CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
1520 West Adams St.
Phoenix, AZ 85007
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

The following file is part of the

Arizona Department of Mines and Mineral Resources Mining Collection

ACCESS STATEMENT

These digitized collections are accessible for purposes of education and research. We have indicated what we know about copyright and rights of privacy, publicity, or trademark. Due to the nature of archival collections, we are not always able to identify this information. We are eager to hear from any rights owners, so that we may obtain accurate information. Upon request, we will remove material from public view while we address a rights issue.

CONSTRAINTS STATEMENT

The Arizona Geological Survey does not claim to control all rights for all materials in its collection. These rights include, but are not limited to: copyright, privacy rights, and cultural protection rights. The User hereby assumes all responsibility for obtaining any rights to use the material in excess of "fair use."

The Survey makes no intellectual property claims to the products created by individual authors in the manuscript collections, except when the author deeded those rights to the Survey or when those authors were employed by the State of Arizona and created intellectual products as a function of their official duties. The Survey does maintain property rights to the physical and digital representations of the works.

QUALITY STATEMENT

The Arizona Geological Survey is not responsible for the accuracy of the records, information, or opinions that may be contained in the files. The Survey collects, catalogs, and archives data on mineral properties regardless of its views of the veracity or accuracy of those data.

PRINTED: 11/21/2002

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES AZMILS DATA

PRIMARY NAME: ARIZONA ONE

ALTERNATE NAMES:

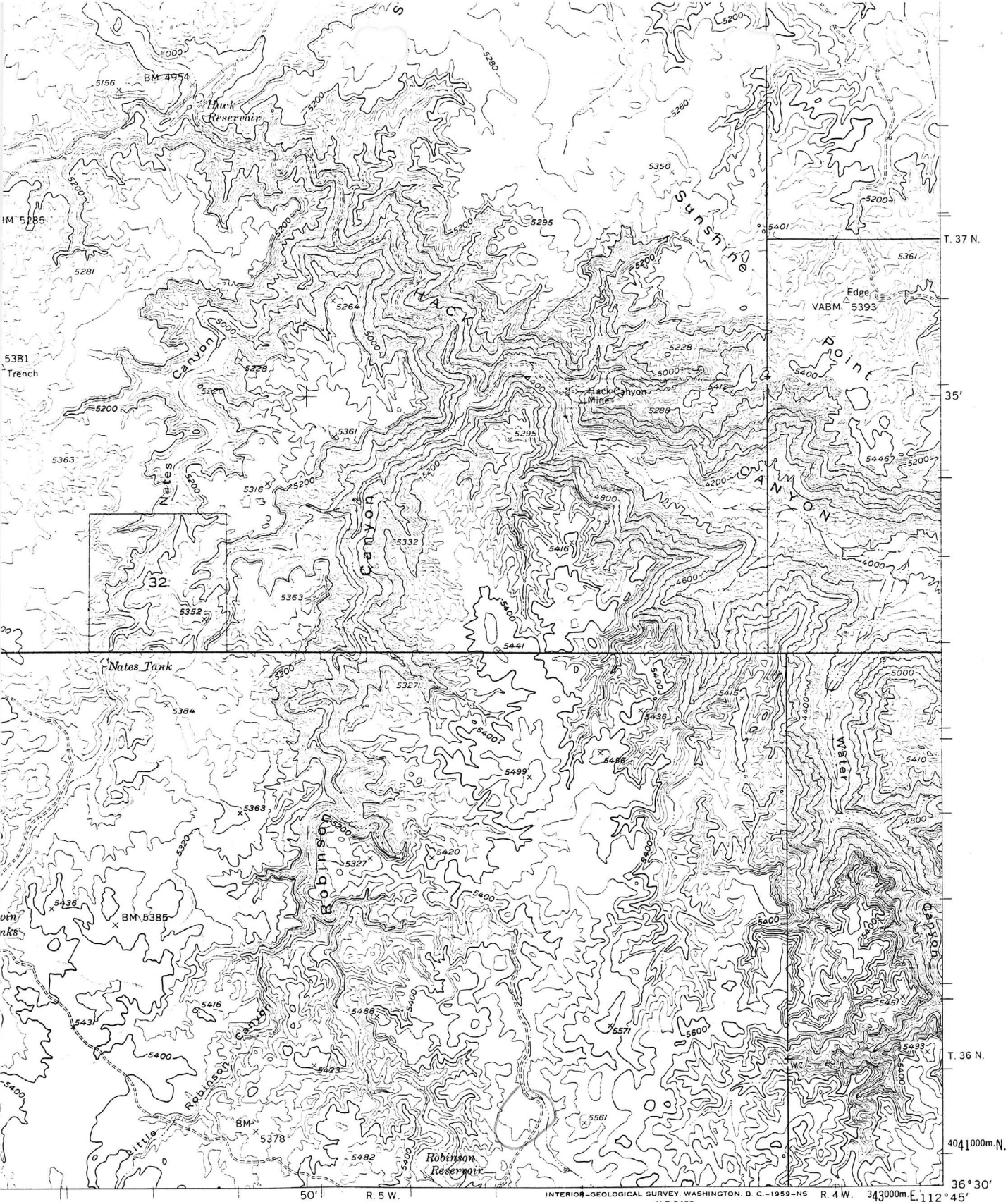
MOHAVE COUNTY MILS NUMBER: 755

LOCATION: TOWNSHIP 36 N RANGE 5 W SECTION 22 QUARTER E2
LATITUDE: N 36DEG 30MIN 27SEC LONGITUDE: W 112DEG 48MIN 21SEC
TOPO MAP NAME: ROBINSON CANYON - 7.5 MIN

