishment of the weather station in the permit area.

14.5 Cont.

Olympus Aerial Surveys, Inc.
50 West 2950 South
Salt Lake City, Utah 84115

Robert Frailey
Stacey Struhle
Maurice Piaf

Aerial photography and topographic mapping of the mine plan and related access areas.

Perry Plummer, Range Scientist
P. O. Box 70
Ephraim, Utah 84627

Contract seed picking and growing.

Utah Power and Light Company
P. O. Box 277
American Fork, Utah 84003

G. Robert Thompson

Consultation re. mine power supply; power transmission line design, routing and right-of-way; and step down transformer design and siting.

Clint Wasser, Range Ecologist
1400 S. Shields Street
Fort Collins, Colorado 80521

Elymus salina.