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ENVIRONMENTAL SURVEY

URANIUM/COPPER PROJECT
COPPERTON SITE, UTAH

WYOMING MINERAL CORPORATION
LAKEWOOD, COLORADO

REVISION I
AUGUST 1982

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SECTION 1.0

ACTIVITIES

1.1 INTRODUCTION

Wyoming Mineral Corporation (WMC) has constructed and presently operates a uranium extraction facility at the Kennecott Copper Corporation's Bingham Canyon Mine near Copperton, Utah (see Figure 1.1-1). Accordingly, this environmental survey has been prepared to fulfill the requirements of the U.S. Nuclear Regulatory Commission using USNRC Regulatory Guide 3.8 as a pattern to the extent possible.

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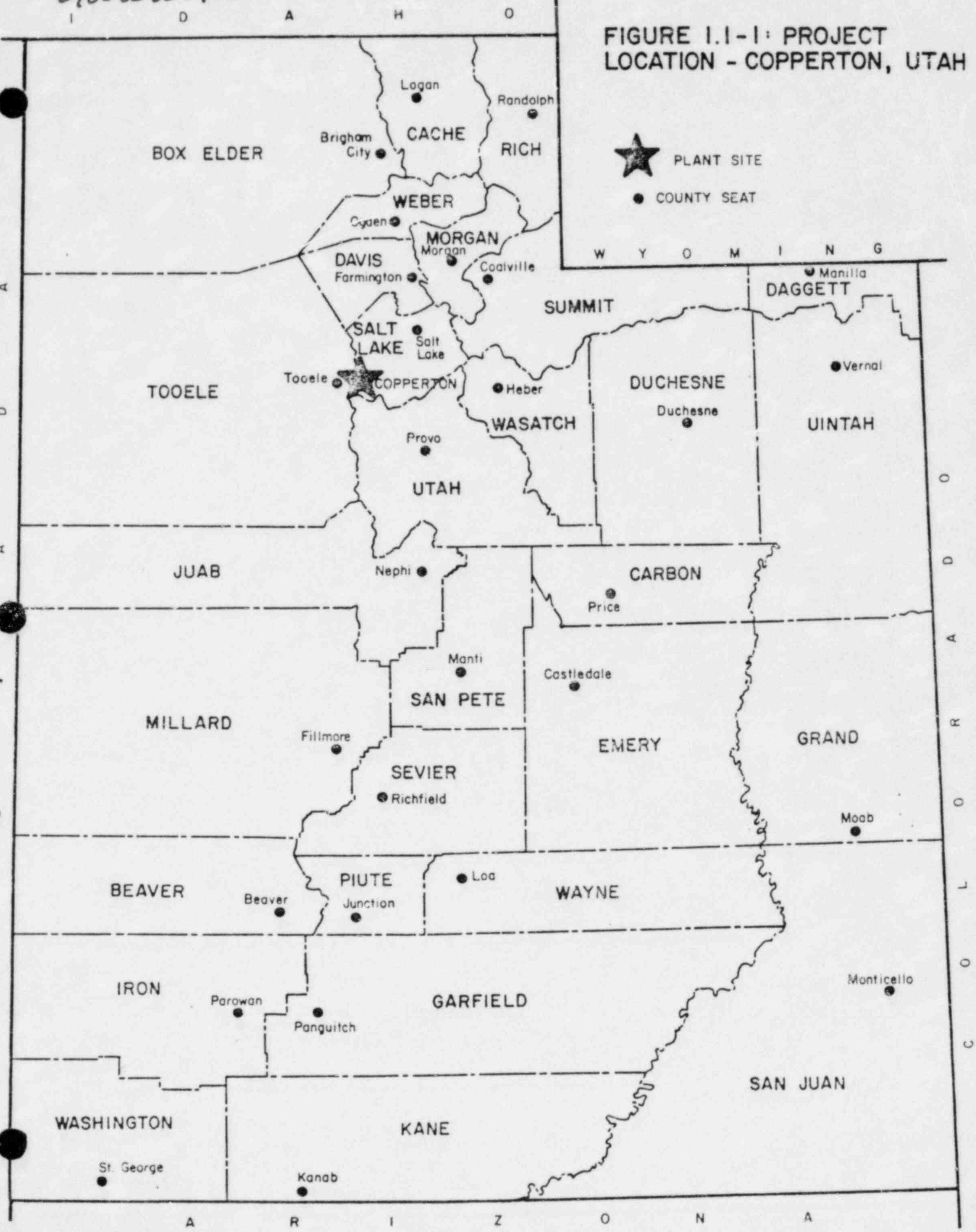

FIGURE 1.1-1: PROJECT LOCATION - COPPERTON, UTAH

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1.2 DESCRIPTION OF THE PROJECT

The large-scale copper mines of the world typically work porphyry deposits from which a significant portion of copper production is obtained by leaching dump material. In a copper leach operation, oxidation reactions involving water, air and naturally occurring bacteria leach copper from the dump material. The dumps are constructed so that the leach solution is recovered at the bottom of the dumps. This solution flows from the dumps to a copper cementation plant where the copper values are recovered. The solution is then returned to the top of the dumps (Figure 1.2-1) forming a closed loop system.

At the same time that copper is leached from the dumps, uranium is also leached. Wyoming Mineral Corporation has signed a contract with Kennecott Copper Corporation to build and operate a plant to recover the uranium from their copper leach operation at the Bingham Canyon Mine.

The 1981 production rate of the uranium extraction facility was approximately 140,000 pounds U_3O_8. The facility is estimated to have an operating life of 20 years. The average concentration of U_3O_8 in the leach solution is considered to have reached an equilibrium value and production is expected to remain in the 140,000/lb./year range.

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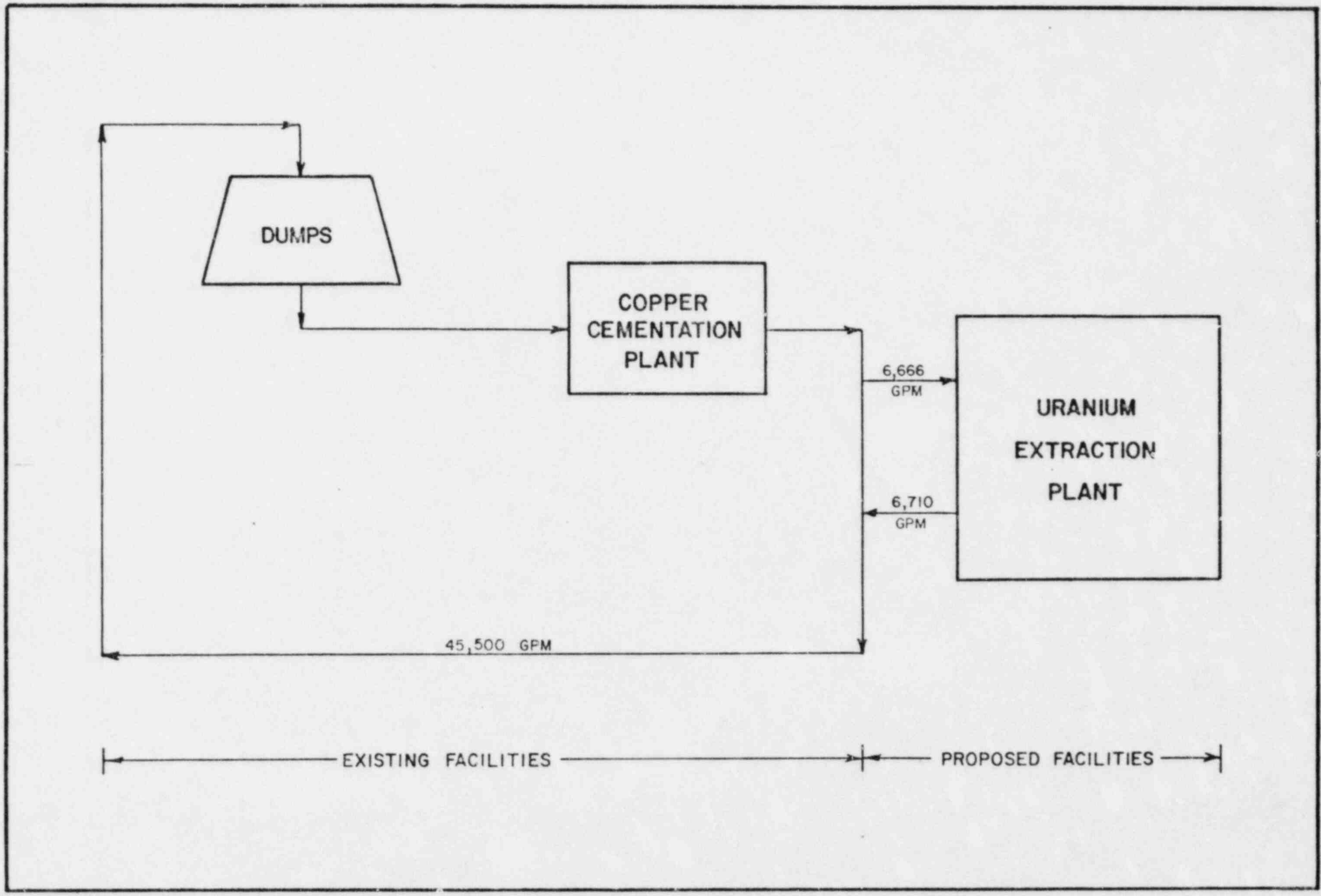

FIGURE 1.2-1: GENERALIZED FLOW SHEET OF LEACH SOLUTION

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1.2.1 PROJECT AND PLANT ORGANIZATION

Wyoming Mineral Corporation owns and operates the uranium recovery plant on Kennecott property. A royalty is paid to Kennecott on a production basis. Management of the plant is under a Wyoming Mineral Plant Manager who reports to the President of Wyoming Mineral.

1.2.2 PROCESS AND PLANT DESCRIPTION

The uranium recovery plant uses the ELUEX type of process which is commonly used in the uranium industry. There are three characteristic features of the ELUEX process, viz, resin ion exchange, solvent extraction and precipitation (see Section 3.0). Because the project does not involve conventional mining methods, neither overburden nor tailings disposal problems exist. Solution flows from the Kennecott copper precipitation plant through the WMC uranium extraction plant and back to the mine dumps in a continuous cycle.

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SECTION 2.0

THE SITE

2.1 SITE LOCATION AND LAYOUT

The site is a tract of approximately 1.3 acres located in the NE1/4 of Section 18, T3S, R2W, near the unincorporated town of Copperton, Salt Lake County, Utah. (Fig. 2.1-1 and 2.1-2). Copperton is approximately thirty (30) miles southwest of Salt Lake City on the eastern slope of the Oquirrh Mountain Range in what is known as the Bingham or West Mountain Mining District. The site is located on property owned by Kennecott Copper Corporation and is a part of the Bingham Canyon Mine. The site is under lease to Wyoming Mineral Corporation and zoned for heavy industrial uses by Salt Lake County. (2,3,4) All the property immediately adjacent to the proposed site is owned by Kennecott Copper Corporation.

The plant covers approximately 8,000 sq. ft. of the site with a remainder allocated to parking and loading areas, storage and boundary space. No other uses are proposed for the property.

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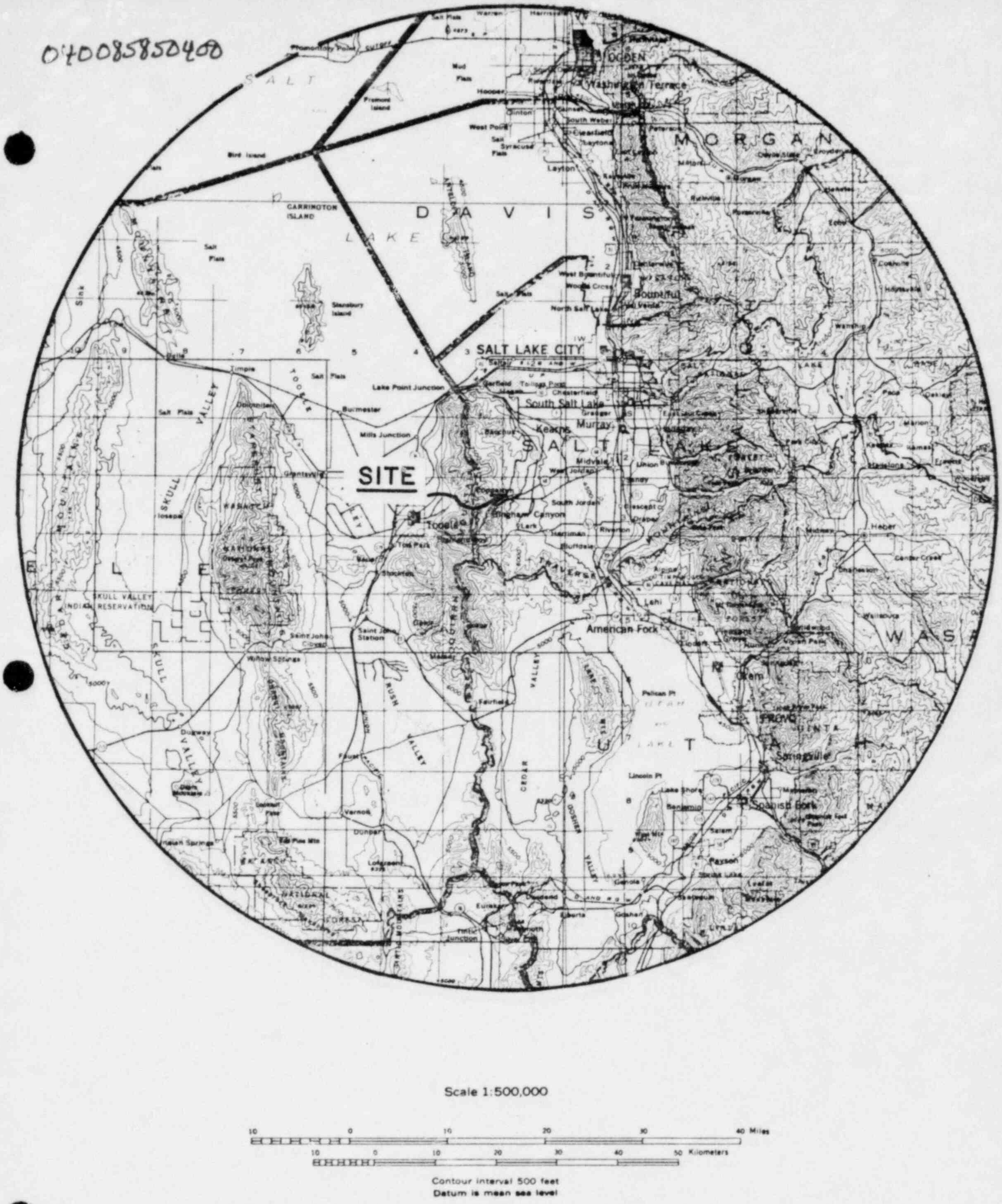

FIGURE 2.1-1: AREA WITHIN 50-MILE RADIUS OF SITE

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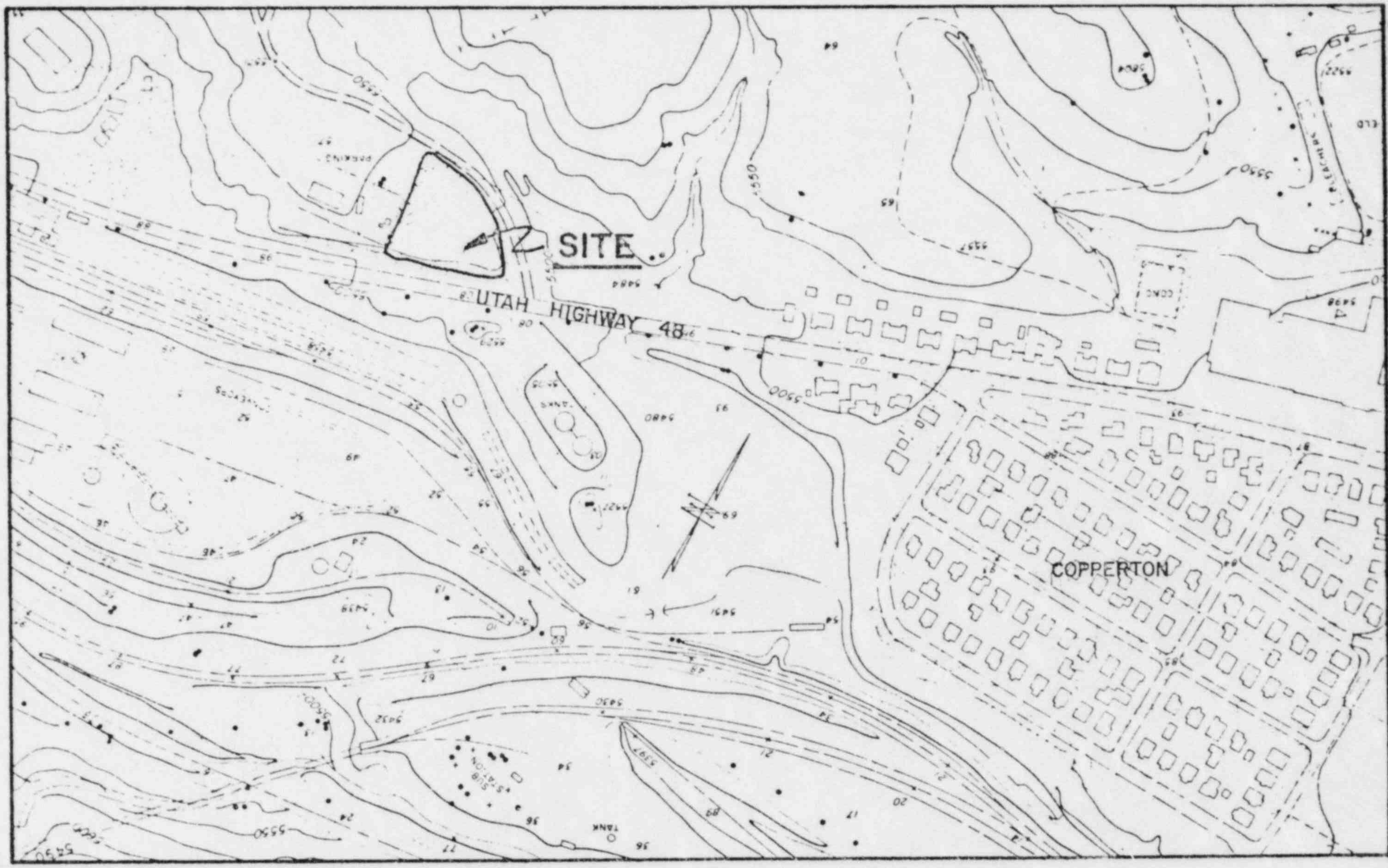

FIGURE 2.1-2: DETAILED SITE MAP

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2.2 REGIONAL DEMOGRAPHY AND LAND USES

Figure 2.1-1 describes a fifty (50) mile radius of the proposed site. Included in the area described by this radius are all or portions of nine (9) Utah counties which contain Utah's two (2) Standard Metropolitan Statistical Areas (Ogden-Salt Lake City and Provo-Orem) and the majority of the state's inhabitants (see Table 2.2-1).(1) Also within this radius are portions of four (4) National Forests (the Ashley, Cache, Uinta and Wasatch National Forests), the Skull Valley Indian Reservation, Utah Lake and portions of the Great Salt Lake. No other nuclear fuel cycle facilities are known to be located with this radius.(2,3,4,5)

A five (5) mile radius of the proposed site is shown in Figure 2.2-1. (Enclosed map in pocket.) Two (2) unincorporated towns are found in this radius and nearly all of the population in the radius are located in the sparsely populated Bingham Enumeration Districts 0006A and 0007A of Salt Lake County (Table 2.2-2)(1). The area is predominantly rural in character. In the immediate vicinity of the site, the population has decreased, from an estimated 2,173 persons reported in the original impact statement (1977) to 1,259 persons reported in the 1980 census. This is a result of Kennecott Copper Corporation's 1,800-acre Bingham Mine operation expansion in the area and is in contrast to the expected increase in population which is occurring and is expected to continue in the more populated areas of the region (see Table 2.2-3).(8)

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TABLE 2.2-1

1980 POPULATIONS OF STANDARD METROPOLITAN STATISTICAL AREAS

(1980 Census)

	NUMBER	PERCENT
The State	1,461,037	100.0
Inside SMSA's, Total	1,154,361	79.0
Salt Lake City - Ogden	936,255	64.1
Provo-Orem	218,106	14.9
Outside SMSA's, Total	306,676	21.0

TABLE 2.2-2

POPULATION OF NEARBY INHABITED AREAS

AREA	POPULATION	PERCENT
Copperton (unincorporated) (1980 estimate)	646	51.3
Herriman (unincorporated) (1976 estimate)	613	48.7
Total of Census Enumeration Districts 0006A and 0007A	1,259	100.0

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TABLE 2.2-3

POPULATION PROJECTIONS

(April 1982)

Wasatch Front Regional Council

(Davis, Salt Lake and Weber Counties)

Ogden City	1970 Census	69,537
	1980 Census	64,235
	1995 Estimate	95,546
Weber County (Including Ogden City)	1970 Census	124,130
	1980 Census	139,709
	1995 Estimate	184,062
North Davis County	1970 Census	51,489
	1980 Census	78,825
	1995 Estimate	137,280
South Davis County	1970 Census	99,028
	1980 Census	144,294
	1995 Estimate	227,631
Salt Lake City	1970 Census	179,431
	1980 Census	160,784
	1995 Estimate	179,402
Salt Lake County (Including Salt Lake City)	1970 Census	475,800
	1980 Census	626,795
	1995 Estimate	795,567

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Since November 1971, the town of Bingham Canyon, the area's only incorporated municipality, has ceased to exist due to mine expansion. To the west, north and south of the site (with the exception of the mine) is undeveloped and nearly uninhabited mountain land, with the rich agricultural land of the Jordan River Valley lying directly to the east. Land use in the populated area to the east is summarized in Table 2.2-4. (8) The area is under the jurisdiction of the Salt Lake County Planning Commission and the proposed use of the site area is consistent with the Salt Lake Valley master plan. (10)

No National Forests nor National Parklands are located in the five (5) mile radius although there is considerable undeveloped mountain land used for recreation. There are no hospitals nor institutions of higher learning in the five-mile radius; the area's residents receive these services in metropolitan Salt Lake City or other heavily populated nearby areas. School population in the five-mile radius is limited to secondary-school pupils. Public school attendance in the Bingham Canyon Census Tract, Enumeration Districts 0006A and 0007A in 1982 is 910 persons.(11). In 1982, the areas's largest employer is Kennecott Copper Corporation's Bingham Canyon Mine with approximately 2,000 employes, most of whom commuted from outside the immediate vicinity of the mine site. (1,9)

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TABLE 2.2-4

LAND USE ACREAGE SUMMARY

BINGHAM CANYON CENSUS TRACT - 1755.2 TOTAL ACRES

LAND TYPE	ACRES
Residential	165.1
Commercial	0
Industrial	31.6
Transportation	138.8
Institutional	0
Utilities	17.4
Parks and Recreation	2.3
Agricultural	1,382.3
Vacant	28.8

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2.3 REGIONAL HISTORIC, SCENIC, CULTURAL AND NATURAL LANDMARKS

A search of the National Historic Register of Historic Places listings through early 1982 revealed a number of sites within 50 miles (see Appendix A-1). Three sites (Dansie Farmstead, Harwarden House, and McLachlen Farmhouse) are within a ten-mile radius toward the east. Each one is occupied by the owners, and none is of major importance such that it attracts crowds. The Bingham Canyon Open Pit Mine lies about five miles to the southwest and draws a steady flow of about 250,000 tourists per year, but the number present at one time usually for not more than about 30 minutes, is at most 60-80.

The archaeological survey of the site originally reported (see Appendix A of the "Environmental Survey, Uranium/Copper Project, Copperton, Utah" of 1976) that no pre-historic or historic cultural remains were found. None was found during construction on the site and none since. The Utah State Preservation Officer reports (Appendix A-2) that a search of Utah State Historical and Archaeological Files reveals no known cultural resources at the Copperton Site or nearby.

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2.4 GEOLOGY

The plant site is located on the east side of the Oquirrh Mountains (Figure 2.1-1), which are part of the Basin and Range Physiographic Province. This province is characterized by long, narrow, isolated, nearly-parrallel mountain ranges separated by elongate basins which are filled with unconsolidated sediments.(1) The Oquirrh Mountains are a north-south trending mountain range that has been strongly folded and pushed upward as part of a thrust sheet that has moved eastward (Figure 2.4-1).(1)

Surficial material at the site is the Harpers Fanglomerate Formation (identified as alluvium in Figure 2.4-2).(2) The Harpers Fanglomerate Formation consists of poorly sorted, poorly consolidated alluvial material, which is composed of angular to subrounded quartzites, sandstones, dark limestones, andesites and latites which range in size from silt particles to boulders 6 to 8 feet across.(3) It was determined from a well log taken at the site that this formation is 202 feet thick (Table 2.4-1). Beneath the Harpers Fanglomerate Formation are Brecciated Latites (igneous rock) of unknown thickness (Table 2.4-1) that dip eastward from the Oquirrh Mountains.

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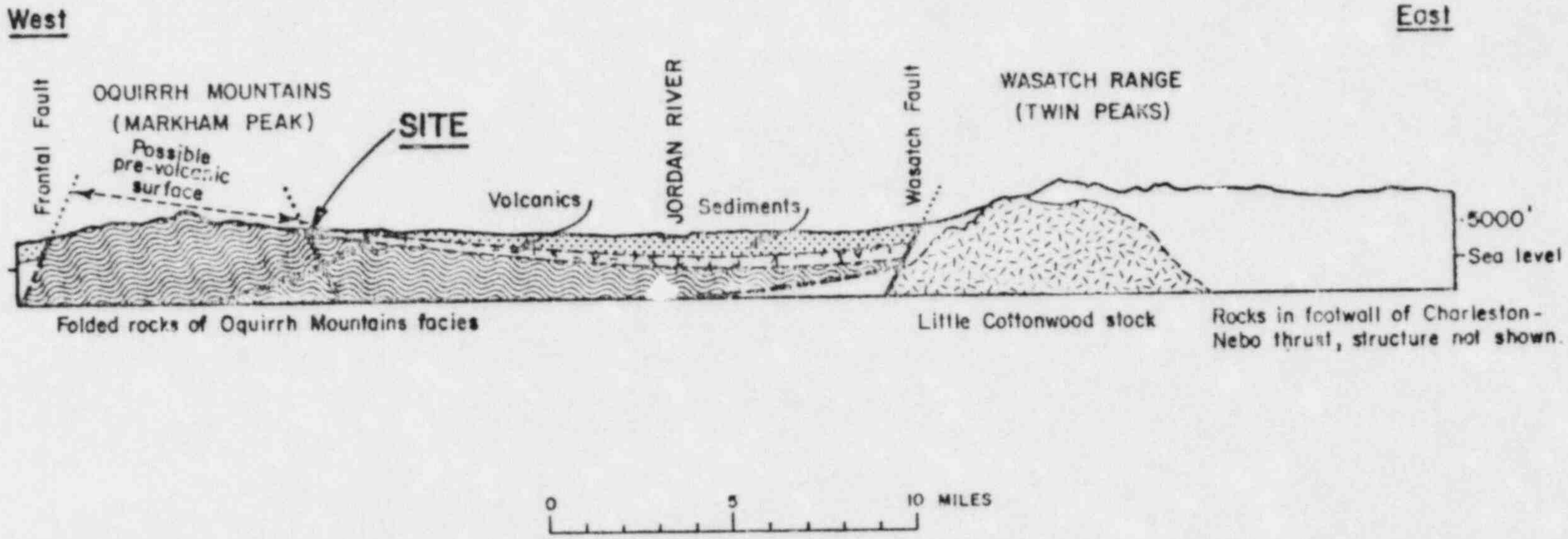

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FIGURE 2.4-1: GENERALIZED CROSS SECTION FROM MARKHAM PEAK IN OQUIRRH MOUNTAINS TO TWIN PEAKS IN WASATCH RANGE.

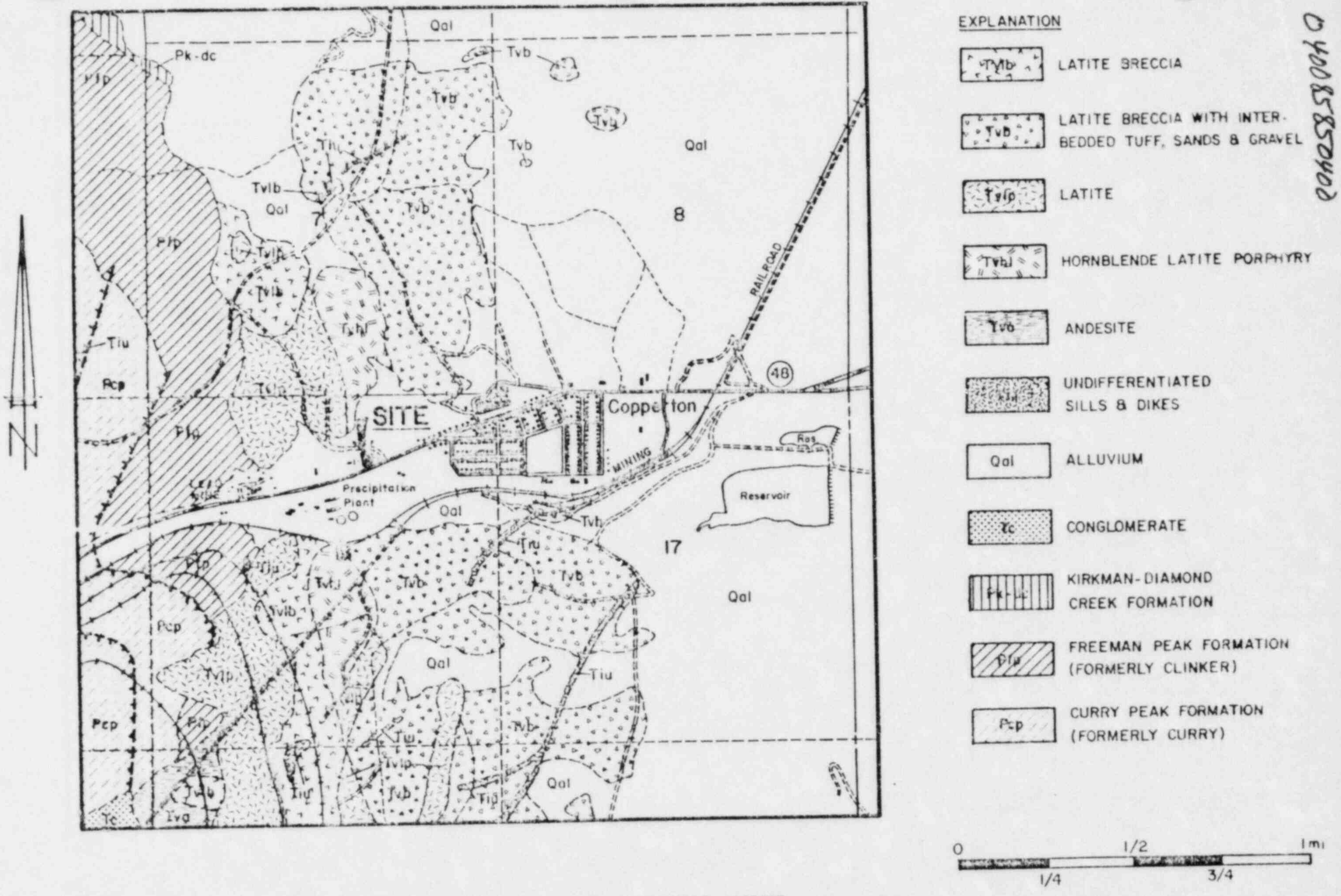

FIGURE 2.4-2: GEOLOGIC MAP OF COPPERTON SITE.

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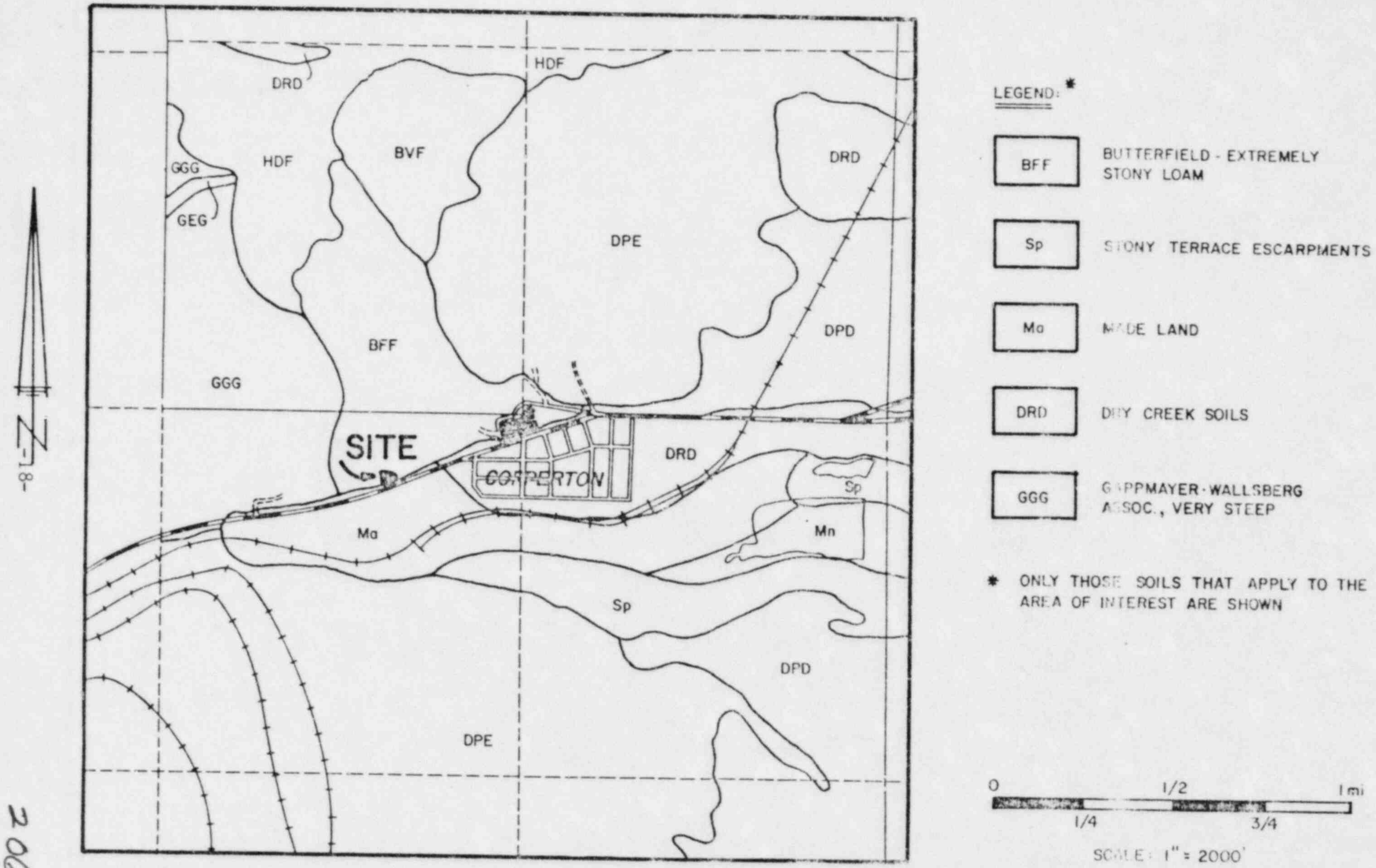

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FIGURE 2.4-3: U.S.G.S. SOIL MAP OF COPPERTON SITE

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The soil at the site is the Butterfield extremely-stony loam.(4) This soil formed to a depth of 20 to 40 inches in colluvium and residuum from andesite rocks on alluvial fans.(2) This soil is well drained, has a moderately slow permeability and runoff is rapid. A soil description is provided in Table 2.4-2(4) and a soil map in Figure 2.4-3.(4)

TABLE 2.4-1

LOG OF WELL X-24

Well Depth (Ft.)	Description
0-5*	Medium sand - 0.8 mm - 80%, gravel - 20%, quartzite - 100% pale yellow to brown subrounded
5-95*	Quartzite 99+%, pale reddish orange volcanics 1%, 95% gravel 10mm, 5% medium sand, poor sorting with sand and gravel grading into each other
95-202*	Quartzite 99+%, pale reddish orange volcanics, 85% gravel +5 mm, 15% medium sand, poor sorting subangular to subround
202-210**	Gray Latite, soft weathered
210-221.5**	Brecciated Latite

* Well Cutting

** Well Core

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TABLE 2.4-2

SOIL DESCRIPTION OF BUTTERFIELD
EXTREMELY-STONY LOAN

A11	0 to 5 inches, dark grayish-brown (10YR 5/2) extremely stony loam, very dark brown (7.5YR 2/2) when moist; moderate, fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; 50 percent stones, cobblestones, and gravel; moderately alkaline (pH 7.9); clear, wavy boundary.
A12	5 to 10 inches, grayish-brown (10YR 5/2) very cobbly light clay loam, dark brown (7.5YR 3/2) when moist; moderate, fine, granular structure; hard, very friable, slightly sticky and slightly plastic; common fine roots; 55 percent stones, cobblestones, and gravel; moderately alkaline (pH 7.9); gradual, wavy boundary.
B2t	10 to 22 inches, brown (7.5YR 5/4) very cobbly heavy clay loam, reddish brown (4YR 4/4) when moist; moderate, fine, subangular blocky structure; very hard, firm, sticky and plastic,; common fine roots; common moderately thick clay films on ped faces and nearly continuous coatings around coarse fragments; 65 percent stones, cobblestones, and gravel; some thin lime accumulations on the bottoms of the coarse fragments; moderately alkaline (pH 7.9); gradual, irregular boundary.
B3ca	22 to 30 inches, light-brown (7.5YR 6/4) very cobbly clay loam, reddish brown (5YR 4/4) when moist; massive, very hard, firm, sticky and plastic; slightly calcareous matrix with thick lime coatings on the bottoms and sides of coarse fragments; 80 to 90 percent stones, cobblestones, and gravel; moderately alkaline (pH 7.9); abrupt, wavy boundary.
R	30 inches, weathered bedrock.

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2.5 SEISMOLOGY

The seismology data for Utah has been updated based on new references (7,8). Since the start of plant operations, there have been no earthquakes felt at the plant site. In the time period from the original impact statement to present (January 1971 to December 1980) there has been only one reported earthquake of 3.0 or greater on the Richter Scale in Salt Lake County. On March 9, 1978, there was an earthquake of 3.2 strength centered at 40° - 45.82'N, 112° - 5.87°W.

2.6 HYDROLOGY

2.6.1 GROUNDWATER

Extrapolating from holes drilled at the copper cementation plant, it is estimated that the groundwater is found at a depth of 125 feet beneath the site.(1)

The dominant direction of groundwater movement beneath the site is estimated to be southeast toward Bingham Creek, the nearest stream to the site. This conclusion is based on the eastward dip of the Harpers Fanglomerate Formation (Section 2.4) and the southeasterly slope of the surface towards Bingham Creek.

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The nearest groundwater user to the site is the town of Copperton (Figure 2.2-1). Copperton obtains its water from two wells located approximately 3 miles north of the town,(2) both of which are drilled to a depth of 1,200 feet. All Kennecott facilities near the Copperton plant are supplied by a potable water system that obtains its water from the Oquirrh Mountains and from deep wells.(3) None of the water for either of these systems is obtained locally near the Copperton Site.

2.6.2 SURFACE WATER

Surface drainage at the site is southeast toward Bingham Creek. Bingham Creek is a part of the copper leach circuit and has an average annual flow rate of approximately 3,470 gpm. It receives its water from the copper leach dumps (approximately 33% of its watersled is covered by dumps), from runoff and springs upstream in the Oquirrh Mountains (Section 2.4), and flows eastward into a reservoir about one-half mile southeast of Copperton.(4) This reservoir has no outlet and water from it is pumped up to the copper leach dumps.

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In 1963, Woodward-Clyde-Sherard, consulting engineers, completed a study of flood flows that included Bingham Creek.(5) Runoff in this study was calculated using the formula Q = AIR, where Q = runoff, A = size of drainage area, I = factor of imperviousness of each area, and R = maximum average rate of rainfall over the area. This study estimated that the factor of imperviousness was 0.3, the flow velocity of Bingham Creek was 3 ft./sec., and the rate of rainfall was 10 percent greater than the maximum recorded precipitation for Salt Lake City (1.9 inches in 45 minutes). Using the same data, formulas and assumptions, it is possible to calculate the maximum flood discharge for that segment of Bingham Creek nearest the test site. These calculations yield a maximum flood discharge of 256 cu. ft./sec. At this discharge, the flood stage is estimated to 5,480 MSL. The site is located at 5,540 MSL, sixty feet above flood stage

On May 27, 1976, a water sample was taken from Bingham Creek southeast of the site. Analysis of this sample showed that the stream had a pH of 3 and contained 56,000 ppm total dissolved solids. This pH and level of dissolved solids are to be expected since all of the perennial tributaries of Bingham Creek orginate in mine dump areas.

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2.7 METEOROLOGY

The original survey of weather and climate of the plant site as presented in the Environmental Survey, Uranium/Copper Project, Copperton Site, Utah submitted in 1977 was based on data gathered from the National Weather Service, Salt Lake City, Utah Station (located at the Salt Lake City Airport) and from a cooperative station four miles to the southwest of the project at the Bingham Canyon Mine.

A local meteorological station was installed by the Wyoming Mineral Corporation at the Copperton Plant Site in 1980, and data were gathered for a one-year period as reported in the following documents which are reproduced in Appendices C-2 and C-3:

(1) Semi-annual Meteorological Data Summary Report for the Copperton Uranium Facility: 19 Dec 80 - 30 Jun. 81; Camp, Dresser & McKee Inc., Wheatridge, CO; Aug '81.

(2) Semi-annual Meteorological Data Summary Report for the Copperton Uranium Facility: 1 July - 31 Dec. '81; Camp, Dresser & McKee Inc., Wheatridge, CO; Feb '82.

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Site Meteorological Data:

The meteorological monitoring program at the Copperton Uranium Facility from 16 December 1980 to 31 December 1981, in achieving an average data recovery of 86 percent, recorded wind speed, wind direction, sigma theta (standard deviation of wind direction), and temperature.

The 12-month data set presented in the two summary reports is without any anomalies and reflects the semiarid continental climate of Utah and the mesoclimatic features associated with a location at the mouth of a steep canyon. The temperatures recorded during this 12-month period were generally moderate. The lowest mean monthly temperature was $0^{o}C$ ($32^{o}F$), which occurred during January, and the highest mean monthly temperature was $24^{o}C$ ($75^{o}F$), which occurred during July.

The prevailing wind direction was west and was associated with down-valley flow in Bingham Canyon The monthly mean wind speeds varied from a maximum of 3.0 m/sec (6.7 mph) in May to a minimum of 1.4 m/sec (3.1 mph) in December. Pasquill-Gifford atmospheric stability conditions were neutral (Class D) or stable (Classes E & F) 50 to 67 percent of the time.

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Monthly summaries of key parameters are presented in Table 2.7-1 (Temperature), Table 2.7-2 (Wind Direction and speed), Table 2.7-3 (Stability), and Table 2.7-4 (Relative Humidity).

Prior to the meteorological data acquired during the period December 16, 1980 and December 31, 1981 by the electronic weather station described above, Wyoming Mineral Corporation compiled data by a mechanical weather station for a period of more than two and one-half years in order to carry out the commitment expressed in its original environmental study document submitted with the 1976 application. While these data do not equal that of the electronic weather station with respect to precision, accuracy, or percent data capture, it is on file and available for examination.

LOCAL ALTERNATE DATA SOURCES:

Wyoming Mineral Corporation has discontinued the operation of its electronic and mechanical weather stations. The reasons, in addition to having completed the commitment to acquire two-year's meteorologic data, are as follows:

1) The Copperton operation is a small one which has very small radiological or non-radiological impacts on the environment.

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TABLE 2.7-1

MONTHLY TEMPERATURE MEANS AND EXTREMES (° C)

December 1980 - December 1981

	MEAN	MEAN	MEAN	EXREMEMES	
MONTH	MAXIMUM	MINIMUM	MONTHLY	HIGHEST	LOWEST
December[a]	9	2	6	13	-1
January	3	-3	0	10	-8
February	7	-1	3	16	-11
March	8	1	4	14	-3
April	14	7	11	20	-2
May[b]	15	5	10	20	0
June[c]	29	18	23	35	11
July	30	20	25	36	17
August	28	18	23	32	11
September	24	14	19	31	6
October	13	5	9	21	-2
November	12	4	8	21	-8
December	8	0	3	18	-10

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[a] Covers period 16 December 1980 - 31 December 1980.

[b] Covers period 1 May 1981 - 14 May 1981

[c] Covers period 15 June 1981 - 30 June 1981

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TABLE 2.7-2

MONTHLY PREVAILING WIND DIRECTION AND MEAN WIND SPEED

December 1980 - December 1981

MONTH	PREVAILING WIND DIRECTION	MEAN WIND SPEEDS (m/sec.)	MPH	Kts.
DECEMBER[a]	West	1.4	3.1	2.7
January	West	1.5	3.7	2.9
February	West	2.5	5.6	4.8
March	West	2.6	5.8	5.1
April	West	2.8	6.3	5.6
May[b]	West-Southwest	3.0	6.7	5.8
June[c]	West-Southwest	2.9	6.5	5.6
July	Southeast	2.7	6.0	5.3
August	West-Southwest	2.5	5.6	4.8
September	West	2.2	4.9	4.3
October	West	2.1	4.7	4.1
November	West	2.2	4.9	4.3
December	West	1.7	3.8	3.3

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[a] Covers period 16 December 1980 - 31 December 1980

[b] Covers period 1 May 1981 - 14 May 1981

[c] Covers period 15 June 1981 - 30 June 1981

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TABLE 2.7-3

FREQUENCY OF OCCURRENCE (%) OF PASQUILL-GIFFORD STABILITY CLASSES BY MONTH

December 1980 - December 1981

MONTH	CLASS A	CLASS B	CLASS C	CLASS D	CLASS E	CLASS F
December[a]	0	18	9	32	25	16
January	0	21	9	49	16	5
February	4	17	11	29	20	19
March	14	15	8	25	22	16
April	23	15	8	26	16	12
May[b]	22	16	8	18	22	14
June[c]	30	14	3	13	13	27
July	24	12	8	33	10	14
August	27	11	9	21	16	15
September	19	14	7	26	16	18
October	12	17	7	31	18	14
November	0	17	10	21	24	26
December	0	20	10	46	18	6

[a] Covers period 16 December 1980 - 31 December 1980

[b] Covers period 1 May 1981 - 14 May 1981

[c] Covers period 15 June 1981 - 30 June 1981

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TABLE 2.7-4

PERCENT RELATIVE HUMIDITY

DECEMBER 1, 1980 through DECEMBER 31, 1981

	MEAN	MAXIMUM	MINIMUM
December, 1980	77.7	100	22
Annual -- 1980	77.76 Avg	100	-
January, 1981	81.3	100	43
February, 1981	65.8	99	22
March, 1981	60.9	99	23
April, 1981	48.4	80	18
May, 1981	49.9	99	17
June, 1981	38.4	86	13
July, 1981	29.9	58	13
August, 1981	29.3	63	12
September, 1981	40.4	92	14
October, 1981	60.0	98	21
November, 1981	64.9	100	23
December, 1981	68.2	99	29
Annual -- 1981	52.88 Avg	100	12

NOTE: (1) The day-by-day record from which this summary table was derived is contained in Appendix C.

(2) The measurements of relative humidity were made at the Kennecott Copper Corporation's tailings pond. It is located in R2W,T1S,Sec8, SE1/4.

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2) The Copperton operation has a single discharge point.

3) The only effluent of concern is particulate.

4) The level of effluent is significantly below established regulatory requirements.

5) The cost of operations, maintenance, calibration, repair and supplies to continue the electronic weather station is disproportionate to the benefit.

In the event of an emergency event involving release of radioactive particulates, meteorologic data are available from the Utah Department of Health, Air Quality Control Division at an air quality monitoring station located about one-half mile east on Highway 48.

The data from the air quality monitoring station would be particularly useful, if needed, as it is near to the plant and downwind with respect to the prevailing wind direction. Its data is also appropriate because of its being located down-canyon and subject to the same topographically-influenced local micro-climate and meteorology. Data acquisition at this station was begun early in 1982. As yet, none has been reduced but this is expected to begin in about 30 days when funds will be available.

