CHAPTER 11
CLIMATOLOGY AND AIR QUALITY

CASTLE GATE MINE
AMAX COAL COMPANY
Carbon County, Utah

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CHAPTER 11

CLIMATOLOGY AND AIR QUALITY

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11.0 CLIMATOLOGICAL DATA

The proposed Mine Plan Area is in a mean annual precipitation belt of 13 to 25 inches (U.S. Geological Survey, 1978). Precipitation generally increases to the northwest, as shown by the isopleths in Figure 11-1. Most precipitation falling on the Mine Plan area is received in the form of snowfall during the winter months of January, February and March. The majority of the rainfall on the area occurs in the later summer and early fall, with the peak in August. Mean monthly rainfall data collected at monitoring stations located at the Scofield Dam (west of the plan area) and at the Price Game Farm (south and east of the plan area) are presented on Figure 11.1-2 (Utah Division of Water Resources, 1985).

Temperatures in the area are seasonal, with the high mean monthly temperature occuring in July and the low mean monthly temperature occuring in January. The summer season is short, with maximum temperatures averaging in the low 80's; in winter, average lows range from 5 to 10 degrees in January. Monthly average temperatures are listed on Table 11-1.

Local air patterns in the Central Utah Coal Basin area tend to follow the general drainage patterns; night breezes tend to flow down-drainage, due to the inducement of denser, cool air, while daytime breezes tend to flow up-drainage due to surface heating effects. Generally, however, the winds in the study area are from the west and northwest. Winds generally do not exceed 20 miles per hour (U.S. Geological Survey, 1978). Additional air pattern and air quality information has been excerpted from the USDI EIS for the Central Utah Coal Region and included to supplement discussions.

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TABLE 11-1

MEAN MONTHLY TEMPERATURES AND PRECIPITATION

Month	Average Mean Monthly Temperature - F	Average Mean Monthly Precipitation - Inches
January	23.7	1.06
February	27.5	0.87
March	34.9	1.03
April	43.2	1.06
May	52.6	1.10
June	61.2	1.25
July	69.2	1.13
August	66.9	1.09
September	59.6	1.09
October	48.5	1.35
November	34.1	0.85
December	26.1	1.27
Mean Annual Temperature	45.5F°	

Normal Total
Rainfall: 14.15 Inches

NOTE: Weather: Meteorlogical data for the general area in the form of average mean monthly temperture and average mean monthly precipitation has been obtained from the U.S. National Climate Center of Asheville, North Carolina on February 25, 1975.

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FIGURE 11-1

EXCERPTS FROM USDI EIS FOR THE CENTRAL UTAH COAL REGION

4. Air

Most of the region lies within the central area of Upper Colorado River Air Basin described in Environmental Research and Technology (1976). The air basin concept is useful for air quality impact analysis, but it must be emphasized that the concept is valid only under certain meteorlogical conditions. The assumption of contained flow is most accurate under drainage or light flow conditions. Under vigorous, large-scale flow, the assumption breaks down and mixing between air basins occurs with relative ease (AeroVironment, 1977). The central area has been further divided into smaller "sub-basins" where meteorlogical conditions are homogeneous enough to assume relatively homogeneous dispersion characteristics (AeroVironment, 1977). The sub-basins include the east slope of the Wasatch Plateau, the Book and Roan Cliffs, Castle Valley, the east slope of the Sevier Range, and Salt ~~Wash (fig. II-11).~~

a. Surface airflow

Nighttime airflow in the region is primarily drainage in character and generally follows river drainage systems (fig. II-12). Because the flow is induced by the descent of dense, cold air, the atmosphere generally tends toward stability under these circumstances. Wind speeds are generally light.

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FIGURE 11-1 (Continued)

The typical daytime flow regime is strongly influenced by surface heating effects. Solar heating of the surface and the layer of air near the surface tends to create a better mixing situation than the stable drainage flow. A neutral or unstable atmosphere is the result, and mixing is generally strong enough to cause the surface flow to link up with the flow aloft, as far as terrain constraints will allow, resulting in a flow from the southwest as depicted in figure II-12. However, the valley flow regime may alter this pattern. Daytime flow in the rugged terrain tends toward up-valley as the higher ridges act as chimneys or raised heat sources in influencing the flow.

b. Upper level winds

Upper level wind data in the region are scarce, but certain patterns can be discerned from the limited observations available. During most of the year prevailing flow above 1,600 feet (50 m) above ground level (AGL) is generally from the southwest. Topographic barriers present less of an obstruction to flow at this level.

Upper level flow takes on a different character during the winter months. Flow from the northeast predominates due to high pressure centered northwest of the region.

c. Atmospheric stability

Most of the region experiences strong insulation during the day and rapid nocturnal cooling, resulting in a generally stable atmosphere at night and neutral or unstable in the lower layers during the day.

FIGURE 11-1 (Continued)

Areas subject to strong drainage flow, such as mountain valleys, show a high frequency of nighttime stability. In addition, elevated inversions over valleys or canyons may persist throughout the day, further increasing air pollution potential. Table II-11 presents frequency of stability categories in the layer from 500 to 1,500 feet above the valley floor in the Huntington Canyon and Emery area east of the Wasatch Plateau.