CURRENT STATUS: EXP PROSPECT

COMMODITY:
URANIUM

BIBLIOGRAPHY:
ADMMR ARIZONA ONE FILE



INTERIOR-GEOLOGICAL SURVEY, WASHINGTON, D. C.-1959-NS
M R 5499

62500

2 3 4 MILES

12000 15000 18000 21000 FEET

3 4 5 KILOMETERS

VAL 40 FEET
SEA LEVEL

ARIZONA ONE
T36N R5W
Sec 22

ROAD CLASSIFICATION

Light-duty ——— Unimproved dirt - - - - - -

ARIZONA

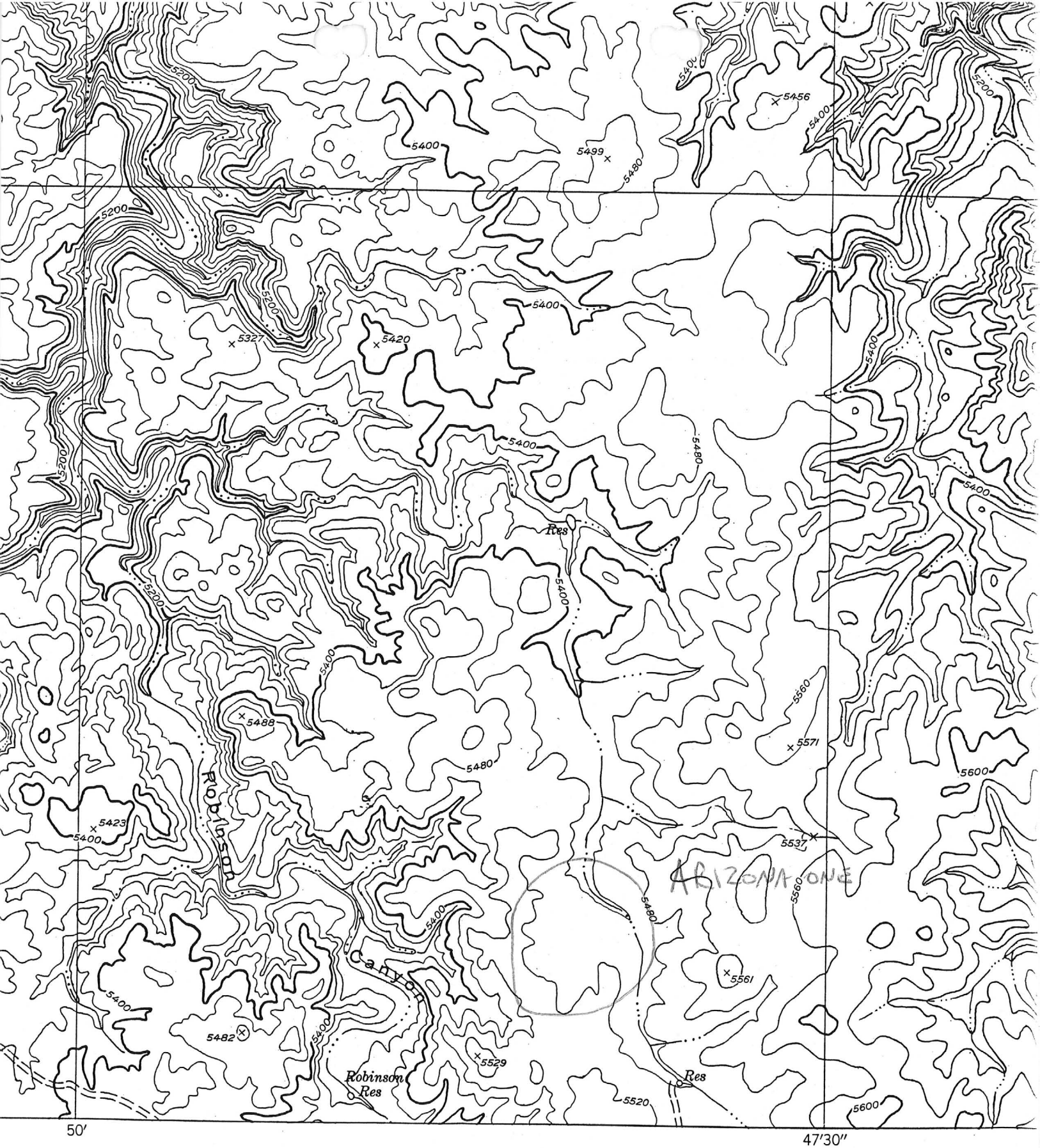
QUADRANGLE LOCATION

HEATON KNOLLS, ARIZ.
N3630—W11245/15

1954

9
MO

AL MAP ACCURACY STANDARDS
ER 2, COLORADO OR WASHINGTON 25, D. C.
ND SYMBOLS IS AVAILABLE ON REQUEST



50′ 47′30″

SCALE 1:24000

HEATON KNOLLS SE
T36N R5W Sec 22

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

1129

ABSTRACTED FROM ADMMR ACTIVE MINES DIRECTORY, 1992

Mohave County

ENERGY FUELS NUCLEAR INC.

P.O. Box 36, Fredonia, AZ 86022 - Phone 643-7321
Manager Mining Operations Roger Smith
Arizona One T36N R5W Sec. 22
Employees: 40 - Located 45 miles southwest of Fredonia -Underground uranium mine - Sinking shaft through March 1992.
Mine Superintendent John Stubblefield
Kanab North T38N R3W Sec. 17
Employees: 35 - Located 25 miles southwest of Fredonia - Underground uranium mine - Developed - On Standby.
Hermit T38N R4W Sec. 17
Located 30 miles southwest of Fredonia - Underground uranium mine - Developed - On standby.
Pine Nut T36N R4W Sec. 21
Located 45 miles southwest of Fredonia - Underground uranium mine - Developed - On standby.
Canyon T29N R3E Sec. 20
Located 45 miles north of Williams - Underground uranium mine - Development awaiting regulatory approval.

ABSTRACTED FROM ADMMR ACTIVE MINES DIRECTORY, 1991

ENERGY FUELS NUCLEAR INC.

P.O. Box 36, Fredonia, AZ 86022 - Phone 643-7321
Manager Mining Operations ..... Roger Smith
Arizona One T36N R5W Sec. 22
Employees: 15 - Located 45 miles southwest of Fredonia - Sinking shaft during 1991.
Mine Superintendent ..... John Stubblefield

ABSTRACTED FROM ADMMR ACTIVE MINES DIRECTORY, 1990

ENERGY FUELS NUCLEAR INC.

P.O. Box 36, Fredonia, AZ 86022 - Phone 643-7321
Manager Mining Operations ..... Roger Smith
Arizona One T36N R5W Sec. 22
Employees: 15 - Located 45 miles southwest of Fredonia - Sinking shaft during 1991.
Mine Superintendent ..... John Stubblefield

ABSTRACTED FROM ADMMR ACTIVE MINES DIRECTORY, 1989

ENERGY FUELS NUCLEAR INC.

P.O. Box 36, Fredonia 86022 - Phone 643-7321

Manager Mining Operations ..... Roger Smith

Arizona One T36N R5W Sec. 22

Employees 15 - Located 45 miles southwest of Fredonia - Anticipate development during 1990.

Mine Superintendent .....John Stubblefield

ARIZONA ONE MOHAVE COUNTY

NJN WR 11/27/87: Bob Toner, with Energy Fuel (file) reports that their new uranium breccia pipe discovery called Arizona One is located in T36N R5W Sec 22 E2. Further data on this property will become available in 1988 when the deposit is publically announced and permits applied for.