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A secondary source of data is Kennecott Utah Copper Division's meteorologic station located up-canyon within one mile of the Copperton Plant Site and the hygrometer located at the tailings pond north of Magna. The humidity data are less representative because of the distance from the Wyoming Mineral Corporation's Copperton Site and the intervening topography.

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Neighboring Meteorological Stations:

To place the meteorology and climatology of the Copperton Site in perspective and to provide some modicum of experimental control, data from two U.S. Armed Forces Station and one National Weather Service Station were obtained. They were Salt Lake City (Airport), Hill Air Force Base (near Ogden), and Michaels Army Aviation Facility at Dugway. The locations of these facilities, as related to the Copperton Plant are as follows:

STATION	LATITUDE/LONGITUDE	ELEVATION	DISTANCE	BEARING
Copperton	40°33'N; 112°07'W	5540 ft.	0 mi.	0°T
Salt Lake City	40°47'N; 111°57'W	4221 ft.	16 mi.	037°T
Hill AFB	41°07'N; 111°58'W	4748 ft.	35 mi.	015°T
Michaels AAF	40°11'N; 112°56'W	4349 ft.	50 mi.	245°T

In comparing one station with another, of course, one must consider certain conditions that inevitably must cause variances in the data recorded. Obviously, the region is (and especially at Hill AFB and Salt Lake City Airport) greatly influenced by the Great Salt Lake which affects wind speed because of its huge mass of water and direction because of its flat surface and temperature and humidity. The mountainous topography, especially of the surrounding Wasatch, Oquirrah and Onaqui Mountains, as

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well as the local canyon terrain about the Copperton Site, can be expected to cause wind and precipitation regimes at variance from those of the other stations. Temperatures and humidity are, of course, also affected by terrain and altitude.

Climatologic data for Salt Lake City, Utah (Airport) are given in detail in Table 2-7.5. Less extensive data are given for Hill AFB and Michaels AAF in Tables 2.7-6 and 2.7.7, respectively.

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TABLE 2.7-5

CLIMATOLOGICAL DATA - SALT LAKE CITY, UTAH

(Ref: Local Climatologic Data, Annual Summary With Comperative Data, 1980 - Salt Lake City, Utah; NOAA, Asheville, N.C.)

Narrative Climatological Summary*:

Salt Lake City is located in northern Utah on the western slope of the Wasatch Mountains, a range rising to heights of 8,500 to nearly 12,000 feet above sea level. Due to the proximity of this mountain range, about three to five inches more precipitation per year can be expected along the eastern edge of the city than over the valley a few miles to the west.

Aside from the altitude (approximately 4,200 feet above sea level) and the Wasatch Mountains, the most influential natural condition affecting the climate of Salt Lake City is the Great Salt Lake. This large inland body of water, which never freezes over due to its high salt content, tends to moderate the temperature of cold winter winds blowing from the west and northwest. Of lesser importance are the Oquirrh Mountains located twenty miles to the southwest. This range, with several peaks to above 10,000 feet, shelters the Salt Lake Valley somewhat from storms associated with southwesterly winds.

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Salt Lake City has a semi-arid continental climate, with four well defined seasons. Summers are characterized by hot, dry weather; but the high temperatures during this season are usually not oppressive, since the relative humidity is generally low and the nights usually cool. July is the hottest month with average maximum readings in the nineties.

The average daily temperature range is about thirty degrees in the summer and eighteen degrees during the winter. Temperatures above 102° in the summer or colder than 10° below zero in the winter are likely to occur one season out of four.

Winters are cold, but usually not severe. Mountains to the north and east act as a barrier to frequent invasions of cold continental air. The average annual snowfall ranges from under 60 inches at the Airport to over 70 inches in the foothill area of the eastern portion of the city. Similarly, the average maximum depth of snow during the winter varies from 9 to about 13 inches. The average duration of continuous snow cover is 29 days. Precipitation, generally light during the summer and early fall, reaches a maximum in spring when storms from the Pacific Ocean are moving through the area more frequently than at any other season of the year. Winds are usually light, although occasional high winds have occurred in every month of the year, particularly in March.

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The growing season, or freeze-free period, is quite long, averaging over five months in length. Yard and garden foliage generally are making good growth by the end of March or the first week in April, even though the last freezing temperature in the spring usually occurs in late April.

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*NOTE: The weather station from 06-30-78 to present has been located at the Executive Terminal Building, Salt Lake City International Airport. Wind instruments are 20 feet above ground; extreme thermometers, psychrometer, and hygrothermometer, 6 feet; sunshine switch and weighing rain gage, 5 feet; and tipping-bucket and eight-inch rain gage, 3 feet.

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TABLE 2.7-5 (continued)

METEOROLOGICAL DATA FOR THE YEAR 1980

(Note: Data for 1981 not ready at press time)

Station: SALT LAKE CITY, UTAH International Airport

	Temperature °F							Precipitation in Inches		Relative Humidity, pct.				Wind					
	Averages			Extremes										Resultant		Avg.	Fastest Mile		
Month	Daily Max.	Daily Min.	Monthly	Highest	Date	Lowest	Date	Equiv. Water	Snow	Hour 05	Hour 11 (local time)	Hour 17	Hour 23	Direction	Speed m.p.h.	Speed m.p.h.	Speed m.p.h.	Direction	Date
JAN	41.1	26.2	33.7	57	13	-4	31	2.87	24.5	82	74	70	79	19	2.6	8.8	59	NW	10
FEB	46.0	25.9	36.0	67	27	3	1	2.25	2.9	81	68	62	79	17	4.4	9.0	28	S	19
MAR	50.7	32.2	41.5	64	14	23	22	2.46	19.9	72	56	49	69	19	3.0	10.5	36	S	5
APR	64.8	40.5	52.7	35	20	30	13	0.89	1.2	62	38	33	57	20	3.0	10.4	32	S	22
MAY	68.1	45.8	57.0	86	22	37	24	2.70	T	76	51	46	71	20	2.6	6.8	40	SW	23
JUN	82.2	52.7	67.5	97	29	42	7	0.42	0.0	58	29	27	50	20	2.7	10.8	38	W	30
JUL	92.2	63.0	77.6	101	28	56	11	1.34	0.0	53	29	24	45	16	1.6	9.3	31	S	29
AUG	88.3	59.9	74.1	99	12	48	20	0.26	0.0	51	30	23	41	18	3.2	10.6	36	NW	15
SEP	79.9	52.6	66.3	93	5	38	22	0.72	0.0	61	33	26	50	18	4.7	9.9	33	S	10
OCT	65.4	39.7	52.6	84	11	28	23	1.74	T	70	42	39	65	20	1.8	7.5	40	S	12
NOV	52.3	30.3	41.3	74	7	15	25	1.17	3.9	74	56	55	71	18	2.3	6.9	28	S	7
DEC	40.2	27.0	33.6	58	26	19	9	0.37	3.3	81	73	72	80	19	2.1	5.7	38	S	4
YEAR	64.3	41.3	52.8	101	JUL 28	-4	JAN 31	17.19	55.7	68	48	44	63	19	2.7	9.0	59	NW	JAN 10

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TABLE 2.7-5 (continued)

NORMALS, MEANS, AND EXTREMES FOR THE YEAR 1980

(Note: Data for 1981 not ready at press time)

Station: SALT LAKE CITY, UTAH International Airport

	Temperature °F							Precipitation in Inches				Relative Humidity, pct.				Wind				
	Normal			Extremes				Water Equivalent			Snow					Mean	Prevail.	Fastest Mile		
Month	Daily Max.	Daily Min.	Monthly	Record Highest	Year	Record Lowest	Year	Normal	Max. Monthly	Minimum Monthly	Monthly	Hour 05	Hour 11 (local time)	Hour 17 (local time)	Hour 23	Speed m.p.h.	Direction	Speed m.p.h.	Direction	Year
JAN	37.4	18.5	28.0	61	1971	-22	1949	1.27	3.14	0.09	32.3	78	70	68	77	7.7	SSE	59	NW	1980
FEB	43.4	23.3	33.4	69	1972	-30	1933	1.19	3.22	0.12	27.9	77	64	58	76	8.2	SE	56	SE	1954
MAR	50.8	28.3	39.6	78	1960	2	1966	1.63	3.67	0.10	41.9	70	52	46	67	9.3	SSE	71	NW	1954
APR	61.8	36.6	49.2	85	1980	14	1936	2.12	4.90	0.45	26.4	67	44	39	62	9.5	SE	57	NW	1964
MAY	72.4	44.2	58.3	93	1958	25	1965	1.49	4.76	T	7.5	65	38	32	57	9.4	SE	57	NW	1953
JUN	81.3	51.1	66.2	104	1979	35	1962	1.30	2.93	0.01	T	59	31	26	50	9.4	SSE	63	W	1963
JUL	92.6	60.5	76.7	107	1960	40	1968	0.70	2.52	T	0.0	51	26	20	41	9.4	SSE	49	W	1936
AUG	90.2	58.7	74.5	104	1979	37	1965	0.93	3.66	T	0.0	54	29	22	45	9.6	SSE	58	SW	1946
SEP	80.3	49.3	64.8	100	1979	27	1965	0.68	4.07	T	4.0	61	34	27	53	9.1	SE	61	W	1952
OCT	66.4	38.4	52.4	89	1963	16	1971	1.16	3.61	0.00	16.6	68	42	39	65	8.5	SE	67	NW	1950
NOV	50.0	28.1	39.1	75	1967	-14	1955	1.31	2.57	0.01	19.5	74	57	58	72	7.8	SSE	63	NW	1937
DEC	39.0	21.5	30.3	67	1969	-21	1932	1.39	3.82	0.08	35.2	78	70	71	78	7.4	SSE	54	S	1955
YEAR	63.8	38.2	51.0	107	JUL 1960	-30	FEB 1933	15.17	4.90	0.00	41.9	67	46	42	62	8.8	SSE	71	NW	MAR 1954

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TABLE 2.7-6

CLIMATOLOGICAL DATA - HILL AIR FORCE BASE

(Ref. AWS Climatic Brief - Hill AFB, UT - USAFETAC, June, 1980)

	Temperature (°F)					Precipitation (in)			Snowfall (in)		Mean Relative Humidity		Surface Winds		
	Mean			Extreme		Monthly			Monthly		(%) LST		Prevailing	Speed	
	Daily												Direction	Mean	Max.
Month	Max.	Min.	Monthly	Max.	Min.	Mean	Max.	Min.	Mean	Max.	04	13	(16 PT)	(KT)	(KT)
JAN	33	21	27	86	-13	2.3	5.6	.1	18	45	69	64	ESE	7	65
FEB	39	25	32	65	-5	1.6	4.1	.4	12	32	68	59	ESE	8	59
MAR	47	30	39	72	3	1.9	4.3	#	12	38	63	50	ESE	8	73
APR	56	38	48	83	17	2.4	5.8	.6	9	37	58	43	ESE	7	62
MAY	67	47	58	91	24	1.8	6.4	#	2	20	55	37	ESE	7	83
JUN	78	55	67	101	37	1.3	4.0	#	#	#	50	32	ESE	7	69
JUL	88	64	76	104	49	.5	2.2	#	0	0	43	28	ESE	7	62
AUG	85	62	74	101	39	.8	3.9	#	#	#	41	26	ESE	8	66
SEP	75	53	64	97	28	1.2	4.0	#	#	4	45	29	ESE	7	64
OCT	62	43	52	88	21	1.5	4.2	.0	2	16	49	37	ESE	7	75
NOV	47	32	39	70	-6	1.5	3.1	.1	7	23	59	49	ESE	6	66
DEC	36	23	30	59	-9	2.1	5.0	.1	17	48	68	63	ESE	6	57
ANN	59	41	51	104	-13	18.9	6.4	.0	79	48	56	43	ESE	7	83
ETR	30	30	30	30	30	30	30	30	30	30	10	10	10	10	30

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TABLE 2.7-7

CLIMATOLOGICAL DATA - MICHAELS AAF

(Ref. AWS Climatic Brief - Michaels AAF, UT - USAFETAC, June 1974)

	Temperature (°F)					Precipitation (in)			Snowfall (in)		Mean Relative Humidity		Surface Winds		
	Mean			Extreme		Monthly			Monthly		(%) LST		Prevailing Direction (16 PT)	Speed	
	Daily														
Month	Max.	Min.	Monthly	Max.	Min.	Mean	Max.	Min.	Mean	Max.	05	14		Mean (KT)	Max. (KT)
JAN	38	16	27	66	-16	.5	1.4	#	4	10	79	61	S	4	64
FEB	44	23	34	70	-11	.5	1.4	#	3	12	77	55	S	4	50
MAR	51	27	39	80	-6	.7	4.9	#	3	16	70	44	S	6	59
APR	62	36	50	87	14	.8	2.0	.1	1	6	63	36	S	6	81
MAY	74	46	60	97	25	.7	2.4	#	1	6	58	29	S	6	62
JUN	83	54	69	107	31	.7	2.4	.0	0	0	52	26	S	6	58
JUL	94	63	79	108	41	.3	1.1	#	0	0	41	20	S	5	62
AUG	91	61	76	104	39	.5	1.4	#	0	0	46	22	S	5	51
SEP	82	49	66	101	27	.4	2.0	.0	0	0	47	25	S	5	52
OCT	69	33	54	89	17	.5	1.4	.0	#	1	58	33	S	4	54
NOV	50	26	39	74	-8	.5	1.5	#	2	8	72	68	S	4	44
DEC	49	20	30	61	-5	.6	1.6	#	3	7	82	66	S	3	45
ANN	65	38	52	108	-16	6.7	4.9	.0	17	16	62	39	S	5	81
ETR	20	20	20	20	20	24	24	24	22	22	23	25	25	25	15

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2.8 ECOLOGY

2.8.1 VEGETATION

A general vegetation map of the Copperton area is shown in Fig. 2.8-1(1) and of the site in Fig. 2.8-2. A botanical survey of the site was completed by personnel of the Utah Agricultural Experiment Station, Utah State University on July 15, 1976 and incorporated in the environmental survey document submitted with the original license application (Appendix D-1). Their report stated that the area was contiguous to industrial development and the original vegetation had already been altered to such an extent that it consisted mostly of weedy species. The original top soil had been pushed into an east-west ridge along the south end of the property and then replaced by a cap of fine cinder material. More than half the area was destitute of vegetation, and the rest was covered by sparse vegetation. It was therefore concluded that there would be only a small effect on the local flora with the establishment of the uranium recovery operation site.

2.8.2 WILDLIFE

A wildlife survey (birds, mammals, reptiles) was conducted also in 1976 by personnel of the Utah Agricultural Station, Utah State University. Their report, also contained in the 1976 environmental survey document, stated that no known endangered species of wildlife are living on this site or the surrounding area.

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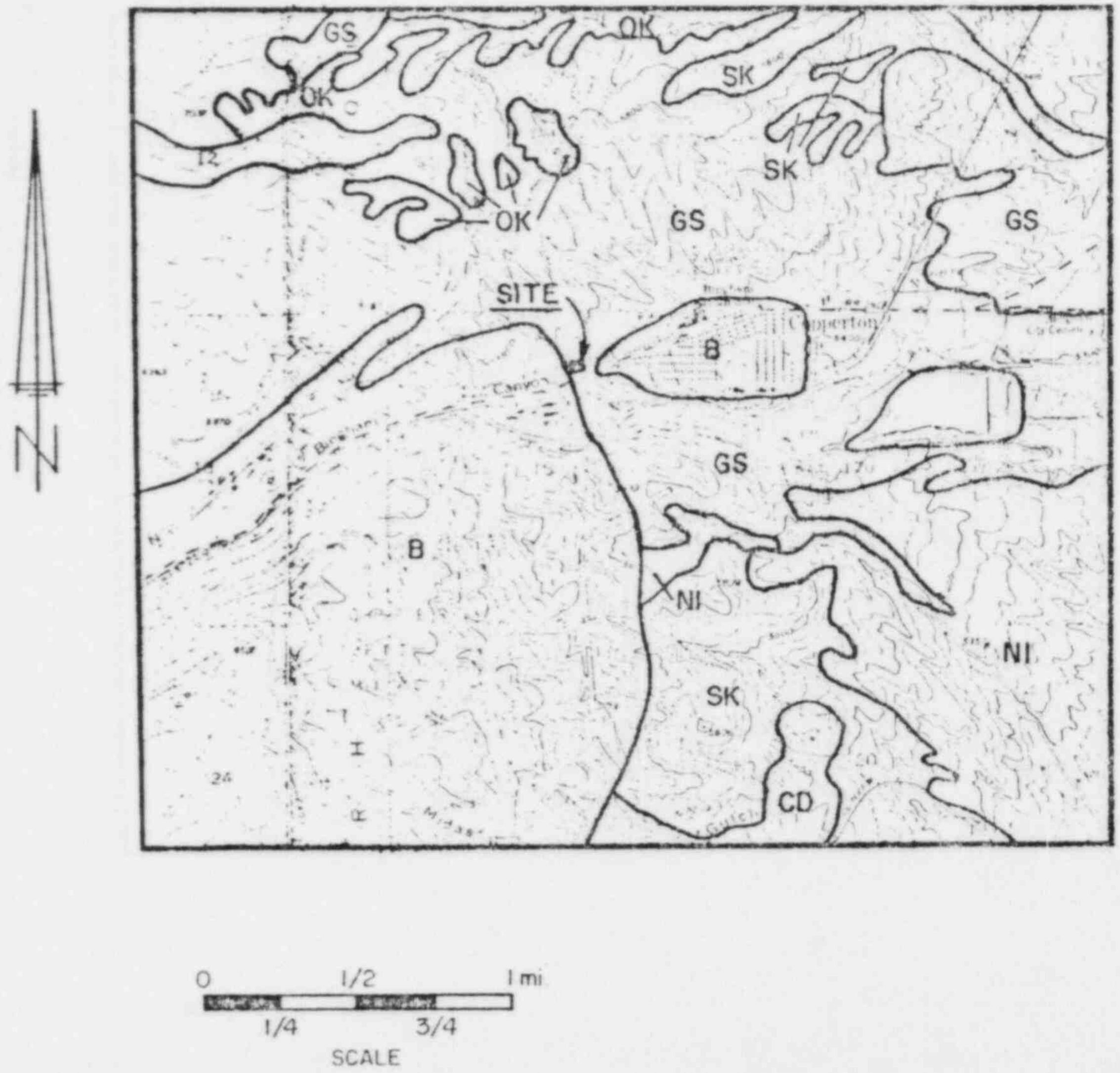

LEGEND:

GS — GRASSES & SAGEBRUSH: bluebunch wheatgrass, basin wildrye, squirrel tail, Indian ricegrass, sandberg bluegrass, muttongrass, arrowleaf balsamroot, big sagebrush, antelope bitterbrush, yellowbrush.

OK — OAK
Overstory: gambel oak
Understory varieties: bluebunch wheatgrass, bearded wheatgrass, mountain brome, slender wheatgrass, Nevada bluegrass, arrowleaf balsamroot, antelope bitterbrush, big sagebrush, mountain snowberry.

SK — SCATTERED OAK: Dispersed oak stands mixed with grass & sage.

CD — CEDAR
Overstory: Utah juniper
Understory Varieties: bluebunch wheatgrass, cheatgrass, Great Basin wildrye, Indian ricegrass, neddle and thread, big sagebrush, snakeweed, yellowbrush.

NI — NON-IRRIGATED CROPLAND:
Common Crop: Alfalfa, small grains, sugar beets, corn for silage, truck garden crops.

B — BARREN OR DEVELOPED LAND AND BODIES OF WATER NOT CODED.

FIGURE 2.8-1: VEGETATION MAP OF COPPERTON AREA

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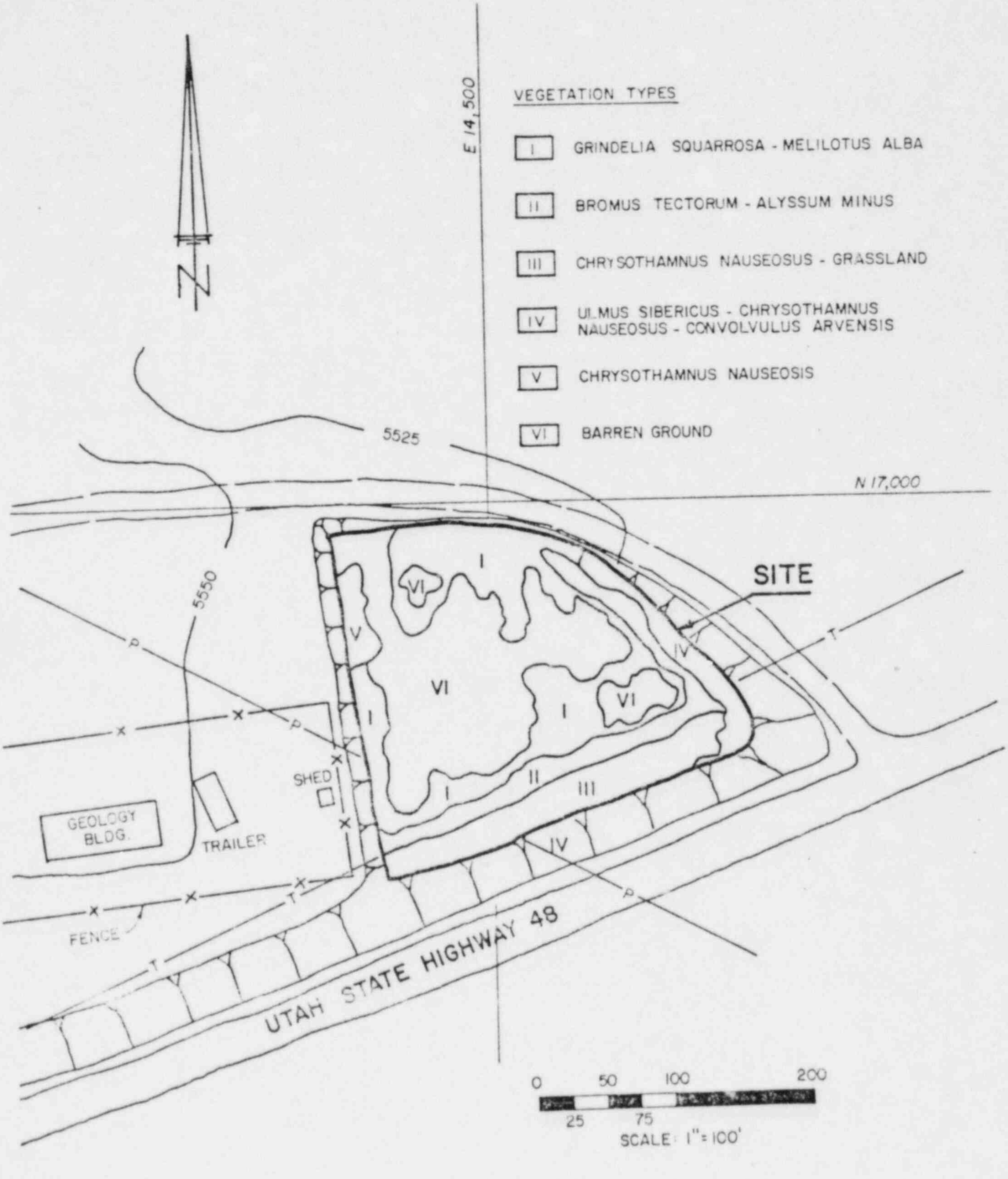

FIGURE 2.8-2: VEGETATION MAP OF COPPERTON SITE

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Because of the small size of the proposed uranium recovery operation development area and the lack of food and cover on this site, they declared the plant would cause little harm to the wildlife in the area surrounding the construction site.

2.8.3 AQUATICS

The nearest stream to the site is Birgham Creek which is a part of the copper leach circuit. No aquatic surveys were done due to the very low pH of this stream.

2.8.4 REASSESSMENT

Through arrangements Wyoming Mineral Corporation made with Kennecott's Utah Copper Division on August 1, 1982, a reconnaissance survey was made of the Copperton Plant Site. The condition of the flora and fauna was reassessed in light of the baseline descriptions reported by the Utah State University personnel on July 15, 1976. The report of the survey states that there are no apparent changes because of the plant, and changes on adjacent hillsides show improvement in the wildlife and vegetation. (Appendix D-2)

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SECTION 3.0

THE PLANT

Wyoming Mineral Corporation (WMC) operates a uranium recovery plant on a 1.3-acre site near Copperton, Utah. Uranium is being recovered from dump leach solution generated by the Kennecott Minerals Corporation. Naturally occurring bacteria, water and oxygen leach the mine dumps in Bingham Canyon and Kennecott Minerals Corporation recovers the copper from the leach solution. Low concentrations of uranium are present in the mine dumps and a portion of the uranium is leached along with the copper. Kennecott operates a cementation plant at a flow rate of approximately 45,500 gallons per minute for the recovery of the copper from the leach solution. The WMC plant processes a portion (up to 10,000 gallons per minute) of the tails solution from the copper cementation plant. All solution discharges from the uranium extraction plant are returned to the copper leach circuit.

The plant recovers uranium from the leach solution by ion exchange. The eluate from the ion exchange is then concentrated by solvent extraction. Ammonium diuranate (ADU) is precipated from the solvent extraction strip solution. The ADU product is washed, dewatered and calcined to U_3O_8 . The packaged yellowcake product is shipped to a conversion plant. Daily production can be up to 600 pounds of U_3O_8 .

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3.1 EXTERNAL APPEARANCE OF URANIUM RECOVERY PLANT

The tallest part of the building houses the ion exchange equipment. The lower part of the building houses the solvent extraction equipment, calcining equipment, a storage area, a plant office and a laboratory. Other structures in the plant area are a fire pump, a house water tank, a sulfuric acid storage tank, an ammonia storage tank, electrical substation, a spare parts warehouse, an office extension and a storage tank for solvent. Figure 3.1-1 shows the pipeline location from KMC and Figure 3.1-2 shows a plan view of the recovery plant.

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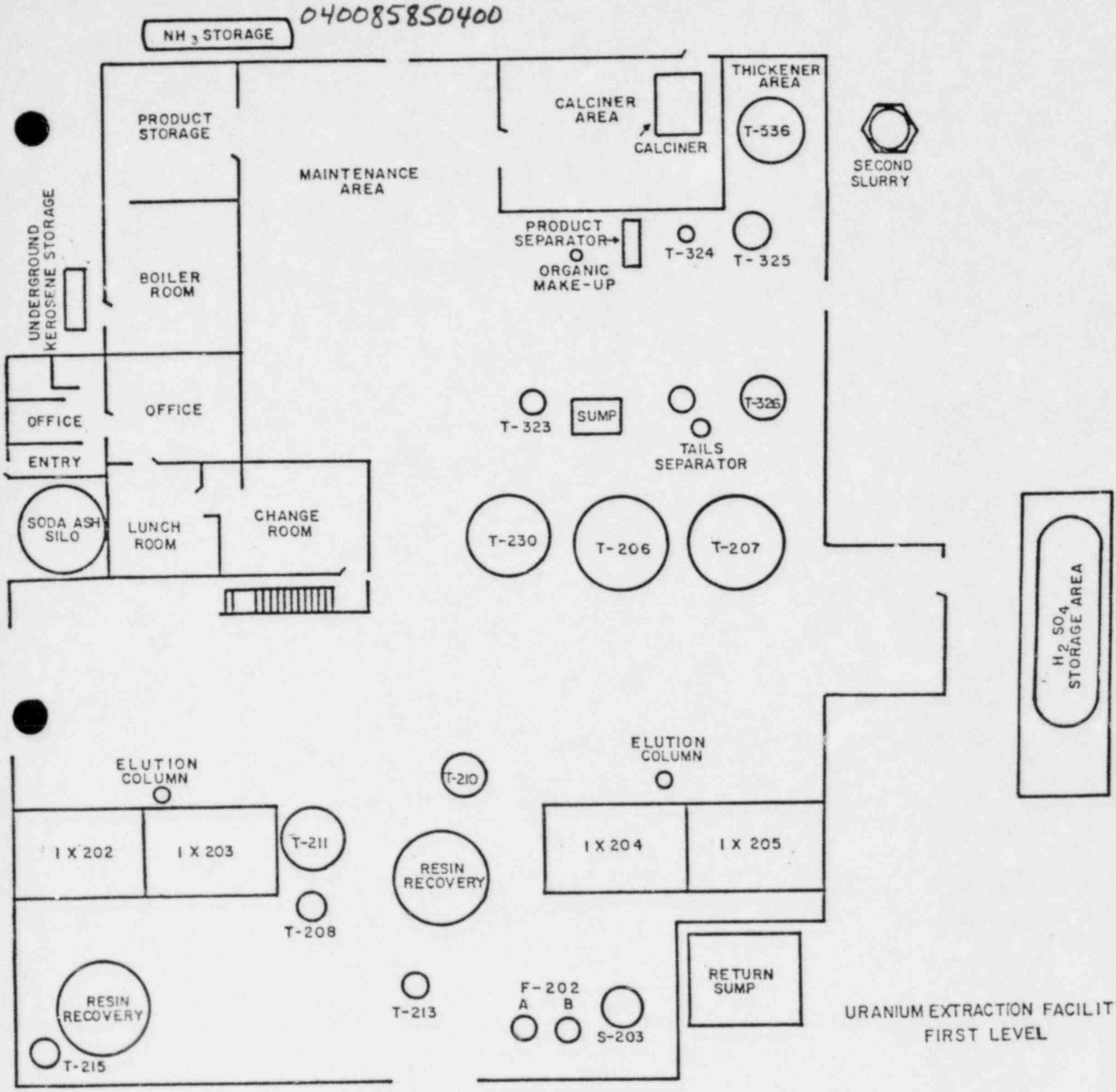

URANIUM EXTRACTION FACILITY
FIRST LEVEL

FIGURE 3.1.2

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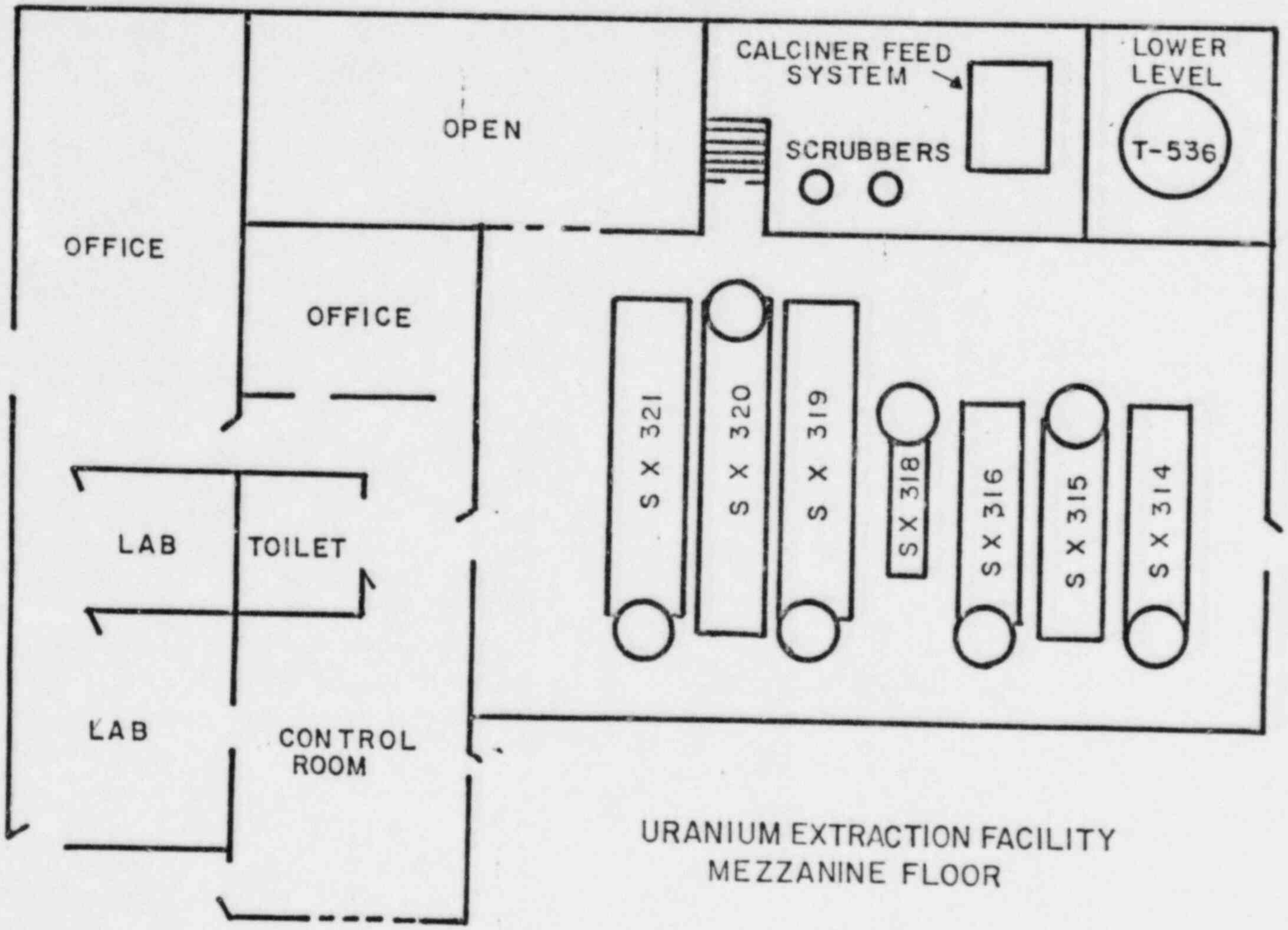

URANIUM EXTRACTION FACILITY
MEZZANINE FLOOR

FIGURE 3.1.2 (CONTINUED)

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FIGURE 3.1.2 (Cont'd.)

TANK IDENTIFICATION INDEX

T208	Pulse Tank
T213	Pulse Tank
T215	Pulse Tank
T211	Iron Scrub
T210	Backwash
T207	IX Product
T206	Strip Acid Makeup
T230	Spills Collection
T323	SX Tails
T326	Waste Solution
T325	Organic Surge
T324	SX Product
T323	SX Tails
S203	Surge Arrester
F202 A & B	IX Feed Filters
T536	Thickner
T431-434	Acid/Precipitation System
SX314-321	SX Mixer - Settlers

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3.2 PLANT CIRCUIT

3.2.1 ION EXCHANGE

A portion of the tails solution from the copper cementation plant is pumped to the uranium recovery plant through pipelines (Figure 3.2-1). Return lines pipe the solution back to the copper cementation plant.

Uranium is removed from the feed solution by a resin ion exchange. The uranium exchanges for a sulfate ion attached to the ion exchange resin. The ion exchange equipment used is a continuous countercurrent unit (Higgins Loop). The resin is pulsed through the Higgins Loop at predetermined intervals. While passing through the loop, the resin is successively loaded, backwashed, stripped and rinsed. After backwashing, the uranium-loaded resin is treated with sulfuric acid to remove the uranium. The resin is then returned to the loading section to start the cycle over again.

3.2.2 SOLVENT EXTRACTION

The eluate from ion exchange contains approximately 800 ppm U_3O_8 . For further concentration and purification, it is

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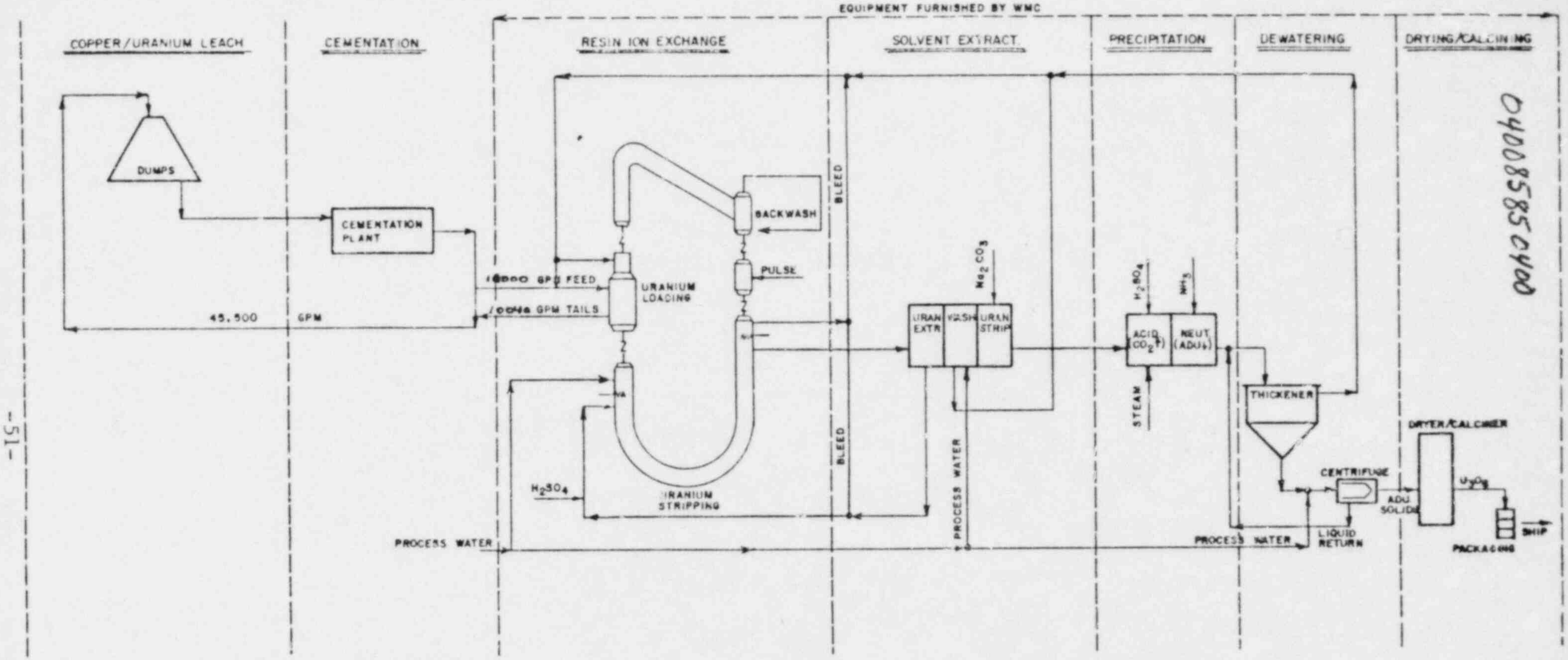

FIGURE 3.2-1: PROCESS FLOW SHEET
(ESTIMATED FLOWS)

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treated by solvent extraction. The solvent extraction equipment consists of mixer/settler units. Three stages of extraction, one stage of solvent washing and three stages of stripping are used.

The solvent used is di-2-ethylhexyl phosphoric acid (D2EHPA) with tri-n-octyl phosphire oxide (TOPO) synergistic agent and a long chain alcohol (tridecyl alcohol) in a kerosene diluent.

The solvent is loaded to approximately 9.5 g/l U_3O_8. Prior to stripping, the solvent is water washed. The uranium is stripped from the organic with sodium carbonate solution. After extraction of uranium in the solvent extraction circuit, the ion exchange strip solution is recycled.

3.2.3 PRECIPITATION

Prior to the precipitation step, the carbonates in the strip solution are eliminated with sulfuric acid. The uranium-bearing solution is transferred to agitator tanks where anhydrous ammonia gas is added to precipitate ammonium diurante (ADU).

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3.2.4 DEWATERING

The ADU slurry is transferred to a thickener for preliminary dewatering. The slurry is then washed and further dewatered in a centrifuge.

3.2.5 DRYING - CALCINING - PACKAGING

The dewatered ADU is dried and calcined to the final product, U_3O_8. The calcined product is discharged directly into drums and stored for future shipment.

3.2.6 PLANT UTILITIES AND SUPPORT

The necessary reagent storage facilities are provided. Concentrated sulfuric acid and anhydrous ammonia storage tanks plus an ammonia vaporizer are located outside the building

Steam is provided by a gas-fired boiler. Process and potable water are provided by Kennecott and stored in an on-site tank. A diesel-powered fire pump is provided on site.

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3.3 SOURCE OF PLANT WASTES AND EFFLUENTS

The uranium recovery plant receives feed directly from the copper cementation plant. The uranium is removed from the solution and the solution is immediately returned to the copper cementation plant. There is no liquid plant effluent as such, since all plant bleeds are added to the feed solution which returns to the copper leach circuit (Figure 3.2-1). Plant bleeds originate from the Higgins Loop, the solvent extraction circuit and dewatering of the ammonium diuranate. The total fluid discharge from all waste streams is estimated at 44 gallons per minute. The solution released contains the following chemical constituents: $SO_4^{=}$, U_3O_8, NH_4^{+}, Na^{+}, solvent and reagent.

Gaseous releases originate from the precipitation circuit, the solvent extraction circuit, the dryer/calciner and the gas fired boiler. Release of carbon dioxide to the atmosphere results from the decomposition of the sodium carbonate prior to the precipitation of ADU. It is estimated that the amount of CO_2 released is approximately 30 liters per minute. The vaporization of organics to the atmosphere from the solvent extraction circuit is minimal due to the low vapor pressure of the solvent. Natural gas is burned at a rate to produce an average of 2 million BTU/hr. with a maximum of 4.9 million BTU/hr. Water vapor, carbon dioxide and ammonia gases are produced during the calcining of the uranium product.

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3.4 CONTROL OF PLANT EFFLUENTS

No treatment of plant bleeds are necessary since the total discharge from the plant is small relative to the tails stream. Before discharge, all waste streams are processed through the Higgins Loop to remove small traces of uranium present.

Carbon dioxide releases are vented out of the building. Atmospheric release of the products of combustion are vented through an appropriately designed stack. Water vapor and ammonia gas are removed by a dust collection and scrubbing system.

3.5 SANITARY AND OTHER PLANT WASTES

Sewage from the plant is handled by a septic tank (Section 5.4) designed in accordance with State of Utah regulations.

3.6 MINING ACTIVITIES

No mining activities are associated with the plant.

SECTION 4.0

ENVIRONMENTAL EFFECTS OF SITE PREPARATION AND PLANT CONSTRUCTION

4.1 SITE PREPARATION AND PLANT CONSTRUCTION

Effects from construction activities were small and of a temporary nature, resulting primarily from dust, fumes and noise effects. The construction phase lasted less than one year.

4.1.1 OFF-SITE EFFECTS

Entrance to the site is along pre-existing roads. The increase of traffic on local roads from construction activites was small and no temporary housing facilities were required.

The dust effects created by vehicular traffic were small since the traffic was low and the only unpaved roads that were used are on Kennecott Copper Corporation land.

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4.1.2 ON-SITE EFFECTS

All temporary equipment lay-down areas were located within or contiguous to the site. The dominant chemicals used during construction were soaps, detergents, paints, cleaning fluids and concrete admixtures. Sanitary wastes were handled by portable chemical toilets. All trash and oil generated by construction activities were hauled off-site for disposal.

Erosion from the site was small due to the low annual rainfall of the area, the low slope of the site ground surface, the use of existing roads, and the graveling of the road constructed into the site.

4.2 RESOURCES COMMITTED

The only irretrievable resources committed during construction were those materials used to construct the facility that cannot be recycled after the facility is decommissioned (e.g., paints, chemicals, contaminated equipment, etc.).

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SECTION 5.0

ENVIRONMENTAL EFFECTS OF PLANT OPERATION

5.1 RADIOLOGICAL IMPACTS

Uranium mining activities do not result in significant increases in environmental radioactivity outside the immediate environment of the mine/mill. (1) Although conventional uranium milling activities contribute a small amount to the content of radioactive material in the immediate environment of the facility, population doses from this source cannot be distinguished from background radiation. In the Salt Lake Valley, the annual whole body radiation dose is approximately 140 to 160 millirems per year per person. For reasons described in Section 5.1.1, the radiological impact of the uranium recovery process described in this report were appreciably less than that of conventional uranium mining/milling activities.

5.1.1 RADIOLOGICAL EFFLUENTS

Due to the "closed loop" nature of the uranium recovery process, radiological release to the natural environment is possible only through loss of product in drying. This emission would be in the form of radionuclide particulates released into the atmosphere, i.e., natural uranium and its daughter products. A drying process selected minimizes product loss and effluent release. This process includes a low temperature with a venturi type of water scrubber. The unit is sealed so that emissions are possible only through the exhaust stack.

The total loss of product from the system was expected to be less than 0.006%. The data found in Table 5.1.1 verifies this expectation. This figure is consistent with those reported by Sears for similar dryer/wet scrubber systems.(2) The complete drying/scrubbing system is designed to ensure that all radionuclide concentrations in the air will be less than maximum permissible concentrations for non-occupationally exposed environments at all site boundaries in accordance with the limits specified in the Code of Federal Regulations, Title 10, Part 20, Appendix B (Table 5.1.1).

5.1.1.1 RADIONUCLIDE RELEASE FROM DRYING AND PACKAGING OPERATIONS

Results obtained from stack sampling of the general fume system and the drying and packaging operations follow in Table 5.1-1.

5.2 EFFECTS OF CHEMICAL DISCHARGES

Liquid effluents from the uranium recovery plant flow out from the plant in the tails solution. These wastes are from plant bleeds and are released from the plant at a measured rate of 44 gpm

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TABLE 5.1-1

RADIONUCLIDE RELEASE FROM DRYING AND PACKAGING OPERATIONS

JANUARY 1, 1981 - JANUARY 1, 1982

	General Fumes	Calciner
1. Average Uranium Concentration for 4 years (24 hour period)	1.17X10^{-17}µci/cc	3.34X10^{-12}µci/cc
2. Maximum Uranium Concentration in 4 years	7.62X10^{-12}µci/cc	22.6X10^{-12}µci/cc
3. Average Uranium Release Rate for 4 years	8.63X10^{-7}µci/sec	21.6X10^{-7}µci/sec
4. Total Uranium Released in 4 years	126 µci	93.6 µci
5. Average 230 Th Concentration for 4 years	7.31X10^{-16}µci/cc	12.98X10^{-16}µci/cc
6. Average 230 Th Release for 4 years	19.2X10^{-11}µci/sec	29.8X10^{-11}µci/sec
7. Average 226 Ra Concentration for 4 years	36.1X10^{-18}µci/cc	135.7X10^{-18}µci/cc
8. Averaage 226 a Release rate for 4 years	1.36X10^{-13}µci/sec	26.7X10^{-13}µci/sec

Radiochemical isotopic analysis of yellowcake
product indicates 230Th activity fraction = (1.54X10^{-4}) (Total Activity)
226Ra activity fraction = (1.34X10^{-6}) (Total Activity)

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(Figure 3.2-1). The waste stream consists of water, $SO_4^{=}$, U_3O_8, NH_4^{+}, Na^{+}, solvent and reagent.

A sodium carbonate strip is used in the solvent extraction process. Table 5.2-1 shows the measured concentration of wastes in the waste stream, the feed stream to the plant, and the waste stream from the plant. The only increase of waste concentrations in the plant waste stream over the feed stream is in $SO_4^{=}$, NH_4^{+}, solvent and reagent. Due to the large dilution capacity of the tails stream, NH_4^{+} is estimated to increase in the tails stream by 3×10^{-3} ppm, solvent increase by 1×10^{-5} ppm, reagent by 4×10^{-3}, Na^{+} decrease by 1 ppm, $SO_4^{=}$ decrease by 524 ppm and U_3O_8 decrease by 5.4 ppm.

In addition to the above-listed effects oan the plant waste stream, the ion exchange unit will remove trace amounts of the following elements along with the product: Al, Ag, B, Bi, Ca, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Ni, Pb, Sc, Sb, Si, Sn, Ti, V, Zn and Zr.

All releases in the plant waste stream flow into the copper leach circuit. With time there will be no increase in the concentration of the waste ions that are presently in the feed stream. Since the feed solution is already saturated with these ions, they will precipitate in the mine dumps. Ammonium releases will either be absorbed by clays in the dumps or used as nutrients by bateria in the dumps.

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TABLE 5.2-1

ESTIMATED CONCENTRATION OF COPPERTON PLANT RETURN STREAM USING A SODIUM CARBONATE SOLVENT EXTRACTION STRIP

	FEED STREAM	WASTE STREAM FROM PLANT
$SO_4^{=}$	80,000 ppm	79,476 ppm
U_3O_8	5.0 ppm	-1
NH_4	0.0 ppm	$3x10^{-3}$ ppm
Na^+	120 ppm	119 ppm
Solvent	0.0 ppm	$1x10^{-5}$ ppm
Reagent	0.0 ppm	$4x10^{-3}$ ppm
pH	3.2-3.5	3.2-3.5

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5.3 EFFECTS OF SANITARY AND OTHER WASTE DISCHARGES

Trash and garbage is hauled off site and disposed of at an approved location. Sewage is handled by a septic tank and the liquid released to the copper leach system. Laboratory wastes are placed into the copper leach system.