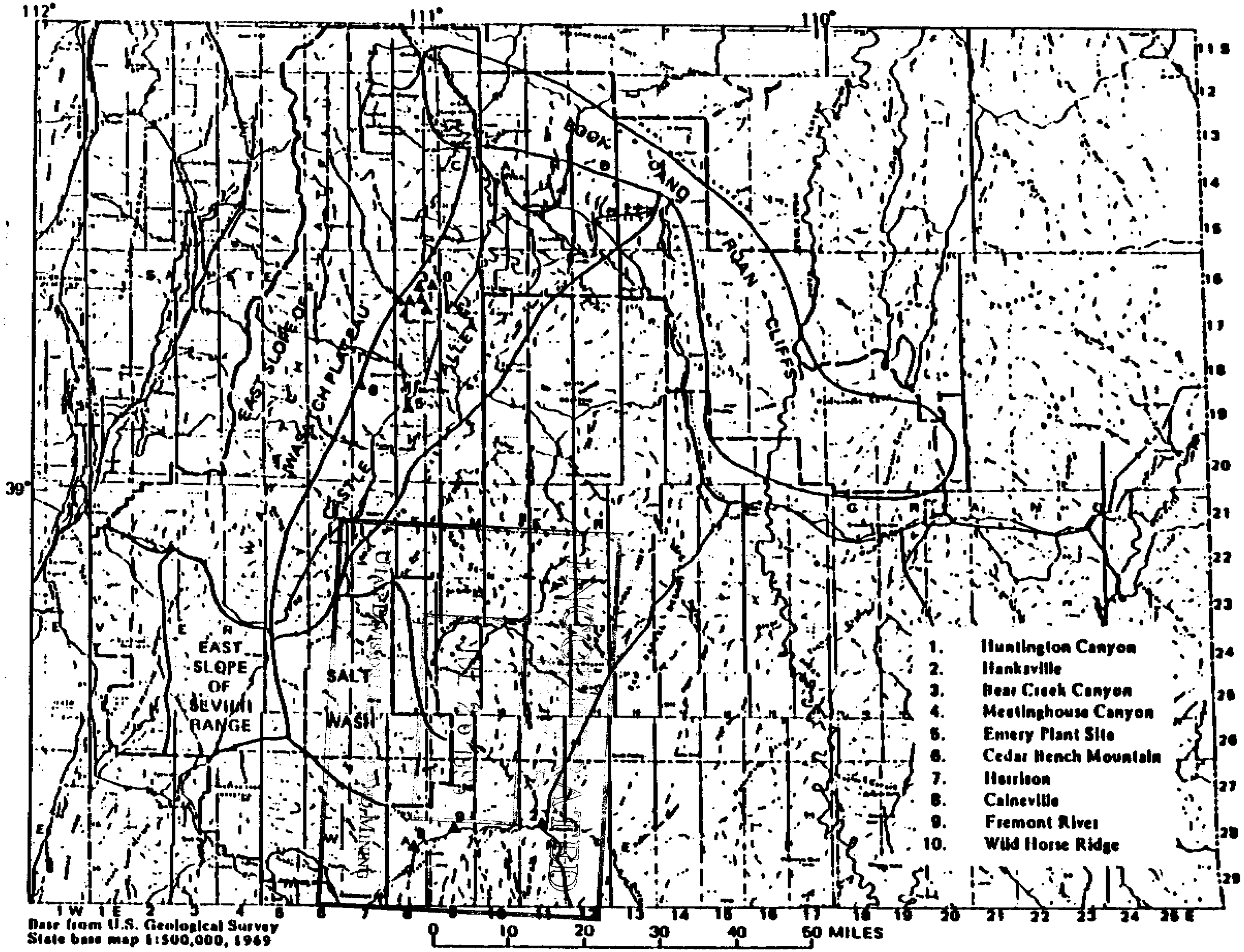

FIGURE II-11.--Air sub-basins and air quality monitoring stations in central Utah (modified from AeroVironment, 1977).