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES

VERBAL INFORMATION SUMMARY

1. Mine file: 1. HERMIT 2. PINE NUT 3. ARIZONA ONE
2. Mine name if different from above:
3. County: Mohave
4. Information from: Don Kilmore

   Company: Energy Fuels Nuclear Inc.

   Address: P.O. Box 36

   Fredonia, AZ 86022

   Phone: 643-7321

5. Summary of information received, comments, etc.:

Low prices for uranium ($14/lb) are causing Energy Fuels to restructure some of their operations. Development of the Hermit mine continues, while the Pine Nut deposit is developed but has been put on standby. No development is occurring at the Arizona One pipe at this time.

Date: October 23, 1988

Nyal J. Niemuth, Mining Engineer

HML
PIGEON #1 COCONINO
HACK'S CANYON URANIUM #1
ARIZONA ONE #1 MOHAVE
Staff
MOHAVE

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Fife Symington, Governor Russell F. Rhoades, Director

NOTICE OF THE PRELIMINARY DECISION TO ISSUE A PERMIT TRANSFER OF AN INDIVIDUAL AQUIFER PROTECTION PERMIT

Pursuant to Arizona Administrative Code, Title 18, Chapter 9, Article 1, the Director of the Arizona Department of Environmental Quality (ADEQ) intends to transfer the individual Aquifer Protection Permits (APP) issued to the following applicant:

Public Notice No. 1197APAZ On or about March 7, 1997

Energy Fuels Nuclear, Inc.
Three Park Central, Suite 900
1515 Arapahoe Street
Denver, CO 80202

Aquifer Protection Permit Numbers: P-100519, P-101898, P-102018

Responsibilities will be transferred to the following:

International Uranium (USA) Corporation
950 Independence Plaza
1050 17th Street
Denver, CO 80202

Aquifer Protection Permit Numbers: P-100519, P-101898, P-102018

On or about March 31, 1997, all Hack Canyon, Pigeon, and Arizona 1 Mine assets of Energy Fuels Nuclear, Inc. (EFN), will be transferred to a new company named International Uranium [USA] Corporation (IUC). IUC will own and operate the Hack Canyon, Pigeon, and Arizona 1 mines pursuant to the conditions of the current APPs. Financial assurance for closure and post closure costs were approved by the Water Permits Section - Mining Unit (WPS-MU) of the Arizona Department of Environmental Quality (ADEQ) on February 19, 1997.

Hack Canyon Mine

The Hack Canyon Mine site is located approximately 30 miles southwest of the city of Fredonia in Coconino County, Arizona over groundwater of the Kanab Plateau

Groundwater Basin in Township 37 N, Range 5 W, Section 26, N½, Gila and Salt River Base Line and Meridian.

Latitude 36° 35' 3.9" North
Longitude 112° 47' 50.9" West

The current permit authorizes clean closure of the Hack Canyon Mine, a former underground uranium mine. The site is classified as a clean closure pursuant to the APP. No mining operations are permitted at the mine site.

Pigeon Mine

The Pigeon Mine site is located approximately 15 miles south of the city of Fredonia in Coconino County, Arizona over groundwater of the Kanab Plateau Groundwater Basin in Township 38 N, Range 2 W, Section 5, SW¼ and N½, Gila and Salt River Base Line and Meridian.

Latitude 36° 43' 30" North
Longitude 112° 31' 30" West

The current permit authorizes clean closure of the Pigeon Mine, a former underground uranium mine. The site is classified as a clean closure pursuant to the APP. No mining operations are permitted at the mine site.

Arizona 1 Mine

The Arizona 1 Mine site is located approximately 35 miles southwest of Fredonia, approximately 12 north of the Grand Canyon, 9 miles west of Kanab Canyon, Mohave County, Arizona over groundwater of the Kanab Plateau Groundwater Basin in Township 36 north, Range 5 west, Sections 22 & 23, Salt River Base Line and Meridian.

Latitude 36° 45' 05" North
Longitude 112° 45' 03" West

The current permit authorizes IUC to operate the Arizona 1 Mine, an underground uranium mine. The site is classified as a temporary closure pursuant to the APP. No mining operations are permitted at the mine site.

The permits and related materials are available for public review Monday through Friday 8:00 a.m. to 5:00 p.m. at the Arizona Department of Environmental Quality, 3033 North Central Avenue, 4th Floor, Phoenix, Arizona 85012.

Persons may submit comments or request a public hearing on the proposed action, in writing, to Tony Bode, Arizona Department of Environmental Quality, 3033 North Central Avenue, Phoenix, Arizona 85012 within thirty (30) days from the date of this notice. Public hearing request must include the reason for such request.

ARIZONA ONE (P) MOHAVE CO.

HMC
K 9

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Fife Symington, Governor Edward Z. Fox, Director

NOTICE OF THE PRELIMINARY DECISION TO ISSUE AN INDIVIDUAL AQUIFER PROTECTION PERMIT

Pursuant to Arizona Administrative Code, Title 18, Chapter 9, Article 1, the Director of the Arizona Department of Environmental Quality intends to issue an individual Aquifer Protection Permit to the following applicant(s):

Public Notice No. 27-94AZAP On or about June 30, 1994
Arizona 1 Partners
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, Colorado 80202

Aquifer Protection Permit No. P-102008

The Energy Fuels Nuclear, Inc. - Arizona 1 Mine facility located approximately 35 miles southwest of Fredonia, Arizona, Mohave County, over groundwater of the Kanab Plateau groundwater basin in Township 36 N, range 5 W, Sections 23, - Gila and Salt River Base Line and Meridian Latitude 36° 45' 05.00", North, Longitude 112° 45' 03.00" West.

The proposed facility will operate as an underground uranium mine, consisting of a shaft and mine workings, and evaporation/runoff control storage pond with leak detection system., ore and waste rock storage pads, and two underground mine sumps, according to the approved plans and diagrams in the Aquifer Protection Permit (APP) application.

The facility is expected to produce uranium ore for a period of 5 to 7 years. No ore processing will occur at the facility; with all ore produced at the site trucked to a uranium processing facility in Blanding, Utah. Completion of the shaft and mine will be at a depth of approximately 1,600 feet below ground surface.

The facility's location is at a uranium ore deposit within and immediately adjacent to a breccia pipe. Stratigraphic units of interest at the site are the Hermit Shale and the breccia material. The shaft base will be within the Hermit Shale that has permeability's in the range of 7×10^{-10} cm/sec; the mine workings will be within the breccia pipe. The only significant water supply aquifer in the area is the Redwall-Muav aquifer, which is present approximately 3,000 feet below grade at the site.