5.4 OTHER EFFECTS

Other wastes that the plant produces are atmospheric releases and degraded resin from the Higgins Loop. Natural gas is now burned to provide steam heat for the facilities and plant processes. The boiler can produce approximately 4.9 million BTU/hr., but its estimated average is 2 million BTU/hr.

Carbon dioxide is released from the acidification step in the precipitation process (Figure 3.2-1) at about 75 liters/minute at standard temperature and pressure. Ammonia is released from the neutralization step in the precipitation process and from the dryer. This ammonia release is very small since the dryer has a wet scrubber which absorbs the gaseous NH_3 released in drying the uranium slurry. In addition, there is little gaseous NH_3 released from the precipitation tanks since the highest concentration free ammonia is less than 5 ppm. The precipitation circuit is hooded and the gases exhausted out of the building after scrubbing. Organic atmospheric releases are considered to be minimal since the organic mixture has a low vapor pressure.

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Degraded resin (500 cu. ft./yr.) is packaged and transported to a licensed conventional mill for disposal in the tailings impoundment.

5.5 RESOURCES COMMITTED

The irreversible and irretrievable commitments of resources are the following annually:

1. Depletion of Uranium reserves - 140,000 lbs.
2. Consumption of 460 product drums
3. Consumption of 5.56 x 10^6 KWH
4. Consumption of $mmft^3$ of natural gas
5. Consumption of the following materials:
    - a. Sulfuric acid - 1200 tons
    - b. Ammonia - 43 tons
    - c. Resin - 500 cu. ft.
    - d. Solvent - 600 gal.
    - e. Reagent mix - 700 lbs.
    - f. Sodium Carbonate - 45 tons

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SECTION 6.0

EFFLUENT & ENVIRONMENTAL MEASUREMENTS & MONITORING PROGRAMS

6.1 PRE-OPERATIONAL MONITORING PROGRAM

6.1.1 SURFACE AND GROUNDWATERS

Surface water and groundwater data were obtained from literature sources in Section 2.6. One water sample was taken from Bingham Creek and analyzed for pH and total dissolved solids.

6.1.2 AIR

Meteorologic studies were done from literature and previous studies as described in Section 2.7.

6.1.3 LAND

6.1.3.1 GEOLOGY AND LAND USE

Geology and land use were done from literature sources (Sections 2.2 and 2.4) and previously drilled well logs.

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6.1.3.2 ECOLOGY

Ecologic surveys were completed by consultants at Utah State University (Appendix D) and reassessed by the Environmental Department of Kennecott Metal Corporation.

6.1.4 RADIOLOGICAL SURVEYS

A pre-operational radiological monitoring program was run over a period of approximately 12 months prior to full operation. It consisted of the following monitoring procedures performed quarterly:

1. Evaluation of natural background radiation via 12 Thermoluminescent Dosimetry monitoring stations are shown in Figure 6.1-1. Data are shown in Table 6.1-1.

2. Grab samples of soil and vegetation collected from site vicinity and analyzed for Gross Alpha, Thorium 230, Radium 226 and natural Uranium. Data are shown in Tables 6.1-2 and 6.1-3.

3. Samples of Copperton drinking water collected and analyzed for Gross Alpha, Thorium 230, Radium 226 and natural Uranium. Data are shown in Table 6.1-4.

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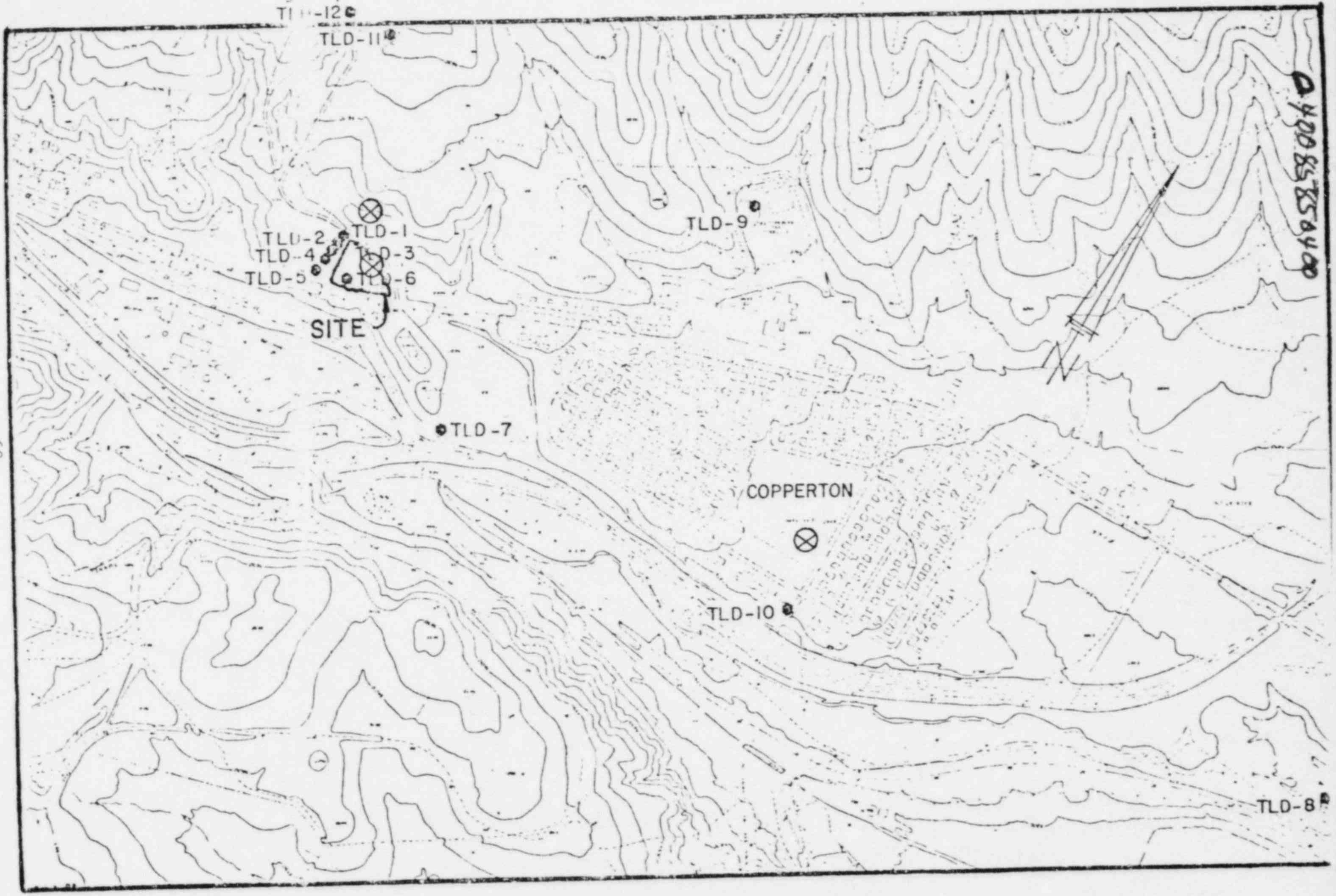

FIGURE 6.1-1: THERMOLUMINESCENT DOSIMETRY MONITORING STATIONS AND AIR, VEGETATION, SOIL SAMPLE POINTS ⊗

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TABLE 6.1-1

SURVEY OF RADIOLOGICAL BACKGROUND

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Dates	Number of Stations	Ave. Exposure Rate
5/26/76 - 9/09/76	12	11.4 μR/hr
9/09/76 - 1/06/76	11	13.9 μR/hr
1/06/76 - 6/06/77	6	27.1 μR/hr
6/06/76 - 8/09/77	9	12.7 μR/hr

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TABLE 6.1-2

PRE-OPERATIONAL SOIL

ENVIRONMENTAL AIR SAMPLES - WYOMING MINERAL CORPORATION BINGHAM CANYON PLANT

SAMPLES LOCATIONS	(1) PLANT SITE - DOWNWIND
(see attached map)	(2) CITY PARK OF TOWN OF COPPERTON
FIG. 6.1.1	(3) METEORLOGICAL STATION NNW OF PLANT SITE

Year	Quarter	Location	Gross (pci/g)	Th230(pci/g)	Ra226(pci/g)	Uranium(pci/g)
1976	2nd	(3)	*	*	5.7 ± 2.2	*
1976	3rd	(3)	*	7.6 ± 3.8	3.1 ± 1.5	*
1976	4th	(1)	0.0 ± 0.5	3.8 ± 1.0	0.6 ± 1.2	1.7
		(3)	0.0 ± 1.7	5.7 ± 1.6	0.5 ± 1.4	-1.7
1977	2nd	(2)	13 ± 6	0.6 ± 1.3	0.6 ± 1.3	6.8
		(3)	28 ± 8	0.7 ± 1.6	0.7 ± 1.6	6.8
1977	3rd	(2)	9.4 ± 4.7	2.8 ± 0.5	0.6 ± 1.3	11.5
		(3)	22 ± 7	2.9 ± 0.6	0.8 ± 1.6	-6.8

Minus Sign Indicates Less Than Lower Limit of Detection
* - Indicates No Sample Data Available

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TABLE 6.1-3

PRE-OPERATIONAL VEGETATION SAMPLES

WYOMING MINERAL CORPORATION BINGHAM CANYON PLANT

SAMPLES LOCATIONS	(1)	PLANT SITE - DOWNWIND
(see attached map)	(2)	CITY PARK OF TOWN OF COPPERTON
FIG. 6.1.1	(3)	METEORLOGICAL STATION NNW OF PLANT SITE

Year	Quarter	Location	Gross (pCi/g)	Th230(pCi/g)	Ra226(pCi/g)	Uranium(pCi/g)
1976	2nd	(3)	*	*	10.5 ± 3.1	*
1976	3rd	(3)	*	5.4 ± 3.4	4.4 ± 1.8	*
1976	4th	(1)	0.0 ± 1.2	0.3 ± 0.1	0.07± 0.13	0.2
		(3)	0.0 ± 0.5	0.2 ± 0.1	0.08± 0.12	-0.3
1977	2nd	(2)	0.1 ± 2.4	0.0 ± 0.1	0.09± 0.09	-6.8
		(3)	3.6 ± 3.7	2.2 ± 0.4	0.8 ± 0.6	2.7
1977	3rd	(2)	1.0 ± 2.0	0.4 ± 0.2	0.3 ± 0.2	6.8
		(3)	9.0 ± 5.7	1.3 ± 0.3	1.6 ± 0.5	6.8

Minus Sign Indicates Less Than Lower Limit of Detection
* - Indicates No Sample Data Available

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TABLE 6.1-4

PRE-OPERATIONAL COPPERTON WATER

WYOMING MINERAL CORPORATION BINGHAM CANYON PLANT

CDW = COPPERTON DRINKING WATER

Year	Quarter	Location	Gross (uCi/ml)	Th230(uCi/ml)	Ra226(uCi/ml)	Uranium(uCi/ml)
1976	2nd	CDW	10.9 ± 1.4 E-9	*	0.5 ± 0.5 E-9	*
1976	4th	CDW	3.0 ± 1.8 E-9	0.0 ± 0.4 E-9	0.0 ± 0.4 E-9	20.02 E-9
1977	2nd	CDW	2.6 ± 2.1 E-9	0.0 ± 0.8 E-9	0.1 ± 0.2 E-9	*
1977	3rd	CDW	3.4 ± 2.3 E-9	0.0 ± 0.3 E-9	0.5 ± 0.7 E-9	4.6 E-9

* - Indicates No Sample Data Available

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4. Particulate air samples taken from the three locations specified below and analyzed for Gross Alpha, Thorium 230, Radium 226 and natural Uranium. Data is shown in Table 6.1-5.

4.1 Plant Site - Downwind

4.2 City Park of Town of Copperton

4.3 Top of Hill -- NNW of Plant Site

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TABLE 6.1-5

PRE-OPERATIONAL
ENVIRONMENTAL AIR SAMPLES - WYOMING MINERAL CORPORATION BINGHAM CANYON PLANT

SAMPLES LOCATIONS	(1)	PLANT SITE - DOWNWIND
(see attached map)	(2)	CITY PARK OF TOWN OF COPPERTON
FIG. 6.1.1	(3)	METEORLOGICAL STATION NNW OF PLANT SITE

Year	Quarter	Location	Gross (uCi/ml)	Th230(uCi/ml)	Ra226(uCi/ml)	Uranium(uCi/ml)	Sample Volume (Liters)
1976	2nd	(1)	1.3 ± 8.2 E-12	*	*	*	83
		(2)	1.8 ± 9.5 E-12	*	*	*	80
		(3)	0.7 ± 2.9 E-12	*	*	*	314
1976	3rd	(1)	*	*	*	*	*
		(2)	*	*	*	*	*
		(3)	*	*	*	*	*
1976	4th	(1)	1.8 ± 5.4 E-14	-9.1 E-14	9.1 ± 27.2 E-14	*	1,100
		(2)	3.3 ± 5.8 E-14	8.3 ± 8.3 E-14	8.3 ± 16.6 E-14	*	1,200
		(3)	-4.6 E-14	9.3 ± 9.3 E-14	-18.5 E-14	*	1,080
1977	2nd	(2)	0.4 ± 0.8 E-14	1.5 ± 1.5 E-14	-2.9 E-14	5.8 E-14	6,875
1977	3rd	(2)	0.7 ± 2.3 E-14	-6.9 E-14	-6.9 E-14	-5.2 E-14	4,372

Note: Extreme variability in pre-operational air data is due to the small sample size.
Minus Sign Indicates Less Than Lower Limit of Detection
* - Indicates No Sample Data Available

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6.2 OPERATIONAL MONITORING PROGRAMS

Monitoring programs for radioactivity, chemical effluents, meteorology and ecology are described in the following sections.

6.2.1 RADIOLOGICAL MONITORING

The operational radiological monitoring program is consistent with those in practice throughout the uranium mining industry. It includes the following (see Appendix D for radiochemical procedures index):

1.0. Annual grab samples are taken of soil and vegetation from the following locations and analyzed for Gross Alpha, Thorium 230, Radium 226 and natural Uranium:

   a. Within site boundary fence, downwind.
   b. Copperton City Park
   c. Top of hill, NNW of site.

   Data are shown in Tables 6.2-1 and 6.2-2 recorded as concentrations in picocuries per gram. Soil samples are

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TABLE 6.2-1

OPERATIONAL SOIL SAMPLES

WYOMING MINERAL CORPORATION BINGHAM CANYON PLANT

SAMPLES LOCATIONS (1) PLANT SITE - DOWNWIND
(see attached map) (2) CITY PARK OF TOWN OF COPPERTON
FIG. 6.1.1 (3) TOP OF HILL NNW OF PLANT SITE

Year	Location	Gross (pci/g)	Th230(pci/g)	Ra226(pci/g)	Uranium(pci/g)
1978	(1)	8.1 ± 1.4	0.56 ± .04	1.3 ± .4	4.01
	(2)	3.1 ± 1.0	0.04 ± .01	0.62 ± .15	0.61
	(3)	5.7 ± .8	0.19 ± .02	0.22 ± .05	0.44
1979	(1)	530 ± 8	0.09 ± .01	3.7 ± .1	81.6
	(2)	3.0 ± .4	0.02 ± .01	0.8 ± .1	1.84
	(3)	5.1 ± .5	0.12 ± .02	-.06	- .68
1980	(1)	18.4 ± 2.8	.06 ± .01	8.7 ± 3.9	16.9
	(2)	10.7 ± 2.3	.42 ± .1	-.05	2.23
	(3)	6.5 ± 1.6	.22 ± .04	.2 ± .03	2.01
1981*	(1)	*	*	1.11 ± .25	2.72
	(2)	*	*	-.05	- .05
	(3)	*	*	-.05	2.03
1981	(1)	6.2 ± 1.3	0.19 ± .05	1.5 ± .2	2.58
	(2)	4.1 ± 1.2	-0.05	5.0 ± .7	0.48
	(3)	2.8 ± 1.1	-0.05	3.1 ± .4	0.37

*Note: An extra set of samples were taken for Ra-226 and Uranium due to the variability seen in the 1979-1980 data.

Minus Sign Indicates Less Than Lower Limit of Detection
* - Indicates No Sample Data Available

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TABLE 6.2-2

OPERATIONAL VEGETABLE SAMPLES

WYOMING MINERAL CORPORATION BINGHAM CANYON PLANT

SAMPLES LOCATIONS (1) PLANT SITE - DOWNWIND
(see attached map) (2) CITY PARK OF TOWN OF COPPERTON
FIG. 6.1.1 (3) TOP OF HILL NNW OF PLANT SITE

Year	Location	Gross (pci/g)	Th230(pci/g)	Ra226(pci/g)	Uranium(pci/g)
1978	(1)	4.4 ± 1.0	0.28 ± .06	0.29 ± .08	1.09
	(2)	2.2 ± 0.6	0.04 ± .01	0.29 ± .04	0.25
	(3)	1.1 ± .05	0.09 ± .02	0.24 ± .03	0.37
1979	(1)	71 ± 4	0.11 ± .01	1.50 ± .10	55.8
	(2)	1.0 ± .6	0.03 ± .01	2.2 ± .2	1.16
	(3)	16.3 ± 2.2	0.05 ± .01	0.8 ± .1	0.88
1980	(1)	5.3 ± .9	-.05	-.05	- .32
	(2)	2.1 ± .8	.23 ± .09	.06 ± .04	7.07
	(3)	5.7 ± 1.1	.45 ± .15	-.05	9.25
1981*	(1)	*	*	.06 ± .04	4.1
	(2)	*	*	-.05	- .05
	(3)	*	*	-.05	1.36
1981	(1)	8.3 ± 1.7	0.05 ± .03	0.7 ± .2	4.3
	(2)	3.0 ± 1.1	0.05 ± .03	1.0 ± .2	.62
	(3)	2.2 ± 1.0	0.07 ± .03	0.9 ± .2	.27

*Note: An extra set of samples were taken for Ra-226 and Uranium due to the variability seen in the 1979-1980 data.

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* - Indicates No Sample Data Available

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from the top few centimeters only and vegetation samples are selected such that potential contamination will be maximized (leafy, large surface, etc.).

2.0 Particulate air samples are taken annually at the same three locations mentioned in Section 6.1.4 and analyzed for Gross Alpha, Thorium 230, Radium 226 and natural Uranium. Data are shown in Table 6.2-3.

6.2.2 CHEMICAL EFFLUENT MONITORING

The Wyoming Mineral Corporation uranium extraction plant is a "no-discharge" operation, i.e., no chemical effluent is discharged into the environment. As described in Section 1.2 and Figure 1.2-1, copper leach solution flows into the plant from the Kennecott Copper

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TABLE 6.2-3

ENVIRONMENTAL AIR SAMPLES - WYOMING MINERAL CORPORATION BINGHAM CANYON PLANT

SAMPLES LOCATIONS	(1)	PLANT SITE - DOWNWIND
(see attached map)	(2)	CITY PARK OF TOWN OF COPPERTON
FIG. 6.1.1	(3)	TOP OF HILL NNW OF PLANT SITE

Year	Quarter	Location	Gross (uCi/ml)	Th230(uCi/ml)	Ra226(uCi/ml)	Uranium(uCi/ml)
1978	1st	(1)	2.17×10^{-14}	0.05×10^{-14}	0.47×10^{-14}	2.80×10^{-14}
		(2)	2.03×10^{-14}	$.13 \times 10^{-14}$	3.11×10^{-14}	1.81×10^{-14}
		(3)	0.83×10^{-14}	$.16 \times 10^{-14}$	$.49 \times 10^{-14}$	3.29×10^{-14}
	2nd	(1)	5.27×10^{-14}	4.09×10^{-14}	$.11 \times 10^{-14}$	1.51×10^{-14}
		(2)	1.67×10^{-14}	2.94×10^{-14}	$.93 \times 10^{-14}$	0.88×10^{-14}
		(3)	1.76×10^{-14}	1.06×10^{-14}	1.06×10^{-14}	1.21×10^{-14}
	3rd	(1)	16.50×10^{-14}	1.14×10^{-14}	2.81×10^{-14}	*
		(2)	*	*	*	*
		(3)	*	*	*	*
	4th	(1)	6.05×10^{-14}	2.01×10^{-14}	1.25×10^{-14}	3.78×10^{-14}
		(2)	3.02×10^{-14}	0.45×10^{-14}	3.05×10^{-14}	2.52×10^{-14}
		(3)	11.30×10^{-14}	0.80×10^{-14}	1.96×10^{-14}	5.58×10^{-14}
1979	1st	(1)	1.51×10^{-14}	0.96×10^{-14}	0.15×10^{-14}	4.46×10^{-14}
		(2)	1.58×10^{-14}	0.44×10^{-14}	0.63×10^{-14}	2.80×10^{-14}
		(3)	6.70×10^{-14}	0.61×10^{-14}	2.75×10^{-14}	6.00×10^{-14}
	2nd	(1)	6.40×10^{-14}	*	3.49×10^{-14}	10.00×10^{-14}
		(2)	$.18 \times 10^{-14}$	$.04 \times 10^{-14}$	$.05 \times 10^{-14}$	$.16 \times 10^{-14}$
		(3)	$.23 \times 10^{-14}$	$.05 \times 10^{-14}$	0.61×10^{-14}	0.58×10^{-14}
	3rd	(1)	0.73×10^{-14}	0.14×10^{-14}	0.40×10^{-14}	0.14×10^{-14}
		(2)	0.35×10^{-14}	0.34×10^{-14}	$.17 \times 10^{-14}$	0.34×10^{-14}
		(3)	0.40×10^{-14}	0.24×10^{-14}	0.24×10^{-14}	0.33×10^{-14}
	4th	(1)	4.20×10^{-14}	0.72×10^{-14}	$.15 \times 10^{-14}$	9.32×10^{-14}
		(2)	1.30×10^{-14}	2.05×10^{-14}	0.18×10^{-14}	24.10×10^{-14}
		(3)	1.22×10^{-14}	2.35×10^{-14}	$.14 \times 10^{-14}$	23.00×10^{-14}

Minus Sign Indicates Less Than Lower Limit of Detection
* - Indicates No Sample Data Available

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TABLE 6.2-3 (continued)

ENVIRONMENTAL AIR SAMPLES - WYOMING MINERAL CORPORATION BINGHAM CANYON PLANT

SAMPLES LOCATIONS (1) PLANT SITE - DOWNWIND
(see attached map) (2) CITY PARK OF TOWN OF COPPERTON
FIG. 6.1.1 (3) TOP OF HILL NNW OF PLANT SITE

Year	Quarter	Location	Gross (uCi/ml)	Th230(uCi/ml)	Ra226(uCi/ml)	Uranium(uCi/ml)
1980	1st	(1)	$.47 \times 10^{-14}$	0.37×10^{-14}	0.62×10^{-14}	2.73×10^{-14}
		(2)	$.39 \times 10^{-14}$	$.13 \times 10^{-14}$	0.67×10^{-14}	5.18×10^{-14}
		(3)	2.85×10^{-14}	0.31×10^{-14}	$.13 \times 10^{-14}$	7.51×10^{-14}
	2nd	(1)	39.50×10^{-14}	2.75×10^{-14}	61.30×10^{-14}	2.21×10^{-14}
		(2)	59.80×10^{-14}	$.16 \times 10^{-14}$	56.70×10^{-14}	0.20×10^{-14}
		(3)	25.90×10^{-14}	$.16 \times 10^{-14}$	47.10×10^{-14}	0.85×10^{-14}
	3rd	(1)	$.35 \times 10^{-14}$	$.12 \times 10^{-14}$	0.35×10^{-14}	0.19×10^{-14}
		(2)	1.14×10^{-14}	0.50×10^{-14}	1.48×10^{-14}	0.90×10^{-14}
		(3)	1.95×10^{-14}	$.15 \times 10^{-14}$	15×10^{-14}	0.24×10^{-14}
	4th	(1)	4.40×10^{-14}	0.35×10^{-14}	$.14 \times 10^{-14}$	0.37×10^{-14}
		(2)	10.70×10^{-14}	$.98 \times 10^{-14}$	0.40×10^{-14}	1.29×10^{-14}
		(3)	2.03×10^{-14}	$.12 \times 10^{-14}$	$.12 \times 10^{-14}$	0.29×10^{-14}
1981	1st	(1)	5.48×10^{-14}	1.15×10^{-14}	$.17 \times 10^{-14}$	0.77×10^{-14}
		(2)	11.20×10^{-14}	0.39×10^{-14}	1.34×10^{-14}	1.50×10^{-14}
		(3)	1.76×10^{-14}	0.73×10^{-14}	$.17 \times 10^{-14}$	$.37 \times 10^{-14}$
	2nd	(1)	$.45 \times 10^{-14}$	$.18 \times 10^{-14}$	$.18 \times 10^{-14}$	0.72×10^{-14}
		(2)	3.30×10^{-14}	$.20 \times 10^{-14}$	1.17×10^{-14}	1.04×10^{-14}
		(3)	$.45 \times 10^{-14}$	0.37×10^{-14}	0.22×10^{-14}	-
	3rd	(1)	1.00×10^{-14}	0.22×10^{-14}	1.00×10^{-14}	1.98×10^{-14}
		(2)	0.60×10^{-14}	0.40×10^{-14}	$.24 \times 10^{-14}$	0.27×10^{-14}
		(3)	3.83×10^{-14}	0.45×10^{-14}	1.00×10^{-14}	0.28×10^{-14}
	4th	(1)	0.72×10^{-14}	1.85×10^{-14}	$.14 \times 10^{-14}$	$.48 \times 10^{-14}$
		(2)	1.15×10^{-14}	$.19 \times 10^{-14}$	$.19 \times 10^{-14}$	0.58×10^{-14}
		(3)	4.80×10^{-14}	$.19 \times 10^{-14}$	$.19 \times 10^{-14}$	0.47×10^{-14}

Minus Sign Indicates Less Than Lower Limit of Detection

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Corporation Copper Precipitation Plant at the Bingham Canyon Mine. The solution, after leaving the uranium extraction plant, flows into the central pump station sump of the precipitate plant to be immediately pumped back to the mine dumps where it is reused in the copper leaching process. The solution is continuously recycled in a closed system with no solution being bled from the circuit.

The plant heads and tails are routinely monitored for process control purposes, as are streams throughout the plant. The heads and tails are sampled and analyzed for uranium.

6.2.3 METEOROLOGICAL MONITORING

Meteorological monitoring was accomplished through the use of an on-site weather station which records wind direction and speed, precipitation, and temperature.

6.2.4 ECOLOGICAL MONITORING

The ecological monitoring program to be used during the life of the plant operation consists of the environmental radiological monitoring program described in Section 6.2.1.

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SECTION 7.0

ENVIRONMENTAL EFFECTS OF ACCIDENTS

7.1 PLANT ACCIDENTS

The nature of most mining or processing operations leads one to concern about the potential for accidents. although attempts are made to minimize the potential for these industrial accidents, the possibility of their occurrence must be recognized.

7.1.1 RUPTURE OF SUMP OR FEED AND RETURN PIPELINES

Industrial experience indicates that the probability of pipeline rupture is small. In "An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants" (See Sec. 11.1), it is estimated from industrial experience that the probability of failure for pipes less than three inches in diameter ranges from 3 E-11/hr. to 5 E-11/hr. For pipes greater than three inches in diameter, the failure probably ranges from 3 E-12/hr. to 5 E-6/hr.

At the Bingham Canyon facility, leakage from any process line within the plant is controlled by drainage into the plant sump.

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Material collected in this sump is returned to the appropriate point in the process. The curbing and floor slope design of the plant is such that this sump and curbing would contain the maximum contents of all of the vessels if a simultaneous rupture should occur. Protection against rupture of the feedline within the plant area is accomplished by means of a high amperage cutoff on the feed pumps. Any line breakage would result in a decrease in downstream pressure and a subsequent increase in flow from the centrifugal pumps and increase in amperage on the pump drives.

The only areas not protected by the plant sump are:

1) The ammonia and sulfuric acid storage tanks.
2) The tank of fire protection water.
3) The process line that feeds solution from KMC and returns to KMC.

The ammonia and sulfuric acid storage vessels are protected by individual dikes sized to take the total volume of the tanks. The diked area under the sulfuric acid storage tanks is filled with limestone to neutralize any acid spillage.

A rupture of the fire protection water tanks would result in 60,000 gallons of water being discharged onto the pad to the north of the plant. Some of this water would flow into the plant and into the plant sump to be disposed of as above. The balance of the water would overflow to the drainage area to the south and west, eventually ending up in the KMC collection system.

Fig. 7.1-1 describes the piping system from KMC to the Wyoming Mineral operation and return. Several scenarios could be postulated for rupture of the feed line, the return line or the return sump. The most probable failure point is the feed line at the pump discharge, where the pressure is the highest (120 PSIG). In this case, a low pressure switch at the pump discharge would stop the pumps when the pressure at the discharge dropped below 35 PSIG. If the failure occurred downstream of the check valve, the entire contents of the feed line (20,700 gallons) would discharge from the break. If the rupture point was inside the pump building, this solution would flow back into the feed sump and be contained. If the break occurred outside of the building, the solution would flow into the KMC drainage system where it would be contained. The automatic shutdown of the pumps would be immediately alarmed in the process building and alert the operator to the condition.

Rupture of the feedline anywhere along the length would result in a pump shut-down and alarm as a result of the high amperage pump shut-down system noted above. Solution from the rupture, if below the road, would flow into the KMC area and into the KMC

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collection system. A rupture above the road but not inside the processing plant would cause solution to flow on to the road or the drainage ditch on the north side of the road. In either case, because of the slope of the road and drainage ditch, the solution would flow in a westerly direction, away from the town of Copperton. This solution would travel to a catch basin west of the plant where it would be diverted into the KMC collection system. Periodic measurements are made of the wall thickness of the feed line at susceptible points such as elbows. During the first five years of operation, there have been no ruptures in this section and no measurable decrease in wall thickness.

The return sump and line are less susceptible to failure because of the low pressure gravity return. Failure below the road would result in the solution flowing directly into the KMC collection system. Failure of the line above the road or of the sump would result in solution on the road or drainage ditch. As above, this would eventually enter the KMC collection system via the catch basin west of the plant.

7.1.2 FAILURE OF CALCINER EXHAUST SCRUBBER

The tray type turbodryer for the ADU is designed to minimize dust carry-over while drying. A scrubber is installed to remove any particulate that exits with the dryer exhaust gases. This

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scrubber is a venturi type water scrubber which operates continuously when the dryer/calciner is in operation. The total system operates under negative pressure and the only potential cause of failure that would result in particulate release would be failure of the circulating water supply. If this should occur, a flow switch in the water to the scrubber would be activated which would stop the fan drive, interrupt the gas supply to the dryer/calciner, stop the dryer tray rotation and stop the flow of ADU slurry into the dryer. In addition, the condition would sound an alarm at the main control station.

7.1.3 FIRE IN THE SOLVENT EXTRACTION PROCESS

In order to reduce the hazard of fire in the solvent extraction process, the following procedures are followed:

1. No smoking or open fires are allowed in the solvent extraction area, including the adjacent precipitation area. Warning signs are posted in the solvent extraction area.

2. Maintenance work is carefully scrutinized and, if possible, any cutting or spark-producing operations are performed away from the area. Any maintenance within the solvent extraction area is performed only after a responsible supervisor has ascertained that the work can be done safely.

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Should a fire occur in the solvent extraction area, all mixers and pumps will be shut off to prevent the advance of the organic phase and the spread of fire. The fire protection system for the Copperton Plant has been approved by the Salt Lake County Fire Department, Factory Mutual Insurance, and more than meets National Fire Protection Association standards. All tanks in the solvent extraction area that contain kerosene have a high pressure CO_2 nozzle inside the tank.

There is a water sprinkler system over the solvent extraction area. Inside the plant there will also be water hose outlets and manual fire extinguishers.

Outside the plant there is a fire pump (150 gpm) and a fire water nozzle. Fire water will be stored away from the building in the water tank and 65,000 gallons dedicated to fire protection will always be kept in the tank. In addition, the plant roads have been paved up to the fire nozzle to allow faster access for any fire trucks.

Should a fire occur in the solvent extraction system, it is conceivable that some of the uranium could be carried away mechanically by the smoke.(1) Any uranium thus transported would be dispersed over the same area as the carbon soot. Clean-up will be consistent with regulatory guidance.

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7.1.4 SEISMIC DAMAGE TO THE PLANT

The seismicity of the area is described in Section 2.5. The plant is designed to withstand at least a 6 magnitude earthquake. It is estimated that major seismic damage to the plant would at worst result in a fluid leak or fire previously discussed.)

7.2 TRANSPORTATION ACCIDENTS

Transportation and packaging of the uranium product complies with applicable regulations of the Nuclear Regulatory Commission. The uranium oxide is put in drums that are properly blocked and braced before leaving the plant by truck.

Data on the transportation of radioactive materials to and from nuclear power plants indicates that the probability of a truck accident occurring in transport is very small: about one for each million vehicle miles.(1) However, should an accident occur, it would be rare if all the drums in the shipment broke or if the uranium oxide spread over a large area. Should a spill occur on land, the uranium oxide could be scooped up and recovered along with any contaminated soil. If any uranium oxide spilled in water, it would sink due to its higher specific gravity relative to water. In a water spill, divers would be used to recover the drums and

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determine if any had ruptured. If any of the drums had ruptured, a suitable procedure such as vacuum cleaning would be used to reclaim the spilled material.

7.3 OTHER ACCIDENTS

In order to reduce the impact that could result should a storage tank rupture, the solvent storage tank is buried. In addition, the ammonia and sulfuric acid tanks are curbed or diked.

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SECTION 8.0

ECONOMIC AND SOCIAL EFFECTS OF PLANT CONSTRUCTION AND OPERATION

8.1 BENEFITS

The plant is designed to produce approximately 140,000 pounds per year of U_3O_8. During the twenty (20) year contract with Kennecott Copper Corporation, this will be the equivalent of about 1 million megawatt days of electricity.(1) Federal Income Tax revenues are anticipated to be generated at 46%. A 5% sales tax will apply to all purchases made in Salt Lake County. Construction of the plant created approximately 100 temporary jobs for 9 months with a payroll of $700,000. Operation of the plant requires 15 permanent, full-time employes and generates an annual payroll of over $120,000. Permanent employes receive on-the-job training in plant operation and maintenance.

The short duration of the construction period and the small number of permanent jobs resulted in no large influx of families to the Copperton Area. A sufficient labor pool exists in the Salt Lake City Standard Metropolitan Statistical Area to meet projected needs for both permanent and temporary employes and commuting patterns are well established.

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Operation of the plant does not significantly reduce unemployment in the region, but those jobs created offer above-average pay and long-term stability.

8.2 COSTS

8.2.1 INTERNAL COSTS

Capital costs of land acquisition and improvement were $61,000 while capital costs of the facility were $6.16 million. Operation and maintenance costs are approximately $2,300,000/yr. Plant decommissioning costs are estimated to be $100,000. No tailings are generated and therefore no tailings stabilization costs are anticipated. Research and development costs associated with potential future improvements are estimated to be in the neighborhood of $450,000 over the project life.

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8.2.2 EXTERNAL COSTS

External costs associated with plant construction and operation were minimal, of short duration and limited to noise and additional traffic during construction.

Plant operation has minimal impact on both the short and long-term demand for police and fire department services in the area. This is primarily due to the marginal increase in industrial activity represented by this project when viewed in relation to the existing activity of the Kennecott Copper Corporation.

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SECTION 9.0

RECLAMATION AND RESTORATION

A detailed plan and cost analysis for the decontamination and decommissioning of the plant and reclamation of the site is found in Appendix B.

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SECTION 10.0

ALTERNATIVES TO THE PROPOSED ACTION

Various alternatives were available to Wyoming Mineral Corporation in the planning and design of the Uranium/Copper Project - Copperton, Utah. Among the alternatives reviewed were the "No-Action" alternative, and alternate site locations, plant designs and sewage systems. The following is a discussion of these alternatives.

10.1 TERMINATION OF PROJECT

One alternative to the proposed action would be to terminate the project. With the termination of the project, the economic and social costs and benefits of plant construction and operation, as described in Section 8.0, would be voided. Also, uranium to be supplied by this project in order to meet the future demands discussed in Section 1.0 would not be produced.

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10.2 SITE LOCATION ALTERNATIVES

Alternative plant site locations were reviewed with respect to the following elements:

- cost
- access
- availability of utilities
- expansion possibilities
- drainage and waste disposal
- community impact
- site development
- non-interference with Kennecott operation
- operability

Each element was given a weighting factor according to its relative importance with respect to the other elements. An outside consulting firm analyzed seven proposed sites on Kennecott property by this method. After the consultants submitted the site analyses report, an additional alternate site was offered by Kennecott Copper Corporation. This additional site was chosen as the plant location due to its being zoned industrial, its closeness to the Kennecott cementation plant and its low altitude.

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10.3 PLANT DESIGN ALTERNATIVES

The Higgins Loop was chosen as the ion exchange system to be used in the uranium extraction plant after reviewing several alternate systems. In addition to the Higgins Loop, a design proposed by Kennecott Copper was reviewed, as were a standard fixed-packed-bed column. The decision to use the Higgins Loop was based on a comparison of fiteen different parameters including cost, operability, industry experience, availability, lead time for equipment and total plant size.

Environmentally, the Higgins Loop is preferred because of the small plant size requirement and the ability to house all equipment for the system in the plant building.

10.4 ALTERNATE SEWAGE DISPOSAL SYSTEMS

Plant sewage is treated in a septic tank before discharge into the leach solution storage reservoir. The septic tank was chosen as an environmentally preferable alternative to direct discharge of sewage into the reservoir.

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SECTION 11.0

BENEFIT/COST ANALYSIS

The benefits associated with the uranium extraction facility are great with respect to economics and energy supply while the environmental costs are negligible.

The operation provides increased employment and income for the area. The increased income is generated from the plant payroll, plant capital and operating expenses paid out to local businesses, and taxes paid to both Salt Lake County and the State of Utah (see Section 8.0).

Since the operation is a secondary recovery operation, the plant makes more efficient development of a natural resource. The increased supply in uranium from the Uranium/Copper Project - Copperton Site benefits the United States as a whole by decreasing U.S. dependence on imports as an energy source.

The environmental effects of site preparation and plant construction as discussed in Section 4.0 were small and of a temporary nature. The only lasting environmental cost to Copperton is the aesthetic cost of having a plant visible to the local residents. This cost

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must be considered insignificant due to the small plant size and the amount of industrial activity already underway in the area. The site will be restored after termination of the project.

The water quality in the area is not adversely affected by the uranium extraction plant operation. The flow of solution is contained in a closed system, with no discharge of pollutants into the environment (see Sections 1.2, 3.3 and 5.1).

Air quality is monitored for ammonia and radionuclides as described in Section 6.2. This monitoring is done as a matter of procedure, although no dangerously high level of either ammonia or radioactivity has been experienced. The yellowcake dryer/calciner, the one potential source of air pollution, has a dust collection system for air pollution control (see Section 5.0).

The costs in terms of resources committed for the project are described in Section 5.5 Once again, this cost must be considered negligible with respect to the benefits associated with the project.

Relative to other types of mining operations, the Uranium/Copper Project - Copperton Site has negligible environmental impact.

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SECTION 12.0

ENVIRONMENTAL APPROVALS AND CONSULTATIONS

The following licenses and permits apply to the copperton Plant:

(1) NRC Source Materials License

(2) Utah Air Conservation Permit

(3) Utah Mining Permit

(4) Salt Lake County Conditional Use Permit

Consultations have been made with the following agencies:

(1) U. S. Nuclear Regulatory Commission

(2) Utah Department of Health

(3) Utah Department of Natural Resources,
Division of Oil, Gas, and Mining

(4) Utah Industrial Commission

(5) U. S. Environmental Protection Agency

(6) Salt Lake County Planning Commission

(7) Utah State Historic Preservation Officer

(8) Kennecott Utah Copper Division

(9) National Oceanic and Atmospheric Administration

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SECTION 13.0

REFERENCES

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1.2 REFERENCES

2.0 REFERENCES

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8.0 REFERENCES

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APPENDIX A

REGIONAL HISTORIC, SCENIC, CULTURAL AND NATURAL LAND MARKS

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RECEIVED
AUG 12 1982
WYOMING MINERAL
CORPORATION

SCOTT M. MATHESON
GOVERNOR

STATE OF UTAH
DEPARTMENT OF COMMUNITY AND
ECONOMIC DEVELOPMENT

Division of
State History
(UTAH STATE HISTORICAL SOCIETY)

MELVIN T. SMITH, DIRECTOR
300 RIO GRANDE
SALT LAKE CITY, UTAH 84101
TELEPHONE 801 / 533-5755

August 2, 1982

Carleton Rutledge, Jr., Manager
Environmental and Regulatory Programs
Wyoming Mineral Corporation
3900 South Wadsworth Blvd.
Lakewood, Colorado 80235

RE: Bingham Canyon Uranium Extraction Plant, Utah County, Utah

Dear Mr. Rutledge:

The staff of the Utah State Historic Preservation Officer has received for consideration your letter of July 13, 1982, concerning the possibility of any sites in the area of your above referenced plant.

We have checked our files and have found no known cultural resources located in this project area.

The above is provided on request as information or assistance. We make no regulatory requirement, since that responsibiional assistance, please let us know. Contact Wilson Martin or Jim Dykman at 533-7039.

Sincerely,

Melvin Smith

Melvin T. Smith
Director and
State Historic Preservation Officer

jr:F329/4154c

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APPENDIX A-1

UTAH EXCERPTS FROM NATIONAL REGISTER OF HISTORIC PLACES

PLACE	ADDRESS	CITY
SALT LAKE COUNTY		
Brinton House	1981 East 4800 South	Salt Lake City
Savings Bank Bldg.	22 East 100 South	Salt Lake City
Amussen's Jewelry	60 South Main Street	Salt Lake City
Bamburger House	623 East 100 South	Salt Lake City
Beehive House	67 East South Temple Street	Salt Lake City
Beer Estate	181 B Street & 222 4th Avenue	Salt Lake City
Bertolini Block	143-1/2 West 200 South	Salt Lake City
B'Nai Israel Temple	249 South 400 East	Salt Lake City
Capitol Building	Capitol Hill	Salt Lake City
Cathedral of the Madeleine	331 East Temple	Salt Lake City
Chase Mill Liberty Park	600 Street East	Salt Lake City
Converse Hall	1840 South 13 East	Salt Lake City
Council Hall	Capitol Hill	Salt Lake City
Culmer House	33 C Street	Salt Lake City
Daft Block	128 South Main	Salt Lake City
Denver & Rio Grande Rail Road Station	3rd South & Rio Grande	Salt Lake City
Devereaux House	334 West South Temple Street	Salt Lake City
Dinwoody House	411 East 100 South	Salt Lake City
Emigration Canyon	East edge of SLC on UT 65	Salt Lake City
Emmanuel Baptist Church	401 East 200 South	Salt Lake City
Exchange Place	Exchange Place & South Main	Salt Lake City
Fifth Ward Mtg. Hse	740 South 100 West	Salt Lake City
First Church of Christ Science	352 East 3 South	Salt Lake City
First National Bank	163 South Main	Salt Lake City
Fort Douglas	Fort Douglas Military Reservation	Salt Lake City
Fritsch Block	158 East 200 South	Salt Lake City
Granite Paper Mill	6900 Big Cottonwood Canyon Road	Salt Lake City
Hawk Cabin	458 North 3 West	Salt Lake City
Henderson Block	375 West 200 South	Salt Lake City
Herald Building	165-169 South Main	Salt Lake City
Hills House	126 South 200 West	Salt Lake City

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SALT LAKE COUNTY (continued)

Holy Trinity Greek Orthodox Church	279 South 200 West	Salt Lake City
Hotel Utah	South Temple & Main	Salt Lake City
Independent Order of Odd Fellows Hall	41 Post Office Place	Salt Lake City
Irving Junior High	678 East South Temple	Salt Lake City
Karrick Block	286 South Main	Salt Lake City
Keith-Brown Mansion	529 East South Temple	Salt Lake City
Keith-O'Brien Building	242-256 South Main	Salt Lake City
Ladies Literary Club	850 East South Temple	Salt Lake City
Lollin Block	238 South Main	Salt Lake City
McCormick Building	10 West 100 South	Salt Lake City
McCune Mansion	200 North Main Street	Salt Lake City
McDonald Chocolate Co.	155 West 300 South	Salt Lake City
McIntyre Building	68-72 South Main Street	Salt Lake City
McIntyre House	259 7th Avenue	Salt Lake City
Nelden House	1172 East 100 South	Salt Lake City
Old Pioneer Fort Site	400 South & 200 West	Salt Lake City
Oregon Shortline Railroad Co. Bldg.	126-140 Pierpont Avenue	Salt Lake City
Orpheum Theater	46 West 2nd South	Salt Lake City
Ottinger Hall	233 Canyon Road	Salt Lake City
Peery Hotel	270-280 South West Temple	Salt Lake City
Platts House	364 Quince Street	Salt Lake City
Pugh House	1299 East 4500 South	Salt Lake City
Salt Lake City & County Building	451 Washington Square	Salt Lake City
Salt Lake Stock & Mining Exchange Bldg.	39 Exchange Place	Salt Lake City
Salt Lake Union Pacific Railroad Station	South Temple & 400 West	Salt Lake City
St. Mark's Episcopal Ch.	231 East 100 South	Salt Lake City
Temple Square	Temple Square	Salt Lake City
Tenth Ward Square	400 South & 800 East	Salt Lake City
Tracy Loan & Trust Company Building	151 South Main	Salt Lake City
Trinity A.M.E. Church	239 East 600 South	Salt Lake City
University of Utah Circle	University of Utah Campus	Salt Lake City
Utah Commercial & Savings Bank Building	22 East 100 South	Salt Lake City
Utah Savings & Trust Company Building	235 South Main	Salt Lake City
Utah Historical Society Mansion	603 East South Temple	Salt Lake City
Wheeler Farm	6343 South 900 East	Salt Lake City

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SALT LAKE COUNTY (continued)

Whitaker House	975 Garfield Avenue	Salt Lake City
Brigham Young Forest Farmhouse	732 Ashton Avenue	Salt Lake City
Brigham Young (Lion) House	63 South Temple	Salt Lake City
ZCMI Cast Iron Front	15 South Main	Salt Lake City
Nineteenth Ward Mtg. Hse.	168 West 500 North	Salt Lake City
*Bingham Canyon Open Pit Mine	on UT 48	Vicinity of SLC
Little Dell Station	East of SLC on Mountain Dell Canyon near Junction UT 239 & 65	Vicinity of SLC
**Dansie Farmstead	12494 South 1700 West	Vicinity of SLC
Anselmo House	164 South 900 East	Salt Lake City
Beesley House	80 West 200 North	Salt Lake City
Grant Steam Locomotive No. 223	Liberty Park	Salt Lake City
Oakwood	2610 Evergreen Street	Salt Lake City
Rowland Hall - St. Mark's School	205 First Avenue	Salt Lake City
Salt Lake City Public Library	15 South State	Salt Lake City
Whipple House	564 West 400 North	Salt Lake City
Woodruff - Ritter House	225 North State	Salt Lake City
Varley House	180 West 500 North	Salt Lake City
Allen House	1047 East 13200 South	Vicinity of SLC
Draper Park School	12441 South 900 East	Salt Lake City
Armstrong House	667 East 1 South	Salt Lake City
Avenues Historic District	1st & 9th Ave., State & Virginia St.	Salt Lake City
Best-Cannon House	1146 South 900 East	Salt Lake City
Brinton Dahl House	1501 Spring Lane	Salt Lake City
Chapman Branch library	577 South 900 West	Salt Lake City
City Creek Canyon Historic District	Capitol Blvd., A Street, 4th Ave, Canyon Rd.	Salt Lake City
Covey House	1229 East 100 South	Salt Lake City
General Engineering Company Building	159 West Pierpont Avenue	Salt Lake City
Hall House	1340 2nd Avenue	Salt Lake City
**Hawarden House	4396 South 3200 West	Salt Lake City
Kearns- St. Ann's Orphange	430 East 2100 South	Salt Lake City
McDonald House	4659 Highland Drive	Salt Lake City
Judge Building	8 East 300 South	Salt Lake City
**McLachlen Farmhouse	4499 South 3200 West	Salt Lake City
Morris House	314 Quince Street	Salt Lake City

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SALT LAKE COUNTY (continued)

Nelson-Beeseley House	533 11th Avenue	Salt Lake City
Neuhausen House	1265 East 100 South	Salt Lake City
New York Hotel	42 Post Office Plaza	Salt Lake City
Technical High School	241 North 300 West	Salt Lake City
Wasatch Springs Plunge	840 North 300 West	Salt Lake City
Mountain Dell Dam	North of Salt Lake City	Vicinity of SLC
Liberty Park	5th East, 7th East, 9th South, 13th South	Salt Lake City
Utah State Fairgrounds	10th West & North Temple	Salt Lake City
Wasatch Mountain Club Lodge	SE of Salt Lake City	Vicinity of SLC
South Temple Historic District	South Temple Street	Salt Lake City
Woodruff Villa	1622 South 5 East	Salt Lake City
Woodruff-Hart House	1636 South 5 East	Salt Lake City
Woodruff Farmhouse	1604 South 5 East	Salt Lake City

SUMMIT COUNTY

Summit County Courthouse	Main Street	Coalville
Howe Flume Historic District	N.E. Of Oakley in Wasatch Nat'l Forest	
LDS Park City Mtg. Hse	424 Park Avenue	Park City
Park City Miners' Hospital	Off UT97	Park City
Silver King Ore Loading Station	Park Avenue	Park City
Washington School	541 Park Avenue	Park City
Kimball Stage Stop		Near Park City
Main Street Historic District	Main Street	Park City
St. Mary of Assumption Church	121 Park Avenue	Park City
Park City Community Church	402 Park Avenue	Park City
St. Luke's Episcopal Church	523 Park Avenue	Park City

TOOELE COUNTY

Lincoln Highway Bridge	D-Area on 2nd Street (Over Governmemt Creek)	Dugway PG
Iosepa Settlement Cemetary	Iosepa	Skull Valley
Benson Mill	Southwest of UT 138	Near Mills Jct.
Soldier Creek Kilns	SE of Stockton	Stockton

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MORGAN COUNTY

Heiner House	543 North 700 East	Morgan

DAVIS COUNTY

Bountiful Tabernacle	Main & Center Street	Bountiful
Richards House	386 North 100 East	Famington
Adams House	300 North Adamdswood Road	Layton
Farmers' Union Bldg.	State & West Gentile Streets	Layton
Randall House	390 East Porter Lane	Centerville
Blood House	95 South 300 West	Kaysville

WASATCH COUNTY

Crook House	188 West 3 North	Heber City
Hatch House	81 East Center Street	Heber City
Heber Second Ward Meeting House	1st West & Center Street	Heber City
Wasatch Stake Tabernacle	Main Street & 100 North	Heber City
Midway School	1st North & 1st West	Midway
Watkins-Coleman House	5 East Main Street	Midway
Wherritt House	315 East Center	Heber City
Fisher House	125 East 400 South	Heber City
Murdoch House	261 North 400 West	Heber City
Wasatch Saloon	Main Street	Heber City
Wave Publishing Co. Bldg.	55 West Center	Heber City
Wooton House	270 East Main Street	Midway

UTAH COUNTY

Stage Coach Inn		Fairfield
Camp Floyd Site	1/2 Mile South of Fairfield	Fairfield
Titanic Standard Reduction Mill	East of Goshen off US 6	Near Goshen
Christopher F. Dixon Hse	248 North Main	Payson
John Dixon House	218 north Main	Payson
Driggs House	119 East Battlecreek Road	Pleasant Grove
Olphin House	510 Locust Avenue	Pleasant Grove
Clark-Taylor House	306 North 500 West	Provo
Eggertsen House	390 South 500 West	Provo
Hines Mansion	125 South 4 West	Provo

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UTAH COUNTY (continued)

Knight Block	1-13 East Center Street, 20-24 University Avenue	Provo
Provo Tabernacle	50 South University Avenue	Provo
Smoot-Reed House	183 East 100 South	Provo
Weintz House	575 north University Avenue	Provo
Brigham Young Academy	5th & 6th Street and University Avenue	Provo
Olmsted Station Powerhouse	5 Miles North on US 189	Provo
Garner House	10 North Main	Salem
Houtz House	980 north Main	Springville
Smith House	589 East Main	American Fork
Titanic Mining District	8 Mile Radius of Eureka	Eureka
Allen House	135 East 200 North	Provo
Hotel Roberts	192 South University Avenue	Provo
Provo Third Ward Chapel	105 North 500 West	Provo
American Fork Presbyterian Church	75 North 1 East	American Fork
Old Goshen Site	Northwest of Goshen	Goshen
Pleasant Grove School	Main Street	Pleasant Grove
Beebe House	489 West 100 South	Provo
Nunn Power Plant	Off US 189	Provo
Provo Downtown Historic District	Center Street & University Ave.	Provo
Smith House	315 East Center Street	Provo
Talmadge House	345 East 400 North	Provo
Springville Presbyterian Church	251 South 200 East	Springville
Bird House	115 South Main Street	Mapleton

WEBER COUNTY

McGuire Duplex	549 25th Street	Ogden
New Brigham Hotel	2402 Wall Avenue	Ogden
US Post Office	298 West 24th	Ogden
Burch-Taylor Mill	4287 Riverdale Road	Ogden
Eccles Building	385 24th	Ogden

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Notes: (1) Sources of the above information were:
Federal Register, Vol. 44, No. 26, 2/6/79
Federal Register, Vol. 45, No. 54, 3/18/80
Federal Register, Vol 46, No. 22, 2/3/81
Federal Register, Vol. 47, No. 22, 2/2/82
Department of Interior U.S. National Park Service letters, 1982

(2) Places more than 50 miles from Copperton are not listed; those 5 miles or less from Copperton are marked with one asterisk, and 10 miles with two.