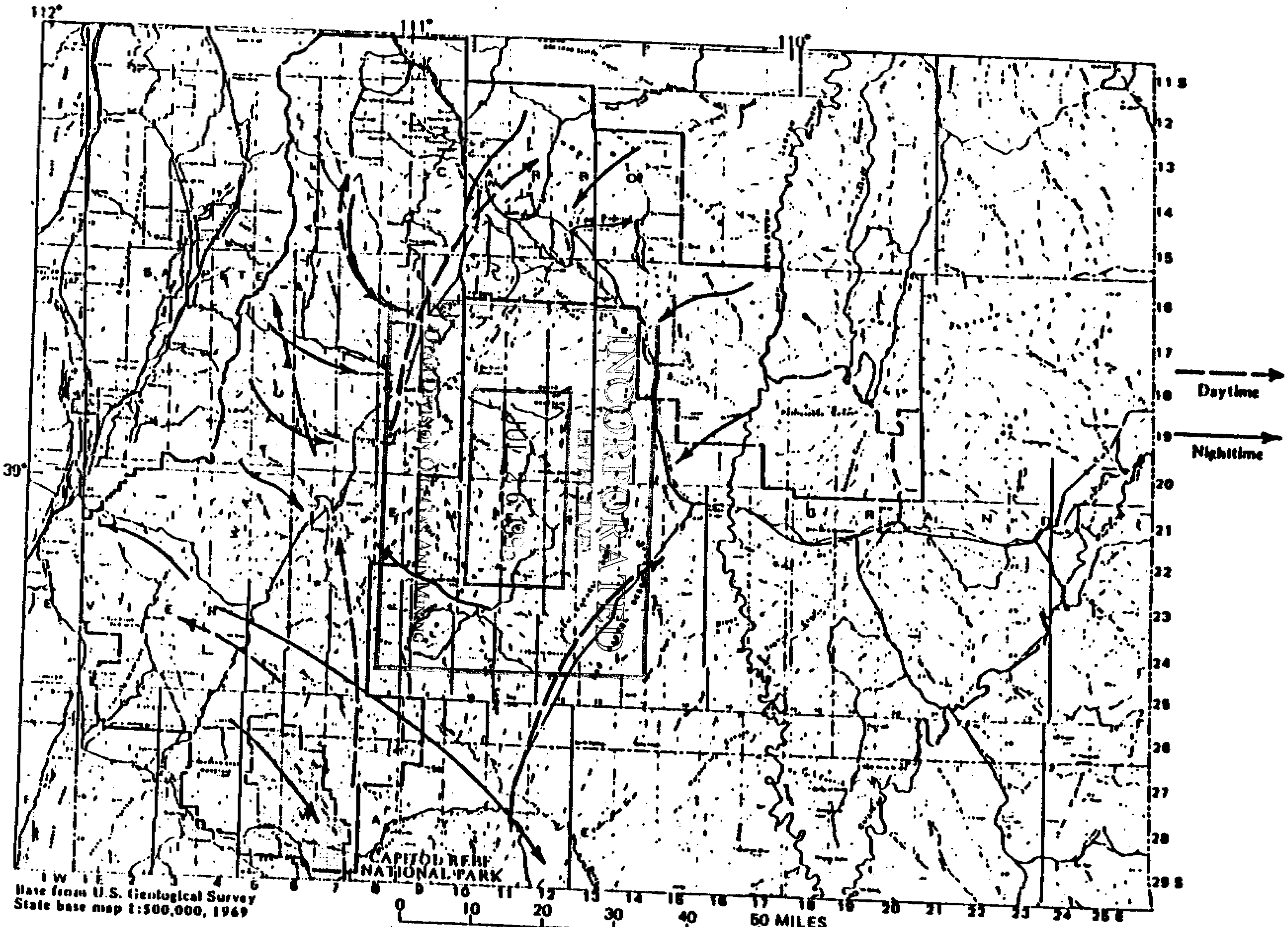

FIGURE II-12.--Streamlines for nighttime drainage air flow and typical daytime surface flow in central Utah (modified from AeroVironment, 1977).

FIGURE II-1 (Continued)

FIGURE II-1

FIGURE 11-1 (Continued)

TABLE II-11.— Stability category frequency for Emery and Huntington Canyon for October 1972-March 1973

(Source: Anderson and Hovind, 1973)

Location	Unstable	Neutral	Moderately Stable	Very Stable	Extremely Stable	Total
	Stability category					
Emery						
a.m.——	1	1	17	22	7	48
p.m.——	0	14	19	12	4	49
Huntington Canyon						
a.m.——	1	5	24	14	4	48
p.m.——	3	19	17	8	2	49

This means that air quality deterioration that would normally accompany moderate, well controlled growth would not be considered significant. The only Federal lands in the region which are presently designed class I areas, in which practically any air quality deterioration would be considered significant, is Capitol Reef National Park (fig. II-12). In addition to the existing mandatory class I area of Capitol Reef National Park, the following areas in the central region are presently being considered by BLM for recommendation to the State of Utah for class I redesignation: Desolation Canyon, the San Rafael Reef, Lower Green River, Mexican Mountain, and Sids Mountain. The implications of power plants affecting these areas will be discussed in detail in the Emery 3 and 4 and IPP environmental impact statements.

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Because most of the region is rural in nature, air quality monitoring has not been extensive. Because of low population density, limited human and industrial activity, air quality is generally considered to be good to excellent. Monitoring has been done around potential and existing power plant sites by consultants and in other areas by the Environmental Health Services Branch of the Utah State Division of Health (fig. II-11). These data are summarized below.

1) Suspended particulate matter

Monitoring of total suspended particulates (TSP) in the study area is relatively extensive compared to that for many other pollutants (Table II-12). Violation of the primary National Ambient Air Quality Standards (NAAQS) for annual geometric mean (AGM) were recorded at Huntington and Cedar Bench Mountains. Violations of the TSP standards in these areas are generally associated with blowing dust during periods of high wind. Based on 6 months of monitoring, violations of the secondary standard were recorded at Price. Violations of the primary standard for 24-hour average were recorded at two locations, and violations of the secondary standard were recorded at four additional locations.