The permit and related materials are available for public review Monday through Friday 8:00

a.m. to 5:00 p.m. at the Arizona Department of Environmental Quality, Aquifer Protection Program Section, 3033 N. Central Avenue, 4th Floor, Phoenix, AZ 85012 and at the Fredonia Public Library, Fredonia,
Arizona.

Persons may submit comments or request a public hearing on the proposed action, in writing, to Michael Wood, ADEQ, at P.O. Box 600, Phoenix, AZ 85001-0600 within thirty (30) days from the date of this notice. Public hearing request must include the reason for such request.

For further information contact Michael Wood, Environmental Program Specialist, Aquifer Protection Permit Program, Arizona Department of Environmental Quality at (602) 207-4585.

DECISION RECORD
ARIZONA 1 URANIUM MINE

AS-010-88-004

Energy Fuels Nuclear, Inc.
A Modification To Site No. 157
AS-010-84-78 P/A

MAY 9, 1988

ARIZONA ONE (f)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
ARIZONA STRIP DISTRICT OFFICE
390 NORTH 3050 EAST
ST. GEORGE, UTAH 84770

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

3800 (015)

MAY 9 1988

We are pleased to announce the decision to approve Energy Fuels Nuclear, Inc., Arizona 1 Mine Project,. This mine is on Public lands within the Arizona Strip and is approximately 35 miles southwest of Fredonia, Arizona.

EFN submitted this proposed Plan of Operations on February 1, 1988. Subsequently, the Bureau of Land Management (BLM) prepared an Environmental Assessment to determine if this proposed project would create undue of unnecessary degradation on the public lands. Additionally, BLM analyzed whether or not this project would create cumulative or synergistic impacts with other ongoing mines as well as with foreseeable actions in close proximity to the Arizona 1 Mine. As a result of the thirty day public comment period over 75 Environmental Assessments were sent out. Of those we received 13 constructive responses and two negative ones. We had over 280 total comments from both solicited and unsolicited people or groups all but 37 supported EFN's activities on the Arizona Strip. Based on the public comments, we enhanced the EA to facilitate the readers ability to better understand the analysis and the conclusions drawn.

Specifically, this proposal was found to be temporary in nature (7 to 10 years) and that it will not create undue or unnecessary degradation as identified in 43 CFR 3809 Surface Protection Regulations. Accordingly, BLM has prepared a Decision Record (DR) approving Alternative 3 (the Plan of Operations subject to Additional Mitigation) citing the rationale for the Decision, as well as mitigating measures that EFN must follow as a condition of approval. This Decision Record is enclosed for your convenience.

Thank you for your continued interest in the Arizona Strip and good sound Land Management decisions. If you have any additional questions on this project or other District related mineral issues, please call us at (801) 673-3545.

Sincerely,

G. William Lamb

G. William Lamb
District Manager

<!--StartFragment-->SUMMARY OF MINERALIZED MATERIAL

The following is a summary of the Registrant's estimates of the uranium and vanadium contained in mineral deposits on the Registrant's various properties, as of March 31, 2000:

Conventional Mines

<Table>
<Caption>

Project	Mineralized Tons	%U(3)O(8)	%V(2
<S> <C>	<C>	<C>	
Arizona Strip Mines(1,4)			
Arizona 1	80,000	0.652	
Canyon	108,000	0.903	
Pinenut	110,000	0.427	
Total Arizona Strip	298,000	0.660	
Colorado Plateau(2,4)	1,506,750	0.206	1
Bullfrog Project(3,4)	1,937,000	0.334	

</Table>

1) The reported mineralized tons for the Arizona Strip mines include extraction dilution losses (which includes mining dilution and mining recovery losses).

2) The reported mineralized tons for the Colorado Plateau mines include extraction dilution losses (which includes mining dilution and mining recovery losses).

3) The reported mineralized tons for the Bullfrog Project do not include extraction dilution losses.

4) Processing of uranium bearing material in a uranium/vanadium recovery mill normally results in recovery of approximately 94% to 98% of the contained uranium and 70% to 80% of the contained vanadium. Milling Recovery losses are not included in the foregoing table.

<!--EndFragment-->

ARIZONA I

EA No. AZ-010-88-004

THE ARIZONA I PROJECT
DRAFT ENVIRONMENTAL ASSESSMENT

A Major Modification to the Sin Project
Plan of Operations for Uranium Ore Extraction

Bureau of Land Management

PUBLIC LANDS ☆USA☆

USE ☆ SHARE ☆ APPRECIATE

ARIZONA I

EA No. AZ-010-88-004

THE ARIZONA I PROJECT
DRAFT ENVIRONMENTAL ASSESSMENT

A Major Modification to the Sin Project
Plan of Operations for Uranium Ore Extraction

Bureau of Land Management

PUBLIC LANDS ☆USA☆

USE ☆ SHARE ☆ APPRECIATE

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

BLDG. _____ MAIL STOP _____

DISTRICT MANAGER, AZ STRIP
BUREAU OF LAND MANAGEMENT
390 North 3050 East
St. George, Utah 84770

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

U.S.MAIL

POSTAGE AND FEES PAID
U.S. DEPARTMENT
OF THE INTERIOR
INT 415

MAIL
CLASS_____

Richard R. Beard, Mining Engin.
Dept. of Mines & Natural Res.
Mineral Building, Fairgrounds
Phoenix, AZ 85007

Form 1542-2
(January 1987)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
ARIZONA STRIP DISTRICT OFFICE
390 North 3050 East
St. George, Utah 84770

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:
8500 (015)

March 4, 1988

We are pleased to send you the enclosed Draft Environmental Assessment (DEA) for the proposed Arizona 1 Uranium Mine. This DEA was written in response to a Plan of Operation submitted by Energy Fuels Nuclear, Inc. (EFN) on January 26, 1988 and subsequently reviewed by BLM to determine if the plan was in conformance with 43 CFR 3809 regulations. Our Environmental Assessment process was begun on February 1, 1988. In addition to the proposal, the DEA evaluates alternatives that propose various modifications to the Plan, including the No Action Alternative.

In preparing the DEA, outside consultants were used to assess the existing environment and the anticipated impacts to Air Quality, Radiation, Cultural Resources, Wildlife Resources, Surface/Subsurface Hydrologic Impacts as well as Cumulative Impacts. While we have attempted to summarize these studies in the DEA, for the readers convenience, the studies are available on a limited basis at the Arizona Strip District (Phone No. (801) 673-3545).