2.3 REGIONAL HISTORIC, SCENIC, CULTURAL AND NATURAL LANDMARKS

A search of the National Historic Register of Historic Places listings through early 1982 revealed a number of sites within 50 miles (see Appendix A-1). Three sites (Dansie Farmstead, Harwarden House, and McLachlen Farmhouse) are within a ten-mile radius toward the east. Each one is occupied by the owners, and none is of major importance such that it attracts crowds. The Bingham Canyon Open Pit Mine lies about five miles to the southwest and draws a steady flow of about 250,000 tourists per year, but the number present at one time, usually for not more than about 30 minutes, is at most 60-80.

The archaeological survey of the site originally reported (see Appendix A of "Environmental Survey, Uranium/Copper Project, Copperton, Utah" of 1976) that no pre-historic or historic cultural remains were found. None was found during construction on the site and none since. The Utah State Preservation Officer reports (Appendix A-2) that a search of Utah State Historical and Archaeological Files reveals no known cultural resources at the Copperton Site or nearby.

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BINGHAM CANYON

URANIUM EXTRACTION PLANT

DECOMMISSIONING STUDY

WYOMING MINERAL CORPORATION

Originally Prepared:
March 10, 1978

Revised:
August 20, 1982

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BINGHAM CANYON URANIUM EXTRACTION PLANT DECOMMISSIONING STUDY

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1.0 Introduction

Wyoming Mineral Corporation (WMC) is currently operating the Bingham Canyon Uranium Extration Plant, a uranium from copper leach stream recovery plant on a 1.3-acre site near Copperton, Utah. Uranium is recovered from dump leach solutions generated by the Kennecott Copper Corporation. Low concentrations of uranium are present in the mine dumps and a portion of the uranium is leached along with the copper. Kennecott operates a cementation plant at a flow rate of approximately 45,500 gallons per minute for the recovery of the copper from the leach solution. The WMC plant processes a portion (approximately 10,000 gallons per minute) of the tails solution from the copper cementation plant. All solution discharges from the uranium extraction plant are returned to the copper leach circuit.

The plant operates to recover uranium from the copper leach solution by a conventional metallurgical extraction process. Initially the uranium is removed from the plant feed stream by an ion exchange process. The eluate from the ion exchange is concentrated by solvent extraction and ammonium diuranate (ADU) is precipitated from the solvent extraction strip solution. The ADU product is washed, dewatered, calcined to U_3O_8, and the packaged yellowcake product is shipped to a conversion plant.

The expected life of the plant is 20 years at which time it will be decommissioned and the site returned to Kennecott. This report

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describes the proposed decommissioning of the Bingham Canyon Extraction Plant. The plan, at time of decommissioning, will assure compliance with all applicable legal and regulatory requirements.

During the course of the decommissioning evaluation, the following general guidelines constituted the decommissioning philosophy for the Bingham Canyon Uranium Extraction Plant:

- Return of the facility and site, after decontamination of all plant equipment and structures to unrestricted use criteria, to Kennecott for process use will be investigated with Kennecott at the time of decommissioning.
- All plant equipment, residual chemicals and ion exchange resins will be decontaminated to the guidelines specified in NRC Annex A or 10CFR20 or to the levels specified in License Condition #29 of the existing license.
- Sulfuric acid washing, followed by water rinsing, will be used to decontaminate all process equipment. The wash and rinse solution will be returned to the main acid dump leach process flow stream.
- Wherever possible, reuse of usable plant equipment and chemicals in other licensed facilities will be attempted.
- Plant equipment and residual chemicals not decontaminatable to the guidelines specified in NRC Annex A or 10CFR20 will be disposed of at a licensed disposal or tailings facility.
- If not acceptable for use by Kennecott, the plant building will be removed to the foundations and the land returned to its previously intended industrial land use.

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These guidelines, described in further detail below, were determined to be the most practical, cost effective and environmentally acceptable methods available to return the plant site to its previously intended use.

The following cost analysis is a revision of a study submitted in March of 1978 to the NRC. Escalation factors used in the revision are based on the Chemical Engineering Plant Cost Index of August 9, 1982. The Index for mid-1978 was 218.8 and for May, 1982, the Index was 313.6. Based entirely on the Index, a multiplier of 1.43 should be used. For the sake of simplicity, a factor of 1.5 was used for all estimates that were escalated.

2.0 Conclusions and Recommendations

Conclusions of the Bingham Canyon Uranium Extraction Plant decommissioning study are summarized below and recommendations concerning the financial requirements needed to assure adequate funding for the decommissioning operation are given.

2.1 Conclusions

1. It will be impossible to dispose of used ion exchange resins as non-radioactive waste due to the very restrictive limits of allowable concentrations of radionuclides in resin as stated in LC #29 of the present license. Resin will have to be shipped to another licensed uranium producer or to a licensed disposal site or tailing facility.

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2. Sulfuric acid washing of all process equipment is capable of achieving acceptable decontamination for release to unrestricted use.

3. Plant equipment and residual chemicals not decontaminated to acceptable standards can be disposed of as low-level radioactive waste in available licensed disposal or tailings facilities.

4. Since the plant operation is contingent on available sulfuric acid feed solutions from the copper dump leach operations, return of all sulfuric acid wash solutions (less than 100,000 gallons for the entire decommissioning operation) to the recirculating feed stream is feasible and represents an insignificant impact on the 10,000,000 gal./day flow through the copper dump extraction circuit.

5. the most probable costs associated with the planned decommissioning operations, assuming complete decontamination of all facilities are summarized below:

o Residual plant chemicals .... -	$ 3,708
o Plant equipment decommissioning .... -	32,650
o Building structure decommissioning and site reclamation .... -	127,000
o Site evaluation and monitoring program ... -	75,000
TOTAL ESTIMATED COSTS ...... -	$171,358

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2.2 FINANCIAL SURETY ALTERNATIVES

At the present time, there is no surety bond for decontamination and decommissioning in effect for the Copperton Site. WMC proposes to demonstrate financial responsibility for decontamination and decommissioning of the Copperton Site from a financial test which demonstrates the financial strength of the corporation. Details of this financial test can be found in FR Vol 47, No. 67; Wed., April 7, 1982; pp. 15032-15074.

If the above test is not acceptable to the agency, other alternatives would be the posting of a surety bond or a letter of credit.

3.0 DECOMMISSIONING ALTERNATIVES AND COST EVALUTION

The Bingham Canyon Uranium Extraction Plant is an operation that extracts and concentrates uranium from a low grade sulfuric acid leach stream used in the leaching of copper from residual copper tailings piles. The process by which this U_3O_8 is removed from the recirculating Cu leach solutions is shown schematically in Figure 1. As is seen, the plant consists of four distinct process operations:

1) Ion exchange
2) solvent extractions

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3) Precipitation

4) Calcination and U_3O_8 Packaging

These operations are housed in a small (11,000 sq. ft.) process building on a 1.3-acre site on Kennecott property. The alternatives and cost evaluation which follows utilizes existing decommissioning practices to reduce residual radioactivity to levels as low as practicably achievable and return the site to unrestricted public or industrial siting use.

3.1 DISPOSITION OF RESIDUAL PLANT CHEMICALS

3.1.1 ION EXCHANGE RESINS

There are two alternatives available to dispose of the ion exchange resins. The first alternative would be to ship the resin, which will most likely have significant resale value, to another uranium producer. The second alternative is to dispose of the resin as a low level radioactive waste at a licensed disposal site or at a conventional uranium mill tailing facility.

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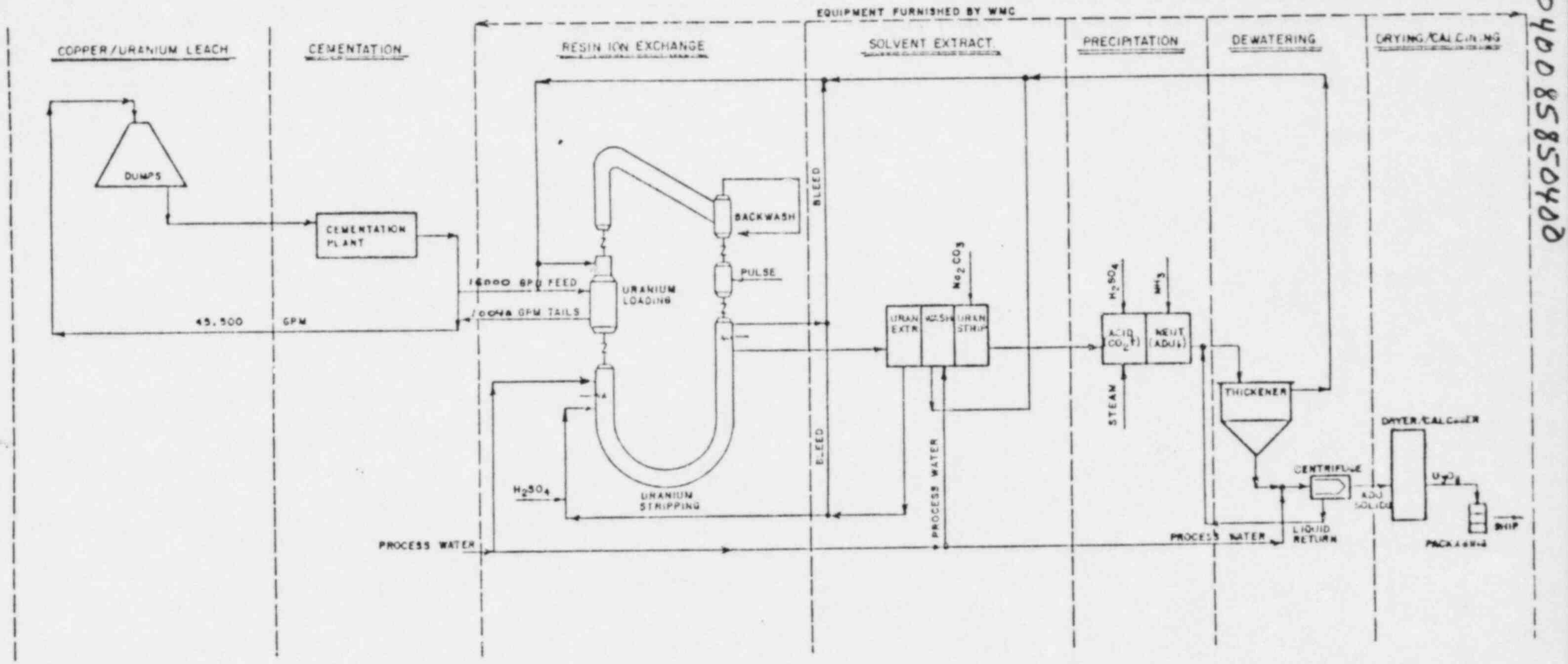

FIGURE 1 PROCESS FLOW SHEET (ESTIMATED FLOWS)

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Alternate 1: Shipment to another uranium producer. this alternate is advantageous in that recycle of the material will be maximized and this alternate represents the lowest cost option. complete decontamination of the resin would not be required.

Costs:	Wash Acid (4.5 tons H_2SO_4)	=	$ 180
	Labor (12 man days @ $184/day)	=	2,208
	Transportation (to be paid by receiver)	=	0
	TOTAL	=	$ 2,388

Alternate 2: Disposal as low-level radioactive waste. In the event that the resin cannot be decontaminated to the desired levels, a licensed burial site or tailings facility will be chosen for disposition of the resin.

Costs:	Labor (12 man days @ $184/day)	=	$ 2,208
	Transportation and Disposal	=	45,000
	TOTAL	=	$47,208

3.1.2 SOLVENT EXTRACTION (SX) SOLVENT

The loaded solvent (6,000 gal. of kerosene with complexing agents DEHPA and TOPO) will be stripped using a 0.5-1.5 M solution of sodium carbonate. since no appreciable amount of Ra-226 was removed in the 1X circuit, it is expected that little will appear in the SX

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solvent. Thorium is, however, eluted with the U_3O_8 and will concentrate in the loaded solvent. It has been demonstrated that a 0.5-1.5 M sodium carbonate strip solution is also very effective for the removal of Th-230 which will report to the precipitation circuit for removal along with the U_3O_8. It is anticipated that 2 - 5 volumes of strip solution will decontaminate the solvent to levels acceptable for non-radioactive discharge (See Section 5 for criteria). The strip solution will be returned to the copper leach solution stream. The solvent can then be disposed of in one of several ways.

Alternate 1: Ship to another uranium producer having a solvent extraction circuit. This is the option that recycles the solvent for continued production use and is lease expensive. Total decontamination of the SX solvent would not be required.

Costs:	Wash Solution	= $ 400
	Labor (5 man days @ $184/day)	= 920
	Transportation (to be paid by receiver)	= 0
	TOTAL	= $ 1,320

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Alternate 2: Disposal as non-radioactive waste with a conventional organic waste disposal service. This alternate could be utilized in the event that no uranium producer is willing to accept the solvent or it is unsuitable for reuse.

Cost:	Wash Solutions	= $ 400
	Labor (5 man days @ $184/day)	= 920
	Disposal Service	= 3,000
	TOTAL	= $ 4,320

Alternate 3: Disposal as low-level radioactive waste in a licensed disposal facility. In the unlikely event that the solvent cannot be decontaminated to the criteria presented in Section 5, disposal will be by sorption in vermiculite-filled drums and disposal at a low-level radioactive handling facility.

Cost:	Wash Solutions	= $ 400
	Labor (12 man days @ $184/day)	= 2,208
	Drums	= 4,000
	Absorber	= 1,800
	Disposal Service	= 27,000
	TOTAL	=$ 35,408

3.1.3 PROCESS CHEMICALS INVENTORY

All process chemicals that were not used in the process and therefore not contaminated, will be disposed of by return to the manufacturer.

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containers of such chemicals will be smear tested to assure no surface contamination. Chemicals included in this cstegory are:

1) Anhydrous Ammonia
2) Sulfuric Acid
3) Sodium Carbonate
4) Organic Solvents
5) Un-used Ion Exchange Resins
6) Miscellaneous Plant Chemicals.

Return of these chemicals have been assumed as a no-cost option. Uncontaminated chemicals that are not returnable or saleable will be disposed of by conventional chemical waste handling services.

3.2 DISPOSITION OF PLANT EQUIPMENT

The general philosophy in dealing with plant equipment is proposed to be:

- Major plant equipment, deemed to have additional useful life, will be decontaminated to the guidelines as outlined in Section 5, and shipped to another licensed uranium production facility.
- Peripheral equipment will be decontaminated to the guidelines for release of plant equip]ment to unrestricted use (Section 5) and disposed of by sale or by conventional scrap disposal.
- All acid and water wash solutions will be returned to the copper leach stream.

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3.2.1 ION EXCHANGE (IX) CIRCUIT

After removal of the ion exchange resin from the equipment, the vessels and piping will be flushed with 2-4 N H_2SO_4 and rinsed with water. The equipment will be dismantled and smear wipe tested to assure adequate removal of residual activity. Rewashing, as required, will be performed on the dismantled equipment should smear tests show contamination above the acceptable levels as outlined in Section 5.

Alternate 1: Decontaminate, dismantle and ship equipment to licensed uranium producer. This alternative recycles the usable portion of the plant and provides the lowest cost alternative. total decontamination would not be required.

Cost:	Labor (30 man days @ $184/day)	= $ 5,520
	Misc. Equipment Rental & Supplies	= 3,000
	Transportation (to be paid by receiver)	= 0
	TOTAL	= $8,520

Alternate 2: Decontaminate, dismantle and dispose of equipment to another user or as non-radioactive scrap.

Cost:	Labor (30 man days @ $184/day)	= $ 5,520
	Misc. Equipment & Supplies	= 3,000
	Disposal Costs	= 7,500
	TOTAL	= $16,020

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Since the equipment is fabricated of stainless steel, it is not expected that difficulty with acid decontamination will be encountered.

3.2.2 SOLVENT EXTRACTION (SX) CIRCUIT

The solvent extraction circuit consists of a series of mixer-settlers and process vessels. All equipment will be decontaminated with repeated 2-4 N H_2SO_4 acid washings and water rinsings. Piping and pumps will be dismantled and cleaned. all wash and rinse solutions will be returned to the copper leach solution stream.

Cost:	Labor (20 man days @ $184)	=	$ 3,680
	Miscellaneous Materials	=	750
	Scrap Disposal	=	3,000
	TOTAL	=	$ 7,430

If any piece of equipment cannot be adequately decontaminated for release to unrestricted areas, the equipment will be dismantled, compressed when possible, boxed and shipped to a low-level waste or tailings disposal facility. An additional cost of $400 for this operation, if needed, is anticipated.

3.2.3 PRECIPITATION CIRCUIT

The precipitation circuit is a small pilot scale multi-tank circuit having a hold-up of approximately 5,000 gallons. The circuit will be

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acid washed with 2-4 N H_2SO_4 and water rinsed until smear testing indicates decontamination to the levels allowable for unrestricted use as described in Section 5.

Cost:	Labor (30 man days @ $184/day)	=	$ 5,520
	Miscellaneous Materials	=	750
	Scrap Disposal	=	3,000
	TOTAL	=	$ 9,270

Since the precipitation circuit contains a high concentraion of ammonium diuranate, it is anticipated that some of this equipment may be contaminated in such a way that acid washing will not be effective. For such equipment, disposal by low-level radioactive waste hauling to a licensed burial or tailings facility will be practiced. Anticipated costs for radioactive waste disposal of half of this process equipment is anticipated at $3,000. The total cost of decommissioning of the precipitation circuit will be $12,270.

3.2.4 CALCINER EQUIPMENT

The calciner currently in use in the plant does not contain fire brick but is fabricated entirely out of steel. The equipment will be acid washed with H_2SO_4, rinsed and smear tested to establish that acceptable decontamination to unrestricted release criteria has been achieved.

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Alternate 1: Partially decontaminate and ship to another uranium producer. This alternative recycles the equipment if deemed usable and minimizes the cost of disposal.

Cost: Labor (20 man days @ $184/day) = $ 3,680

Miscellaneous Materials = 750

Transportation (to be paid by receiver) = 0

TOTAL = $ 4,430

Alternate 2: Decontamination and disposal as non-radioactive equipment salvage or scrap. If the equipment is unusable, it will be decontaminated and scrapped.

Cost: Labor (20 man days @ $184/day) = $ 3,680

Miscellaneous Materials = 750

Scrap Disposal = 3,000

TOTAL = $ 7,430

Alternate 3: Disposal at low-level radioactive disposal or tailings facility. In the event that adequate decontamination cannot be achieved to the criteria for unrestricted use, shipment to a low-level licensed disposal or tailings facility will be made.

Cost: Labor (20 man days @ $184/day) = $ 3,680

Miscellaneous Materials = 750

Disposal Service = 12,000

TOTAL = $16,430

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3.3 DECOMMISSIONING OF BUILDING STRUCTURES AND SITE RECLAMATION

Under the existing conditions of the contract with Kennecott, Wyoming Mineral Corporation will remove all building structures and auxiliary facility structures to their foundations and return the site to Kennecott for its originally intended industrial use. At the time of decommissioning, however, WMC intends to pursue sale of the decontaminated facility to Kennecott for their commercial use. This option represents the most economically feasible solution to facility disposition assuming Kennecott were willing to accept the facility at that time.

3.3.1 BUILDING STRUCTURES

Prior to dismantling of the building structure, an evaluation of contamination will be performed. Those portions of the plant structures that indicate residual U_3O_8 contamination will be acid washed or sandblasted to remove any surface contamination.

Alternate 1: Decontaminate plant structures, dismantle and scrap all structures except for the structural steel which will be salvaged.

Cost:	Decontamination	= $ 7,500
	Labor	= 37,500
	Dismantling Equipment	= 75,000
	Scrap Disposal	= 7,500
	TOTAL	= $127,500

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Alternate 2: Return the decontaminated building to Kennecott for industrial use. This alternative is a low cost option to Wyoming Mineral and will be exercised if acceptable to Kennecott and if it can be demonstrated that decontamination of the structure is sufficient to allow unrestricted use.

Cost: Decontamination = $ 7,500

3.3.2 SITE RECLAMATION

The site upon which the plant is built was an industrial site used by Kennecott. It is anticipated that building structures will be removed to their foundations and the site returned to Kennecott for industrial use. A soil survey will be performed prior to return of the site to assure that no residual contamination is left on the site. Any residual contamination will be removed and disposed of at a licensed tailings or disposal facility

4.0 PROPOSED DECOMMISSIONING PLAN

Wyoming Mineral Corporation proposes to decommission the Bingham Canyon Uranium Extraction Plant at Copperton, Utah according to the following plan:

1) All residual process chemicals will be decontaminated and disposed of using the procedure described at Alternate 1 in Sections 3.1.1 and 3.1.2.

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2) Uncontaminated bulk plant chemicals will be returned to the manufacturer or sold to other users.

3) The ion exchange equipment and calciner will be decontaminated and disposed of at other operating facilities.

4) All other plant equipment will be decontaminated and disposed of as non-radioactive scrap material or sold to other users.

5) Equipment that cannot be decontaminated will be disposed of as low-level radioactive waste in a licensed burial or mine tailings facility.

6) If unacceptable for use by Kennecott, the plant building will be decontaminated, dismantled to the foundation and removed from the site as convential scrap.

7) The site will be returned to Kennecott for continued industrial use as was originally intended.

8) It is WMC's intent to pursue the transfer of all decontaminated equipment and buildings to Kennecott should they choose to use the facility for other industrial purposes. All requirements for equipment and site release will be adhered to unless Kennecott or another site operator chooses to obtain a new NRC Source Material License for the continued operation of the facility.

9) A site evaluation and sampling program as described in Section 5 of this report will be performed to assure

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compliance to all applicable regulations for release of equipment and site to unrestricted use.

Wyoming Mineral Corporation recognizes that contaminated equipment from natural uranium processing facilities can be disposed of at a licensed burial facility or, if acceptable, in a licensed tailings facility.

5.0 DECOMMISSIONING MONITORING PROGRAM

A plant survey and site evaluation will be performed to determine the residual levels of contamination present and to assist in developing the details of decontamination operations that will be required. Currently operable plant monitoring procedures as described in the Source Material License will be continued throughout the decommission operation.

5.1 RESIDUAL PLANT CHEMICALS EVALUATION AND RELEASE CRITERIA

Prior to release from the site, the SX Solvent will be decontaminated using the previously described procedure. After stripping, it will be analyzed for their uranium, radius-226 and thorium-230 content. If the radionuclide concentrations are less than those specified by the NRC, it will be released as non-radioactive chemical waste. No ion exchange resin will be released as non-radioactive waste unless it meets the criteria specified in LC #29.

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5.2 EQUIPMENT RELEASE

All plant equipment which at some time during its operational history may have come in contact with product streams will be surveyed and if necessary, decontaminated to specified limits before being released to unrestricted areas. If said equipment cannot be decontaminated to these limits, it will be transported as radioactive material to another licensed facility or to a licensed radioactive disposal site for burial. Decontamination will be to the limits as specified in Annex A, USNRC, November, 1976 ("Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-Product Source or Special Nuclear Material") or applicable NRC regulation at the time of decommissioning.

5.2.1 PROCEDURE

1) An initial survey shall be performed of all suspect equipment to determine which equipment is contaminated in excess of the limits. This survey shall involve initial scanning of equipment with an alpha survey system with subsequent filter paper swiping of the available representative surface areas. Filter papers will be analyzed via standard gross alpha counting instrumentation.

2) Any equipment found to be contaminated in excess of the limits shall be washed with sulphuric acid and resurveyed. Several washings and water rinsings may be required.

3) Equipment will be segregated as "clean" or "contaminated" and placed in appropriate areas.

4) Before release from the site, a final survey will be performed on equipment classified as "clean".

5) All "clean" equipment will be released as appropriate.

6) Equipment which could not be decontaminated to the specified limits will be disposed of as low-level radioactive waste.

7) The results of all surveys, decontamination activity, and ultimate depositions shall be documented on the form attached.

5.3 STRUCTURAL MATERIALS

1) Appropriate wall/floor surface materials and metallic construction components shall be acid washed. Following washing, representative surface areas of the material shall be smeared via filter paper techniques. Filter papers shall be analyzed via standard gross alpha counting techniques.

2) At the conclusion of this initial survey, materials shall be segregated as "clean" or "still contaminated".

3) Contaminated materials will be rewashed and sand blasted if necessary and resurveyed.

EQUIPMENT CONTAMINATION SURVEY
AND RELEASE FORM

License Condition 20 (a)

WYOMING MINERAL CORPORATION
BINGHAM CANYON EXTRACTION PLANT

D400858400

escription of Equipment to be Surveyed: ____________________

nitial Survey Location	Date	Total Counts	Count Time	CPM	BKG	CPM -BKG	$\frac{1}{EFF}$	$\frac{DPM}{100\ cm^{-2}}$

ost Decontamination Survey Locations	Date	Total Counts	Count Time	CPM	BKG	CPM -BKG	$\frac{1}{EFF}$	$\frac{DPM}{100\ cm^{-2}}$

Decontamination Methods if Applicable (describe below):

____

____

____

Storage on Site (describe location): ____________________

____

____

Release from Site (to whom or where): ____________________

____

____

____

Released by: ____________________ Date of Release: ________

1. Sample Area 100 cm^2 with 47 mm Filter Paper.
2. Count for 1 minute.
3. Smearable Limits: 1000 DPM/100 cm^2 α(Alpha)
4. Calibration Check:

   Thorium 230 Standard I.D. No. ____________________

   1 min. Count DPM ____________________

   Gross Counts (CPM) ____________________

   $\frac{CPM}{DPM}$ X 100 = % EFF Efficiency = ________% $\frac{1}{EFF}$ = ________

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DEGR RESIN ANALYSIS

License Condition 29

WYOMING MINERAL CORPORATION

BINGHAM CANYON EXTRACTION PLANT

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Amount Of Degraded Resin (weight)	Date	Uranium %/weight	Ra 226 μCi/g	Th 230 μCi/g	Type of Strip	Placement of Strip	Resin Disposal Location	Comments

Resin not decontaminated below 0.05% uranium, 3×10^{-8} μCi/gram radium, and 2×10^{-6} μCi/gram thorium 230, will be shipped to a licensed commercial disposal site.

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4) Any materials which cannot be decontaminated below the specified limits shall be drummed and packaged and transported to a licensed disposal site for burial.

5) A form similar to the one supplied with Section 5.2.1 shall be used to document these activities.

5.4 FINAL SITE SURVEY

After all the equipment and materials have been removed from the site, a final site survey shall be performed. Representative samples of soil from the immediate vicinity of the site shall be collected and analyzed for radionuclide content. Analysis shall be for natural uranium and radium-226.

Should analysis indicate any parameter in excess of the limits as specified by the "Environmental Standards for Cleanup of Open Land and Building Contaminated With Residual Radioactive Material From Inactive Uranium Processing Sites", the top soil will be removed to a licensed tailings or burial facility.

The soil sampling locations and associated analysis results shall be documented on a form similar to the one attached.

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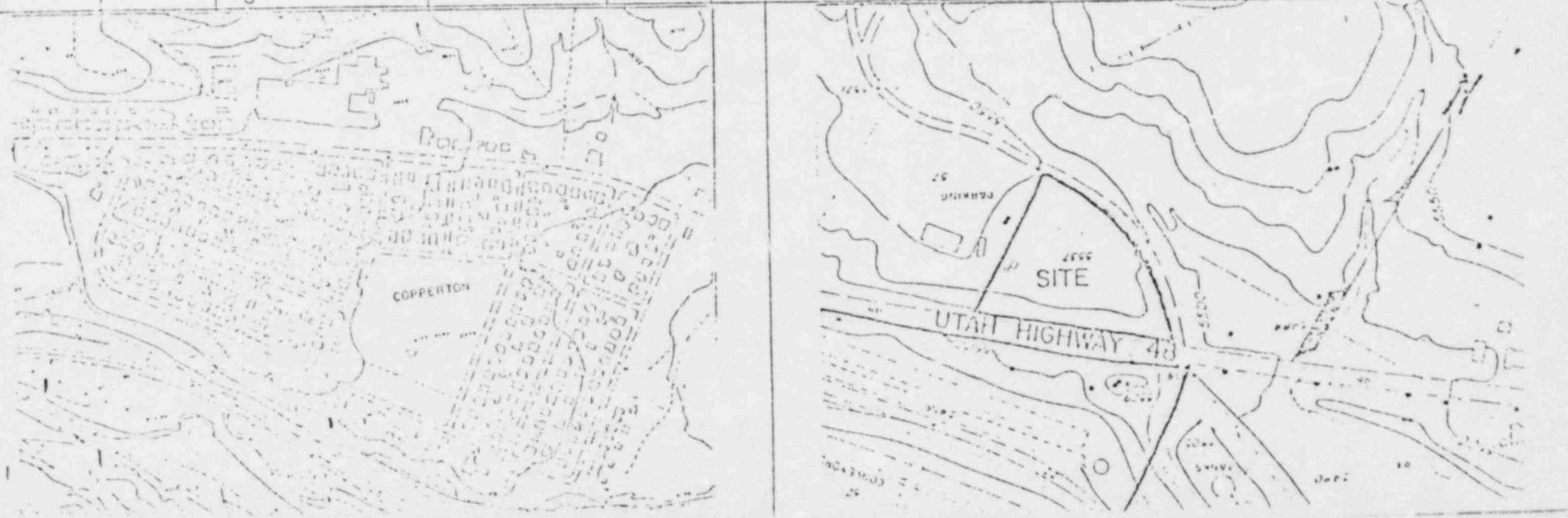
ENVIRONMENTAL SOIL
AND VEGETATION SAMPLES

WYOMING MINERAL CORPORATION
BINGHAM CANYON EXTRACTION PLANT

Surveyor	Date	Location (mark on map)	Sample Type	Lab	Gross Alpha	Th 230	Ra 226	Uranium	Comments
		1							
		2							
		3							
		4							
		5							
		6							
		7							
		8							



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APPENDIX C

METEOROLOGY

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APPENDIX C-1

RELATIVE HUMIDITY

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TABLE C-1

PERCENT RELATIVE HUMIDITY
DAILY MEAN, MAXIMUM AND MINIMUM

DECEMBER 1, 1980 through DECEMBER 31, 1981

DECEMBER 1980				JANUARY 1981				FEBRUARY 1981				MARCH 1981				APRIL 1981			
DAY	MEAN	MAX	MIN	DAY	MEAN	MAX	MIN	DAY	MEAN	MAX	MIN	DAY	MEAN	MAX	MIN	DAY	MEAN	MAX	MIN
01	66	95	26	01	91	100	87	01	83	88	70	01	64	77	55	01	47	65	37
02	59	72	38	02	-	-	-	02	-	-	-	02	71	82	54	02	43	71	26
03	36	44	29	03	-	-	-	03	76	98	53	03	81	93	65	03	66	80	58
04	29	40	22	04	-	-	-	04	78	96	61	04	74	95	59	04	55	73	46
05	65	90	34	05	-	-	-	05	80	93	70	05	56	73	37	05	54	69	34
06	79	91	71	06	-	-	-	06	76	85	54	06	60	76	34	06	39	59	29
07	80	91	74	07	81	98	76	07	73	89	54	07	68	74	58	07	47	55	40
08	77	88	66	08	83	86	77	08	71	87	54	08	68	79	56	08	50	70	36
09	80	93	67	09	83	100	79	09	58	77	39	09	68	82	42	09	44	55	34
10	77	91	61	10	83	86	78	10	59	75	44	10	60	87	46	10	50	71	29
11	81	93	66	11	85	89	79	11	65	75	51	11	56	86	47	11	57	66	45
12	82	97	68	12	86	89	82	12	80	99	56	12	48	69	33	12	44	58	30
13	86	98	73	13	86	93	79	13	78	99	66	13	58	85	38	13	38	55	26
14	93	100	87	14	86	96	78	14	62	76	43	14	67	88	41	14	46	60	33
15	90	99	86	15	86	91	82	15	65	96	50	15	60	74	49	15	44	64	36
16	87	97	75	16	87	91	84	16	71	82	55	16	50	69	38	16	50	75	36
17	91	100	82	17	83	88	76	17	62	80	47	17	63	84	40	17	41	58	27
18	92	100	85	18	83	95	64	18	60	81	42	18	60	81	42	18	42	63	43
19	91	100	87	19	84	98	69	19	57	70	39	19	54	67	43	19	59	75	37
20	92	99	86	20	87	97	68	20	51	83	22	20	53	68	29	20	60	70	42
21	91	99	86	21	92	98	88	21	64	82	51	21	61	81	44	21	56	72	35
22	83	98	59	22	91	97	87	22	63	88	51	22	54	64	37	22	61	73	49
23	75	95	68	23	90	99	85	23	65	89	44	23	52	87	30	23	50	72	36
24	64	92	45	24	89	96	85	24	54	72	29	24	53	76	37	24	46	64	32
25	70	81	57	25	74	93	63	25	22	34	15	25	48	67	35	25	40	53	26
26	76	90	59	26	61	76	46	26	49	86	22	26	31	65	23	26	31	41	25
27	76	96	59	27	65	78	49	27	81	98	61	27	84	88	65	27	45	77	18
28	81	97	62	28	57	71	50	28	73	93	58	28	79	84	73	28	56	73	37
29	86	98	79	29	63	74	44					29	58	68	49	29	48	62	34
30	87	94	74	30	70	86	43					30	66	88	37	30	41	65	25
31	88	98	79	31	88	93	64					31	67	99	50				

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TABLE C-1 (Cont.)

PERCENT RELATIVE HUMIDITY
DAILY MEAN, MAXIMUM AND MINIMUM

DECEMBER 1, 1980 through DECEMBER 31, 1981

MAY 1981				JUNE 1981				JULY 1981				AUGUST 1981				SEPTEMBER 1981			
DAY	MEAN	MAX	MIN	DAY	MEAN	MAX	MIN	DAY	MEAN	MAX	MIN	DAY	MEAN	MAX	MIN	DAY	MEAN	MAX	MIN
01	41	57	30	01	43	60	28	01	29	47	18	01	24	34	17	01	35	55	25
02	28	37	17	02	33	42	22	02	38	56	24	02	20	27	15	02	27	47	16
03	56	82	30	03	64	86	25	03	-	-	-	03	25	47	13	03	34	54	25
04	58	80	33	04	54	78	39	04	-	-	-	04	22	42	12	04	28	41	20
05	29	37	21	05	40	67	25	05	-	-	-	05	22	31	14	05	28	58	14
06	47	83	23	06	37	54	25	06	-	-	-	06	20	33	13	06	67	82	55
07	49	65	35	07	43	67	26	07	-	-	-	07	26	40	14	07	71	92	60
08	47	79	28	08	42	60	29	08	37	46	26	08	30	43	20	08	54	69	39
09	54	99	35	09	41	64	19	09	32	36	29	09	-	-	-	09	60	74	46
10	45	70	30	10	46	65	32	10	-	-	-	10	-	-	-	10	57	71	40
11	43	80	19	11	37	46	26	11	30	36	23	11	46	58	33	11	49	68	36
12	40	53	26	12	35	52	26	12	25	32	15	12	40	50	29	12	44	58	33
13	50	73	37	13	52	78	31	13	34	45	20	13	34	48	22	13	38	55	24
14	44	58	35	14	58	84	33	14	29	45	15	14	39	49	25	14	37	56	25
15	49	84	18	15	48	72	33	15	30	44	18	15	32	45	19	15	31	47	20
16	72	85	50	16	41	62	27	16	23	36	13	16	32	45	22	16	32	46	22
17	76	91	58	17	31	52	13	17	40	56	19	17	28	42	19	17	32	51	21
18	58	76	35	18	35	50	23	18	40	58	25	18	24	33	17	18	31	49	20
19	41	54	28	19	34	55	20	19	33	53	20	19	28	41	16	19	28	41	21
20	42	74	20	20	40	60	26	20	25	46	14	20	35	51	25	20	29	40	17
21	73	83	58	21	39	54	25	21	27	43	14	21	30	63	19	21	37	52	21
22	-	-	-	22	32	49	21	22	27	44	14	22	33	48	17	22	41	56	25
23	-	-	-	23	28	41	18	23	25	41	14	23	32	51	21	23	41	48	31
24	-	-	-	24	32	45	17	24	28	45	13	24	32	61	18	24	42	55	31
25	-	-	-	25	27	36	20	25	26	36	16	25	27	38	20	25	34	53	23
26	-	-	-	26	24	29	16	26	30	46	13	26	21	30	14	26	50	62	36
27	-	-	-	27	22	40	15	27	37	53	22	27	29	39	20	27	46	65	30
28	-	-	-	28	33	47	23	28	30	44	16	28	27	39	18	28	28	49	20
29	57	74	38	29	28	44	16	29	20	28	13	29	32	44	16	29	28	62	19
30	46	62	29	30	31	40	20	30	22	42	13	30	29	38	22	30	53	67	39
31	52	86	27					31	31	47	17	31	29	43	17				

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TABLE C-1 (Cont.)

PERCENT RELATIVE HUMIDITY
DAILY MEAN, MAXIMUM AND MINIMUM

DECEMBER 1, 1980 through DECEMBER 31, 1981

OCTOBER 1981				NOVEMBER 1981				DECEMBER 1981			
DAY	MEAN	MAX	MIN	DAY	MEAN	MAX	MIN	DAY	MEAN	MAX	MIN
01	47	62	36	01	63	95	41	01	-	-	-
02	40	53	32	02	69	95	51	02	-	-	-
03	42	78	22	03	72	100	56	03	-	-	-
04	76	85	59	04	75	100	56	04	-	-	-
05	78	95	58	05	72	100	55	05	81	90	74
06	67	81	55	06	69	86	51	06	73	87	47
07	46	70	36	07	69	94	55	07	62	82	50
08	58	95	23	08	74	99	63	08	65	94	49
09	61	85	43	09	69	92	50	09	75	99	50
10	44	51	36	10	71	95	56	10	47	76	30
11	58	75	49	11	68	86	54	11	56	74	33
12	-	-	-	12	63	83	51	12	68	94	52
13	80	90	70	13	43	65	34	13	76	94	61
14	73	85	55	14	45	68	31	14	68	97	59
15	70	80	59	15	62	84	31	15	62	74	52
16	71	83	50	16	72	82	59	16	61	85	35
17	83	89	72	17	40	69	27	17	64	90	49
18	72	98	50	18	52	80	23	18	69	85	49
19	70	94	55	19	61	77	46	19	73	87	66
20	61	76	44	20	60	73	45	20	75	92	54
21	57	72	39	21	63	78	46	21	64	85	29
22	57	81	42	22	63	77	34	22	74	86	54
23	57	75	46	23	75	83	65	23	82	94	67
24	56	72	39	24	72	85	49	24	74	91	51
25	55	80	40	25	63	85	36	25	73	85	61
26	44	59	34	26	82	86	75	26	62	73	56
27	40	61	33	27	-	-	-	27	72	89	57
28	31	38	23	28	-	-	-	28	68	83	59
29	54	86	21	29	-	-	-	29	62	75	44
30	77	90	52	30	-	-	-	30	64	80	50
31	74	89	50					31	71	88	52

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APPENDIX C-2

METEOROLOGIC DATA

DECEMBER 1980 THROUGH JUNE 1981

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C. Rutledge

SEMIANNUAL METEOROLOGICAL DATA SUMMARY REPORT FOR THE COPPERTON URANIUM FACILITY

19 DECEMBER 1980 - 30 JUNE 1981

RECEIVED
AUG 20 1981
GOVERNMENT AND
ENVIRONMENTAL AFFAIRS

environmental engineers, scientists, planners, & management consultants

CDM

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SEMIANNUAL METEOROLOGICAL DATA SUMMARY REPORT FOR THE COPPERTON URANIUM FACILITY
19 DECEMBER 1980 - 30 JUNE 1981

Prepared for:

Wyoming Mineral Corporation
3900 South Wadsworth Boulevard
Lakewood, Colorado 80235

Prepared by:

Camp Dresser & McKee Inc.
11455 West 48th Avenue
Wheat Ridge, Colorado 80033

CDM Project No. 3153

August 1981

Gary B. McWilliams
Project Manager

Roger A. Nelson
Operations Manager

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EXECUTIVE SUMMARY

The meteorological monitoring program at the Copperton uranium facility from 16 December 1980 to 30 June 1981 was successful in providing good quality data and achieving an overall data recovery of 95 percent. The meteorological monitoring program recorded wind speed, wind direction, sigma theta (standard deviation of wind direction), and temperature.

The six month data set represented by this summary report is without any anomalies and reflects the semiarid continental climate of Utah and the mesoclimatic features associated with a location at the mouth of a steep canyon. The temperatures recorded during this six month period were very moderate. The lowest mean monthly temperature was 0°C (32°F), which occurred during January, and the highest mean monthly temperature was 23°C (73°F), which occurred during June. The prevailing wind directions were west and west-southwest and were associated with down-valley flow in Bingham Canyon. The monthly mean wind speeds varied from a minimum of 1.4 m/sec (3.1 mph) in December to a maximum of 3.0 m/sec (6.7 mph) in May. On an average, the Pasquill-Gifford atmosphere stability classes D (neutral) and E (stable) accounted for about 50 percent of the stability conditions during this monitoring period.

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1.0 INTRODUCTION

This semiannual report was prepared for the Wyoming Mineral Corporation (WMC) by Camp Dresser and McKee Inc. (CDM) to summarize the meteorological data collected at WMC's Copperton Uranium Facility from 16 December to 30 June 1981. The meteorological monitoring consists of wind speed, wind direction, standard deviation of wind direction (sigma theta), and ambient temperature measurements. The primary objective of the meteorological monitoring program is to provide on-site information about the existing meteorology during the operation of the uranium mine. These meteorological data are being collected in support of state and federal air quality permit applications.

This report consists of four sections: (1) an introductory section which provides background information on the monitoring program as well as a description of the monitoring site, (2) a data collection section which discusses the monitoring instrumentation and data handling procedures, (3) a data interpretation section which discusses the means, extremes, and trends of the meteorological data, and (4) a quality assurance section which describes the procedures used to ensure the high quality of the data.

1.1 BACKGROUND

The Copperton Uranium Facility is located on the western edge of the city of Copperton, Utah, at the mouth of Bingham Canyon. The facility extracts uranium from a water solution which remains after copper is mined by an in situ process. The copper is removed by the Kennecott Copper Company, and the residual water solution is stored in a large reservoir and pumped to the WMC facility as needed. The location of the WMC facility is shown in Figure 1-1.