FIGURE 11-1 (Continued)

TABLE II-12.— Total suspended particulate readings at stations in and near the study area

Location	Period of Observation	Maximum 24-hour Average	AGM[1] (ug/m^3)
Price	6/75-12/75	181	72
Huntington	1974	356	89
Huntington Canyon	1975	191	22
Bear Creek Canyon	1974	222	21
Emery plantside	7/74, 12/74	179	—
Castle Dale	7/74, 12/74	86	—
Ferron	7/74, 12/74	150	—
Cedar Bench Mountain	1971	1016	84
Harrison	1972	56	20
North Emery	1974	119	26

[1] National Ambient Air Quality Standard for Maximum 24-hour secondary standard is 140 ug/m^3 for the primary standard.

[2] National Ambient Air Quality Standard for Annual Geometric Mean (AGM) is 60 ug/m^3 for the primary standard.

2) Sulfur dioxide

Ambient air quality data for sulfur dioxide is available ~~from 12 loca~~tions near the region (Table II-13). No violation of any NAAQS for SO_2 has been reported in or near the region. The highest values at more rural sites have been 15 cirograms per cubic meter (ug/m^3 maximum 24-hour and 502 ug/m^3 maximum 3-hour average at Meetinghouse, both near Huntington Canyon. These values are 19 percent, 59 percent and 39 percent of the NAAQS, respectively.

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FIGURE 11-1 (Continued)

3) Oxidant

Only two stations near the region have monitored oxidant. Because it is a major constituent of photochemical smog, it is primarily an urban pollutant. (AeroVironment, 1977) has shown that ozone violations can occur in very rural areas in Utah. Monitoring of ozone at Salt Wash and Price in 1975 have shown no violations of the NAAQS.

FIGURE 11-1 (Continued)

TABLE II-13— Sulfur dioxide readings at locations in and near the study area

Location	Period of observation (month/year)	Annual average ug/m^3	Maximum 24-hour average ug/m^3	Maximum 3-hour average ug/m^3
Price	1975	3	26	131
Huntington	7/74, 12/74-1/75	8	19	—
Huntington Canyon(1)	1975	30	52	260
Huntington Canyon(2)	1/75	—	69	251
(valley floor)	6/75-8/75	4	13	58
Bear Creek Canyon	7/74, 12/74-1/75	15	28	—
Emery plantsite	7/74, 12/74	8	8	—
Castle Dale	7/74, 12/74	8	13	—
Ferron	7/74, 12/74	5	13	—
Cedar Bench Mountin	7/74	5	5	—
Harrison	7/74, 12/74-1/75	8	18	—
Wild Horse Ridge	6/75-8/75	3	13	134
Wild Horse Ridge	1/75	—	161	502
Meetinghouse Canyon	6/75-8/75	14	26	202
Meetinghouse Canyon	1/75	13	216	472

(1) Measurements made by Environmental Health Services Branch of Utah State Division of Health.

(2) Measurements made by North American Weather Consultants.

(3) Value below detectable limit of instrument.

4) Oxides of nitrogen.

Nine locations have monitored NO_2 near the region and NO_x has been monitored at one other (Table II-14). Annual averages are well-below the NAAQS. Two months of monitoring at Huntington in 1971 demonstrated an average of only 17 ug/m^3 , which is 17 percent of the NAAQS for other annual average. Averages at other locations are lower.

FIGURE 11-1 (Continued)

5) Carbon monoxide

No data for carbon monoxide is available for the region. However, because the area is essentially rural in nature, carbon monoxide levels are assumed to be low. Monitoring performed in other rural or suburban parts of Utah and Arizona has shown maximum 8-hour averages of 5 ug/m^3 at Lindon, Utah, 1 ug/m^3 at Florence, Ariz. and 3.7 ug/m^3 at the remote proposed oil shale tracts in the Uintah Basins. Thus, it is unlikely that NAAQS are currently being violated.

FIGURE 11-1 (Continued)

Location	Period of Observation (month/year)	Average ug/m^3	Maximum 24-hour Average $/ug/m^3$
Huntington	11/71-12/71	17	—
Huntington	7/74, 12/74-1/75	7	16
Huntington Canyon (valley floor)	7/75-8/75	6	19
Bear Creek Canyon	1972	—	34
Bear Creek Canyon	7/74, 12/74-1/75	10	24
Castle Dale	7/74, 12/74	14	24
Ferron	7/74, 12/74	7	12
Cedar Bench Mountain	7/74	2	4
Harrison	7/74, 12/74-1/75	10	22
Emery County	8/70	—	155
Meetinghouse	12/74-1/75	5	23
Meetinghouse Canyon	6/75-8/75	15	39
Emery plant site	7/74, 12/74	4	8

1 This reading includes both NO and NO_2 .

6) Hydrocarbons

No monitoring of hydrocarbons has been performed in the region. The relatively small automobile population and lack of industry in the study area implies that concentrations are low. However, measurements in the proposed oil shale tracts and in Florence, Arizona have shown that rural areas may exceed the 6-9 a.m. non-methane hydrocarbon NAAQS guideline levels. Thus, it is not possible to rule out current excesses of the guideline concentrations in the region.