A response, preferably in writing on the DEA will be required in order for you to remain on our active minerals mailing list. Comments are due by April 4, 1988 in order for them to be incorporated into the Final Environmental Assessment.

The Bureau will target May 4, 1988 for making a decision on this proposal. If you wish to be notified about that decision, please make that request with your submission.

Sincerely,

G. William Lamb
District Manager

Enclosure

Ref. EA. No. AZ-010-88-004
DR. No. AZ-010-88-020

DECISION RECORD
ARIZONA 1 URANIUM MINE PROPOSAL
ENERGY FUELS NUCLEAR, INC.
MODIFICATION TO SITE NO. 157 (AS-010-84-78 P/A)

I. PROPOSAL

Energy Fuels Nuclear, Inc., (EFN) proposes to expand the nature and duration of previously approved exploration activities at Site No. 157 (AS-010-84-78 P/A) in T. 36 N., R. 5 W., Section 23 (W½) and Section 22 (E½). The site is approximately 35 air miles from Fredonia, Arizona (See Map 1).

The scope and extent of this modification is to:

- Sink a 1,650 foot vertical shaft to obtain access to an underground ore deposit.
- Upgrade 0.7 miles of existing road and construct 0.7 miles of new road (and reclaim old portions of existing road).
- Ultimately grade 19.4 acres of mine yard area to accommodate offices, hoist, ore pads and ore piles, barren waste rock and two evaporation ponds.

The duration of this operation is approximately 10 years. The plan of operations was designed to minimize environmental disturbance and to provide for complete reclamation of the surface after completion of activities to the standards prescribed by law.

EFN proposed a number of environmental mitigating, monitoring and reclamation measures in the proposed Arizona 1 Mine plan. All of the proposals have been reviewed by BLM in EA NO. AZ-010-88-04 and accepted as required mitigation unless modified below in Part IV of this document.

II. ENVIRONMENTAL ASSESSMENT AND ALTERNATIVE CONSIDERED

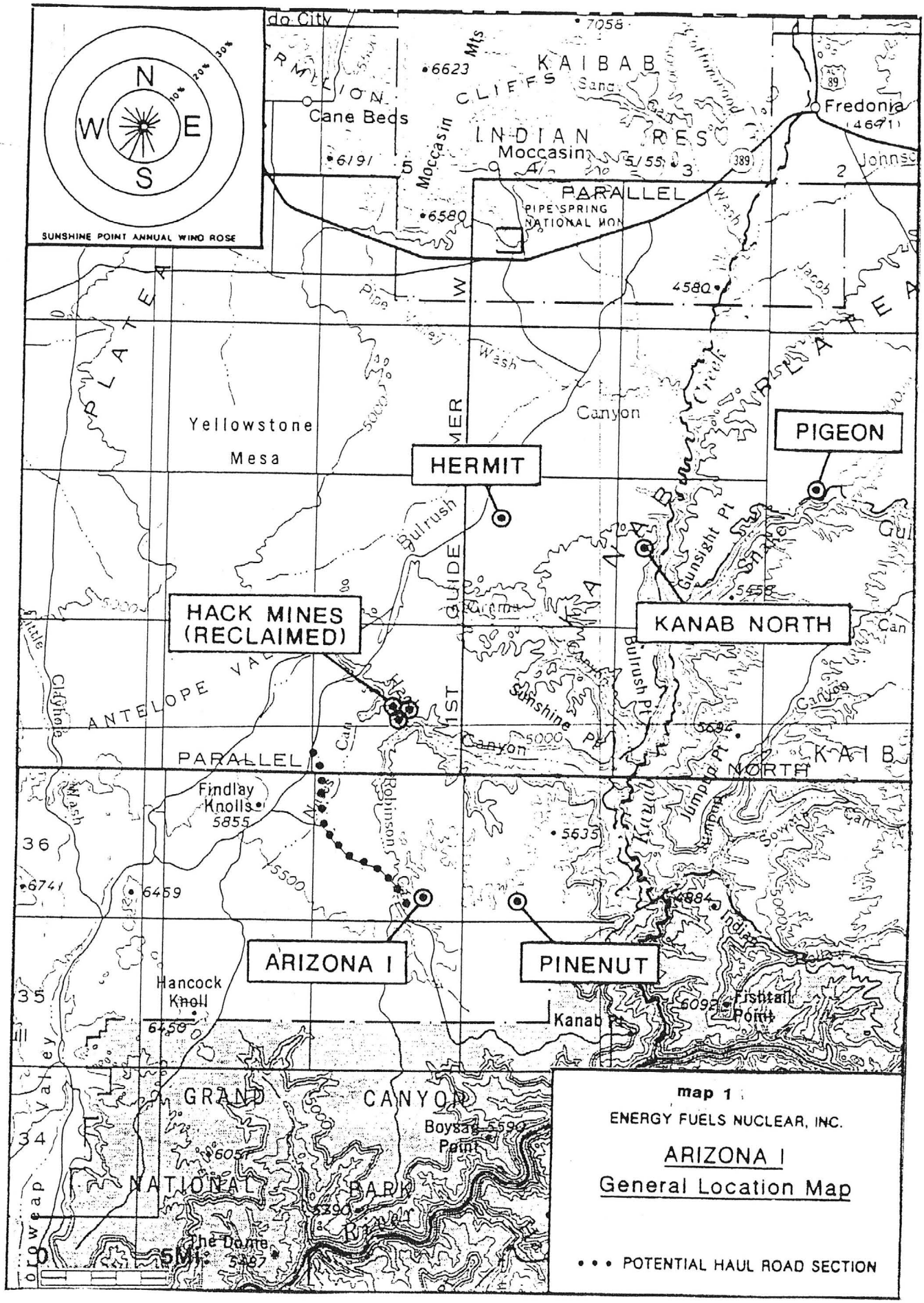
The following sections highlight the major reasons for selecting or not selecting the alternatives evaluated in the EA.

1. No Action

The No Action alternative is that action where the plan of operations would be denied if it did not meet the criteria of 43 CFR 3809 Surface Protection Regulations to prevent undue and unnecessary degradation. The plan would be rejected and returned

B-Series

Folder 2-016


SUNSHINE POINT ANNUAL WIND ROSE
N
S
E
W
HERMIT
PIGEON
HACK MINES (RECLAIMED)
KANAB NORTH
ARIZONA I
PINENUT
Cane Beds
Moccasin
Fredonia
Yellowstone Mesa
Canyon
Findlay Knolls 5855
Hancock Knoll 6450
Fishtail Point
Boysag Point
The Dome
5Mi.
map 1
ENERGY FUELS NUCLEAR, INC.
ARIZONA I
General Location Map
• • • POTENTIAL HAUL ROAD SECTION

to EFN, who would have the option to resubmit (if the plan could be upgraded).