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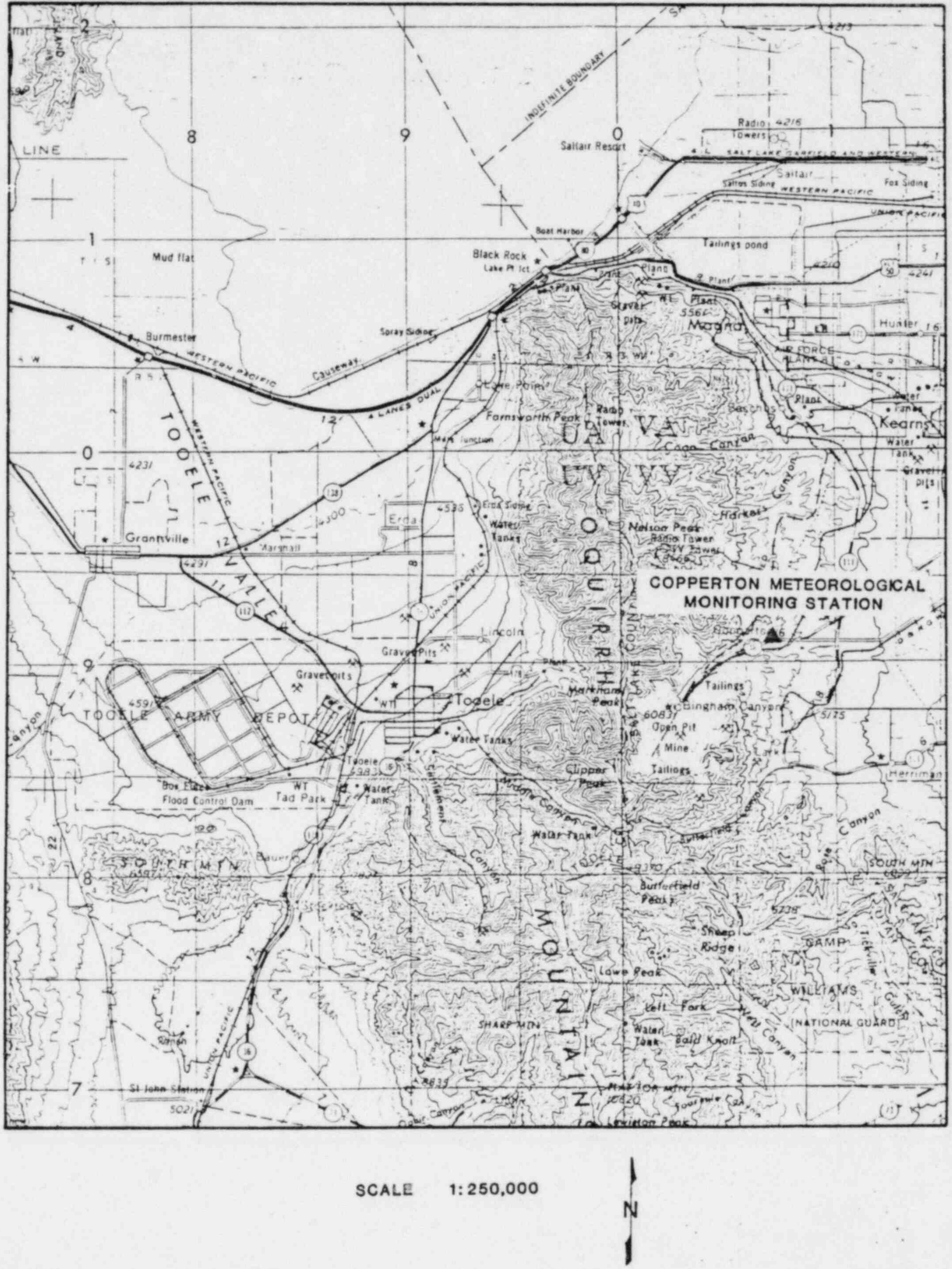

Figure 1-1 Regional Map Showing Location of Copperton Meteorological Monitoring Station.

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1.2 SITE DESCRIPTION

The Copperton Uranium Facility is located at a latitude of 43.7°N and a longitude of 106.0°W on the eastern edge of the Oquirral Mountains and at the mouth of Bingham Canyon. The elevation of the WMC facility is 1,646 m (5,400 ft), and the elevation of the top of Bingham Canyon is 2,438 m (8,000 ft.)

The meteorological sensors are mounted atop a 3-m tripod which is fixed to the top of the roof of the 20 m (65 ft) high WMC building. The meteorolgical sensors were mounted on the roof after it was determined that the building structure would not bias the temperature and wind readings. A photograph of the tripod with the mounted sensors is shown in Figure 1-2.

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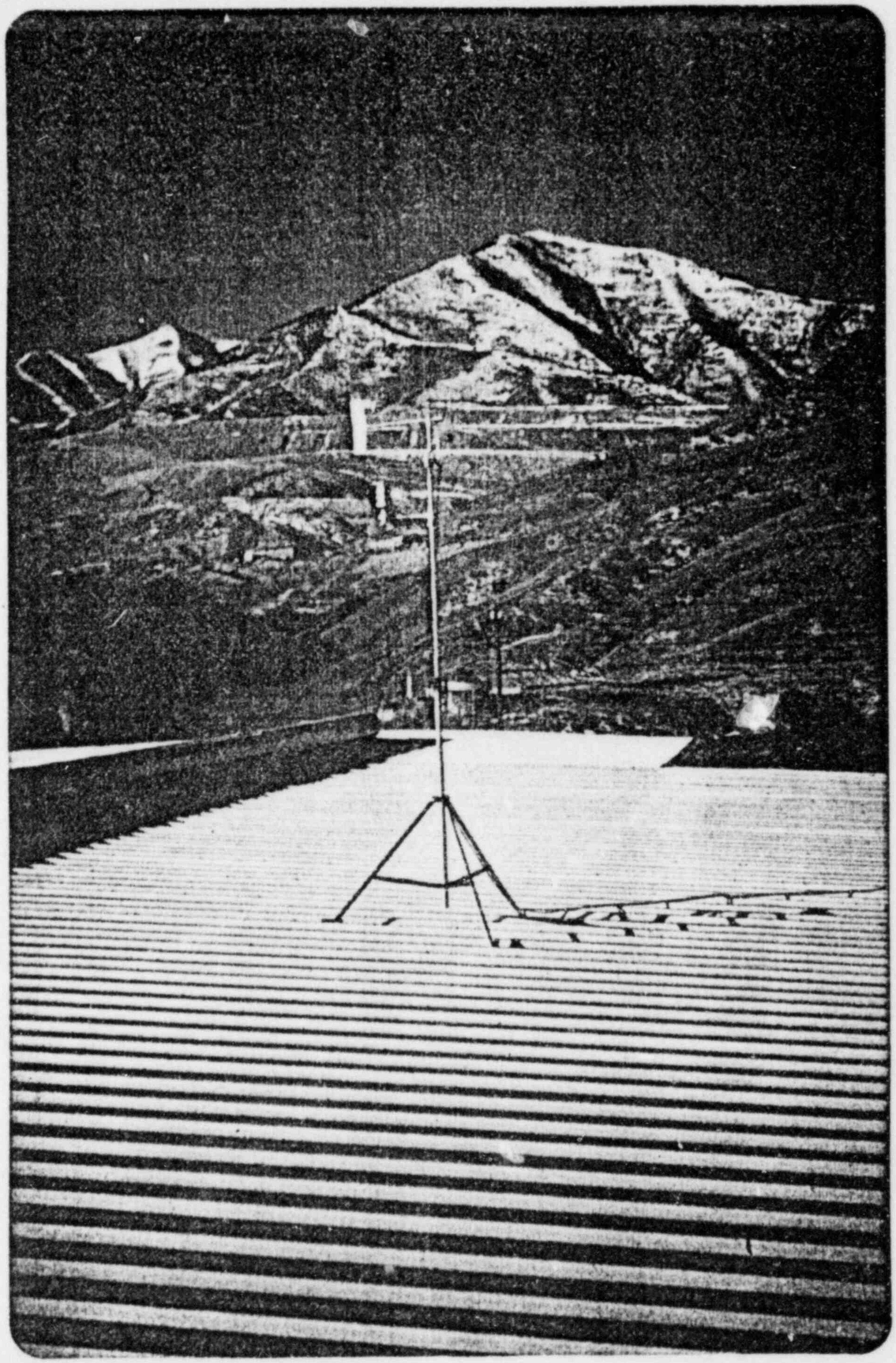

Figure 1-2 Photograph of Tripod with Meteorological Sensors

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2.0 METEOROLOGICAL INSTRUMENTATION AND DATA REDUCTION

Instrumentation

The meteorological monitoring is performed with a Climatronics Electronic Weather Station (EWS) and a cassette data acquisition system (CDAS). All the data are recorded continuously on a strip chart recorder located in the EWS unit, while one-minute instantaneous values are recorded on the CDAS. The strip chart record is reduced only when required for quality assurance checks or for backup to missing CDAS data. The wind and temperature sensors are located atop a 3-m tripod which is bolted to the roof of the WMC building, where the EWS and CDAS units are also housed. The signal from the sensors is transmitted to the EWS via 46 m (150 ft) of signal cable. The operating specifications for the monitoring instruments used in the program are given in Table 2-1. These specifications meet the Environmental Protection Agency's (EPA) Prevention of Significant Deterioration (PSD) guidelines (EPA 1980).

The EWS is calibrated by a CDM technician on a semiannual basis, or after any major repair. In addition, the EWS was calibrated immediately after installation. The EWS is calibrated electronically with the aid of a certified digital voltmeter (DVM). The dates of the calibrations are given below.

Date	Explanation of Calibration
16 December 1980	Startup of EWS
15 June 1981	Semiannual calibration

The meteorological equipment is serviced and maintained by WMC personnel. The WMC personnel are also responsible for completing a weekly equipment function checklist. CDM technicians perform the calibrations and emergency repairs and servicing requested by WMC.

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Table 2-1 SPECIFICATIONS OF METEOROLOGICAL INSTRUMENTATION

Sensor	Manufacturer's Model Number	Sensing Technique	Accuracy	Range
Wind Speed	Climatronics WM-II	Cups-Light Chopper	0.25 m/sec	0-50 m/sec
Wind Direction	Climatronics WM-III	Wind Vane Potentiometer	± 3°	0-540°
Sigma Theta	Climatronics 101035	Wind Vane Microprocessor	± 3°	0-60°
Temperature	Climatronics 100093	Thermistor	± 0.2°C	-30 to 50°C

Data Reduction

Hardware modifications required on the CDM microporcessor made reading the cassette tapes infeasible within the project schedules. Therefore, the data recorded by the EWS were reduced from the strip charts. The strip chart data were processed through several reduction, editing, and quality assurance steps before analysis for this report. These steps include the following:

1. Logging-in of strip charts upon receipt from WMC
2. Verifiying dates and times on strip charts
3. Reviewing strip chart data and editing data for reasonableness
4. Reducing strip chart data to hourly averages
5. Verifying 10 percent of the hourly averages for accuracy
6. Keypunching the data onto a magnetic tape
7. Processing the data on the tape through editing programs which identify off-scale readings and sequential errors and incorporate corrections into the data base
8. Preparing data summaries using computer programs

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Each parameter was reduced from the strip chart to the following limits:

Parameter	Reduction Limit
Wind Speed	0.25 m/sec
Wind Direction	5°
Temperature	0.5°C
Sigma Theta	1°

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3.0 DATA INTERPRETATION

The meteorological data summarized below were derived from hourly averaged validated values. The hourly averages for the wind speed, wind direction, temperature, and sigma theta are listed in Storage and Retrieval of Aerometric Data (SAROAD) format in Appendix A.

3.1 DATA RECOVERY

The data recovery for the wind speed, wind direction, temperature, and sigma theta from 16 December 1980 through 30 June 1981 is shown in Table 3-1. The data recovery for this period averaged well above 90 percent for each of the parameters. PSD monitoring guidelines require 90 percent or better annual data recovery for each of the monitored meteorological parameters. Data losses common to all the parameters were attributed to infrequent power outages, weekly changes of the strip charts and cassette tapes, and routine servicing and calibration of the sensors. During the period 14 May 1981 through 15 June 1981, the EWS was not operated because the work schedule at the facility did not allow time for the changing of the strip charts and cassette tapes. The data loss during this period is not considered as missing data in the reported recovery rates.

Table 3-1 DATA RECOVERY FOR METEOROLOGICAL PARAMETERS
16 DECEMBER 1980 - 30 JUNE 1981

Parameter	Recovery (%)
Wind Speed	95
Wind Direction	95
Sigma Theta	94
Temperature	95

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3.2 AMBIENT TEMPERATURE

The monthly temperature means and extremes are summarized in Table 3-2. The mean maximum and minimum temperatures are the averages of the daily high and low temperatures, respectively. The extreme temperatures are the highest and lowest hourly average temperatures occurring during the month.

June was the warmest of the six months in the monitoring period; the mean monthly temperature was 23°C (73°F). January was coldest of the six months with a mean temperature of 0°C (32°F). The highest recorded temperature was 35°C (95°F), which last occurred on 26 June 1981, and the lowest recorded temperature was -11°C (12°F), which occurred on 10 February 1981.

3.3 WIND DIRECTION AND SPEED

The wind direction and wind speed data have been used to calculate monthly wind roses. The wind roses are presented in both a tabular and plot format in Appendix B. The tabular wind roses relate the frequency of occurrence of the wind direction to the wind speed. The wind rose plots include (1) diurnal wind roses which relate the frequency of occurrence of the wind direction to the time of day and (2) a wind rose which relates the frequency of occurrence of the wind direction to the wind speed.

Table 3-3 gives the prevailing wind direction by month. The prevailing wind direction was from the west and west-southwest during the six month period. The dominance of the westerly wind is caused by the down-valley flow present in Bingham Canyon. Down-valley flow is caused by gravity and the local density gradient established between the valley and plain below. The density gradient is a result of the valley air being colder and therefore more dense than the air over the plain below.

The monthly mean wind speeds presented in Table 3-4 varied from a minimum of 1.4 m/sec (3.1 mph) in December to a maximum of 3.0 m/sec (6.7 mph) in May. The wind speeds increase in the spring because there is greater coupling of the surface winds with the higher momentum upper level winds in the spring than in the winter. The coupling in the spring is caused by the enhanced vertical mixing of the atmosphere.

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Table 3-2 MONTHLY TEMPERATURE MEANS AND EXTREMES (°C) DECEMBER 1980 - JUNE 1981

Month	Mean Maximum	Mean Minimum	Mean Monthly	Extremes Highest	Extremes Lowest
December[a]	9	2	6	13	-1
January	3	-3	0	10	-8
February	7	-1	3	16	-11
March	8	1	4	14	-3
April	14	7	11	20	-2
May[b]	15	5	10	20	0
June[c]	29	18	23	35	11

[a] Covers period 16 December 1980 -.31 December 1980.
[b] Covers period 1 May 1981 - 14 May 1981.
[c] Covers period 15 June 1981 - 30 June 1981.

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Table 3-3 MONTHLY PREVAILING WIND DIRECTION
DECEMBER 1980 - JUNE 1981

Month	Prevailing Wind Direction
December[a]	west
January	west
February	west
March	west
April	west
May[b]	west-southwest
June[c]	west-southwest

[a] Covers period 16 December 1980 - 31 December 1980.
[b] Covers period 1 May 1981 - 14 May 1981.
[c] Covers period 15 June 1981 - 30 June 1981.

Table 3-4 MONTHLY MEAN WIND SPEED
DECEMBER 1980 - JUNE 1981

Month	Mean Wind Speed (m/sec)
December[a]	1.4
January	1.5
February	2.5
March	2.6
April	2.8
May[b]	3.0
June[c]	2.9

[a] Covers period 16 December 1980 - 31 December 1980.
[b] Covers period 1 May 1981 - 14 May 1981.
[c] Covers period 15 June 1981 - 30 June 1981.

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3.4 JOINT FREQUENCY DISTRIBUTION

Joint frequency distributions (JFD) of the wind speed, wind direction, and atmospheric stability were calculated in a manner that closely approximates the method the National Climatic Center (NCC) uses to calculate STAR (stability array) distributions from the National Weather Service data. Like the STAR data, the atmospheric stability at the Copperton facility was classified according to the Pasquill-Gifford system, which categorizes stabilities into six classes from A to F, in order of increasing stability. In order of decreasing stability, stability classes A, B, and C represent unstable atmospheric conditions. Stability classes E and F represent stable (inversion) atmospheric conditions, where class F is more stable than class E. Stability class D represents neutral conditions.

The atmospheric stability at the WMC plant was caluclated from the algorithm outline in Table 3-5. This algorithm incorporates wind speed, solar angle, and sigma theta into its stability classification scheme. The monthly joint frequency distributions are presented in Appendix C.

A summary of the frequency of occurrence of the Pasquill-Gifford stability classes, as determined from the JFD's, in Appendix C is given in Table 3-6. Stablility class D (neutral) was predominate from December through April. Stability class A (very unstable) was predominate in May and June. The increasing occurrence of class A stability during the spring can be attributed mainly to the increased solar angle. The combined frequency of occurrence of the stable classes (E and F) remains relatively constant during the six month period.

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Table 3-5 PASQUILL STABILITY CLASS DERIVATION FROM SIGMA THETA, WIND SPEED, AND SOLAR ANGLE (α)

			Sigma Theta (degrees)				
		Wind Speed (m/sec)	0-5	5-10	10-15	15-20	>20
	NIGHT	0-2	F	F	E	E	D
		2-4	F	F	E	D	D
		4-6	E	E	D	D	D
		6-8	E	E	D	D	D
		>8	D	D	D	D	D
DAY	15> α	0-2	E	E	D	C	C
		2-4	E	E	D	D	C
		4-6	E	D	D	D	D
		6-8	D	D	D	D	D
		>8	D	D	D	D	D
	35 > α > 15	0-2	E	D	C	C	B
		2-4	E	D	D	C	C
		4-6	D	D	D	D	C
		6-8	D	D	D	D	D
		>8	D	D	D	D	D
	60 > α > 35	0-2	E	D	C	B	A
		2-4	D	D	C	B	A
		4-6	D	D	D	C	C
		6-8	D	D	D	D	C
		>8	D	D	D	D	D
	α > 60	0-2	D	C	B	A	A
		2-4	D	D	C	B	A
		4-6	D	D	C	B	B
		6-8	D	D	D	C	C
		>3	D	D	D	C	C

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Table 3-6 FREQUENCY OF OCCURRENCE (%) OF PASQUILL-GIFFORD STABILITY CLASSES BY MONTH DECEMBER 1980 - JUNE 1981

Month	Class A	Class B	Class C	Class D	Class E	Class F
December[a]	0	18	9	32	25	16
January	0	21	9	49	16	5
February	4	17	11	29	20	19
March	14	15	8	25	22	16
April	23	15	8	26	16	12
May[b]	22	16	8	18	22	14
June[c]	30	14	3	13	13	27

[a] Covers period 16 December 1980 -.31 December 1980.

[b] Covers period 1 May 1981 - 14 May 1981

[c] Covers period 15 June 1981 - 30 June 1981.

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4.0 QUALITY ASSURANCE PROGRAM

In order to ensure the integrity of the monitoring data, CDM has instituted a quality assurance program similar to the framework cited in the EPA PSD monitoring guidelines. This program involves all aspects of the monitoring effort and includes semiannual instrument calibrations, documentation of all program activities, and documented data reduction procedures.

4.1 INTERNAL QUALITY CONTROL PROCEDURES

The primary responsibility of overseeing and ensuring the high quality of the air monitoring program rests with the Project Manager. The Project Manager is an experienced atmospheric scientist, thoroughly familiar with PSD and other related monitoring programs.

PSD monitoring guidelines specify that appropriate quality assurance and program control procedures must be employed throughout the monitoring program. The guidelines established specific siting requirements, instrumentation, sampling heights, operation, calibration, and data reduction criteria. The quality assurance program is designed to meet these requirements. Instrument siting was performed by an experienced atmospheric scientist who is thoroughly familiar the PSD siting requirements. The meteorological instrumentation meets the specifications required for PSD monitoring, and installtion of the monitoring station was overseen by the Project Manager. All operational and maintenance functions used during the course of the monitoring program are being thoroughly documented. The instrumentation is being calibrated every six months and after any major repair.

4.2 DATA REDUCTION

Data are transmitted from the monitoring station to the CDM Wheat Ridge office by registered mail. In order to reduce the possibility of losing all of the data during transmittal, the digital and strip chart data are shipped in separate packages.

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Upon receipt of the monitoring data at the CDM Wheat Ridge office, the data are subject to CDM data reduction and QA validation procedures. As the first step of these procedures, the data are logged. Next, the analog (strip chart) data are inspected for any missing data or indication of sensor malfunctions, and the digital data are run through a data edit computer program to check for anomalies. Data that fall outside of the control limits are flagged, and each anomaly is corrected or voided. The data are then checked for any anomalies indicated in the log books, maintenance, calibration, and audit records. Afterwards, the data are reduced to hourly values of appropriate sensor units. Any missing digital data are filled by corresponding backup recorder data.

As part of the quality assurance program, ten random hours per two weeks of digital data are checked for comparison with the corresponding strip chart. If fewer than 10 percent errors are detected, the digtial data are assumed to be correct, additional cross checks are not required. If more than 10 percent errors are found, and additional 10-hr block will be cross checked. If this block also contains more than 10 percent errors and the cause does not appear to be attributable to the strip chart recordings, the remainder of the strip charts is reduced, and a determination is made by the Project Manager as to which data set to utilize. Documentation of the digital-analog cross checks is completed on data quality check forms. Since all the data in the report were reduced from strip charts and not from the cassette tapes, this quality assurance procedure was not necessary.

Analog data that are incorporated into the digital data base are reduced by visually estimating the integrated value of trace variations during the hour. Verification of this data required that a quality assurance reviewer actually repeat the reduction of a random 5 percent of that data and compare his values to those obtained by the data reducer. Gross errors in reduction are corrected, and minor differences which could be purely judgemental in nature are discussed with the Project Manager but not necessarily changed. If the number of gross errors in readings exceeds 10 percent of the reviewed data, an additional 5 percent are reviewed. If this block of data also contains greater than 10 percent errors, then the entire block of analog data are reduced again and the validation procedure repeated. Documentation of this verification task is completed on data quality check forms. When the reduced data in this report was reviewed, no significant errors were found.

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REFERENCES

U.S. Environmental Protection Agency (EPA). 1980. Ambient monitoring guidelines for prevention of significant deterioration (PSD). Research Triangle Park, N.C.: U.S. EPA, EPA-450/4-80-012.

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APPENDIX A

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MONTHLY SAROAD LISTING

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(This Appendix has not been
included due to its size.
Data is available upon request)

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APPENDIX B

WIND ROSES

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WYOMING MINERAL CORPORATION
COPPERTON SITE

FROM DEC. 16 1980 THROUGH DEC. 31 1980

	+-------WIND SPEED CLASSES (MPS)--------+							AVERAGE WIND
DIRECTION	0-2	2-3	3-5	5-8	8-11	>11	TOTAL	SPEED
N	5.98	0.54	0.00	0.00	0.00	0.00	6.52	1.7
NNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
NE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
ENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
ESE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
SE	8.97	0.81	0.00	0.27	0.00	0.00	10.05	1.5
SSE	0.00	0.00	0.54	0.54	0.00	0.00	1.08	2.0
S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
SSW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
SW	0.00	0.00	0.27	0.00	0.00	0.00	0.27	1.1
WSW	17.94	1.63	0.00	0.00	0.00	0.00	19.57	1.7
W	50.83	4.61	0.54	0.00	0.00	0.00	55.98	1.4
WNW	2.99	0.27	0.00	0.00	0.00	0.00	3.26	1.0
NW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
NNW	2.99	0.27	0.00	0.00	0.00	0.00	3.26	1.3
TOTAL	89.70	8.13	1.36	0.81	0.00	0.00	100.00	1.4

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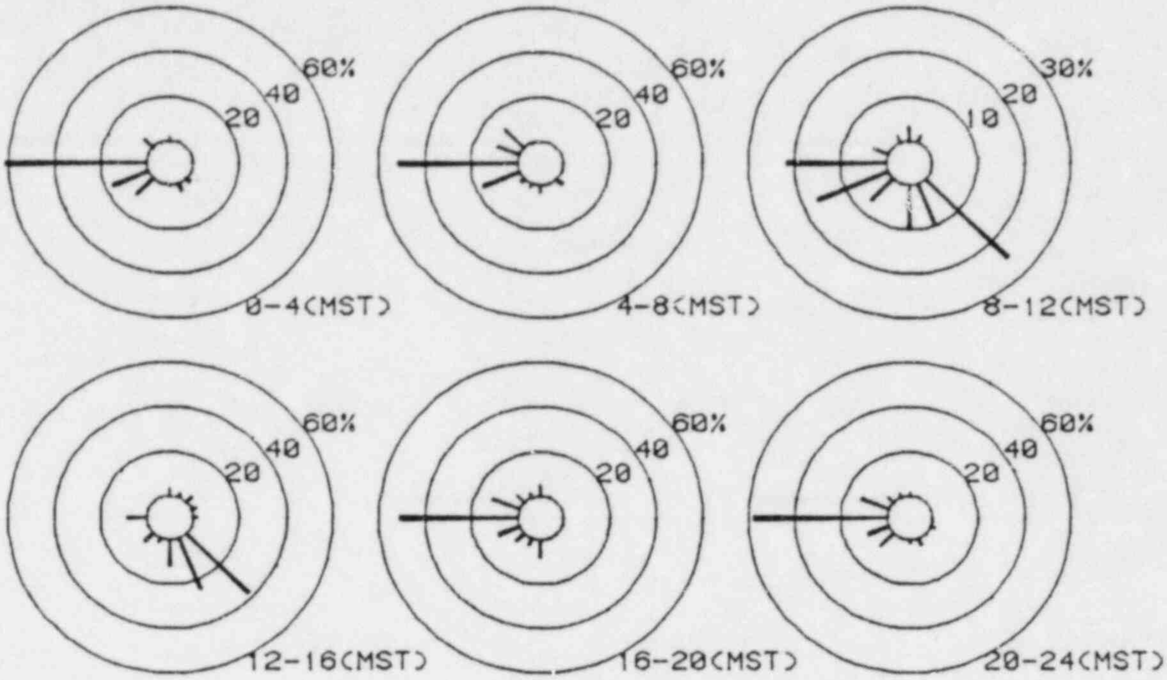
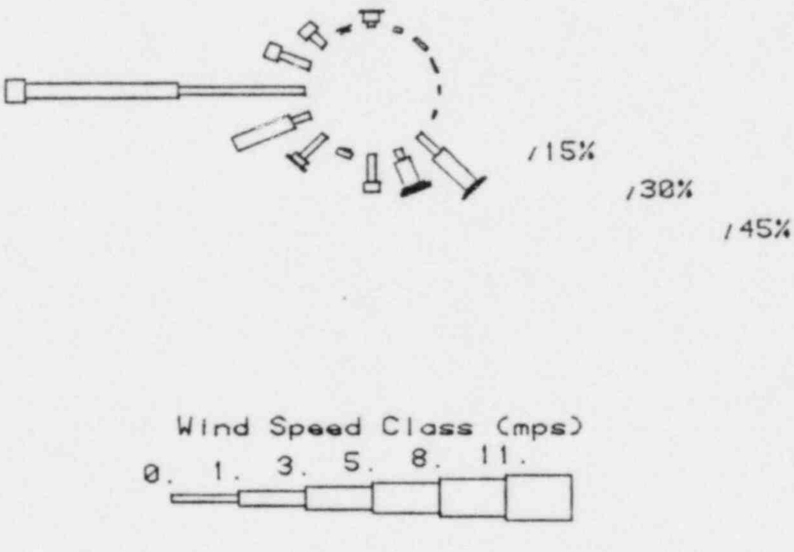
DIURNAL WIND DIRECTION ROSES



WIND SPEED AND DIRECTION ROSE



COPPERTON DECEMBER 1980 WIND ROSE

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WYOMING MINERAL CORPORATION
COPPERTON SITE

FROM JAN. 1 1981 THROUGH JAN. 31 1981

DIRECTION	+-------WIND SPEED CLASSES (MPS)--------+						TOTAL	AVERAGE WIND SPEED
	0-2	2-3	3-5	5-8	8-11	>11		
N	6.65	0.54	0.27	0.14	0.00	0.00	7.60	1.5
NNE	1.66	0.14	0.68	0.00	0.00	0.00	2.48	1.9
NE	1.66	0.14	0.00	0.00	0.00	0.00	1.80	1.3
ENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
ESE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
SE	4.98	0.41	0.14	0.00	0.00	0.00	5.53	1.3
SSE	14.95	1.23	1.91	1.36	0.00	0.00	19.45	2.3
S	4.98	0.41	0.27	0.00	0.00	0.00	5.67	1.1
SSW	3.32	0.27	0.14	0.00	0.00	0.00	3.73	1.6
SW	9.97	0.82	0.41	0.00	0.00	0.00	11.20	1.3
WSW	3.32	0.27	0.41	0.00	0.00	0.00	4.00	1.6
W	24.92	2.04	0.95	0.00	0.00	0.00	27.92	1.5
WNW	0.00	0.00	0.27	0.00	0.00	0.00	0.27	1.4
NW	3.32	0.27	0.14	0.00	0.00	0.00	3.73	1.2
NNW	4.98	0.41	1.23	0.00	0.00	0.00	6.62	1.9
TOTAL	84.74	6.95	6.81	1.50	0.00	0.00	100.00	1.5

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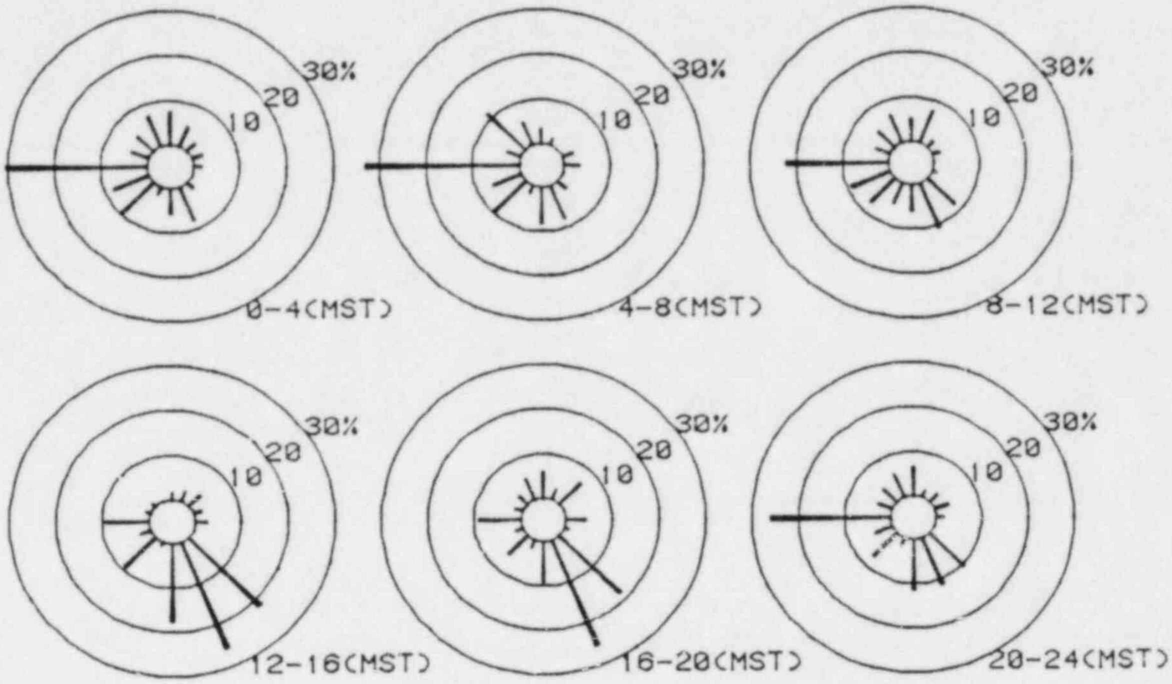
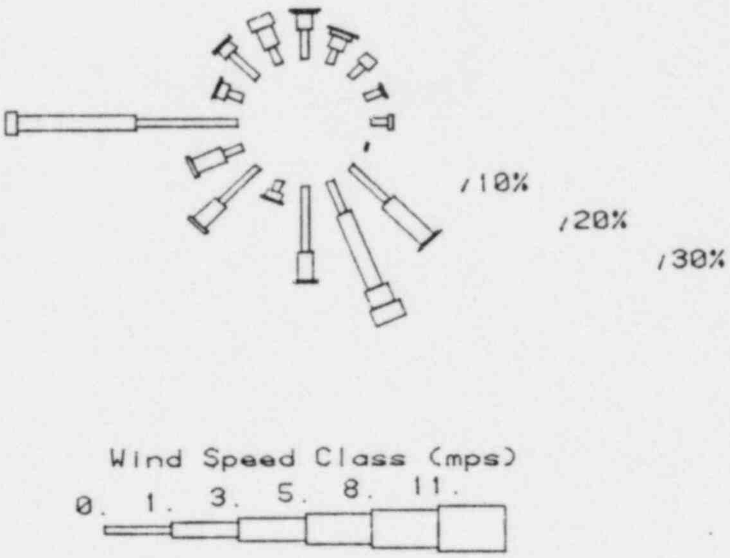
DIURNAL WIND DIRECTION ROSES



WIND SPEED AND DIRECTION ROSE



COPPERTON JANUARY 1981 WIND ROSE

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WYOMING MINERAL CORPORATION
COPPERTON SITE

FROM FEB. 1 1981 THROUGH FEB. 28 1981

	+-------WIND SPEED CLASSES (MPS)-------+							AVERAGE
DIRECTION	0-2	2-3	3-5	5-8	8-11	>11	TOTAL	WIND SPEED
N	2.08	0.69	0.86	0.52	0.00	0.00	4.14	2.8
NNE	3.12	1.03	0.52	1.03	0.00	0.00	5.70	3.4
NE	1.04	0.34	0.34	0.00	0.00	0.00	1.73	2.2
ENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
ESE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
SE	2.08	0.69	1.55	0.86	0.00	0.00	5.18	2.6
SSE	3.64	1.20	2.41	0.34	0.52	0.00	8.11	2.8
S	1.04	0.34	0.69	0.17	0.00	0.00	2.24	1.8
SSW	0.52	0.17	0.00	0.00	0.00	0.00	0.69	1.7
SW	2.60	0.86	0.69	0.69	0.00	0.00	4.83	2.2
WSW	6.23	2.07	2.07	0.34	0.00	0.00	10.71	2.4
W	29.08	9.64	0.86	0.34	0.00	0.00	39.93	2.2
WNW	2.08	0.69	0.52	1.03	0.00	0.00	4.32	2.7
NW	1.04	0.34	0.86	1.38	0.00	0.00	3.62	3.2
NNW	4.67	1.55	1.20	1.38	0.00	0.00	8.81	3.2
TOTAL	59.21	19.62	12.56	8.09	0.52	0.00	100.00	2.5

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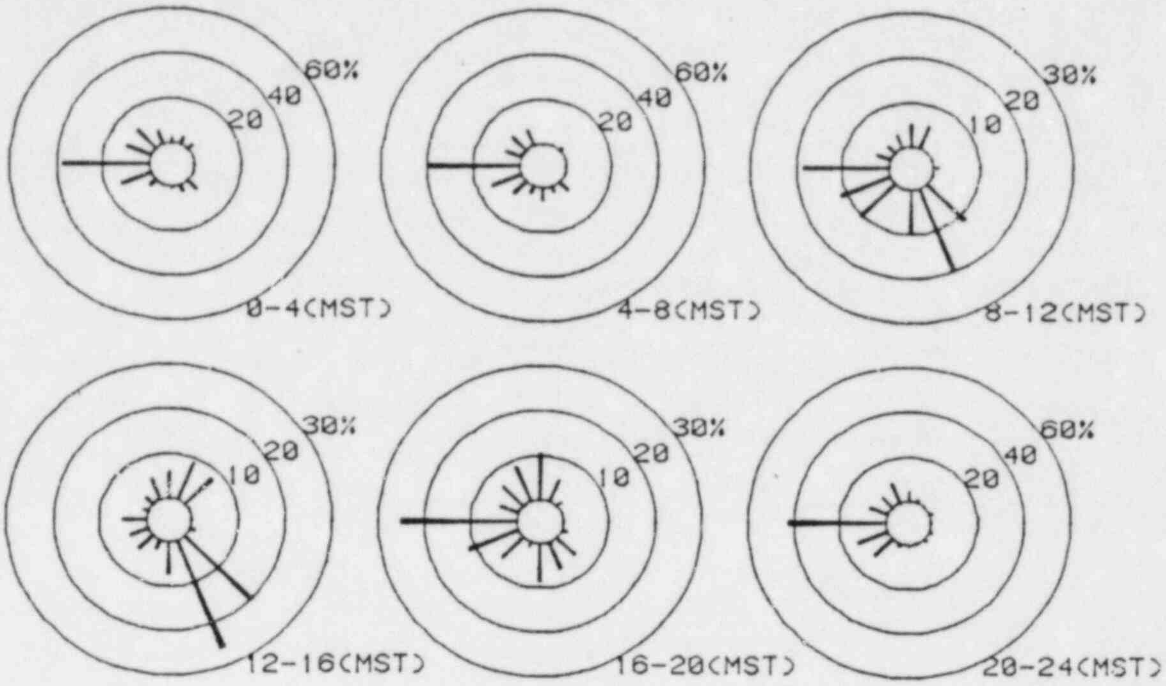
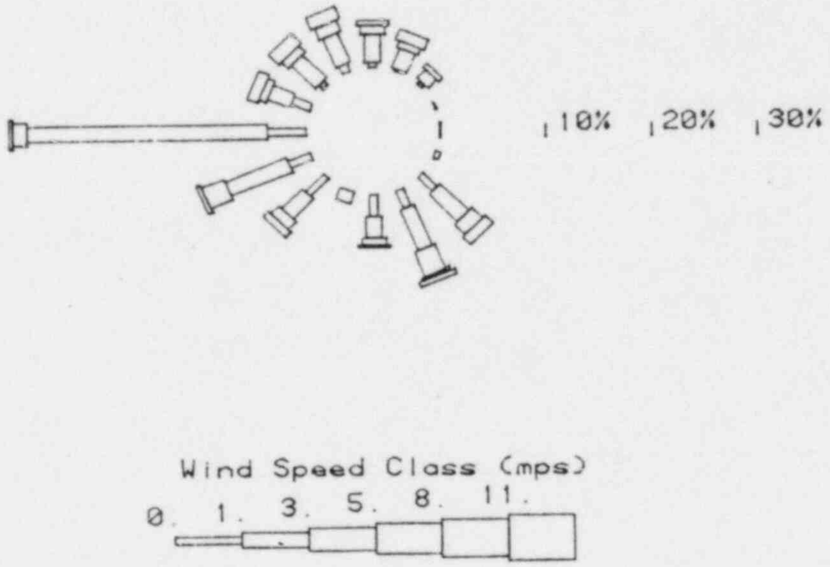
DIURNAL WIND DIRECTION ROSES



WIND SPEED AND DIRECTION ROSE



COPPERTON FEBRUARY 1981 WIND ROSE

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WYOMING MINERAL CORPORATION
COPPERTON SITE

FROM MAR. 1 1981 THROUGH MAR. 31 1981

	+-------WIND SPEED CLASSES (MPS)--------+							AVERAGE WIND SPEED
DIRECTION	0-2	2-3	3-5	5-8	8-11	>11	TOTAL	
N	2.03	0.89	1.34	0.30	0.00	0.00	4.55	2.7
NNE	2.71	1.19	2.67	0.15	0.00	0.00	6.72	3.1
NE	2.37	1.04	0.89	0.00	0.00	0.00	4.30	2.4
ENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
ESE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
SE	1.01	0.45	1.34	0.15	0.15	0.00	3.09	2.7
SSE	5.41	2.38	2.23	1.49	0.30	0.00	11.80	3.3
S	2.71	1.19	1.19	0.15	0.00	0.00	5.23	2.3
SSW	0.34	0.15	0.30	0.00	0.00	0.00	0.78	1.7
SW	3.72	1.63	1.49	0.30	0.00	0.00	7.14	2.2
WSW	7.78	3.42	1.04	0.00	0.00	0.00	12.23	2.1
W	21.98	9.66	1.78	1.04	0.74	0.00	35.20	2.7
WNW	1.35	0.59	0.74	0.30	0.30	0.00	3.28	3.1
NW	1.01	0.45	1.04	0.45	0.30	0.00	3.24	2.8
NNW	0.34	0.15	1.19	0.59	0.15	0.00	2.42	3.6
TOTAL	52.75	23.18	17.24	4.90	1.93	0.00	100.00	2.6

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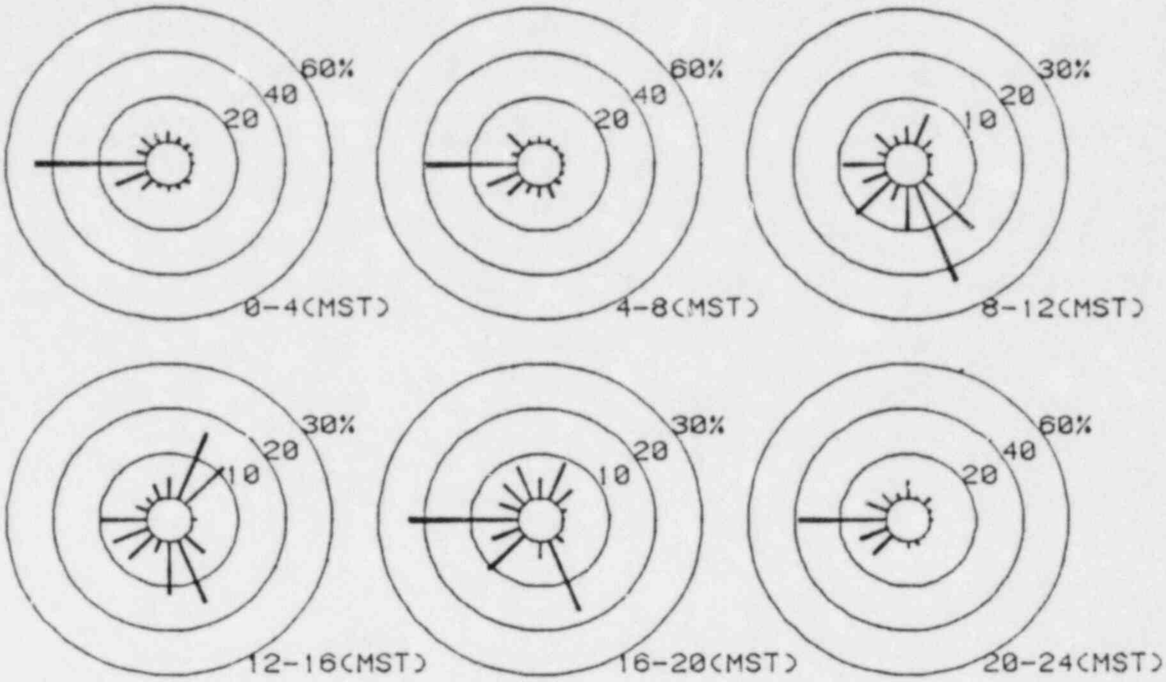
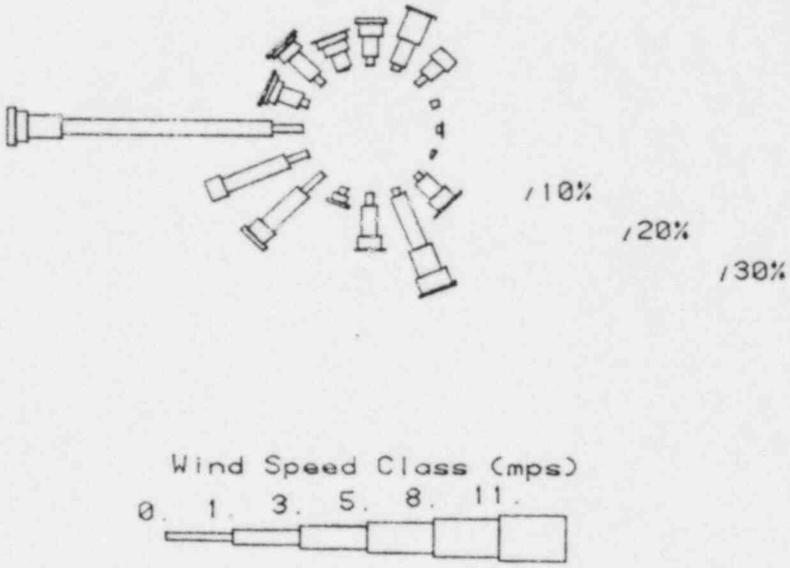
DIURNAL WIND DIRECTION ROSES



WIND SPEED AND DIRECTION ROSE



COPPERTON MARCH 1981 WIND ROSE

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WYOMING MINERAL CORPORATION
COPPERTON SITE

FROM APR. 1 1981 THROUGH APR. 30 1981

	+------WIND SPEED CLASSES (MPS)--------+							AVERAGE WIND SPEED
DIRECTION	0-2	2-3	3-5	5-8	8-11	>11	TOTAL	
N	2.07	1.18	1.62	1.03	0.00	0.00	5.90	3.3
NNE	2.85	1.62	3.98	1.18	0.00	0.00	9.63	3.9
NE	2.85	1.62	2.06	0.44	0.00	0.00	6.98	3.2
ENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
ESE	0.00	0.00	0.15	0.00	0.00	0.00	0.15	4.0
SE	0.26	0.15	0.59	0.15	0.00	0.00	1.14	2.8
SSE	1.81	1.03	3.83	1.33	0.29	0.00	8.30	3.7
S	2.07	1.18	0.44	0.00	0.00	0.00	3.69	1.9
SSW	0.78	0.44	0.15	0.00	0.00	0.00	1.37	1.8
SW	3.62	2.06	1.77	0.00	0.00	0.00	7.46	2.1
WSW	4.40	2.51	1.47	0.00	0.00	0.00	8.38	2.3
W	17.08	9.73	4.72	0.29	0.00	0.00	31.83	2.5
WNW	1.04	0.59	0.59	0.59	0.00	0.00	2.80	2.8
NW	2.33	1.33	1.47	0.74	0.29	0.00	6.16	3.7
NNW	3.11	1.77	1.33	0.00	0.00	0.00	6.20	2.8
TOTAL	44.25	25.22	24.19	5.75	0.59	0.00	100.00	2.8

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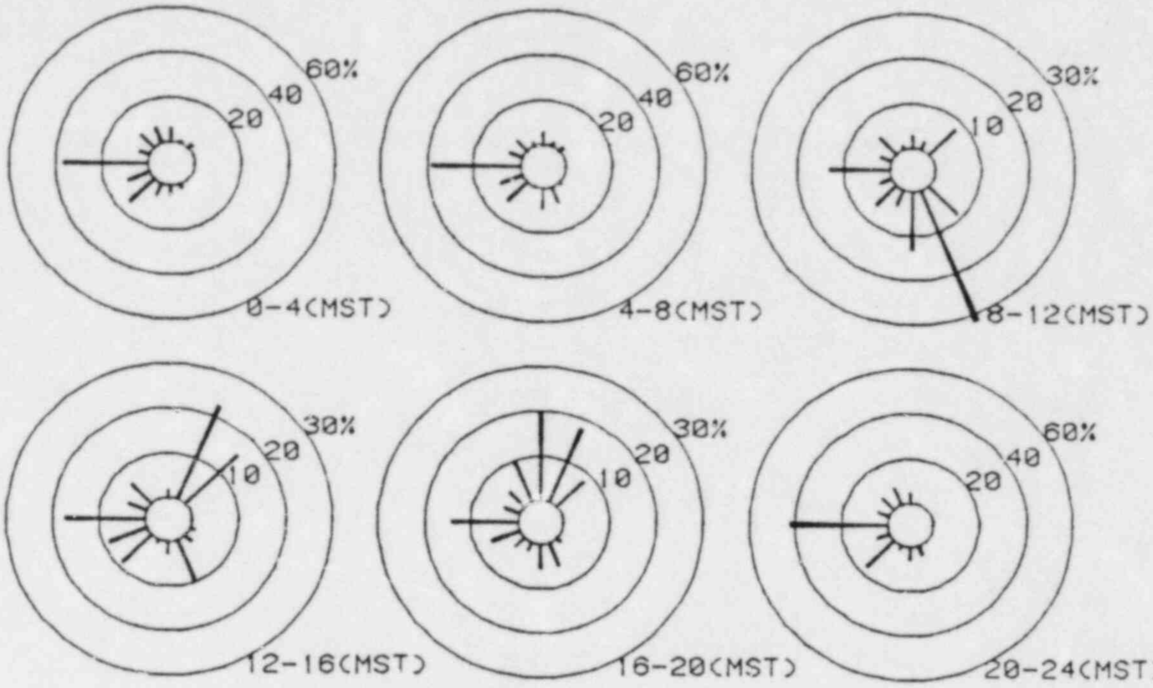
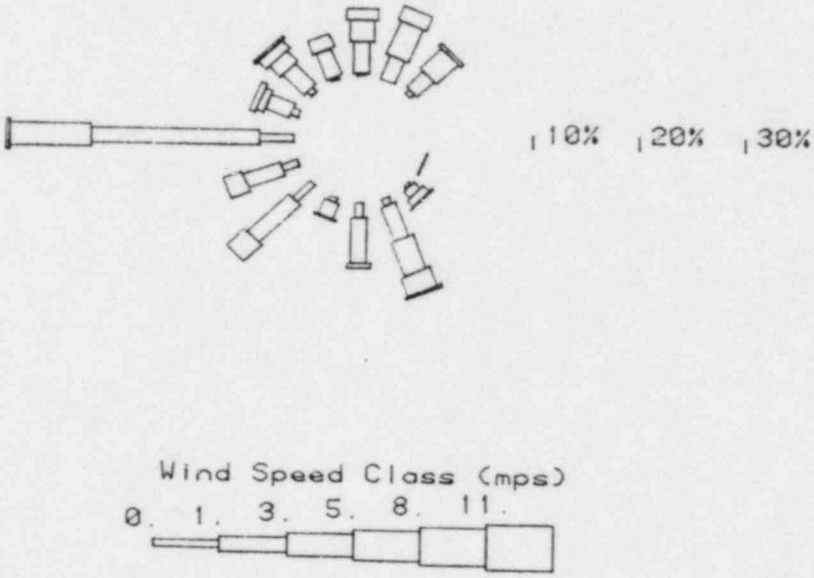
DIURNAL WIND DIRECTION ROSES