7) Visibility

Measurements of atmosphere visibility (visual range or discoloration) are extremely limited in the region. Trijonis (1978) concludes that median visibilities in non-urban areas of the Southwestern United States are 65 to 80 miles. Values of visual distance in the Huntington area using light-scattering measurements from an integrating nephelometer demonstrated an average of 67 miles for the period September 1970 to March 1971. Average visual range calculated from particle-size distributions at Bear Creek and Huntington Canyons in 1974 was approximately 45 miles. Analysis of photographs taken at Clawson, Utah from January to June, 1974, indicated 50-mile visibility 49 percent of the time. Visibility was reduced below 5 miles only 12 percent of the time. Visibility measurements at Cedar Mountain, east of Castle Dale using photographic photometry have shown averages between 94 miles in November-December 1976 and 54 miles in April 1977 (Pueschel and others, 1978). The National Park Service, in cooperation with the EPA Environmental Monitoring and Support Laboratory at Las Vegas, is presently instrumenting stations at Capitol Reef, Canyonlands, Arches, Bryce Canyon, and Zion National Parks to document visibility.

1. Air Quality

Applicable legislation and regulations relating to air quality include:

—— Clean Air Act, as amended in 1977;

—— National Ambient Air Quality Standards (NAAQS);

—— New Source Performance Standards (NSPS);

—— Prevention of significant Air Quality Deterioration Regulations (PSD) of June 19, 1978);

—— Fugitive Dust Policy: State Implementation Plans (SIP) and New Source Review (EPA, August 1, 1977);

—— Utah Ambient Air Quality Regulations.

The Clean Air Act of 1970 specified that each State would be responsible for ensuring the air quality within its borders and for specifying the way it would be achieved and maintained.

On April 30, 1971, the EPA officially announced the primary and secondary NAAQS (Federal Register, 1971). The primary standards were established to protect human health, whereas the secondary standards were established to protect the public welfare from any known or anticipated adverse effects. Standards were put into effect for suspended particulate matter, sulfur oxides, nitrogen oxides, photochemical oxidants, carbon monoxide, and hydrocarbons.

Utah Air Conservation Regulations presently in effect were promulgated September 25, 1971, and revised May 22, 1977. These regulations do not officially adopt the NAAQS, but NAAQS are enforceable in the State. Changes to the Utah regulations are presently being considered by the Air Conservation Committee and are presently in public hearing (December 1978).

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The Clean Air Act mandated division of each State and appropriate interstate area into air quality control regions (AQCRs). The Clean Air Act Amendments of 1977 require the States to identify regions and parts of regions that do and do not meet the NAAQS by December 7, 1977, thereby determining which areas are governed by Prevention of Significant Deterioration (PSD) and nonattainment (NA) requirements, respectively. In January 1978, the State of Utah submitted to EPA its initial list of seven NA areas in Utah. The only area potentially impacted by central regional development would be Price (Carbon County).

EPA promulgated PSD regulations to protect air quality in those areas where present quality is better than required under NAAQS. The State of Utah was initially classified a Class II area with the exception of five national parks: Arches, Canyonlands, Capitol Reef, Bryce, and Zion, which are mandatory Class I. Of these five Class I areas, only Capitol Reef National Park is located in the region (fig. II-12, in pocket). At present, neither the State of Utah nor the Indian Tribal Councils has definite plans to reclassify any other areas of the State.

Fugitive dust resulting from mine operations is not subject to requirements of the PSD regulations. However, a review is required to determine the best available control technology (BACT) where potential fugitive dust emissions are equal to or greater than 250 tons per year. Each mine operator will have to employ the best management practices for each mining plan and the Department's approval thereof shall use, at a mimimum, an appropriate combination of the following fugitive dust controls:

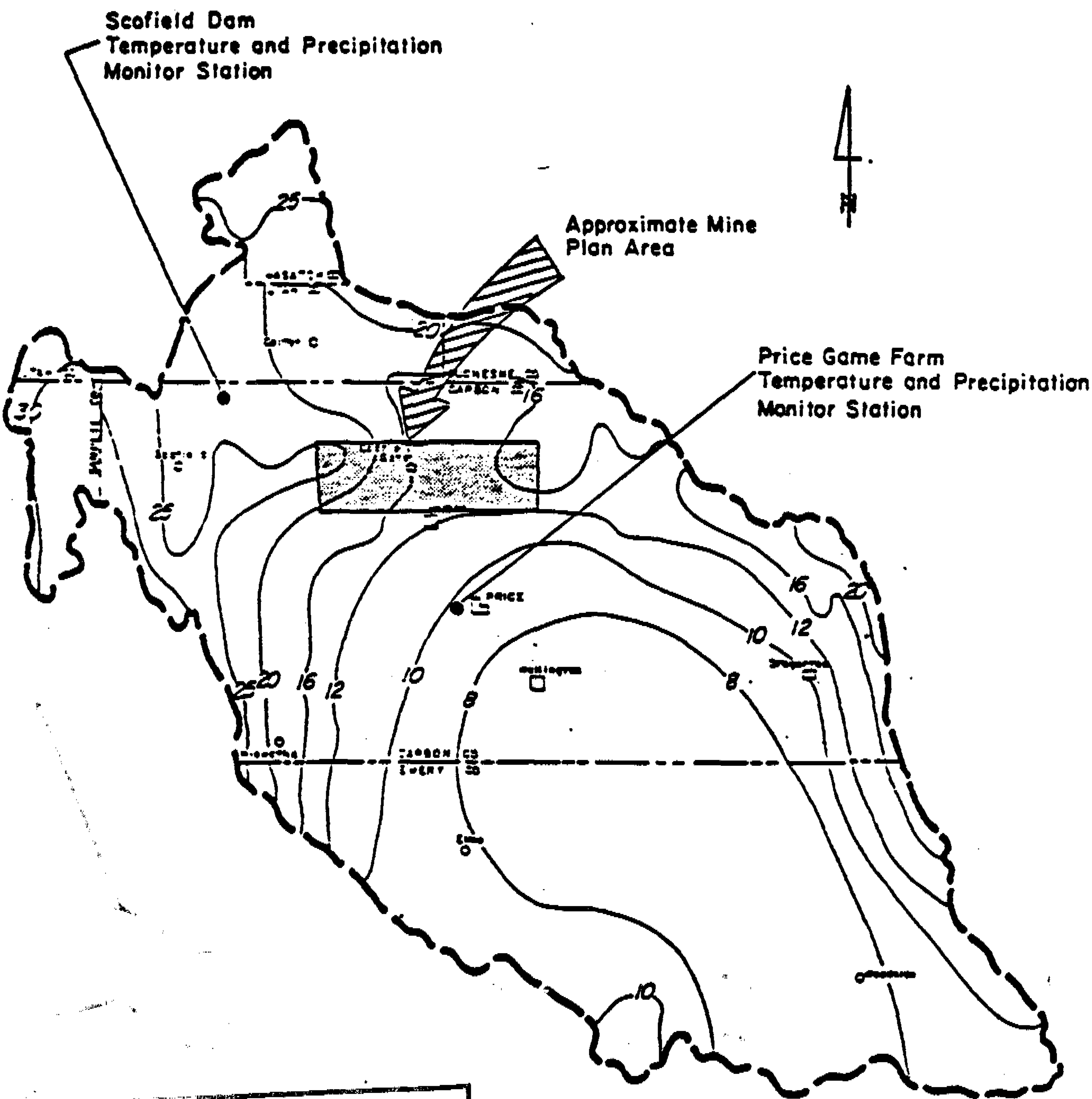
- Pavement or equivalent stabilization of all haul roads used or in place for more than 1 year;
- Treatment with semipermanent dust suppressant of all haul roads used or in place for less than 1 year or for more than 2 months;
- Watering of all other roads in advance of and during use whenever sufficient unstabilized material is present to cause excessive fugitive dust:
- Reduction of fugitive dust at all coal dumps and truck to crusher locations through use of negative-pressure bag house or equivalent methods. Inclusion of conveyor and transfer point covering and spraying and the use of coal loadout silos.

In the above measures, the term haul road should be interpreted to include roads used for haulage of coal and major mine access roads. Busing of employees to and from work would result in less impact to air quality and visibility than allowing workers to drive their own cars.

In the 1977 Clean Air Act amendments, Congress declared as a national goal "the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas which impairments result from man-made air pollution". The EPA is required to develop regulations regarding visibility in mandatory Class I areas by August 1979.