If this alternative were selected, EFN would not be allowed to expand their operations at this site and would be subject to the original stipulations required for Site No. 157 (AS-010-84-78 P/A).

The EA demonstrates that the proposed action would not create undue or unnecessary degradation and that no permanent significant adverse environmental impacts would surpass any significant environmental threshold or limits.

Therefore, pursuant to BLM 3809 Manual, Section 2, part c., "If modifications completely compensate for any adverse environmental impacts stemming from the original proposal, the statutory threshold of significant environmental impacts will not be crossed and an EIS is not necessary." No matter, what level of environmental document is required by the proposed plan, the plan must be approved if it will not cause unnecessary or undue degradation, or if it contains appropriate mitigating measures that will prevent undue or unnecessary degradation.

Based on the analysis of the proposed action and alternatives considered, the no action alternative was not considered further.

2. Approval as Submitted

Under this alternative, BLM would approve the plan of operations as submitted with no additional mitigation required. Based on the EA prepared for this proposal, the operations were found to be in compliance with 43 CFR 3809 regulations. However, through the EA process, BLM has identified and EFN has agreed to implement, further means of reducing overall environmental impacts. These requirements will be presented in Part IV.

3. Modification of Plan Through Alternatives and Stipulations

This series of alternatives involves the modification of several aspects of the original plan of operations. This section is intended to describe which alternatives have or have not been selected in order to enhance environmental protection.

- **Deny bussing of employees and require use of private vehicles.**

  This alternative could result in 240 vehicle trips per day if EFN personnel (estimated at 40/shift/day Phase I) were to drive individual vehicles. A parking lot would be required that would add additional surface disturbance and associated adverse impacts to visual resources, vegetation removal, soil compaction runoff, erosion, wildlife and air quality due to dust.

In effect this alternative defeats the objectives of reducing traffic volumes, eliminating surface disturbance and reducing air quality impacts. Increased vehicle use could potentially increase the amount of liter along the roadways and would increase the probability for vehicle accidents. Therefore, this alternative was not considered further.

- **Require personnel to be transported by aircraft.**

  This alternative would result in the need for additional surface disturbance to accommodate and airstrip. The use of aircraft could potentially adversely affect recreation user, Peregrine falcon re-establishment, livestock, safety and wildlife. It is also doubtful that this alternative could be required as it would most likely violate the "reasonable access" provisions of the General Mining Laws. (Maley). Therefore, this alternative has not been considered further.

- **Require relocation of surface facilities within the mine yard.**

  Because the ore body is stationary there are not many viable alternatives to evaluate regarding the mine yard. However some options were analyzed within the scope of this alternative as follows:

- **Require ore piles to be located at the northern part of the mine yard.**

  This alternative would result in ore storage at the lowest part of the mine yard. The area would be subject to runoff from within the yard and would preclude placement of the evaporative/holding pond where it would be most effective in gathering surface runoff. The potential for slightly more contamination of holding pond water would increase. In effect, this alternative would defeat the objective of keeping the ore piles in a topographically high part of the yard. Therefore, this alternative was not considered further.

- **Require surface construction facilities to be placed along the east and/or west perimeters of the mine yard.**

  This would preclude proper placement of ore piles and would also possibly affect the placement of barren waste rock. It would affect proper storage of topsoils which must be protected throughout the duration of operations. Buildings that would not be in the higher areas of the yard would be subject to impacts from runoff within the mine yard. This alternative would defeat the objectives of requiring surface facilities to be located in a compact area to reduce surface

disturbance and would effectively cut down on the usable space in which heavy equipment could operate (i.e., ore stock piling, loading areas, turn around areas, etc.). Therefore, this alternative was not considered further.

- **Move the mine yard facilities within the surrounding area to the best suitable locations (i.e., ridge tops, flat area, etc.).**

  This would increase the size of the yard significantly making security and safety much less efficient. The beneficial impacts from reducing cut and fill operations would be off set by the disturbance from normal operations between the selected areas. The resulting adverse impact would be greater for surface disturbance, water, wildlife, noise, flooding, vegetation, air quality, soils, cultural resources and visual resources. It would be less cost effective and increase the potential for accidents and environmental contamination through the sheer increase in the size of the mine yard.

  Based on the increase of environmental impacts from these alternatives these alternatives were not considered further.

- **Require use of the existing access versus allowing road relocation.**

  This alternative would eliminate the need for realigning approximately 0.7 miles of road between the Pinenut haul road and the Arizona 1 mine yard. The existing access has two engineering concerns. First, a large portion of the road is located in a bog area and second there is one short steep grade that would be difficult to upgrade and require the ore trucks to travel very slow.

  This alternative would require 2 to 3 times the amount of gravel and fill than the realignment proposal to upgrade the road through the bog. The bog area would most likely require continual maintenance throughout the life of the mine to assure safe winter access. Since good gravel sources do not occur in the local area, EFN and BLM would have to find a source of gravel.

  This alternative would reduce the visual impact in the immediate road area by not allowing the additional surface disturbance from the realigned sections. There should be no real difference to the recreational or remoteness character of the area since both the upgrade and the realignment are in the same basin. Long term impacts to wildlife may be more adverse under this alternative in that bottom soils are far more productive and, once rehabilitated, would provide much better

habitat and forage value. EFN has stated that the road upgrade would be more expensive than the realignment proposal. Both road alternatives will not have any adverse impact on T&E species or cultural resources. Upgrading the existing road in the bog has a greater potential for affecting water flow to the Robinson livestock reservoir.

Based on the above, the long term benefits of road relocation would out weigh the short term impacts to wildlife and the general environment due to construction. Additionally, it will be stipulated that EFN ensure the permittee is able to maintain reasonable access to Robinson Reservoir. Furthermore, appropriate culvert designs are necessary in order to prevent a situation which would adversely effect water flow into Robinson Reservoir.

- **Require EFN to utilize existing facilities at Pinenut rather than duplicating the same facilities at Arizona 1**

  While this alternative has the potential to eliminate some surface facilities and therefore surface disturbance, the following has been determined:

  - The Pinenut facilities are not large enough to accommodate additional workers for sanitation purposes (i.e., showers, change rooms, rest rooms).

  - Utilizing the existing warehouses, machine shops, diesel storage areas etc., would create the necessity of more travel between the two mines and would result in more impacts to recreational users and wildlife, and would defeat the objective of bussing to reduce travel impacts. Additionally it would be extremely burdensome economically and functionally, for EFN to make continual trips back and forth between mines. Based on the above analysis this alternative was not considered further.