WIND SPEED AND DIRECTION ROSE



COPPERTON APRIL 1981 WIND ROSE

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WYOMING MINERAL CORPORATION
COPPERTON SITE

FROM MAY 1 1981 THROUGH MAY 14 1981

DIRECTION	+-------WIND SPEED CLASSES (MPS)--------+ 0-2	2-3	3-5	5-8	8-11	>11	TOTAL	AVERAGE WIND SPEED
N	3.00	2.45	2.14	1.22	0.00	0.00	8.81	3.4
NNE	0.75	0.61	0.00	0.31	0.00	0.00	1.67	2.9
NE	0.37	0.31	0.00	0.00	0.00	0.00	0.68	3.0
ENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
ESE	0.75	0.61	0.31	0.00	0.00	0.00	1.67	2.0
SE	1.12	0.92	4.59	3.06	0.00	0.00	9.69	4.2
SSE	1.12	0.92	1.22	1.53	0.00	0.00	4.79	3.3
S	0.00	0.00	0.61	0.00	0.00	0.00	0.61	3.8
SSW	3.00	2.45	1.53	0.00	0.00	0.00	6.97	2.4
SW	1.87	1.53	0.31	0.00	0.00	0.00	3.71	2.1
WSW	13.86	11.31	3.36	0.00	0.00	0.00	28.53	2.5
W	2.25	1.83	0.31	1.53	0.00	0.00	5.92	3.2
WNW	4.12	3.36	1.83	0.61	0.00	0.00	9.93	2.8
NW	2.62	2.14	4.59	0.61	0.00	0.00	9.96	4.0
NNW	1.87	1.53	2.75	0.92	0.00	0.00	7.07	3.4
TOTAL	36.76	29.97	23.55	9.79	0.00	0.00	100.00	3.0

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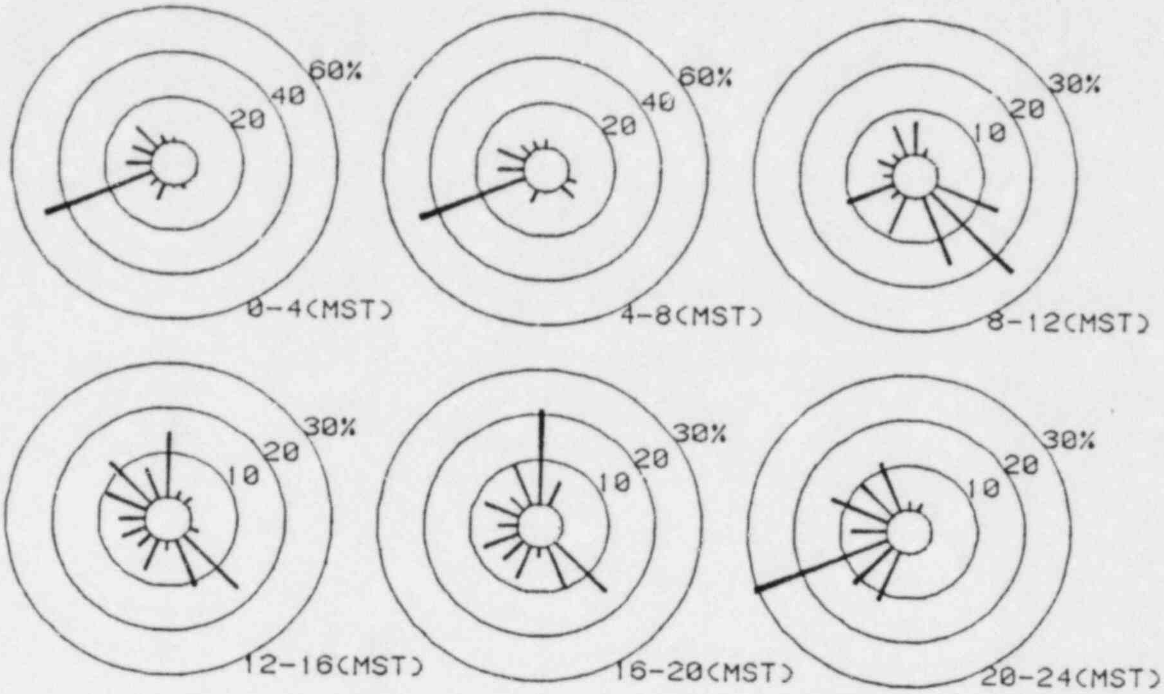
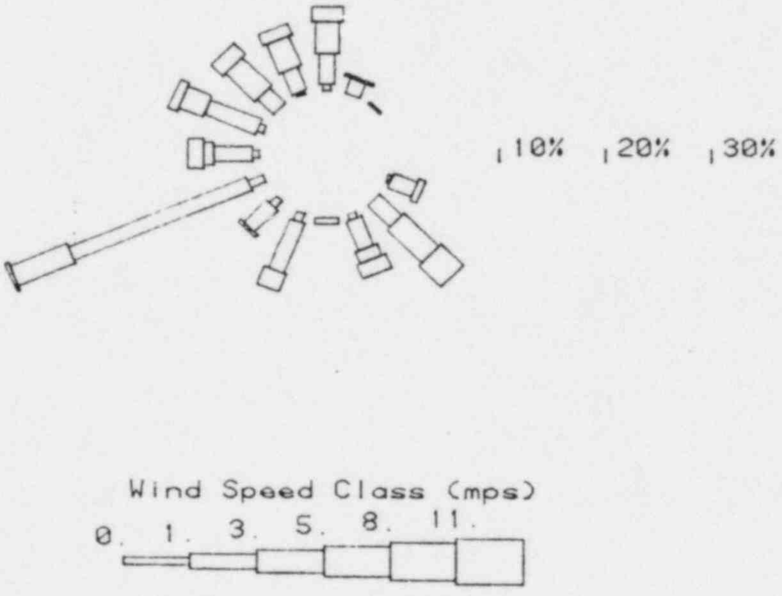
DIURNAL WIND DIRECTION ROSES



WIND SPEED AND DIRECTION ROSE



COPPERTON MAY 1981 WIND ROSE

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WYOMING MINERAL CORPORATION
COPPERTON SITE

FROM JUNE 15 1981 THROUGH JUNE 30 1981

DIRECTION	+------WIND SPEED CLASSES (MPS)-------+						TOTAL	AVERAGE WIND SPEED
	0-2	2-3	3-5	5-8	8-11	>11		
N	3.32	3.20	2.93	0.80	0.00	0.00	10.26	3.2
NNE	1.94	1.87	3.73	0.80	0.00	0.00	8.34	3.5
NE	0.55	0.53	0.80	0.00	0.00	0.00	1.89	2.4
ENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
ESE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
SE	1.94	1.87	2.40	0.80	0.00	0.00	7.00	3.0
SSE	0.83	0.80	0.80	0.53	0.00	0.00	2.96	4.0
S	1.11	1.07	0.53	0.00	0.00	0.00	2.71	1.9
SSW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
SW	1.94	1.87	1.07	0.00	0.00	0.00	4.87	2.1
WSW	12.46	12.00	2.40	0.00	0.00	0.00	26.86	2.6
W	9.14	8.80	2.93	0.27	0.00	0.00	21.14	2.6
WNW	0.00	0.00	0.80	0.00	0.00	0.00	0.80	3.8
NW	0.55	0.53	1.60	2.13	0.00	0.00	4.82	4.4
NNW	2.49	2.40	3.20	0.27	0.00	0.00	8.36	3.4
TOTAL	36.27	34.93	23.20	5.60	0.00	0.00	100.00	2.9

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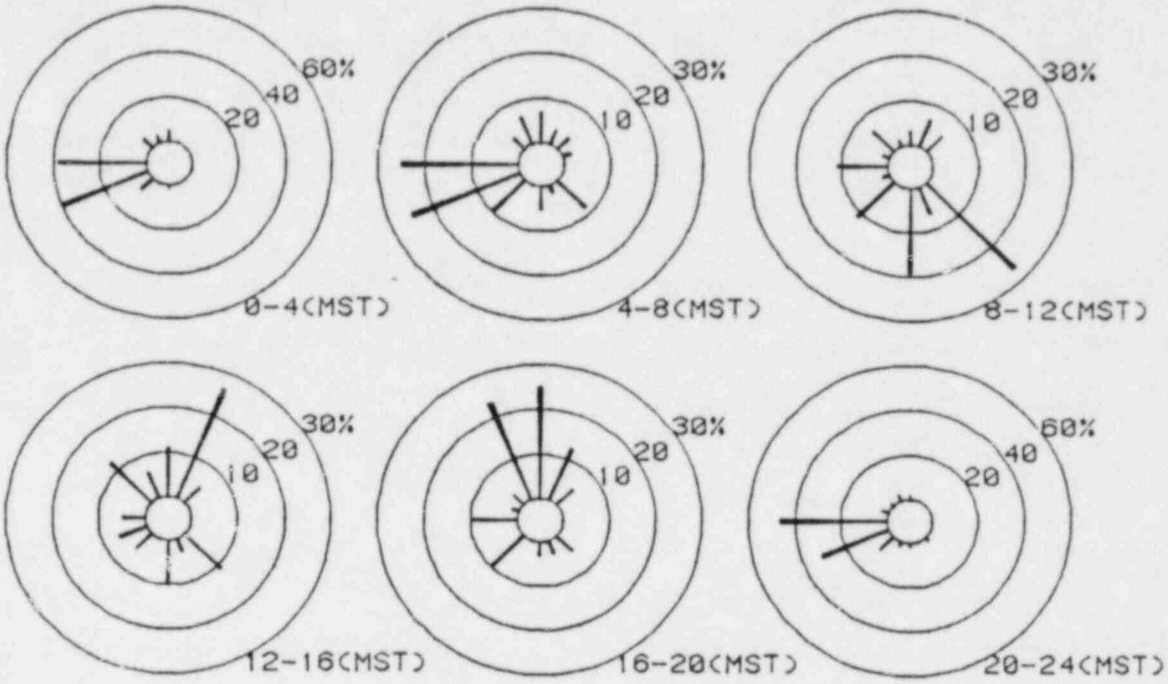
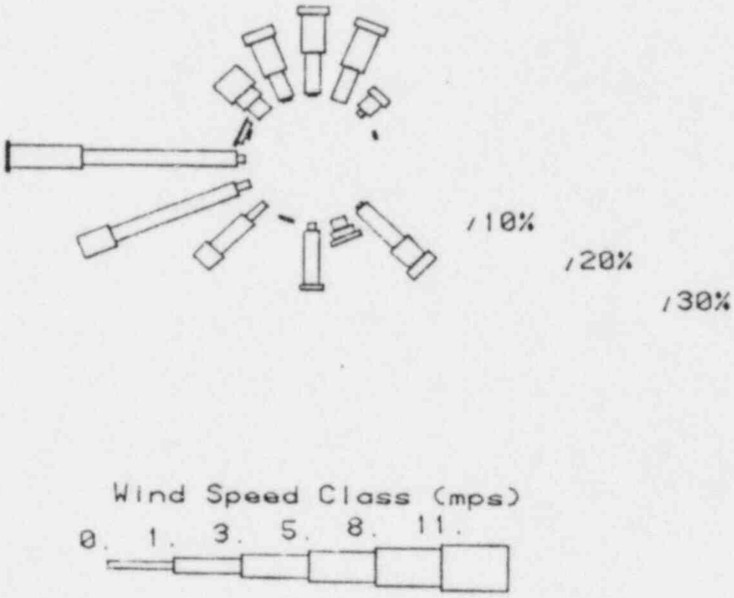
DIURNAL WIND DIRECTION ROSES



WIND SPEED AND DIRECTION ROSE



COPPERTON JUNE 1981 WIND ROSE

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APPENDIX C

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JOINT FREQUENCY DISTRIBUTIONS

***

(This Appendix has not been
included due to its size.
Data is available upon request)

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APPENDIX C-3

METEOROLOGIC DATA

JULY 1981 THROUGH DECEMBER 1981

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SEMIANNUAL METEOROLOGICAL DATA SUMMARY REPORT FOR THE COPPERTON URANIUM FACILITY

1 JULY - 31 DECEMBER 1981

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environmental engineers, scientists, planners, & management consultants

CDM

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SEMIANNUAL METEOROLOGICAL DATA SUMMARY REPORT FOR THE COPPERTON URANIUM FACILITY

1 JULY - 31 DECEMBER 1981

Prepared for:

Wyoming Mineral Corporation
3900 South Wadsworth Boulevard
Lakewood, Colorado 80235

Prepared by:

Camp Dresser & McKee Inc.
11455 West 48th Avenue
Wheat Ridge, Colorado 80033

CDM Project No. 3153

February 1982

Mark J. Komp

Mark J. Komp
Project Manager

Roger A. Nelson
Technical Manager

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LIST OF FIGURES

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EXECUTIVE SUMMARY

The meteorological monitoring program at the Copperton Uranium Facility from 1 July to 31 December 1981 achieved an average data recovery of 77 percent. The meteorological monitoring program recorded wind speed, wind direction, sigma theta (standard deviation of wind direction), and temperature.

The six-month data set presented in this summary report is without any anomalies and reflects the semiarid continental climate of Utah and the mesoclimatic features associated with a location at the mouth of a steep canyon. The temperatures recorded during this six-month period were generally moderate. The lowest mean monthly temperature was 3°C (37°F), which occurred during December, and the highest mean monthly temperature was 24°C (75°F), which occurred during July. The prevailing wind direction was west and was associated with down-valley flow in Bingham Canyon. The monthly mean wind speeds varied from a maximum of 2.7 m/sec (6.0 mph) in July to a minimum of 1.7 m/sec (3.1 mph) in December. Pasquill-Gifford atmospheric stability class D (neutral) occurred 30 percent of the time, with stable (classes E, F) and unstable (classes A, B, C) conditions occurring 37 and 33 percent of the time, respectively.

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1.0 INTRODUCTION

This semiannual report was prepared for the Wyoming Mineral Corporation (WMC) by Camp Dresser and McKee Inc. (CDM) to summarize the meteorological data collected at WMC's Copperton Uranium Facility from 1 July to 31 December 1981. The meteorological monitoring consists of wind speed, wind direction, standard deviation of wind direction (sigma theta), and ambient temperature measurements. The primary objective of the meteorological monitoring program is to provide on-site information about the existing meteorology during the operation of the uranium mine. These meteorological data are being collected in support of state and federal air quality permit applications.

This report consists of four sections: (1) an introductory section which provides background information on the monitoring program as well as a description of the monitoring site, (2) a data collection section which discusses the monitoring instrumentation and data handling procedures, (3) a data interpretation section which discusses the means, extremes, and trends of the meteorological data, and (4) a quality assurance section which describes the procedures used to ensure the high quality of the data.

1.1 BACKGROUND

The Copperton Uranium Facility is located on the western edge of the city of Copperton, Utah, at the mouth of Bingham Canyon. The facility extracts uranium from a water solution which remains after copper is mined by an in situ process. The copper is removed by the Kennecott Copper Company, and the residual water solution is stored in a large reservoir and pumped to the WMC facility as needed. The location of the WMC facility is shown in Figure 1-1.

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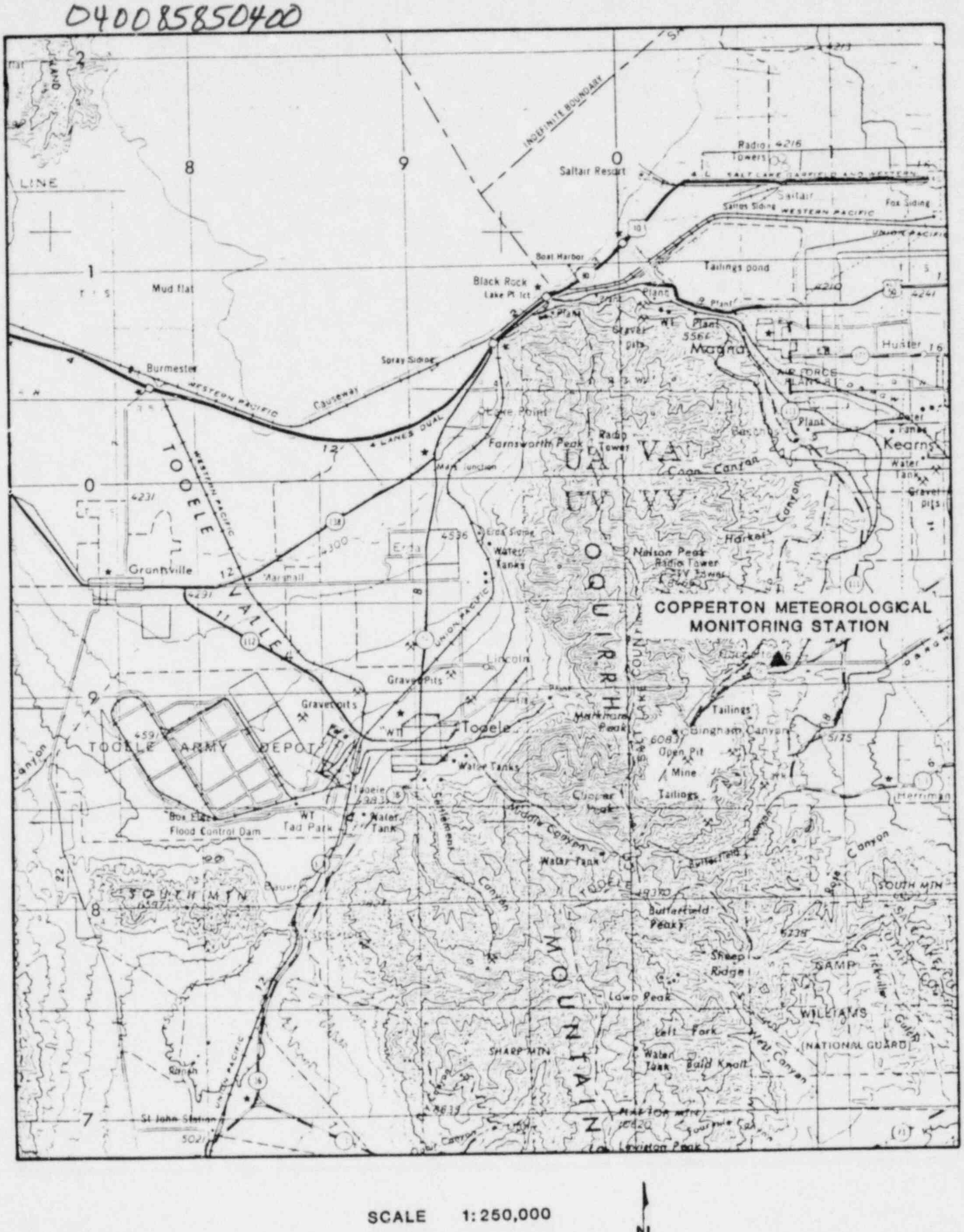

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Figure 1-1 Regional Map Showing Location of Copperton Meteorological Monitoring Station.

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1.2 SITE DESCRIPTION

The Copperton Uranium Facility is located at a latitude of 40.6°N and a longitude of 112.1°W on the eastern edge of the Oquirrh Mountains and at the mouth of Bingham Canyon. The elevation of the WMC facility is 1,695 m (5,560 ft), and the elevation of the top of Bingham Canyon is 2,438 m (8,000 ft.)

The meteorological sensors are mounted atop a 3-m tripod which is fixed to the top of the roof of the 20-m (65-ft) high WMC building. Turbulence is created as the air passes over the building top where the meteorological sensors are located. However, inspection of the data indicates that the turbulence is insignificant and does not affect the mesoscale measurements of temperature, wind speed, and wind direction.

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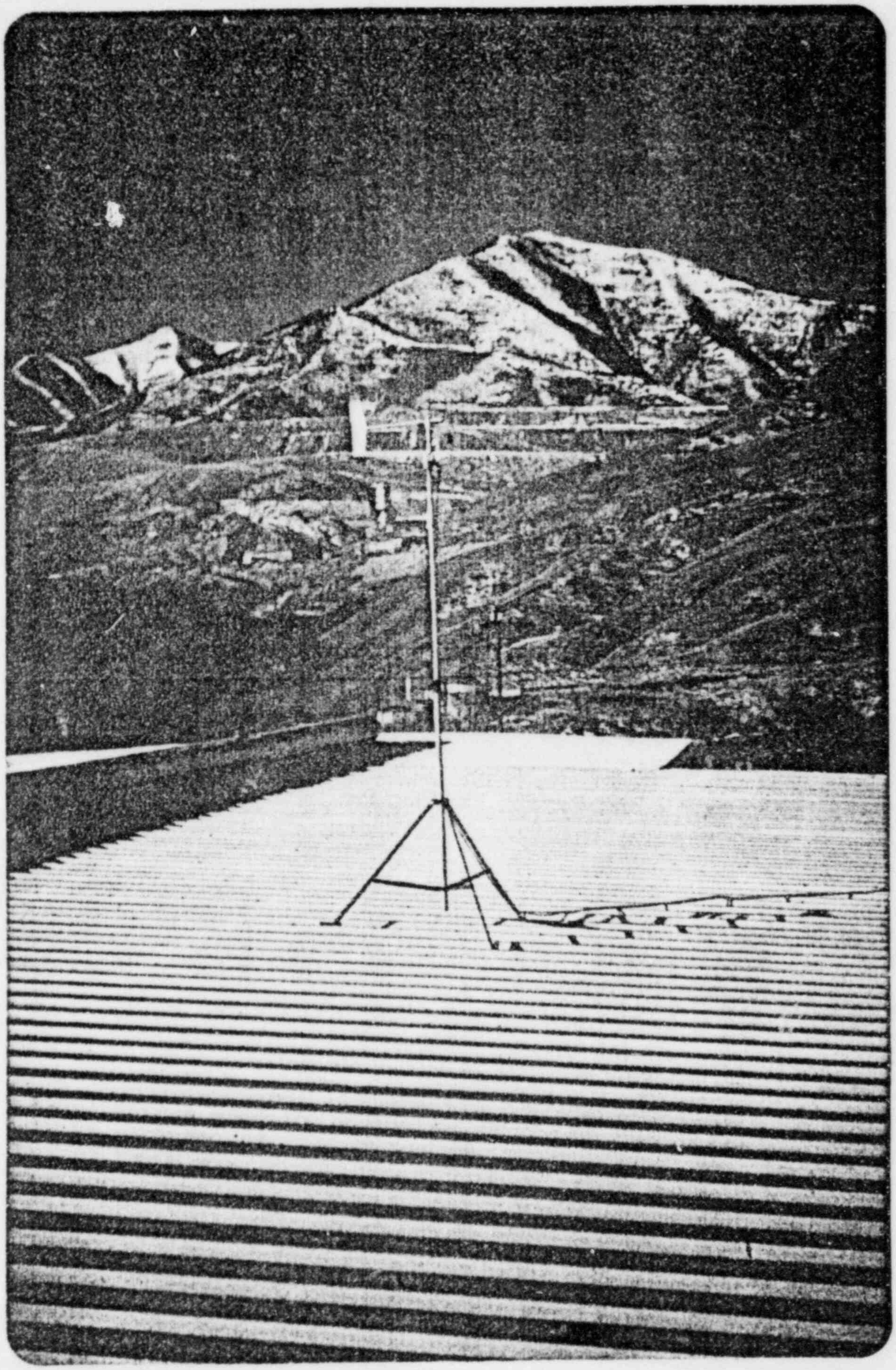

Figure 1-2 Photograph of Tripod with Meteorological Sensors

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2.0 METEOROLOGICAL INSTRUMENTATION AND DATA REDUCTION

Instrumentation

The meteorological monitoring is performed with a Climatronics Electronic Weather Station (EWS) and a cassette data acquisition system (CDAS). All data are recorded continuously on a strip chart recorder located in the EWS unit, and 1 min instantaneous values are recorded on the CDAS. The strip chart record is reduced only when required for quality assurance checks or for backup to missing CDAS data. The wind and temperature sensors are located atop a 3-m tripod which is bolted to the roof of the WMC building in which the EWS and CDAS units are housed. The signal from the sensors is transmitted to the EWS via 46 m (150 ft) of signal cable. The operating specifications for the monitoring instruments used in the program are given in Table 2-1.

The EWS is calibrated by a CDM technician on a semiannual basis, or after any major repair. In addition, the EWS was calibrated immediately after installation. The EWS is calibrated electronically with the aid of a certified digital voltmeter (DVM). The dates of calibrations performed during the past year are given below.

Date	Reason for Calibration
15 June 1981	Semiannual calibration
8 January 1982	Semiannual calibration

The meteorological equipment is serviced and maintained by WMC personnel. The WMC personnel are also responsible for completing a weekly equipment function checklist. CDM technicians perform the calibrations and emergency repairs and servicing requested by WMC.

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Table 2-1 SPECIFICATIONS OF METEOROLOGICAL INSTRUMENTATION

Sensor	Manufacturer's Model Number	Sensing Technique	Accuracy	Range
Wind Speed	Climatronics WM-III	Cups-Light Chopper	0.25 m/sec	0-50 m/sec
Wind Direction	Climatronics WM-III	Wind Vane Potentiometer	± 3°	0-540°
Sigma Theta	Climatronics 101035	Wind Vane Microprocessor	± 3°	0-60°
Temperature	Climatronics 100093	Thermistor	± 0.2°C	-30 to 50°C

Data Reduction

Data collected on cassette tapes were used whenever possible. However, only about 60 percent of data collected during this period were reduced from tapes due to problems with tape noise. The remaining 40 percent of the data were reduced from strip charts. Both CDAS and strip chart data were processed through several reduction, editing, and quality assurance steps before presentation in this report. The steps used for the CDAS data were as follows:

1. Logging-in of CDAS tapes upon receipt from WMC
2. Spot-checking data on the tapes for reasonableness
3. Copying data from tape onto floppy diskettes
4. Copying data from diskettes into CDM's DEC-20 computer and calculating hourly averages
5. Verifying 10 percent of the hourly averages for accuracy
6. Processing the data through editing programs which identify off-scale readings and sequential errors, and incorporating corrections into the data base
7. Preparing data summaries using computer programs

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The CDAS recorded data to the following limits:

Parameter	Recording Limit
Wind Speed	0.03 m/sec
Wind Direction	0.54°
Temperature	0.05°C
Sigma Theta	0.06°

The steps used for reducing strip charts were as follows:

1. Logging-in of strip charts upon receipt from WMC
2. Verifying dates and times on strip charts
3. Reviewing strip chart data and editing data for reasonableness
4. Reducing strip chart data to hourly averages
5. Verifying 10 percent of the hourly averages for accuracy
6. Keypunching the data onto magnetic tape
7. Processing the data on the tape through editing programs which identify off-scale readings and sequential errors, and incorporating corrections into the data base
8. Preparing data summaries using computer programs

Each parameter was reduced from the strip chart to the following limits:

Parameter	Reduction Limit
Wind Speed	0.25 m/sec
Wind Direction	5°
Temperature	0.5°C
Sigma Theta	1°

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3.0 DATA INTERPRETATION

The meteorological data summarized below were derived from hourly averaged validated values. The hourly averages for the wind speed, wind direction, temperature, and sigma theta are listed in Storage and Retrieval of Aerometric Data (SAROAD) format in Appendix A.

3.1 DATA RECOVERY

Data recovery for wind speed, wind direction, temperature, and sigma theta from 1 July to 31 December 1981 is shown in Table 3-1. Data recovery for wind speed and temperature was 84 percent, and for wind direction and sigma theta it was 71 percent.

Data losses common to all parameters were attributed to infrequent power outages, weekly changes of strip charts and cassette tapes, and routine servicing and calibrations. Data were also lost due to two other specific problems during the period. Data from 13 July through 8 August 1981 are missing because the CDAS cassette tape was not readable due to tape noise, and the backup strip chart was lost in transit. The other problem resulted in a loss of approximately 14 percent of wind direction and sigma theta data. The wind direction vane became loosened and mis-aligned because of strong winds. The vane shifted on its shaft intermittently from 13 August to 31 December. Wind directions for the period were corrected by adjusting the wind direction during the occurrence of stable drainage flows. Because of the very stable nature of the drainage wind at the monitoring site, these adjustments were made with minimal data loss and acceptable accuracy. Because of the trouble with the wind direction vane, the accuracy of wind direction stated in Table 2-1 changed for the period 13 August through 31 December and is now estimated at 10 degrees. The changes were overseen by the Project Manager and the corrections were completely documented.

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Table 3-1 DATA RECOVERY FOR METEOROLOGICAL PARAMETERS
1 JULY - 31 DECEMBER 1981

Parameter	Recovery (%)
Wind Speed	84
Wind Direction	71
Sigma Theta	71
Temperature	84

3.2 AMBIENT TEMPERATURE

The monthly temperature means and extremes are summarized in Table 3-2. The mean maximum and minimum temperatures are the averages of the daily high and low temperatures, respectively. The extreme temperatures are the highest and lowest hourly temperatures occurring during the month.

Table 3-2 MONTHLY TEMPERATURE MEANS AND EXTREMES (°C)
1 JULY - 31 DECEMBER 1981

Month	Mean Maximum	Mean Minimum	Mean Monthly	Extremes	
				Highest	Lowest
July	30	20	25	36	17
August	28	18	23	32	11
September	24	14	19	31	6
October	13	5	9	21	-2
November	12	4	8	21	-8
December	8	0	3	18	-10

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July was the warmest of the six months in the monitoring period with a mean monthly temperature of 25°C (77°F). December was coldest of the six months with a mean temperature of 3°C (37°F). The highest recorded temperature was 36°C (97°F), which occurred on 6 July, and the lowest recorded temperature was -10°C (14°F), which occurred on 23 December 1981.

3.3 WIND DIRECTION AND SPEED

Wind direction and wind speed data have been used to calculate monthly wind roses. The wind roses are presented in both a tabular and plot format in Appendix B. The tabular wind roses relate the frequency of occurrence of the wind direction to the wind speed. The wind rose plots include (1) diurnal wind roses which relate the frequency of occurrence of the wind direction to the time of day and (2) a wind rose which relates the frequency of occurrence of the wind direction to the wind speed.

Table 3-3 presents the prevailing wind direction by month. The prevailing wind direction for the six-month period was from the west, and represents the drainage of air out of Bingham Canyon. Drainage is caused by the radiational cooling of mountain slopes at night, and the subsequent sinking of cool air into the valleys. This air flows out of the mouth of Bingham Canyon, resulting in a persistent west wind at the monitoring site.

The monthly mean wind speeds presented in Table 3-4 varied from a maximum of 2.7 m/sec (6.0 mph) in July to a minimum of 1.7 m/sec (3.1 mph) in December. Wind speed is greater in the summer because there is greater coupling of surface winds with higher momentum upper level winds in the summer than in the winter. This is caused by greater instability which is typical of summer. Additionally, drainage flows are typically stronger in the summer months due to greater temperature contrasts at night.

3.4 JOINT FREQUENCY DISTRIBUTION

Joint frequency distributions (JFD) of the wind speed, wind direction, and atmospheric stability were calculated in a manner that closely approximates the method the National Climatic Center (NCC) uses to calculate STAR

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Table 3-3 MONTHLY PREVAILING WIND DIRECTION
JULY - DECEMBER 1981

Month	Prevailing Wind Direction
July	southeast
August	west-southwest
September	west
October	west
November	west
December	west

Table 3-4 MONTHLY MEAN WIND SPEED
JULY - DECEMBER 1981

Month	Mean Wind Speed (m/sec)
July	2.7
August	2.5
September	2.2
October	2.1
November	2.2
December	1.7

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(stability array) distributions from National Weather Service data. Like STAR data, atmospheric stability at the Copperton facility was classified according to the Pasquill-Gifford system, which categorizes stabilities into six classes from A to F, in order of increasing stability. Stability classes A, B, and C represent decreasingly unstable atmospheric conditions. Stability classes E and F represent increasingly stable atmospheric conditions. Stability class D represents neutral conditions.

Atmospheric stability at the WMC plant was calculated from the algorithm outlined in Table 3-5. This algorithm incorporates wind speed, solar angle, and sigma theta into the stability classification. The monthly joint frequency distributions are presented in Appendix C.

A summary of the frequency of occurrence of the Pasquill-Gifford stability classes, as determined from the JFD's in Appendix C, is given in Table 3-6. Stablility class D (neutral) was predominant from July through December.

Stability class A (very unstable) occurred frequently in July and August. The high occurrence of class A stability during the summer is attributed mainly to increased solar angle and, therefore, increased surface heating. The frequency of occurrence of stable classes (E and F) was greatest in November.

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Table 3-5 PASQUILL STABILITY CLASS DERIVATION FROM SIGMA THETA, WIND SPEED, AND SOLAR ANGLE (α)

			Sigma Theta (degrees)				
		Wind Speed (m/sec)	0-5	5-10	10-15	15-20	>20
	NIGHT	0-2	F	F	E	E	D
		2-4	F	F	E	D	D
		4-6	E	E	D	D	D
		6-8	E	E	D	D	D
		>8	D	D	D	D	D
DAY	15>α	0-2	E	E	D	C	C
		2-4	E	E	D	D	C
		4-6	E	D	D	D	D
		6-8	D	D	D	D	D
		>8	D	D	D	D	D
	35 > α > 15	0-2	E	D	C	C	B
		2-4	E	D	D	C	C
		4-6	D	D	D	D	C
		6-8	D	D	D	D	D
		>8	D	D	D	D	D
	60 > α > 35	0-2	E	D	C	B	A
		2-4	D	D	C	B	A
		4-6	D	D	D	C	C
		6-8	D	D	D	D	C
		>8	D	D	D	D	D
	α > 60	0-2	D	C	B	A	A
		2-4	D	D	C	B	A
		4-6	D	D	C	B	B
		6-8	D	D	D	C	C
		>3	D	D	D	C	C

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Table 3-6 FREQUENCY OF OCCURRENCE (PERCENT) OF PASQUILL-GIFFORD STABILITY CLASSES BY MONTH JULY - DECEMBER 1981

Month	Class A	Class B	Class C	Class D	Class E	Class F
July	24	12	8	33	10	14
August	27	11	9	21	16	15
September	19	14	7	26	16	18
October	12	17	7	31	18	14
November	0	17	10	21	24	26
December	0	20	10	46	18	6

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4.0 QUALITY ASSURANCE PROGRAM

In order to ensure the integrity of the monitoring data, CDM has instituted a quality assurance program similar to the framework cited in the EPA PSD monitoring guidelines. This program involves all aspects of the monitoring effort and includes semiannual instrument calibrations, documentation of all program activities, and documented data reduction procedures.

4.1 INTERNAL QUALITY CONTROL PROCEDURES

The primary responsibility of overseeing and ensuring the high quality of the air monitoring program rests with the Project Manager. The Project Manager is an experienced atmospheric scientist, thoroughly familiar with PSD and other related monitoring programs.

PSD monitoring guidelines specify that appropriate quality assurance and program control procedures must be employed throughout the monitoring program. The guidelines establish specific siting requirements, instrumentation, sampling heights, operation, calibration, and data reduction criteria. The quality assurance program is designed to meet these requirements. Instrument siting was performed by an experienced atmospheric scientist who is thoroughly familiar with PSD siting requirements. The meteorological instrumentation meets the specifications required for PSD monitoring, and installation of the monitoring station was overseen by the Project Manager. All operational and maintenance functions used during the course of the monitoring program are thoroughly documented. The instrumentation is calibrated every six months and after any major repair.

4.2 DATA REDUCTION

Data are transmitted from the monitoring station to the CDM Wheat Ridge office by registered mail. Upon receipt of the monitoring data at the CDM Wheat Ridge office, the data are subject to CDM data reduction and Quality Assurance (QA) validation procedures. As the first step of these procedures, the data are logged. Next, the analog (strip chart) data are

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inspected for any missing data or indication of sensor malfunctions, and the digital data are run through a data edit computer program to check for anomalies. Data that fall outside of the control limits are flagged, and each anomaly is corrected or voided. The data are then checked for any anomalies indicated in the log books, maintenance, calibration, and audit records. Afterwards, the data are reduced to hourly values of appropriate units. Any missing digital data are filled by corresponding backup recorder data.

As part of the quality assurance program, ten random hours per two weeks of digital data are checked for comparison with the corresponding strip chart. If fewer than 10 percent errors are detected, the digital data are assumed to be correct, and additional cross checks are not required. If more than 10 percent errors are found, an additional 10-hr block is cross checked. If this block also contains more than 10 percent errors and the cause does not appear to be attributable to the strip chart recordings, the remainder of the strip charts are reduced, and a determination is made by the Project Manager as to which data set to utilize. Documentation of the digital-analog cross checks is completed on data quality check forms.

Analog data that are incorporated into the digital data base are reduced by visually estimating the average value of traces during each hour. Verification of this data requires that a quality assurance reviewer actually repeat the reduction of a random 5 percent of the data and compare the values to those obtained by the data reducer. Gross errors in reduction are corrected, and minor differences which could be purely judgemental in nature are discussed with the Project Manager, but not necessarily changed. If the number of gross errors in readings exceeds 10 percent of the reviewed data, an additional 5 percent are reviewed. If this block of data also contains greater than 10 percent errors, then the entire block of analog data are reduced again and the validation procedure repeated. Documentation of this verification task is completed on data quality check forms.

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REFERENCES

U.S. Environmental Protection Agency (EPA). 1980. Ambient monitoring guidelines for prevention of significant deterioration (PSD). Research Triangle Park, N.C.: U.S. EPA, EPA-450/4-80-012.

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APPENDIX A

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MONTHLY SAROAD LISTING

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(This Appendix has not been
included due to its size.
Data is available upon request)

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APPENDIX B

WIND ROSES

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WYOMING MINERAL CORPORATION
COPPERTON SITE

WIND ROSE DATA ANALYSIS

FROM JULY 1 1981 THROUGH JULY 31 1981

(DATA ANALYZED FOR 0000 HOURS THROUGH 2400 HOURS)

FREQUENCY OF OCCURENCE OF WIND SPEED BY DIRECTION

	+------WIND SPEED CLASSES (MPS)-------+							
DIRECTION	0-2	2-3	3-5	5-8	8-11	>11	TOTAL	AVERAGE WIND SPEED
N	0.75	0.00	0.75	0.37	0.00	0.00	1.87	3.1
NNE	0.75	0.75	0.37	0.00	0.00	0.00	1.87	2.3
NE	0.75	0.00	0.00	0.00	0.00	0.00	0.75	0.9
ENE	1.12	0.00	0.00	0.00	0.00	0.00	1.12	0.7
E	2.24	0.00	0.00	0.00	0.00	0.00	2.24	0.9
ESE	1.12	0.00	0.00	0.00	0.00	0.00	1.12	1.2
SE	2.61	3.73	8.58	6.34	0.00	0.00	21.27	4.1
SSE	2.99	2.24	1.87	0.75	0.00	0.00	7.84	2.7
S	1.49	0.75	0.37	0.00	0.00	0.00	2.61	1.9
SSW	3.73	1.12	1.12	0.00	0.00	0.00	5.97	1.8
SW	4.48	3.73	4.10	0.00	0.00	0.00	12.31	2.4
WSW	7.09	4.85	5.97	0.37	0.00	0.00	18.28	2.6
W	2.61	2.99	2.61	0.75	0.37	0.00	9.33	3.0
WNW	2.61	1.12	1.12	0.00	0.00	0.00	4.85	2.0
NW	2.61	0.37	0.75	0.00	0.00	0.00	3.73	1.8
NNW	1.87	1.87	1.12	0.00	0.00	0.00	4.85	2.4
TOTAL	38.81	23.51	28.73	8.58	0.37	0.00	100.00	2.7

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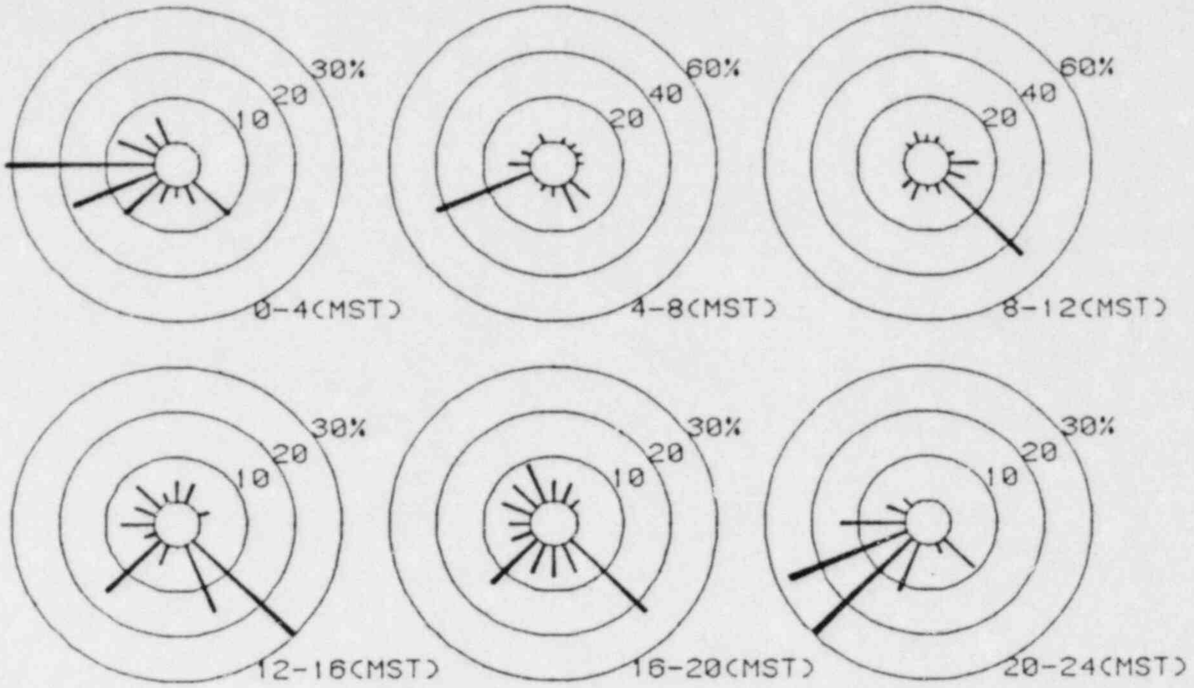
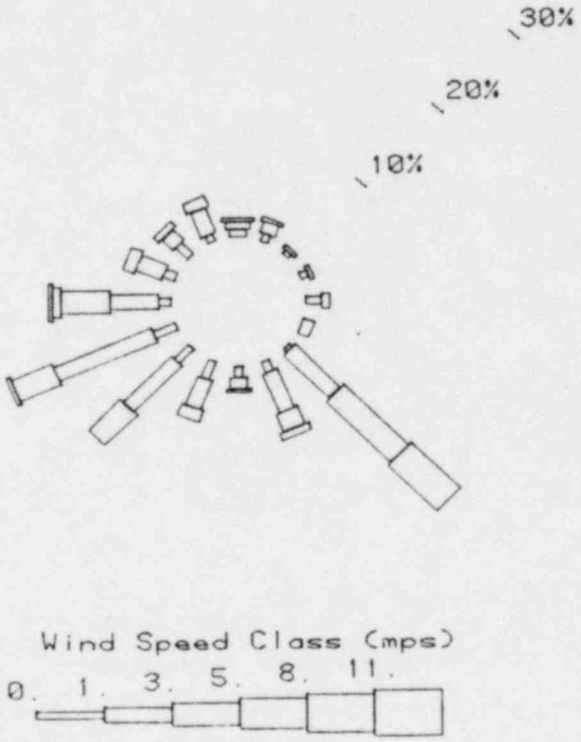
DIURNAL WIND DIRECTION ROSES



WIND SPEED AND DIRECTION ROSE



Copperton July 1981 Wind Rose

20684

WYOMING MINERAL CORPORATION
COPPERTON SITE

04008580400

WIND ROSE DATA ANALYSIS

FROM AUG. 1 1981 THROUGH AUG. 31 1981

(DATA ANALYZED FOR 0000 HOURS THROUGH 2400 HOURS)

FREQUENCY OF OCCURENCE OF WIND SPEED BY DIRECTION

	+------WIND SPEED CLASSES (MPS)-------+							AVERAGE
DIRECTION	0-2	2-3	3-5	5-8	8-11	>11	TOTAL	WIND SPEED
N	1.42	0.35	0.71	0.35	0.00	0.00	2.84	2.5
NNE	3.01	1.42	1.95	0.71	0.00	0.00	7.09	2.7
NE	1.60	0.35	0.18	0.00	0.00	0.00	2.13	1.6
ENE	2.48	0.18	0.53	0.00	0.00	0.00	3.19	1.8
E	1.60	0.35	1.06	0.00	0.00	0.00	3.01	2.4
ESE	4.43	3.72	4.08	1.42	0.00	0.00	13.65	2.9
SE	4.79	2.48	2.48	1.06	0.00	0.00	10.82	2.6
SSE	2.48	0.89	1.06	0.00	0.00	0.00	4.43	2.0
S	1.60	0.35	0.00	0.00	0.00	0.00	1.95	1.7
SSW	1.77	0.53	0.18	0.35	0.00	0.00	2.84	2.2
SW	2.48	1.06	0.18	0.53	0.00	0.00	4.26	2.1
WSW	3.19	6.74	7.45	0.71	0.00	0.00	18.09	2.9
W	2.84	2.48	6.21	0.35	0.00	0.00	11.88	3.0
WNW	1.60	1.60	1.06	0.18	0.00	0.00	4.43	2.4
NW	2.84	0.89	0.89	0.35	0.00	0.00	4.96	2.3
NNW	2.66	0.71	0.71	0.35	0.00	0.00	4.43	2.1
TOTAL	40.78	24.11	28.72	6.38	0.00	0.00	100.00	2.6