ANNUAL PRECIPITATION
PRICE RIVER DRAINAGE

FIGURE 11-2



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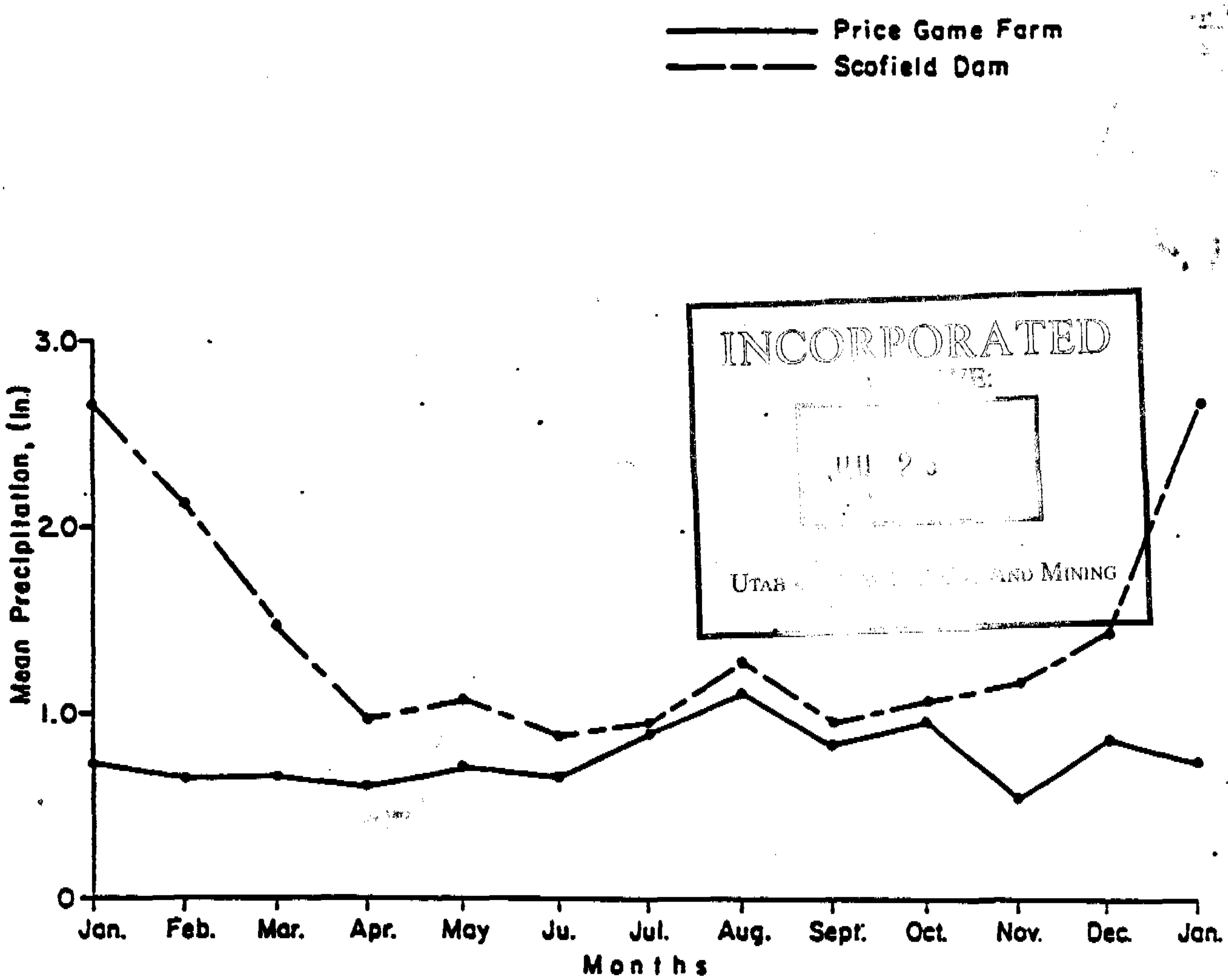
MEAN MONTHLY PRECIPITATION
PRICE RIVER DRAINAGE