III. DECISION AND RATIONALE

A. Decision

Based on the review of public comments, a thorough review of the EA and all of the consultant studies, BLM is approving the Arizona 1 Mine Plan Proposal, subject to mitigation presented in Part IV.

The mitigation as submitted by EFN and those measures required by BLM will ensure that there will not be any significant adverse impacts to the environment. Additionally the plan of operations, as submitted, will prevent undue or unnecessary degradation to public lands (as well as the Grand Canyon National Park) as

mandated by 43 CFR 3809 Surface Management Regulations. The additional mitigation identified by BLM and accepted by EFN will reduce further any anticipated environmental impacts.

B. Rationale

Rationale for this decision is as follows:

1. This decision is in conformance with the Vermillion Resource Area Management Framework Plan, which recommends the area remain open to mineral entry and appropriation.

2. There are no known State, Federal or county ordinances that would prohibit this operation.

3. There is and has been considerable local and regional interest and supporting EFNs activities on the Arizona Strip. This support is evident by the large number of comments received supporting the Arizona 1 mine.

4. EFNs presence in the surrounding 4-5 county region provides an extremely high tangible economic benefit to local communities. EFN also provides indirect economic benefits through the support of other local services not associated with mining.

5. EFN has clearly and consistently demonstrated a professional environmentally sound record of compliance for all applicable State and Federal laws and regulations through their existing mining activities on the Arizona Strip.

6. The reclamation measures provided in the plan of operations and the EA will ensure that all disturbed areas will be returned to approximately those conditions that existed prior to disturbance.

7. EFN follows those standards required by the Bureau of Mine Safety and Health and the State Mine Inspector governing acceptable radiation, exposure and emission standards.

8. There will be no significant direct or indirect impacts on the Grand Canyon National Park, the Kanab Creek Wilderness or the Kaibab National Forest. There are no known significant environmental impacts on the Kaibab Paiute Indian Reservation.

9. Approval of this plan does not preclude the requirement for compliance with other applicable State or Federal laws and regulations, including compliance with Arizona State's Department of Environmental Quality Aquifer Protection Permit requirements.

10. The EA has been finalized to reflect useful and applicable public comments. Several sections have been improved to enhance the readers ability to understand the assessment made and the rationale used to arrive at conclusions. All appropriate comments were incorporated into the EA.

11. The State Historic Preservation Officer (SHPO) has concurred with BLM's findings of the "no effect" conclusion for both the mine yard and the haul route.

12. In accordance with the National Environmental Policy Act, the BLM has concluded that the proposed Arizona 1 mine will not have a significant impact on the quality of the human environment (see EA No. AZ-010-88-004) and therefore an environmental impact statement is not required. Additionally, there is no comprehensive Federal plan for the development of the Federal locatable minerals on the Arizona Strip because the filing of a mining claim is through the volition of citizens of the United States and not the Federal government.

    Also in accordance with the EA, this mine will not create <u>any</u> cumulative or synergystic impacts that will cause undue or unnecessary degradation or permanent significant adverse effect on the quality of the human environment.

13. BLM is satisfied that EA No. AZ-010-88-004 in combination with the Arizona 1 Mine Plan of Operations is consistent with and supported by the decisions and rationale used by the Interior Board of Land Appeals in their decision IBLA 86-1217, appeal of the Pinenut Environmental Assessment/Decision Record.

IV. <u>REQUIRED MITIGATING MEASURES TO ENHANCE ENVIRONMENTAL PROTECTION</u>

A. <u>Mine Yard</u>

1. If the protection of the topsoil stockpile becomes warranted, EFN will use water, tackifiers, asphalt emulsion or rip rap etc., to prevent wind or water erosion as approved by the Authorized Officer.

2. During reclamation activities, EFN will ensure that topsoil is equally distributed to facilitate successful revegetation of the site.

3. Should dust from the mine yard exceed environmental thresholds, EFN will initiate a dust abatement program as required by the Authorized Officer.

4. Signs will be installed at the entrance of the mine yard to inform visitors or other land users that uranium operations

are in progress. No trespassing signs will be posted on the mine yard fences or gates.

5. EFN will dispose of all concrete pads by back filling them into the shaft.

6. To be successfully rehabilitated, ground cover must be established to at least the prevailing conditions (i.e., 20-30 % canopy cover) and approved by the Authorized Officer.

The following seeding mixtures and rates are recommended:

Fourwing saltbush	2.0 lbs/acre
Indian ricegrass	2.0 lbs/acre
Sand dropseed	0.5 lbs/acre
Yellow sweetclover	0.5 lbs/acre
Pubescent wheatgrass	2.0 lbs/acre
Russian wildrye	2.0 lbs/acre
TOTAL	9.0 lbs/acre

Seedings will be planned to take advantage of optimal seasonal moisture.

7. Roads and road crossings will be monitored by EFN for signs of erosion. If any erosional damage is detected, it will be repaired by rip rap or other erosion control measures.

8. EFN will complete the holding ponds prior to any storage of uranium ore on the surface. EFN will ensure that the two cell holding pond is sized to accommodate the maximum amount of run off expected from a 500 year 24 hour event as well as being able to accommodate water produced from the sediment accumulation and direct precipitation.

B. Access

1. All road upgrading or construction must, as a minimum conform to BLM standards. Road designs must be submitted to BLM for engineering review prior to any construction activity. All construction activities will only be allowed within the corridor cleared and flagged by Bill Davis of Abajo Archaeology.

2. Any culverts necessary must be sized according to the expected maximum drainage flow and installed according to at least BLM standards.

3. It is EFNs responsibility to insure that a suitable access is left open to Little Robinson and Robinson reservoirs.

4. The "new construction" and "upgraded" portion of access will be reclaimed to approximately the conditions that existed prior to mineral disturbance in the area (i.e., secondary road, approximately 10-12 foot wide and generally unmaintained).

5. Except for regular county maintenance activities, the haul roads will be the primary responsibility of EFN. This includes but is not limited to proper grading, graveling, dust abatement (as necessary) and signing where necessary for public safety.

6. EFN will report any big game/livestock vehicle accidents to BLM as soon as reasonably feasible.

C. Air Craft Use

1. EFN must not utilize Kanab Creek or Hack Canyon as a flight path to the Arizona 1 Mine.

D. Visual

1. In the event that any liquid release or discharge from within the mine yard occurs, EFN will take immediate aggressive action to clean up and reclaim the affected area.