20684

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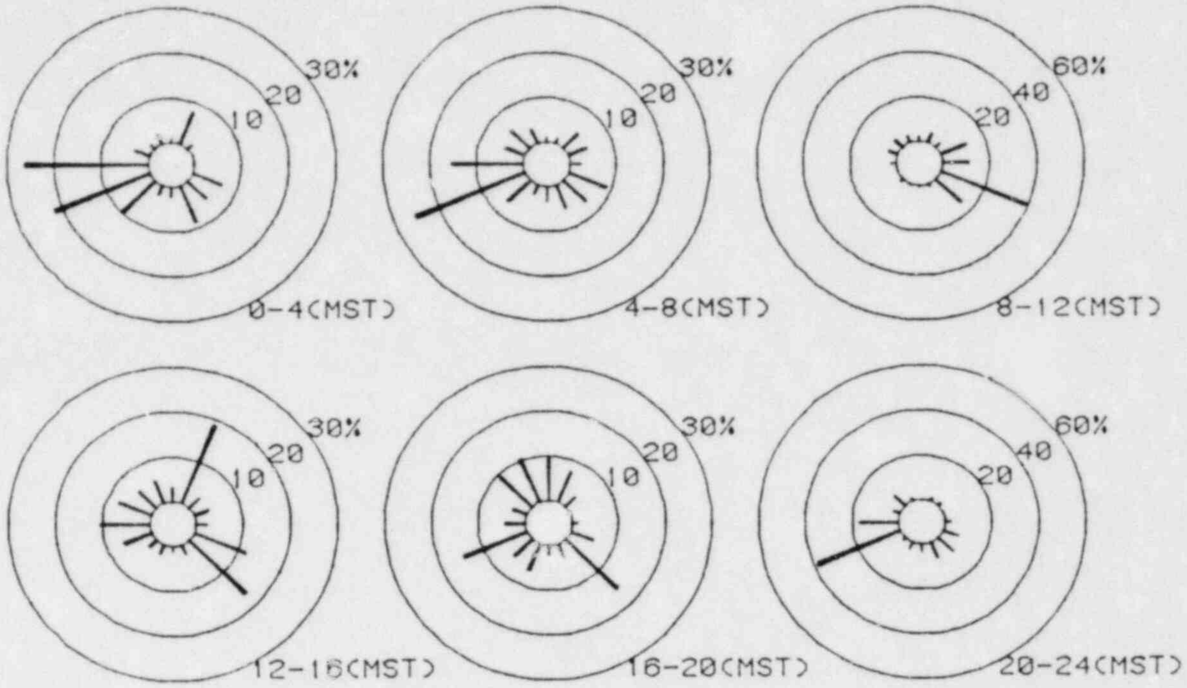
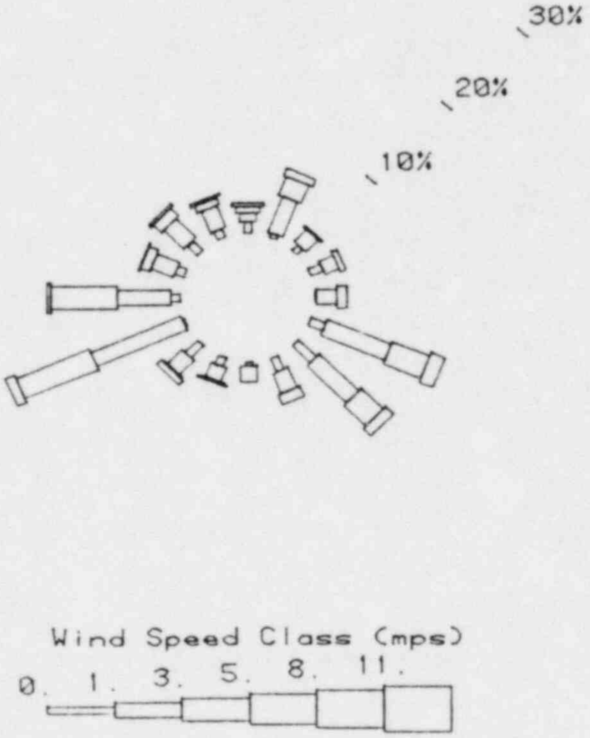
DIURNAL WIND DIRECTION ROSES



WIND SPEED AND DIRECTION ROSE



Copperton August 1981 Wind Rose

20684

WYOMING MINERAL CORPORATION
COPPERTON SITE

040085850400

WIND ROSE DATA ANALYSIS

FROM SEP. 1 1981 THROUGH SEP. 30 1981

(DATA ANALYZED FOR 0000 HOURS THROUGH 2400 HOURS)

FREQUENCY OF OCCURENCE OF WIND SPEED BY DIRECTION

	+------WIND SPEED CLASSES (MPS)-------+							
DIRECTION	0-2	2-3	3-5	5-8	8-11	>11	TOTAL	AVERAGE WIND SPEED
N	2.84	2.05	1.26	0.47	0.00	0.00	6.62	2.4
NNE	3.79	2.84	5.21	0.63	0.00	0.00	12.46	2.8
NE	2.68	0.95	0.79	0.00	0.00	0.00	4.42	1.9
ENE	2.21	0.16	0.00	0.00	0.00	0.00	2.37	1.3
E	3.00	0.00	0.00	0.00	0.00	0.00	3.00	1.2
ESE	7.26	1.10	1.26	0.47	0.00	0.00	10.09	1.9
SE	4.10	0.63	1.58	0.32	0.00	0.00	6.62	2.3
SSE	1.74	0.00	0.00	0.00	0.00	0.00	1.74	0.9
S	0.63	0.00	0.00	0.00	0.00	0.00	0.63	0.9
SSW	1.10	0.16	0.00	0.00	0.00	0.00	1.26	0.7
SW	1.26	0.16	0.16	0.32	0.00	0.00	1.89	2.5
WSW	5.21	2.21	1.89	0.32	0.00	0.00	9.62	2.1
W	5.99	8.99	7.89	0.00	0.00	0.00	22.87	2.6
WNW	5.05	0.32	0.47	0.00	0.00	0.00	5.84	1.4
NW	3.47	0.95	0.32	0.32	0.00	0.00	5.05	1.7
NNW	3.31	0.95	1.10	0.16	0.00	0.00	5.52	2.2
TOTAL	53.63	21.45	21.92	3.00	0.00	0.00	100.00	2.2

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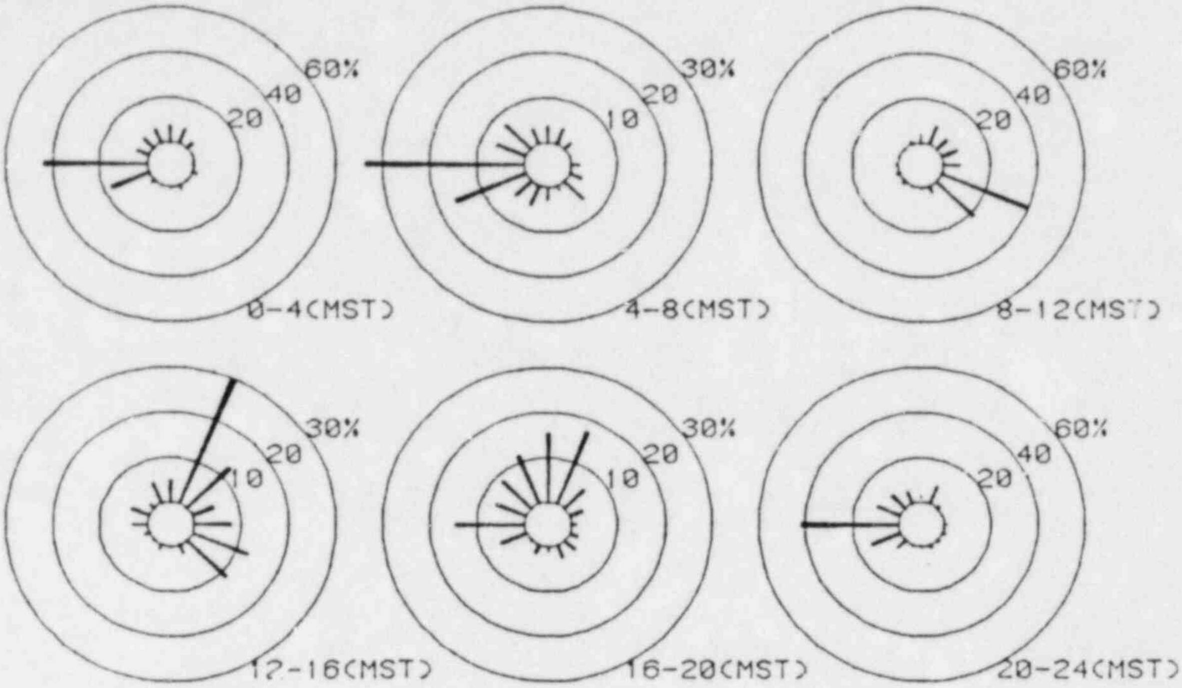
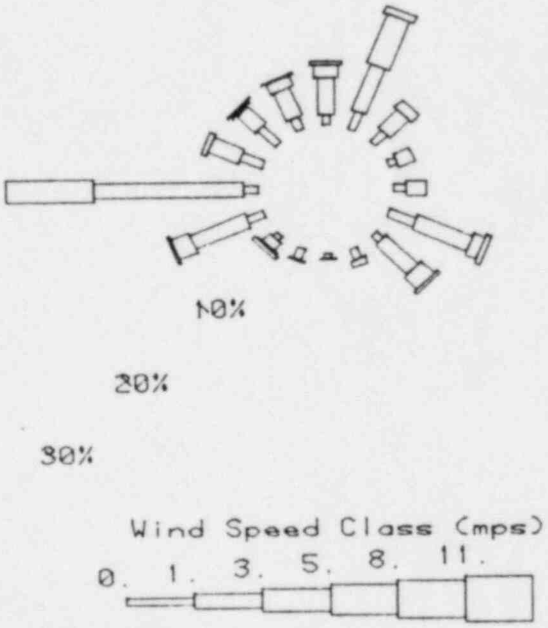
DIURNAL WIND DIRECTION ROSES



WIND SPEED AND DIRECTION ROSE



Copperton September 1981 Wind Rose

20684

WYOMING MINERAL CORPORATION
COPPERTON SITE

040085850400

WIND ROSE DATA ANALYSIS

FROM OCT. 1 1981 THROUGH OCT. 31 1981

(DATA ANALYZED FOR 0000 HOURS THROUGH 2400 HOURS)

FREQUENCY OF OCCURENCE OF WIND SPEED BY DIRECTION

	+------WIND SPEED CLASSES (MPS)-------+							AVERAGE WIND
DIRECTION	0-2	2-3	3-5	5-8	8-11	>11	TOTAL	SPEED
N	1.90	0.95	1.90	0.00	0.00	0.00	4.75	2.6
NNE	3.65	2.06	1.90	0.16	0.00	0.00	7.77	2.2
NE	2.54	1.43	0.00	0.00	0.00	0.00	3.96	1.8
ENE	3.01	0.63	0.32	0.00	0.00	0.00	3.96	1.8
E	2.69	0.95	0.16	0.00	0.00	0.00	3.80	1.6
ESE	5.71	1.27	3.17	0.79	0.00	0.00	10.94	2.5
SE	8.24	2.69	3.33	0.32	0.16	0.00	14.74	2.3
SSE	1.74	0.32	0.16	0.00	0.00	0.00	2.22	1.6
S	0.63	0.00	0.00	0.00	0.00	0.00	0.63	0.6
SSW	0.48	0.16	0.16	0.00	0.00	0.00	0.79	1.9
SW	0.63	0.48	0.48	0.00	0.00	0.00	1.58	2.3
WSW	4.12	1.90	1.43	0.16	0.00	0.00	7.61	2.2
W	9.19	8.56	4.75	0.00	0.00	0.00	22.50	2.2
WNW	4.28	0.79	0.00	0.00	0.00	0.00	5.07	1.4
NW	3.17	0.00	0.63	0.00	0.00	0.00	3.80	1.5
NNW	2.85	2.06	0.95	0.00	0.00	0.00	5.86	1.9
TOTAL	54.83	24.25	19.33	1.43	0.16	0.00	100.00	2.1

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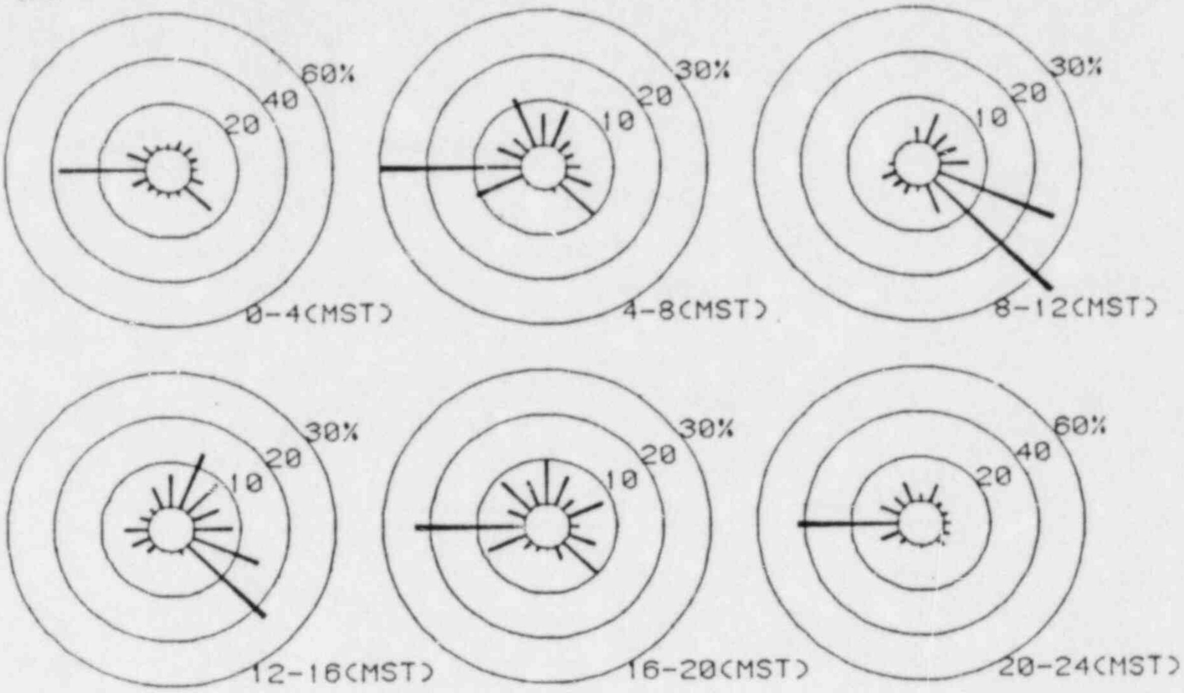
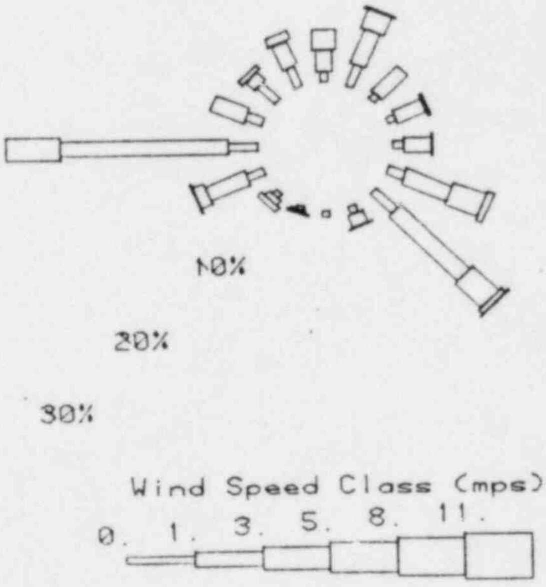
DIURNAL WIND DIRECTION ROSES



WIND SPEED AND DIRECTION ROSE



Copperton October 1981 Wind Rose

20682

WYOMING MINERAL CORPORATION
COPPERTON SITE

040085850400

WIND ROSE DATA ANALYSIS

FROM NOV. 1 1981 THROUGH NOV. 30 1981

(DATA ANALYZED FOR 0000 HOURS THROUGH 2400 HOURS)

FREQUENCY OF OCCURENCE OF WIND SPEED BY DIRECTION

	+------WIND SPEED CLASSES (MPS)-------+							AVERAGE WIND
DIRECTION	0-2	2-3	3-5	5-8	8-11	>11	TOTAL	SPEED
N	0.52	0.26	0.00	0.00	0.00	0.00	0.78	1.6
NNE	1.81	0.52	0.78	0.26	0.00	0.00	3.36	2.5
NE	2.07	0.26	0.00	0.00	0.00	0.00	2.33	1.4
ENE	2.58	0.00	0.26	0.00	0.00	0.00	2.84	1.2
E	1.03	0.00	0.26	0.00	0.00	0.00	1.29	2.2
ESE	2.84	0.26	0.52	0.52	0.00	0.00	4.13	2.3
SE	15.50	1.55	2.07	1.03	0.00	0.00	20.16	1.9
SSE	0.52	0.26	0.26	0.00	0.00	0.00	1.03	1.9
S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
SSW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
SW	1.29	0.52	0.00	0.00	0.00	0.00	1.81	1.6
WSW	7.24	4.91	0.78	0.00	0.00	0.00	12.92	1.9
W	12.66	17.05	2.33	0.00	0.00	0.00	32.04	2.2
WNW	6.72	0.78	1.29	0.00	0.00	0.00	8.79	1.5
NW	4.65	0.26	0.00	0.00	0.00	0.00	4.91	1.0
NNW	3.10	0.52	0.00	0.00	0.00	0.00	3.62	1.4
TOTAL	62.53	27.13	8.53	1.81	0.00	0.00	100.00	1.9

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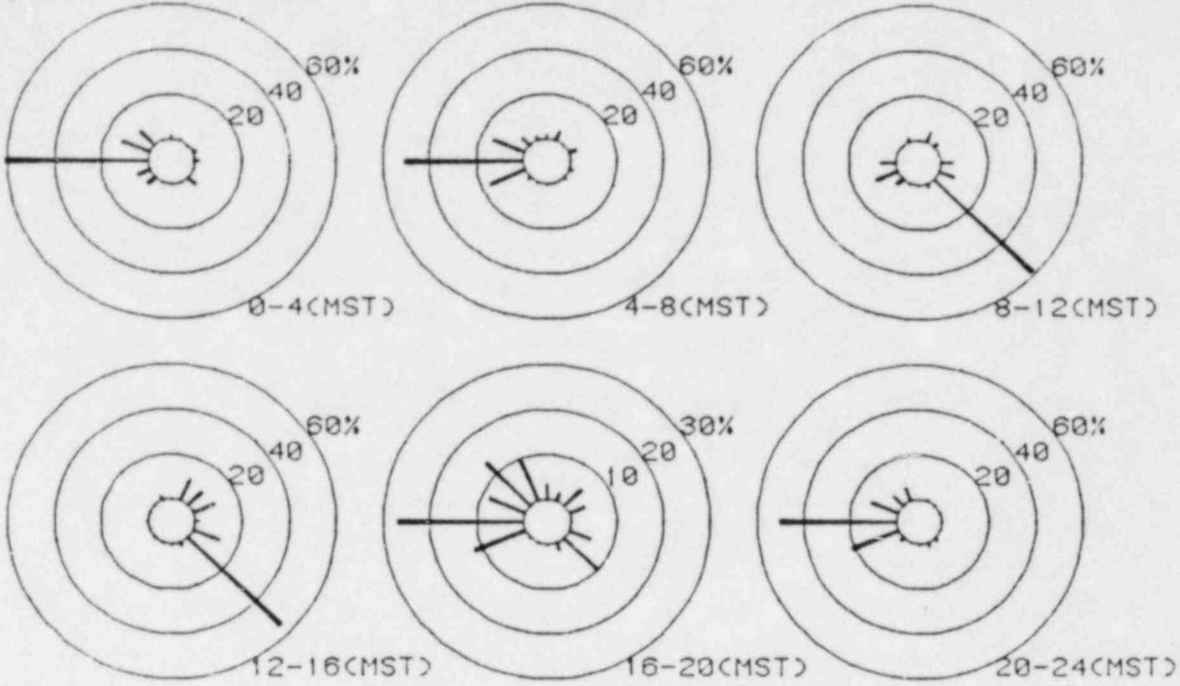
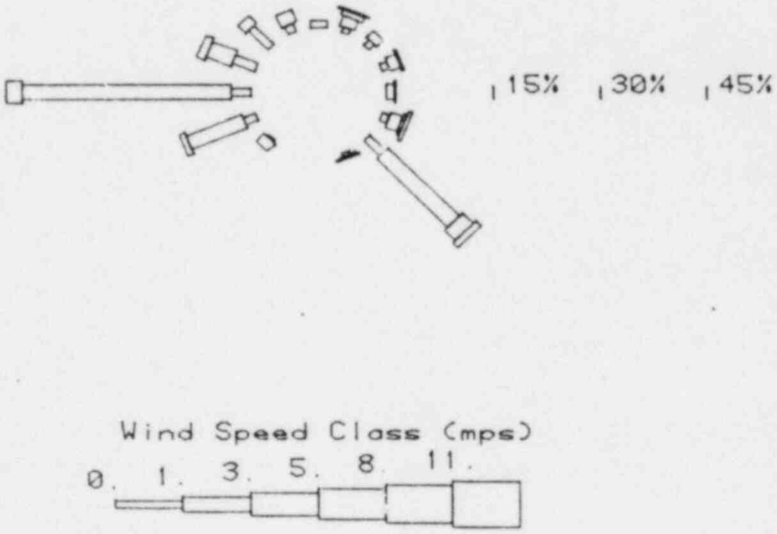
DIURNAL WIND DIRECTION ROSES



WIND SPEED AND DIRECTION ROSE



Copperton November 1981 Wind Rose

20684

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WYOMING MINERAL CORPORATION
COPPERTON SITE

WIND ROSE DATA ANALYSIS

FROM DEC. 1 1981 THROUGH DEC. 31 1981

(DATA ANALYZED FOR 0000 HOURS THROUGH 2400 HOURS)

FREQUENCY OF OCCURENCE OF WIND SPEED BY DIRECTION

	+------WIND SPEED CLASSES (MPS)-------+							AVERAGE WIND SPEED
DIRECTION	0-2	2-3	3-5	5-8	8-11	>11	TOTAL	
N	3.38	0.64	0.96	0.32	0.00	0.00	5.31	2.1
NNE	4.18	1.13	0.96	0.00	0.00	0.00	6.27	1.6
NE	2.73	0.80	0.16	0.00	0.00	0.00	3.70	1.3
ENE	2.89	0.16	0.00	0.00	0.00	0.00	3.05	0.9
E	1.45	0.00	0.00	0.00	0.00	0.00	1.45	0.6
ESE	4.34	1.45	0.00	0.00	0.00	0.00	5.79	1.3
SE	8.04	1.77	1.13	0.00	0.00	0.00	10.93	1.5
SSE	2.25	0.80	0.96	0.48	0.00	0.00	4.50	2.4
S	2.25	0.00	0.00	0.00	0.00	0.00	2.25	0.6
SSW	1.29	0.00	0.00	0.00	0.00	0.00	1.29	0.5
SW	1.29	0.00	0.00	0.00	0.00	0.00	1.29	0.6
WSW	4.66	1.29	0.16	0.00	0.00	0.00	6.11	1.4
W	10.93	7.40	0.80	0.32	0.00	0.00	19.45	1.9
WNW	7.40	1.13	0.96	0.48	0.16	0.00	10.13	1.8
NW	3.86	1.93	3.22	2.89	0.00	0.00	11.90	3.2
NNW	4.82	1.13	0.64	0.00	0.00	0.00	6.59	1.5
TOTAL	65.76	19.61	9.97	4.50	0.16	0.00	100.00	1.8

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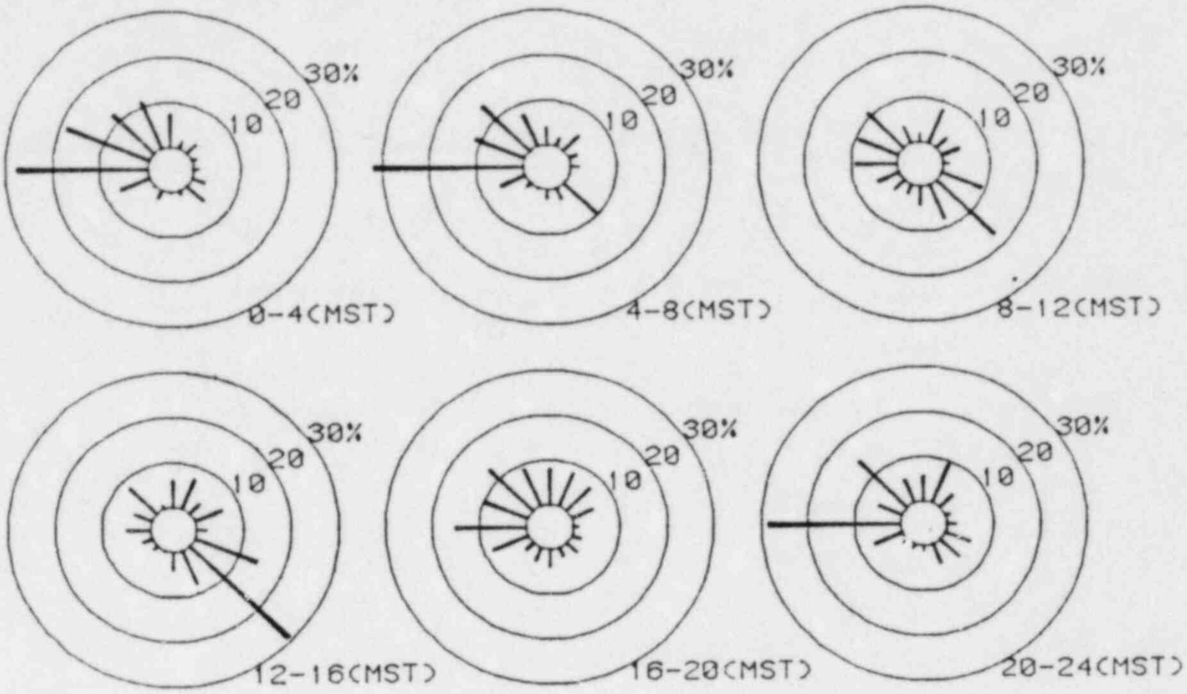
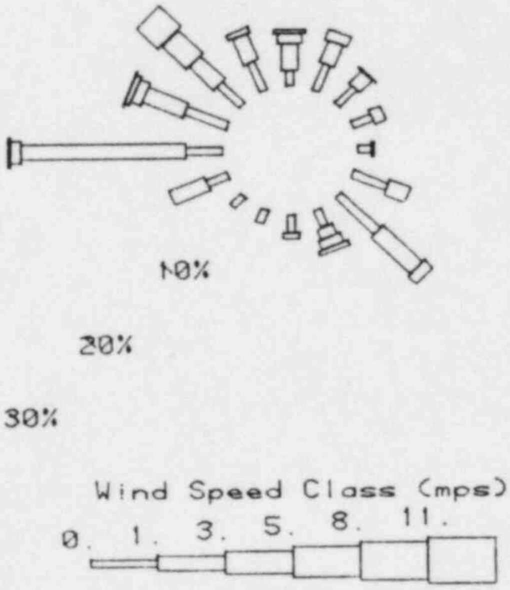
DIURNAL WIND DIRECTION ROSES



WIND SPEED AND DIRECTION ROSE



Copperton December 1981 Wind Rose

20684

WYOMING MINERAL CORPORATION
COPPERTON SITE

040085850400

WIND ROSE DATA ANALYSIS

FROM JULY 1 1981 THROUGH DEC. 31 1981

(DATA ANALYZED FOR 0000 HOURS THROUGH 2400 HOURS)

FREQUENCY OF OCCURENCE OF WIND SPEED BY DIRECTION

	+------WIND SPEED CLASSES (MPS)-------+							
DIRECTION	0-2	2-3	3-5	5-8	8-11	>11	TOTAL	AVERAGE WIND SPEED
N	2.02	0.83	1.03	0.26	0.00	0.00	4.14	2.4
NNE	3.18	1.61	2.12	0.32	0.00	0.00	7.22	2.4
NE	2.22	0.74	0.22	0.00	0.00	0.00	3.18	1.6
ENE	2.50	0.22	0.19	0.00	0.00	0.00	2.92	1.4
E	2.05	0.26	0.26	0.00	0.00	0.00	2.57	1.5
ESE	4.75	1.48	1.70	0.58	0.00	0.00	8.51	2.3
SE	7.13	1.99	2.66	1.00	0.03	0.00	12.81	2.4
SSE	1.93	0.61	0.61	0.16	0.00	0.00	3.31	2.1
S	1.12	0.13	0.03	0.00	0.00	0.00	1.28	1.2
SSW	1.25	0.26	0.16	0.06	0.00	0.00	1.73	1.5
SW	1.64	0.71	0.51	0.16	0.00	0.00	3.02	2.1
WSW	4.91	3.34	2.66	0.26	0.00	0.00	11.17	2.3
W	7.58	7.93	4.46	0.19	0.03	0.00	20.19	2.3
WNW	4.78	0.93	0.74	0.13	0.03	0.00	6.61	1.7
NW	3.47	0.80	1.06	0.71	0.00	0.00	6.04	2.3
NNW	3.24	1.19	0.77	0.10	0.00	0.00	5.30	1.9
TOTAL	53.77	23.02	19.20	3.92	0.10	0.00	100.00	2.2

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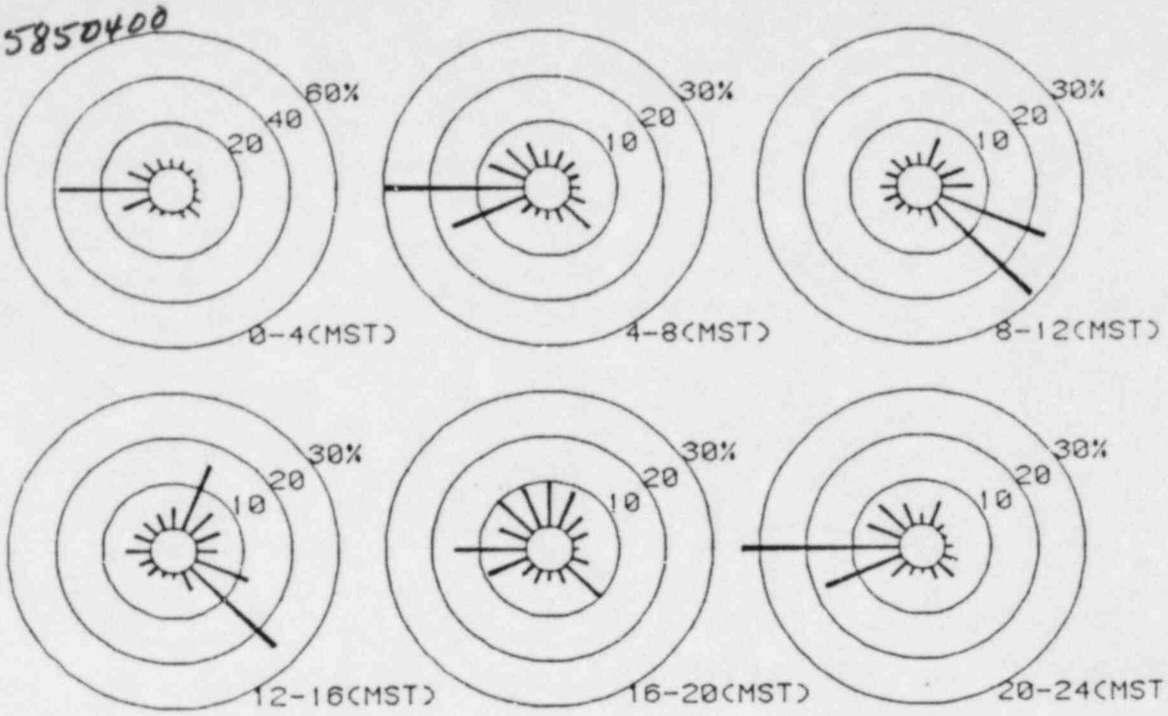
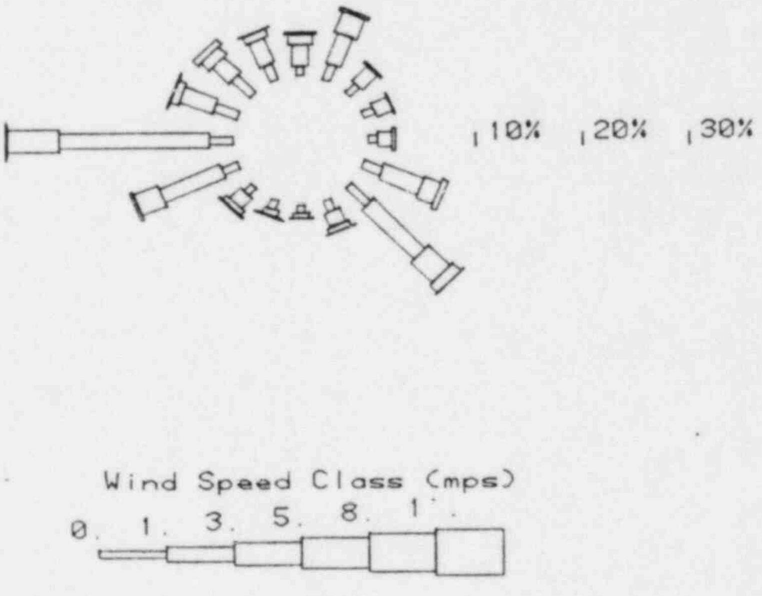


WIND SPEED AND DIRECTION ROSE



Copperton July - December 1981 Wind Rose

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APPENDIX C

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JOINT FREQUENCY DISTRIBUTIONS

***

(This Appendix has not been
included due to its size.
Data is available upon request)

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APPENDIX D-1

ECOLOGY

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TABLE OF CONTENTS

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0400858504OO

ENVIRONMENTAL STATEMENT ON A PROPOSED URANIUM RECOVERY OPERATION SITE

Prepared For

Wyoming Mineral Corporation

by

Personnel of the Departments

of

Veterinary Science, Biology, and Wildlife Science

Utah Agricultural Experiment Station
Utah State University
Logan, Utah 84322

July 15, 1976

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INTRODUCTION

This report describes biological conditions at and surrounding the site of a proposed uranium recovery operation in southwestern Salt Lake County, Utah during June of 1976. The site proper is a small parcel of land near 40,000 square feet in size. The plot is located on a bench or bluff on the west side of Copperton, Utah. The site is north and approximately 50 feet above the principle highway to the Copperton open pit mine. The highway and bluff form the south boundary of the site. A gravel road leaves the highway at the east end of the site and travels north-westerly to form the east and north boundaries. The west boundary is a chain link fence. The site proper and its geographic relationship to surrounding features are shown in Figures 1 and 2.

One report (Section A) is a biological statement regarding wildlife reported to inhabit the area as well as species actually observed on survey trips. Statements regarding animal habitat characteristics of the area are also given.

Because of the lack of botanical mobility, the botanical survey was limited to the immediate site area. The botanical survey report is given as Section B.

Photographs are presented in Section C to represent the site area and surrounding terrain from different directions as recorded in June 1976.

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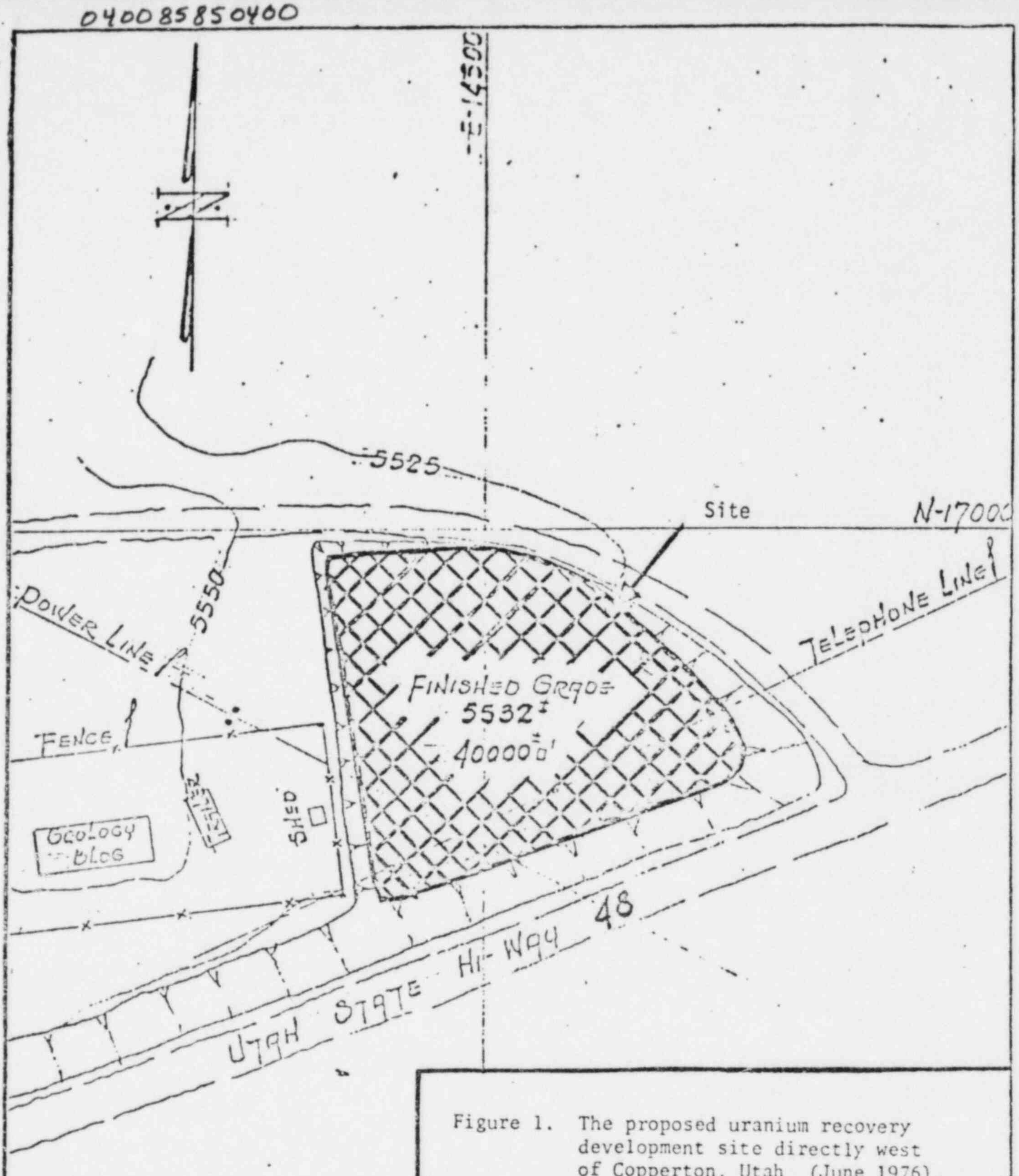

Figure 1. The proposed uranium recovery development site directly west of Copperton, Utah (June 1976).

WYOMING MINERAL CORP.

PROPOSED PLANT SITE — #6

KENNECOTT
COPPER
CORPORATION
UTAH COPPER DIVISION
MINES PLANT
ENGINEERING OFFICE
BINGHAM CANYON, UTAH

Drawn: Cth	Date 3-10-76	Checked	Date	Scale 1"=100'0	Drawing No. EXHIBIT · 2	Rev.

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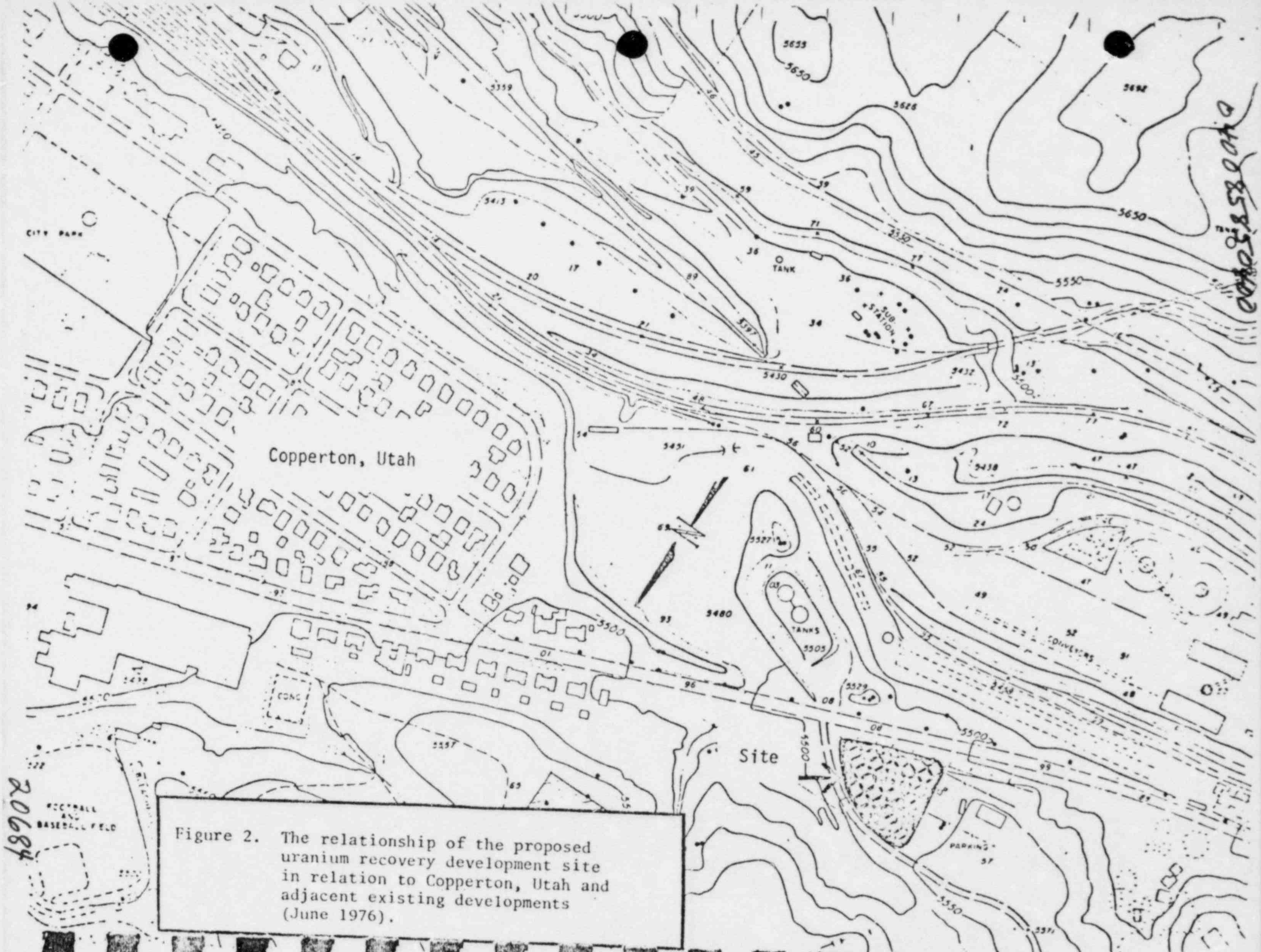

Figure 2. The relationship of the proposed uranium recovery development site in relation to Copperton, Utah and adjacent existing developments (June 1976).

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The biological reports conclude with statements on probable effects of construction of the proposed industrial operation on vegetation and animal populations in the area.

This report is submitted by James L. Shupe and Arland E. Olson of the Veterinary Science Department; Jessop B. Low and Gar W. Workman of the Department of Wildlife Sciences, and Arthur H. Holmgren and Leila M. Shultz of the Biology Department, Utah State University, Logan, Utah 84322.

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SECTION A

Biological Statement

Proposed site

The site itself is in close proximity to an industrial and small residential area. Consequently, this is not considered prime or even poor wildlife habitat because of its small size and proximity to roads and other developments. Presently the site area is partially covered by cinders and has a sparce vegetative cover consisting mainly of annuals and perennial forbes. Immediately adjacent to the site is sage brush (*Artemisia* supp.), rabbitbrush (*Chrysothamnus viscidiflorus*), cheat grass (*Bromus tectorum*), gum-plant (*Grindelia squarrosa*), filaree (*Erodium circutarium*), sunflower (*Helianthus annuus*), clover (*Melilotus* supp.), elm (*Ulmus* sp.), Russian thistle (*Salsola* sp.), and other forbes and annual plants. The development of this site would restrict all wildlife use on the area which even at the present time is not considered to be very significant.

The wildlife presently found on or immediately surrounding this proposed construction site includes numerous lizards, pocket gophers on the western end of the area in some discarded utility poles. All other wildlife species observed at the site live or come from adjacent areas and are not dependent on the site for food, cover, nesting, or brooding areas.

The wildlife observed or known to be on or immediately near the site because of their distribution are listed in Table 1. The number of birds known from the Oquirrh Mountains is 122 kinds, of which 53

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Table 1. Vertebrate animals found on proposed uranium recovery development site.

Common Name	Scientific Name	Relative Abundance**
*Kingbird	*Tyrannus sp.*	C
*Starling	*Sturnus vulgaris*	C
*California gull	*Larus californicus*	U
House sparrow	*Passer domesticus*	C
House finch	*Carpodacus mexicanus*	C
Horned lark	*Eremophila alpestrus*	U
Bullock's Oriole	*Icterus bullockii*	U
Western meadowlark	*Sturnella neglecta*	U
Mouring dove	*Zenaidura macroura*	U
Black-billed magpie	*Pica pica*	U
Turkey valture	*Cathartes aura*	U
Sparrow hawk	*Falco sparverius*	U
*Rock squirrel	*Citellus variegatus*	U
*Pocket gopher	*Thomomys sp.*	C
Deer mice	*Peromyscus sp.*	U
Racer	*Coluber constrictor*	U
Gopher snake	*Pituophis melanoleucus*	U
*Western fence lizard	*Sceloporus occidentalis*	A
*Short-horned lizard	*Phrynosoma douglassi*	U

*Indicates observation of animal or signs left by that species.

**A= abundant, C = common, U = uncommon.

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are permanent residents, 58 are summer residents, 9 are winter visitants, and 2 are transient (Behle and Perry, 1975). Many of the birds were observed in the near vicinity or were actually crossing the area in flight. Power lines and telephone lines running across the site offer perching for small bird life.

Adjacent site--west

A series of transects approximately a mile long were walked in directions away from the proposed construction site to record animal life and their signs. Additional records were made of animal life along back roads leading away from the site. Approximate route of the transects traversed is indicated on Figure 3.

To the west of the proposed site the hills rise rather abruptly. Most of this area is composed of bare hillsides which have resulted from previous mining practices. The only wildlife cover found in this area is found on some of the side hills and canyon or gully bottoms. The ground cover in this area included sagebrush, oakbrush (*Quercus gambelii*) and numerous annual plants. From a wildlife species variety and abundance standpoint, this is the poorest of the adjacent areas. Primary use of this area by wildlife would be in their movements from one area to another. An example of this activity would be principally in birds which travel across the adjacent areas. Such travel by animals is not necessarily limited to birds but may include small mammals and reptiles.

Adjacent site--north

This area consists primarily of rolling hills covered with big sagebrush, rabbitbrush, matchweed (*Gutierrezia* sp.), oakbrush (in draws

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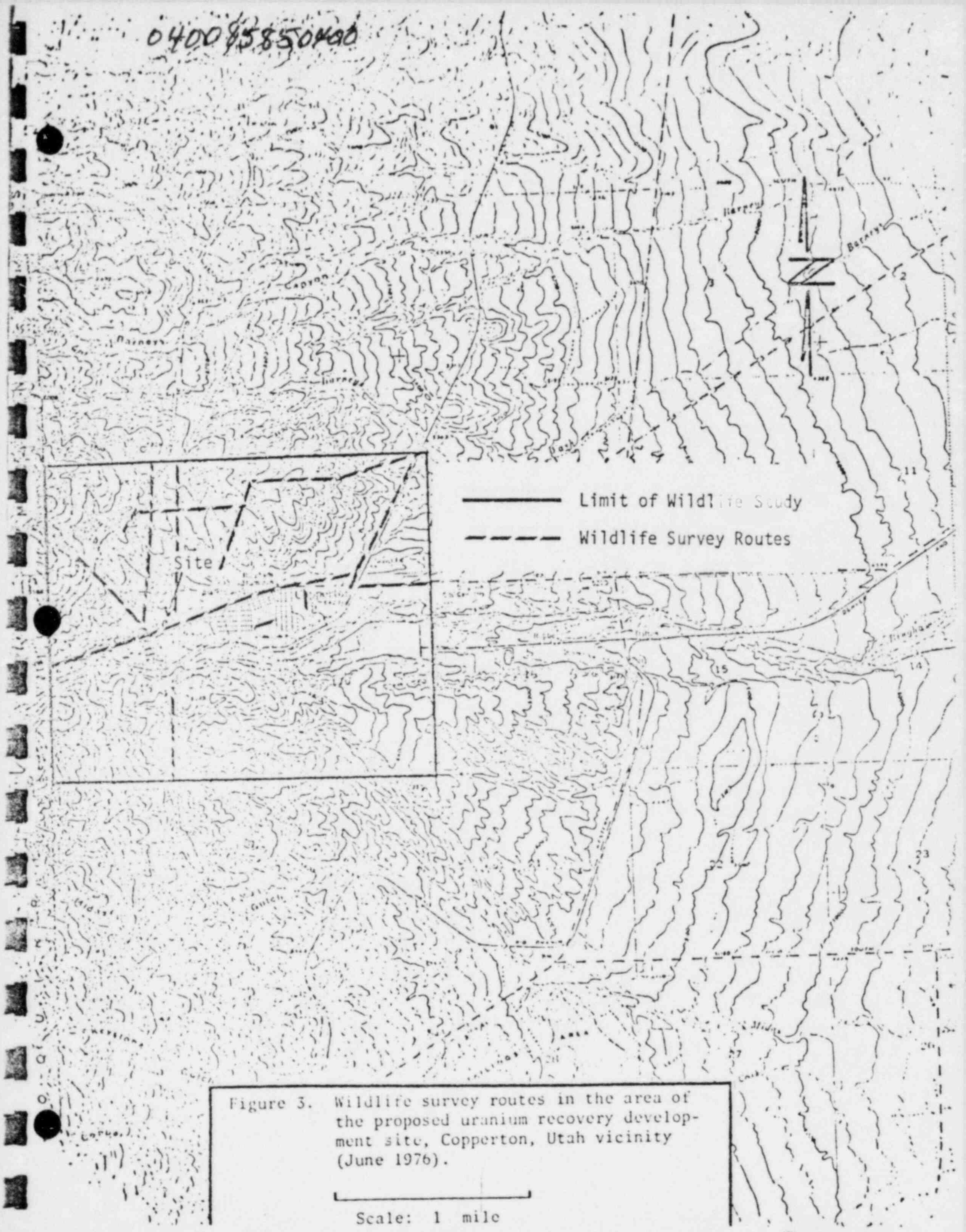

Figure 3. Wildlife survey routes in the area of the proposed uranium recovery development site, Copperton, Utah vicinity (June 1976).