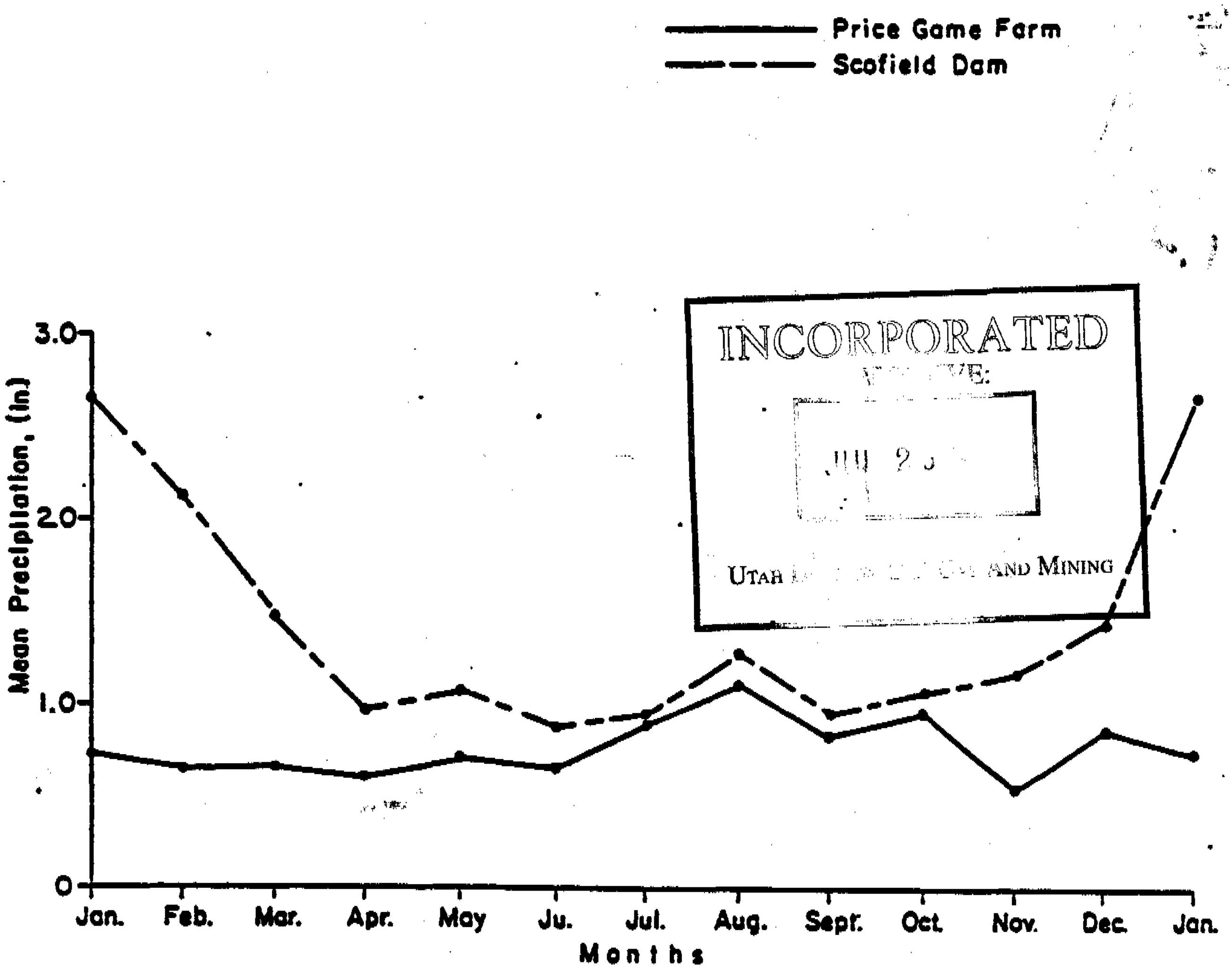
FIGURE 11-3

(from Utah Division of Water Resources, 1975)



MEAN MONTHLY PRECIPITATION
PRICE RIVER DRAINAGE

(from Utah Division of Water Resources, 1975)



11.1 ENGINEERING CRITERIA BASED ON CLIMATOLOGIC DATA.

The principal impact of the regulations on the areas of concern is received from the requirements for protection of the hydrological regime. Presented below and in Chapter 7 are discussions of the background and criteria for the design of sediment control, diversion, drainage, and other hydraulic structures.

11.1-1 REGIONAL HYDROLOGY.

Evaporation and infiltration rates in the area vary with vegetation, soil type, and time of year. Average annual potential evaporation in central Utah is 40 inches per year (Geraghty, et. al., 1973). Net infiltration rates for unfrozen soil under similar conditions to those found in the Helper area are around 0.50 inches per day (Gray, 1973).

Most stream channels in the watersheds considered contain no flowing water except during snow melt or heavy rains. Willow Creek and Price River, however, flow continuously. Watershed runoff during storm events carries heavy sediment load. Cloudburst floods are relatively common in the area, with most occuring in the months of July and August (Butler and Marsell, 1972). Velocities in natural stream channels during 100-year floods were calculated for various representative stream channels in the study area and were found to range from 15 to 25 ft./sec.

Detailed information on hydrology and design data can be reviewed in Chapter 7 of this application.

11.2 AIR QUALITY CONSIDERATIONS.

Castle Gate Coal has no combustion related point source emissions. Most potential emissions are of a non-point source fugitive particulate nature, as can be generated by unpaved roads and coal storage and processing. CGCC uses various control systems and techniques to minimize fugitive emissions.

11.2-1 ACCESS ROADS.

CGCC has about 2 miles of unpaved access road which are treated with magnesium chloride and frequently watered.

11.2-2 TRUCK HAULAGE.

CGCC ceased truck haulage from Hardscrabble Canyon in 1987. Truck haulage will continue on the paved road at the Castle Gate Prep Plant.

11.2-3 COAL CONVEYORS.

Coal conveyors are covered. Additionally coal from the mine averages 10% moisture content.

11.2-4 BAG HOUSES.

Negative pressure bag houses are installed and operating at all above ground coal transfer points. These units are designed to be 99.9% efficient for removal of fugitive dust.

11.2-5 DROP AND LOAD-OUT POINTS.

Storage areas are filled by stacking tubes. Load-out from piles is by sub-pile chutes.

The truck dump grizzly is enclosed with only one wall open for truck access. A "rainbird" type sprinkling system wets the grizzly access area.

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The rail car load out is through a chute positioned approximately four feet above the car bed. Rail cars are sprayed with a glue-like, surface encrusting solution shortly after loading.

The clean coal loadout is filled via a belt conveyor and drop chute but the average moisture after cleaning remains at about 10%. (See Chapter III, Section 3.8 Unit Train Loadout)

11.2-6 STORAGE PILES.

Coal piles have a high moisture content (10%) and are, generally loaded out in a day or two, allowing little time for desiccation. When it is necessary to store coal for longer periods, piles are watered.

We feel that the best currently available technology is being used for control of fugitive dust on CGCC facilities.

11.3 AIR QUALITY MONITORING.

CGCC does not operate an air quality monitoring program. Discussions with Utah Department of Health, Bureau of Air Quality have indicated that a program is unnecessary. CGCC has requested specifically a determination of need for a monitoring program and has been verbally informed to the negative by agency administrators (2-81, Montie Keller; 5-82, Mike Bieling). The included sections, excerpted from the USDI Central Utah Coal Region EIS, discusses monitoring that is on going in the region and suggest that little deterioration to air quality is expected from mining operations using best available control technology.