Scale: 1 mile

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or gullies), mountain mahogany (*Cercocarpus ledifolius*), Utah juniper (*Juniperus utahensis*), cliffrose (*Cowania stansburiana)*, service berry (*Amelanchier alnifolia*), bitter brush (*Purshia tridentata*), numerous annual and perennial grasses, and annual forbes and browse are found in this area. No surface water is found in this area during most of the year although rains would bring water down the numerous draws and gullies.

Wildlife species here include lizards, snakes, mice, squirrels, rabbits, coyotes, deer, birds of prey, doves, chuckar partiridges, pheasants, magpies, starlings, meadowlarks, pinyon jays, sparrows, orioles, kingbirds, and hawks (see Tables 2 and 3 for complete list). This area has a variety and abund of wildlife species that normally inhabit dry hill country. This area is also shared by domestic sheep.

Adjacent site--east

The city of Copperton is situated immediately to the east of the proposed development area. Copperton is an attractive community and contains well developed yards which have numerous shrubs and shade trees. In the center of town there is a city park with an abundance of large trees. This environment contains a habitat that is favorable to the protection and propagation of a great diversity of small bird life.

Some of the bird life of this area includes wild canaries, hummingbirds, starlings, English sparrows, orioles, robins, chickadees, kingbirds, and many other species (Table 3). These birds are abundant and may at times, because of their proximity to the proposed development area, fly over or near the proposed construction site itself. Other forms of wildlife such as larger game and non-game species are not abundant here because of the city environment.

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Table 2. Checklist of possible mammals found within one mile of the proposed uranium recovery development site. List developed from Durrant (1952).

Common Name	Scientific Name
Myotis	*Myotis sp.*
Silvery-haired bat	*Lasionycteris noctivagans*
Big brown bat	*Eptesicus fuscus*
Hoary bat	*Lasiurus cinereus*
Mexican free-tailed bat	*Tadarida mexicana*
White-tailed jackrabbit	*Lepus townsendii*
*Black-tailed jackrabbit	*Lepus californicus*
*Nuttall cottontail	*Sylvilagus nuttalli*
Pigmy rabbit	*Sylvilagus idahoensis*
Townsend ground squirrel	*Citellus townsendii*
*Rock squirrel	*Citellus variegatus*
*Antelope ground squirrel	*Citellus leucurus*
*Least chipmunk	*Eutamias minimus*
Say chipmunk	*Eutamias quadrivittatus*
*Northern pocket gopher	*Thomomys talpoides*
Botta pocket gopher	*Thomomys bottae*
Great Basin pocket mouse	*Perognathus parvlis*
Ord kangaroo rat	*Dipodomys ordii*
Western harvest mouse	*Reithrodontomys megalotis*
Deer mouse	*Peromyscus maniculatus*
Pinon mouse	*Peromyscus truei*
Norther grasshopper mouse	*Onychomys leucogaster*
Desert wood rat	*Neotoma lepida*
Bushy-tailed wood rat	*Neotoma cinerea*

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Table 2 (con't)

Common Name	Scientific Name
Sagebrush vole	*Laguras curtatus*
Pennsylvanian meadow mouse	*Microtus pennsylvanicus*
Montane meadow mouse	*Microtus montanus*
Long-tailed meadow mouse	*Microtus longicaudus*
Big jumping mouse	*Zapus princeps*
House mouse	*Mus musculus*
Norway rat	*Rattus norvegus*
*Porcupine	*Erethizon dorsatum*
Coyote	*Canis latrans*
Kit fox	*Vulpes macrotis*
Long-tailed weasel	*Mustela frenata*
*Badger	*Taxidea taxus*
Striped skunk	*Mephitus mephitus*
Spotted skunk	*Spilogale gracilis*
Bobcat	*Lynx rufus*
*Mule deer	*Odocoileus hemionus*

*Species observed or signs noted

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Table 3. List of possible birds found within one mile of the proposed uranium recovery development site. List developed from Woodbury et al. (1949), and Breeding Bird Survey (1974).

Common Name	Scientific Name
*Turkey vulture	*Cathartes aura*
Goshawk	*Accipiter gentilis*
Sharp-shinned hawk	*Accipiter striatus*
Cooper's hawk	*Accipiter cooperii*
Red-tailed hawk	*Buteo jamaicensis*
Red-shouldered hawk	*Buteo kineatus*
Swainson's hawk	*Buteo swainsoni*
Rough-legged hawk	*Buteo lagopus*
Ferruginous hawk	*Buteo regalis*
*Golden eagle	*Aguila chrysaetos*
Bald eagle	*Haliaeetus leucooephalus*
Marsh hawk	*Circus cyaneus*
*Prairie falcon	*Falco mexicanus*
Pigeon hawk	*Falco columbarius*
*Sparrow hawk	*Falco sparverius*
*Ring-necked pheasant	*Phasianus colchicus*
*Chuckar	*Alectoris graeca*
*Gray partridge	*Perdix perdix*
*California quail	*Lophortyx californicus*
*California gull	*Larus californicus*
*Mourning dove	*Zenaidura macroura*
Barn owl	*Tyto alba*
Screech owl	*Otus asio*
Great horned owl	*Bubo virginianus*

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Table 3 (Cont.)

Common Name	Scientific Name
Long-eared owl	*Asio otus*
Short-eared owl	*Asio flammeus*
Poor-will	*Phalaenoptilus nuttallii*
Common nighthawk	*Chordeiles minor*
*Broad-tailed hummingbird	*Selasphorus platycercus*
*Hummingbird	*Archilochus spp.*
Yellow-shafted flicker	*Colaptes auratus*
Downy woodpecker	*Dendrocopos pubescens*
Red-shafted flicker	*Colaptes cafer*
Yellow-bellied sapsucker	*Sphyrapicus varius*
Western kingbird	*Tyrannus verticalis*
Flycatcher	*Empidonax sp.*
Willow flycatcher	*Empidonax traillii*
*Horned lark	*Eremophila alpestris*
Cliff swallow	*Petrochelidon pyrrhonota*
Violet-green swallow	*Tachycineta thalassina*
Tree swallow	*Iridoprocne bicolor*
*Black-billed magpie	*Pica pica*
Common raven	*Corvus corax*
Common crow	*Corvus brachyrhynchos*
Steller's jay	*Cyanocitta stelleri*
*Pinon jay	*Gymnorhinus cyanocaphala*
Sage thrasher	*Oreoscoptes montanus*
*Robin	*Turdus migratorius*
Hermit thrush	*Catharus guttatus*

Table 3 (con't.)

Common Name	Scientific Name
Mountain bluebird	*Sialia currucoides*
*Starling	*Sturnus vulgaris*
Warbling vireo	*Vireo gilvus*
MacGillivray's warbler	*Oporornis tolmiei*
Yellow-throated warbler	*Dendroica dominica*
Wilson's warbler	*Wilsonia pusilla*
House sparrow	*Passer domesticus*
Western meadowlark	*Sturnella neglecta*
Red-winged blackbird	*Agelaius phoeniceus*
Brewer's blackbird	*Euphagus cyanocephalus*
*Lazuli bunting	*Passerina amoena*
*Sage sparrow	*Amphisipiza belli*
*House finch	*Carpodacus mexicanus*
*American goldfinch	*Spinus tristis*
*Green-tailed towhee	*Chlorura chlorura*
*Vesper sparrow	*Pooecetes gramineus*
*Chipping sparrow	*Spizella passerina*
Mountain chickadee	*Parus gambeli*
House wren	*Troglodytes aedon*
Rufour-sided towhee	*Pipilo erythrophthalmus*
Gray-headed junco	*Junco caniceps*
White-crowned sparrow	*Zonotrichia leucophrys*
Song sparrow	*Melospiza melodia*

*Species observed

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Just east and north of Copperton are sagebrush flats and dry farm areas. It is here that it is possible to observe the prairie falcon, jackrabbits, pheasants, and other species more normally expected on these flat lands. However, most of these species are effectively isolated from the proposed uranium recovery development site by the town.

Adjacent site--south

Immediately south of the proposed area is a state highway to the open pit mine. Next to this is a channelized stream, Butterfield Creek, and a series of industrial settling ponds. Across the canyon to the south there are rolling hills which extend to the community of Lark.

The hills of this area are covered by sagebrush, rabbitbrush, grasses, Utah junipers, and oaks in uncultivated areas. Dry farming is practiced on the lower slopes and level areas of this section of the study area. This area provides good habitat for jays, doves, magpies, numerous species of small rodents, deer, and reptiles (see Tables 2, 3, 4, and Figure 3).

Because of restricted access, this area acts as a wildlife sanctuary of sorts. Also, some surface water is available in this area which further enhances the environment for wildlife.

The canyon road and stream barriers between the proposed site and this area probably restricts wildlife movement in the area of the site, except to birds which might fly over the site.

Endangered species

No rare or endangered species of wildlife are known to occur in this area. The only remote possibility would be in the case of the

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Table 4. List of possible reptiles found within one mile of the proposed uranium recovery development site. List developed from Woodbury (1931).

Common Name	Scientific Name
Brown shouldered uta	*Uta stansburiana*
Sagebrush swift	*Sceloporus graciosus*
*Short-horned toad	*Phyronosoma douglassi*
Desert horned toad	*Phyronosoma platyrohinos*
Desert whiptail lizard	*Cnemidophorus tesselatus*
*Western fence lizard	*Seloporus occidentalis*
*Blue racer	*Coluber constrictor*
Gopher snake	*Pituophis melanoleucus*
Western king snake	*Lampropeltis triangulum*
Garter snake	*Thamnophis sp.*
Rattlesnake	*Crotalis viridis*

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peregrine falcon (*Falco peregrinus*), where it is conceivable that one of these birds might fly over the area.

Summary

Because of the small size of the proposed uranium recovery operation development area and the lack of food and cover on this site, wildlife would not be adversely affected by the construction of the proposed uranium recovery operation. Also, no known endangered species of wildlife are living on this site or the surrounding area.

Although the site and general surrounding area is not "ideal" habitat for many wildlife species, it is inhabited by a number of different wildlife species. The projected list of potential wildlife found on the proposed site is presented in Table 1 while those in the surrounding area are presented for mammals in Table 2; birds in Table 3, and reptiles in Table 4.

Field notes on the surveys taken are available if desired. Literature cited and bibliographical references for further detailed reference are included in this report. The conclusion of this biological investigation is that the construction of the uranium recovery operation will cause little or no harm to wildlife of the general area surrounding the construction site.

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SECTION B

BOTANICAL SURVEY

Survey findings

The flora on the one-acre site may be grouped into five vegetation types. These types are numbered in agreement with the attached vegetation map. (Figure 4).

I. *Grindelia squarrosa - Melilotus alba* type

These species are the dominants among the annual weedy flora of the cinder pile which covers the major part of the plant site. *Grindelia squarrosa* comprises approximately 80% of the plant growth. The following is a complete list of species observed in area I:

		Common to types:
1.	*Atriplex patula* (Chenopodiaceae)	I
2.	*Bromus tectorum* (Poaceae)	I, II
3.	*Grindelia squarrosa* (Asteraceae)	I, II
4.	*Helianthus annuus* (Asteraceae)	I, II, IV
5.	*Kochia scoparia* (Chenopodiaceae)	I
6.	*Lactuca serriola* (Asteraceae)	I, II, III, IV
7.	*Melilotus alba* (Fabaceae)	I, II, IV, V
8.	*Melilotus officinalis* (Fabaceae)	I, II, IV
9.	*Mentzelia laevicaulis* (Loasaceae)	I
10.	*Phacelia leucophylla* (Hydrophyllaceae)	I
11.	*Physalis herterophylla* (Solanaceae)	I, II
12.	*Polygonum aviculare* (Polygonaceae)	I

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13.	*Polygonum buxiforme* (Polygonaceae)	I
14.	*Quercus gambelii* [Seedling] (Fagaceae)	I
15.	*Salsola kali* (Chenopodiaceae)	I

II. *Bromus tectorum* - *Alyssum minus* type

Vegetation type II is on a soil bank of scraped fill dirt, bordering the cinder pile to the South. This type consists primarily of weedy species.

		Common to types:
1.	*Alyssum minus* (Brassicaceae)	II, III, IV
2.	*Ambrosia psilostachya* (Asteraceae)	II, III, IV
3.	*Artemisia tridentata* (Asteraceae)	II, III
4.	*Bromus tectorum* (Poaceae)	I, II, III, IV
5.	*Camelina microcarpa* (Brassicaceae)	II
6.	*Chrysothmnus nauseosus* (Asteraceae)	II, III, IV, V
7.	*Erodium cicutarium* (Geraniaceae)	II
8.	*Gayophytum nuttallii* (Onagraceae)	II, IV
9.	*Grindelia squarrosa* (Asteraceae)	I, II
10.	*Lactuca serriola* (Asteraceae)	I, II, III, IV
11.	*Linaria dalmatica* (Scrophylariaceae)	II, IV
12.	*Melilotus alba* (Fabaceae)	I, II, IV, V
13.	*Melilotus officinalis* (Fabaceae)	I, II, IV
14.	*Oenothera pallida* (Onagraceae)	II
15.	*Physalis heterophylla* (Solanaceae)	II, I
16.	*Sitanion hystrix* (Poaceae)	II, IV
17.	*Tragopogon dubius* (Asteraceae)	II, III, IV

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III. *Chrysothamnus nauseosus* - Grassland type.

This area of rabbitbrush dominated vetetation is found in the flat area beneath the telephone right-of-way. This is the only vegetation on the site which indicates the normal vegetation for the area.

		Common to types:
1.	*Agropyron smithii* (Poaceae)	I, [illegible]
2.	*Alyssum minus* (Brassicaceae)	II, III, IV
3.	*Ambrosia psilostachya* (Asteraceae)	II, III, IV
4.	*Artemisia ludoviciana* (Asteraceae)	III
5.	*Artemisia tridentata* (Asteraceae)	II, III
6.	*Aristida longiseta* (Poaceae)	III
7.	*Astragalus diversifolius* (Fabaceae)	III
8.	*Astragalus utahensis* (Fabaceae)	III
9.	*Bromus tectorum* (Poaceae)	I, II, III, IV
10.	*Calochortus nuttallii* (Liliaceae)	III, IV
11.	*Chaenactis douglasii* (Asteraceae)	III
12.	*Chrysothmnus nauseosus* (Asteraceae)	II, III, IV, V
13.	*Cirsium scopulorum* (Asteraceae)	III
14.	*Crepis occidentalis* (Asteraceae)	III
15.	*Cymopterus longipes* (Umbelliferae)	III, IV
16.	*Erodium cicutarium* (Geraniaceae)	II, III
17.	*Gutierrezia sarothrae* (Asteraceae)	III, IV
18.	*Lactuca serriola* (Asteraceae)	I, II, III, IV
19.	*Aster chilensis* (Asteraceae)	III, IV
20.	*Oenothera caespitosa* (Onagraceae)	III
21.	*Opuntia polyacantha* (Cactaceae)	III

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22.	*Oryzopsis hymenoides* (Poaceae)	III
23.	*Phlox longifolia* (Poaceae)	III, IV
24.	*Poa pratensis* (Poaceae)	III, IV
25.	*Sitanion hystrix* (Poaceae)	II, III
26.	*Sporobolus cryptandrus* (Poaceae)	III
27.	*Solidago canadensis* (Asteraceae)	III, IV
28.	*Sphaeralcea coccinea* (Malvaceae)	III, IV
29.	*Tragopogon dubius* (Asteraceae)	II, III, IV

IV. *Ulmus siberica - Chrysothamnus nauseosus - Convolvulus arvensis* type. Vegetation type IV is found on raw soil banks on the NW side of the site. The slope is steep and the soil has been recently disturbed. As in vegetation types I, II, and V, the species are primarily weeds, but the steep slope provides a habitat for a few species not found in other areas on the site.

		Common to types:
1.	*Achillea millefolium* (Asteraceae)	IV
2.	*Alyssum minus* (Brassicaceae)	II, III, IV
3.	*Ambrosia psilostachya* (Asteraceae)	II, III, IV
4.	*Astragalus diversifolius* (Fabaceae)	III, IV
5.	*Astragalus utahensis* (Fabaceae)	III, IV
6.	*Bromus tectorum* (Poaceae)	I, II, III. IV
7.	*Calochortus nuttallii* (Liliaceae)	III, IV
8.	*Chrysothamnus nauseosus* (Asteraceae)	II, III, IV, V
9.	*Chrysothamnus viscidiflorus* (Asteraceae)	IV
10.	*Convolvulus arvensis* (Convolvulaceae)	IV
11.	*Cymopterus longipes* (Umbelliferae)	III, IV

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12. *Gayophytum nuttallii* (Onagraceae)	II, IV
13. *Grindelia squarrosa* (Asteraceae)	I, II, IV
14. *Gutierrezia sarothrae* (Asteraceae)	III, IV
15. *Lactuca serriola* (Asteraceae)	I, II, III, IV
16. *Linaria dalmatica* (Scrophulariaceae)	II, IV
17. *Melilotus alba* (Fabaceae)	I, II, IV, V
18. *Melilotus officinalis* (Fabaceae)	I, II, IV
19. *Aster chilensis* (Asteraceae)	III, IV
20. *Phlox longifolia* (Polemoniaceae)	III, IV
21. *Poa pratensis* (Poaceae)	III, IV
22. *Sitanion hystrix* (Poaceae)	II, IV
23. *Solidago canadensis* (Asteraceae)	III, IV
24. *Sphaeralcea coccinea* (Malvaceae)	III, IV
25. *Tragopogon dubius* (Asteraceae)	II, III, IV
26. *Ulmus siberica* (Ulmaceae)	IV

V. *Chrysothamus nauseosus* type

Vegetation type V is on a small distrubed area on the NE side of the cinder area. It is composed primarily of a few crowded shrubs of rabbitbrush.

	Common to types:
1. *Chrysothamnus nauseosus* (Asteraceae)	II, III, IV, V
2. *Melilotus alba* (Fabaceae)	I, II, IV, V
3. *Rumex crispus* (Polygonaceae)	V

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Conclusion

We feel that there would be no adverse effect on the environment with the establishment of the uranium recovery operation site indicated on the enclosed map. The area is contiguous to industrial development and the original vegetation has already been altered to such an extent that it consists mostly of weedy species. The original top soil has been pushed into an east-west ridge along the south end of the property and then replaced by a cap of fine cinder material. More than half of the area is destitute of vegetation and the mapped vegetation types consist of sparse vegetation.

The site and surrounding areas are already dedicated to industrial useage. We therefore reiterate our stand that there would be no adverse effect to development of the recovery operation on the porposed site.

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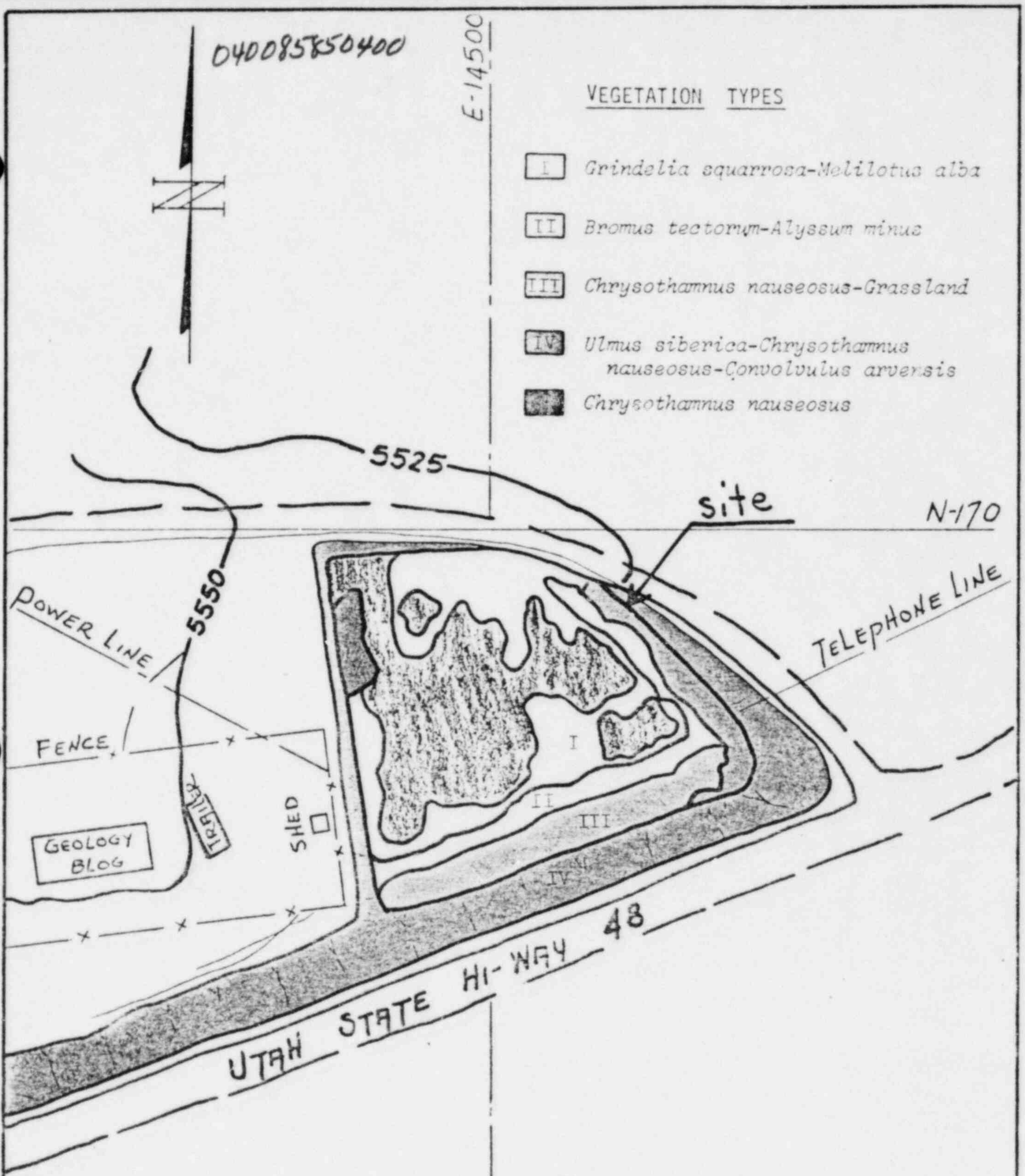

Figure 4.

WYOMING MINERAL CORP.

PROPOSED PLANT SITE #8

KENNECOTT
COPPER
CORPORATION
UTAH COPPER DIVISION
MINES PLANT
ENGINEERING OFFICE
BINGHAM CANYON, UTAH

DRAWN	DATE	CHECKED	DATE	SCALE	DRAWING NO.
Citt	3-10 76			1"=100'0	EXHIBIT

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SECTION C

Representative Recovery Operation Site Area Photographs

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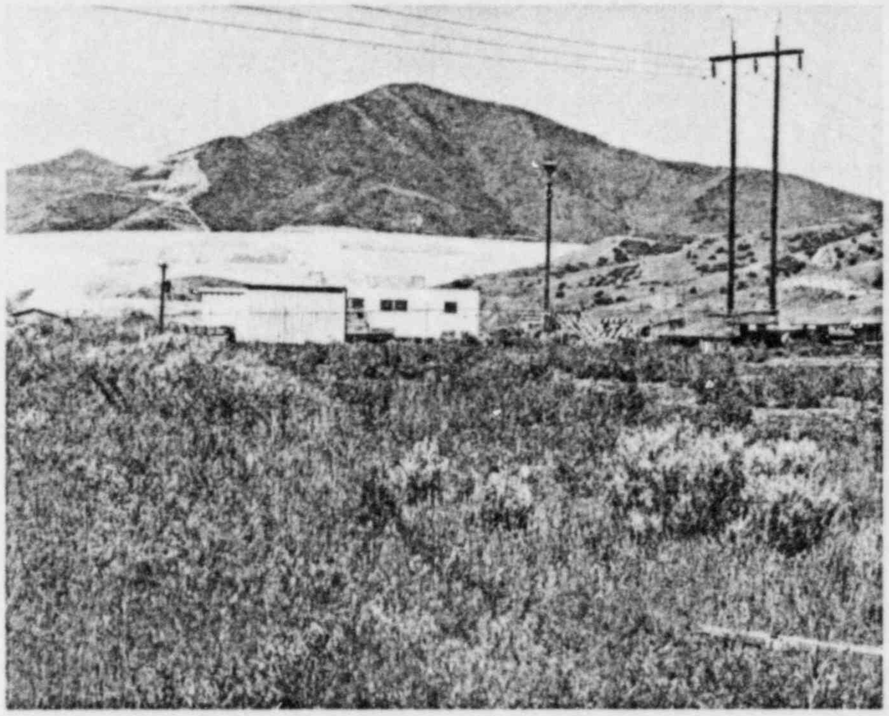

Figure 5. View on site proper, looking westerly and showing vegetation types and buildings beyond west fence.

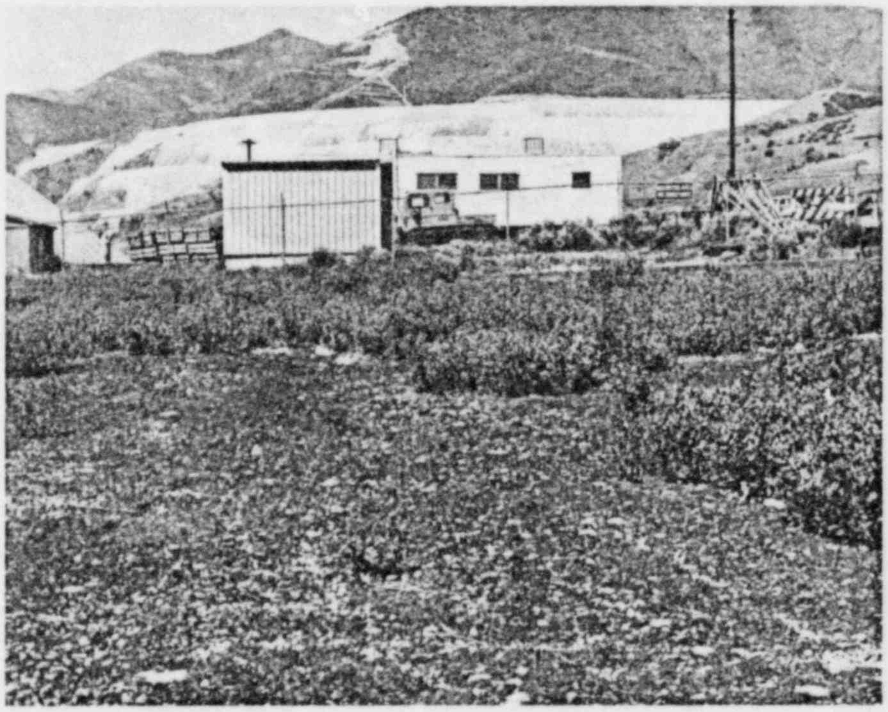

Figure 6. Looking west from center of site. Picture shows cinder cover and vegetation types.

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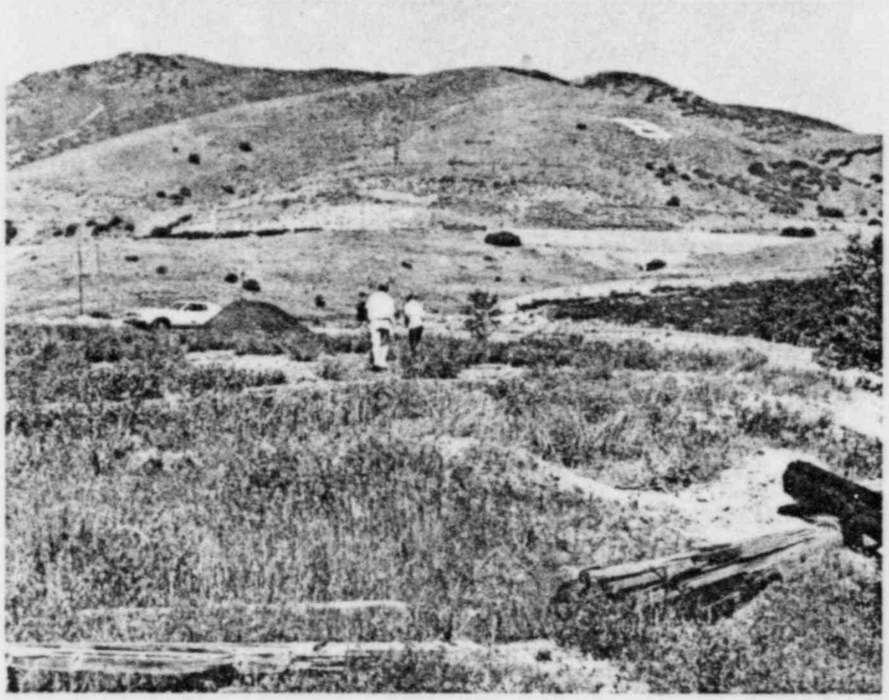

Figure 7. North-westerly view of site from near east end showing scattered vegetation, waste materials (utility poles and cinders) and hills beyond.

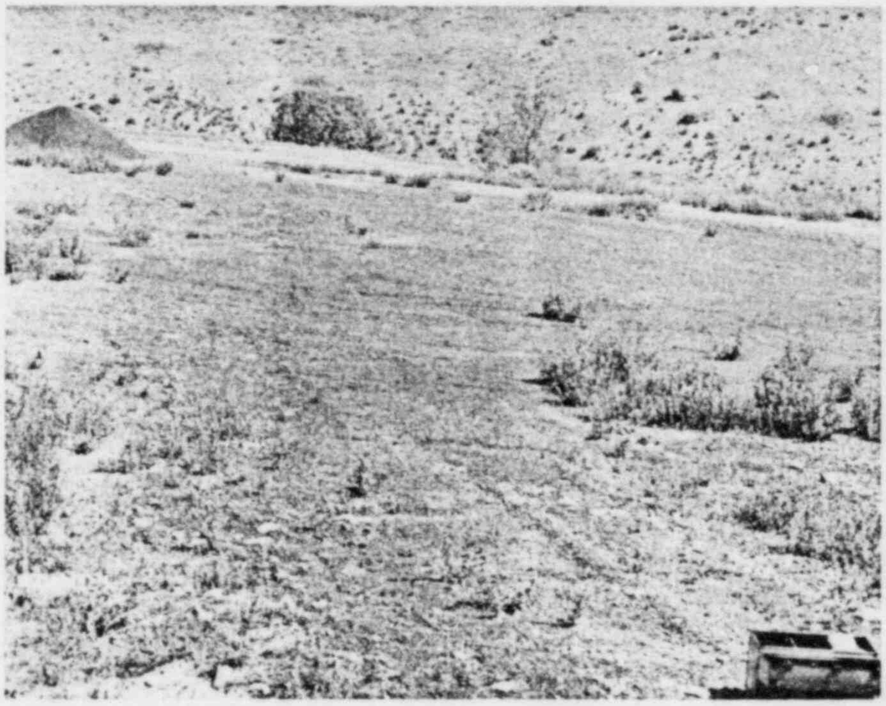

Figure 8. Looking north near west boundary of site. Cinder cover and sparse vegetation are evident.

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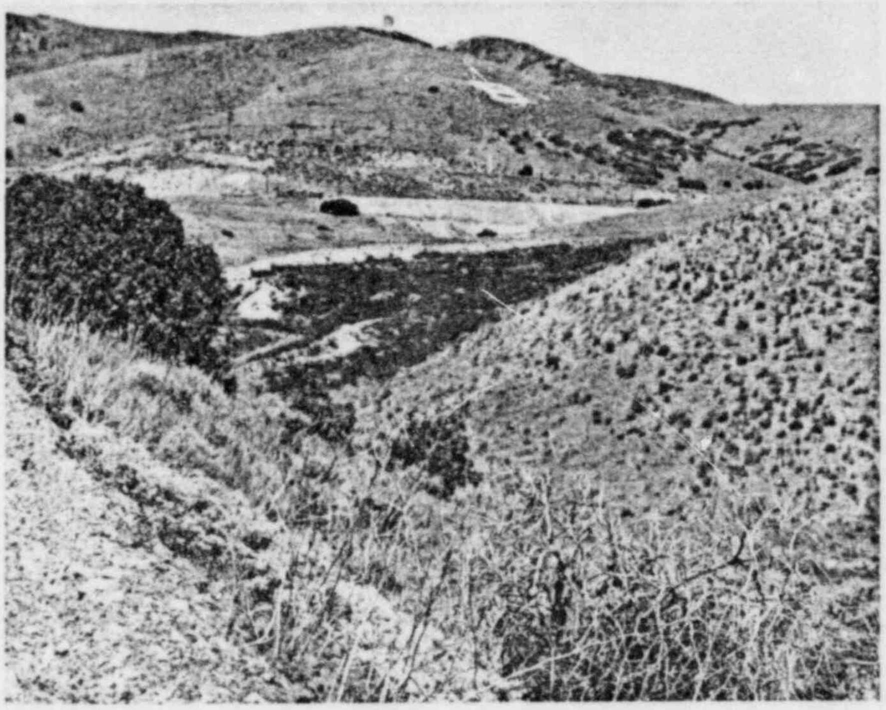

Figure 9. View looking north-westerly showing ravine adjacent to site and hills in background. Edge of gravel road forming east and north site boundaries is in lower left corner.

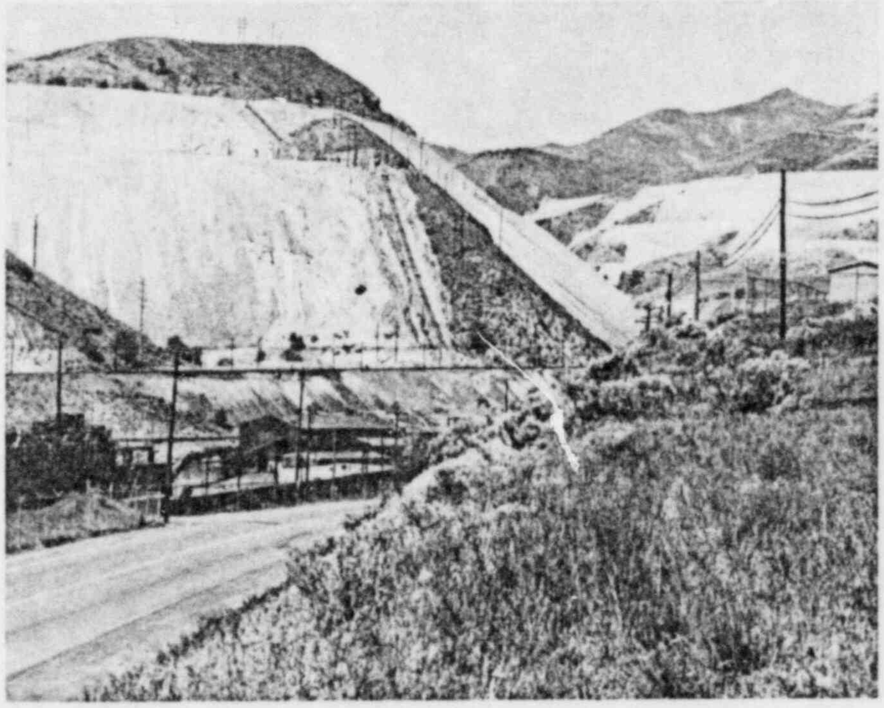

Figure 10. Westerly view from bluff overlooking highway on south side of site.

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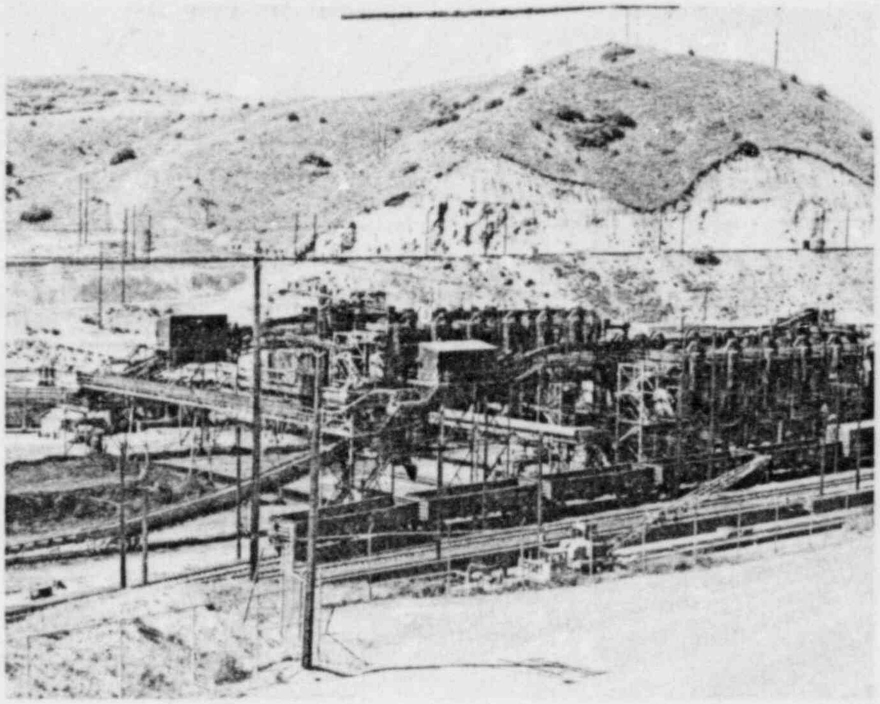

Figure 11. South-westerly view from southern site border overlooking highway, canyon and present industrial installations.

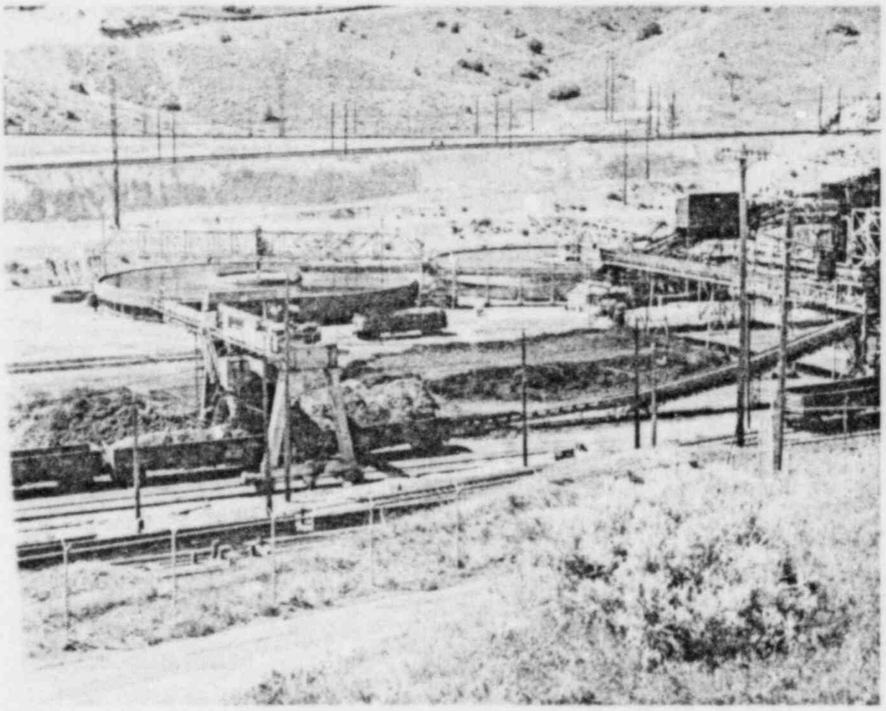

Figure 12. More southerly view than Figure 11 but showing same general features.

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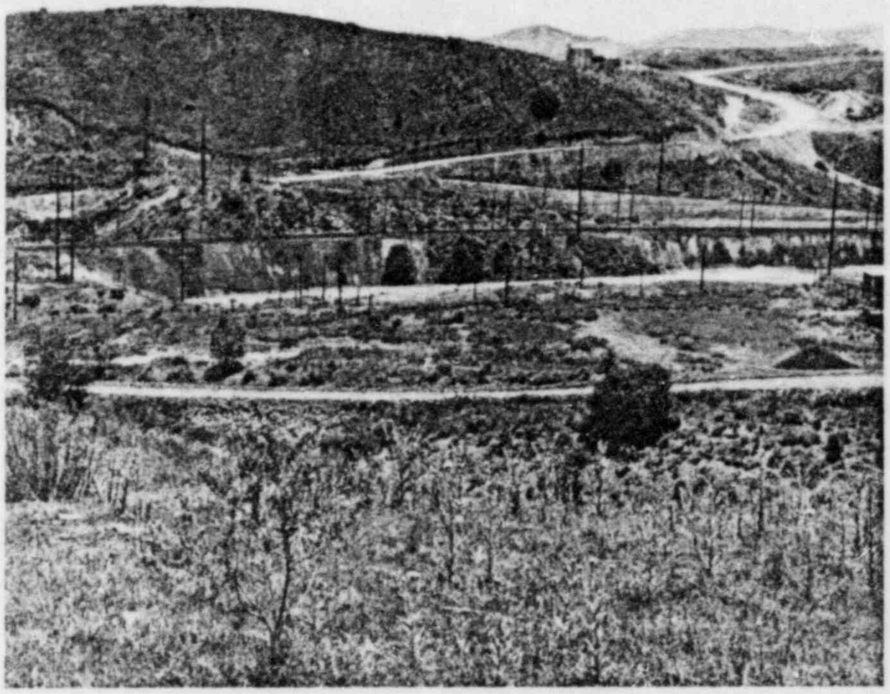

Figure 13. Site as seen from hill to the north. Fence that is west boundary is in extreme right center. Gravel road that is east and north boundary runs across center of photo.

Figure 14. Site and surrounding area as seen from higher on north hill than Figure 13. Site is seen in right center of photo.

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Figure 15. Overview of site area from north. The site itself is not visible but lies just over dark ridge and to the right of metal tanks in upper center of photo.

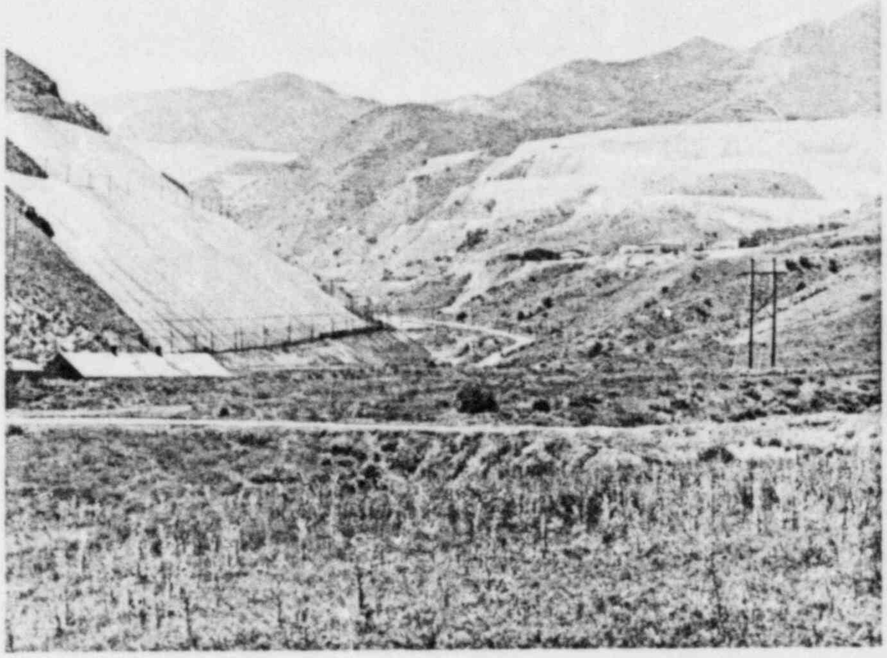

Figure 16. View to west, toward canyon from hill to north of site. This photo was taken from same site as Figure 13.

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Figure 17. View to north-east and Salt Lake City from hill approximately three-fourths of a mile north of site.

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SUMMARY AND CONCLUSIONS

Reports of botanical, wildlife, and wildlife habitat surveys at the proposed uranium recovery operation site and surrounding areas have been given. It is the unanimous opinion of the authors that changes in the ecological environment that have occurred before this time have had a much greater impact on the site area environment than will the proposed development. The relatively small proposed development appears to be insignificant in terms of environmental degradation when compared to changes that have preceded it.

It is our opinion that little environmental damage will directly result from the development of the proposed uranium recovery operation at the west edge of Copperton, Utah.

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APPENDIX D-2

ECOLOGY REASSESSMENT

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P O Box [illegible]
Salt Lake City Utah 84106
801 263 6123

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August 9, 1982

RECEIVED
AUG 12 1982
WYOMING MINERAL
CORPORATION

Kennecott

Mr. B. W. Conroy
Wyoming Mineral Corporation
3900 South Wadsworth Blvd.
Lakewood, Colorado 80235

Dear Mr. Conroy:

At the request of Wyoming Mineral Corporation, Kennecott's Utah Copper Division environmental engineering department has evaluated the impact of the Copperton uranium recovery site on wildlife and vegetation. The evaluation was conducted by Mr. P. M. Rokich, who is a recognized expert on vegetation and wildlife in the area of the Oquirrh Mountains where the Copperton uranium recovery site is located. The following is a summary of his evaluation:

> "A cursory evaluation of the Copperton uranium recovery site on August 1, 1982 revealed no apparent changes in vegetation or impacts on wildlife as a result of the construction or plant operation. This finding is in agreement with statements made on pages 17, 24 and 35 of Appendix D, Ecology, Environmental Statement on a Proposed Uranium Recovery Operation Site, July 15, 1976. Vegetation on hillsides adjacent to the plant site is undergoing successional changes as a result of such factors as climate and land use. In my estimation, these changes have resulted in improvement in the quality and quantity of wildlife and vegetation at the site and surrounding area since the July 15, 1976 statement."

Please advise if we can be of further assistance.

Yours very truly,

S. D. Taylor
Division Environmental Engineer

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APPENDIX E

ANALYTICAL PROCEDURES

REFERENCES

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1. Gross Alpha and Gross Beta

   "Determination of Alpha and Beta Emanations in Air Samples," Handbook of Analytical Methods, Lucius Pitkin, Inc., RMO-3008, pp. 184-185.

2. Iron

   "Determination of Total Iron in Ore Samples by Atomic Absorption," Handbook of Analytical Methods, Lucius Pitkin, Inc., p. 16.

3. Nitrogen (Ammonia)

   "Selective Ion Electrode Method," Methods for Chemical Analysis of Water and Wastewater, Methods Development and Quality Assurance Research Laboratory, National Environmental Research Center, Cincinnati, Ohio, U.S. EPA, EPA 625/6-74-003.

4. Radium

   "Radium," Standard Methods for the Examination of Water and Wastewater, APHA, AWWA and WPCF, 13th Edition, 1971, pp. 611-616.

5. Sodium

   "Determination of Sodium in Water Samples by Flame Emission," Handbook of Analytical Methods, Lucius Pitkin, Inc., pp. 132-133.

6. Specific Conductance

   "Specific Conductance," Standard Methods for the Examination of Water and Wastewater, APHA, AWWA and WPCF, 13th Edition, 1971, pp. 323-327.

7. Sulfate

   "Sulfate," Standard Methods for the Examination of Water and Wastewater, APHA, AWWA and WPCF, 13th Edition, 1971, pp. 330-335.

8. Thorium 230

   "Determination of Thorium 230 in Uranium Ore and Vegetation Samples," Handbook of Analytical Methods, Lucius Pitkin, Inc., pp. 196-198.

9. Uranium

   "Spectrophotometric Determination of Uranium Using" Topo "Extraction - DPM Colorimetric Method," Analysis of Essential Nuclear Reactor Materials, Edited by Clement Rodden, 1st Edition, 1964, pp. 111-113.

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