2. In the event that an ore spill occurs on the Arizona Strip, EFN will take immediate action to alleviate the incident.

3. Any unauthorized release, discharge or spill of any hazardous material or petroleum product must be immediately cleaned up.

V. CONCLUSION

Based upon the environmental analysis of the Arizona 1 project, the mine plan and public comments received, the Bureau of Land Management concludes that this operation will not cause any undue or unnecessary degradation to public lands, contains reasonable reclamation measures and is in conformance with the 43 CFR 3809 Surface Protection

Regulations. Based on the above, the Bureau concludes that there will be no significant adverse long term impacts or any significant long term or short term cumulative or synergistic impacts that would significantly affect the quality of the human environment and, therefore, an Environmental Impact Statement is not necessary.

Approval Recommended:

Robert D. Roudabush
Vermillion Resource Area Manager

Date 5/9/88

Approved:

G. William Lamb
District Manager, Arizona Strip District

Date 5/9/88

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
ARIZONA STRIP DISTRICT OFFICE
390 North 3050 East
St. George, Utah 84770

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:
8500 (015)

March 4, 1988

We are pleased to send you the enclosed Draft Environmental Assessment (DEA) for the proposed Arizona 1 Uranium Mine. This DEA was written in response to a Plan of Operation submitted by Energy Fuels Nuclear, Inc. (EFN) on January 26, 1988 and subsequently reviewed by BLM to determine if the plan was in conformance with 43 CFR 3809 regulations. Our Environmental Assessment process was begun on February 1, 1988. In addition to the proposal, the DEA evaluates alternatives that propose various modifications to the Plan, including the No Action Alternative.

In preparing the DEA, outside consultants were used to assess the existing environment and the anticipated impacts to Air Quality, Radiation, Cultural Resources, Wildlife Resources, Surface/Subsurface Hydrologic Impacts as well as Cumulative Impacts. While we have attempted to summarize these studies in the DEA, for the readers convenience, the studies are available on a limited basis at the Arizona Strip District (Phone No. (801) 673-3545).

A response, preferably in writing on the DEA will be required in order for you to remain on our active minerals mailing list. Comments are due by April 4, 1988 in order for them to be incorporated into the Final Environmental Assessment.

The Bureau will target May 4, 1988 for making a decision on this proposal. If you wish to be notified about that decision, please make that request with your submission.

Sincerely,

William Lamb

G. William Lamb
District Manager

Enclosure

D R A F T

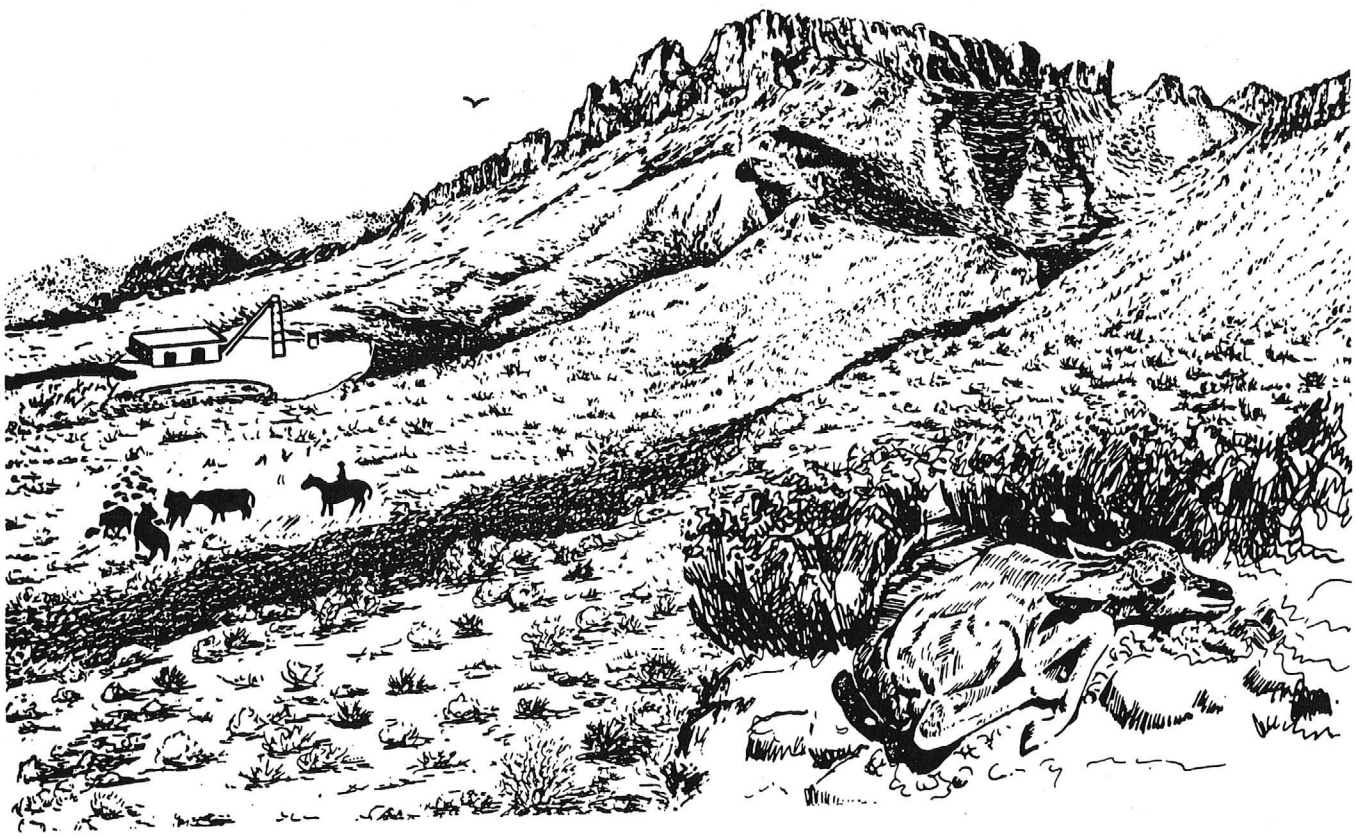
ENVIRONMENTAL ASSESSMENT
ARIZONA ONE URANIUM MINE

EA No. AZ-010-88-004

A Major Modification to the
Plan of Operations for Uranium Site No. 157,
AS-010-84-78P/A

March 3, 1988

ARIZONA I



EA No. AZ-010-88-004

THE ARIZONA I PROJECT
DRAFT ENVIRONMENTAL ASSESSMENT

A Major Modification to the Sin Project
Plan of Operations for Uranium Ore Extraction

Bureau of Land Management

PUBLIC LANDS ☆USA☆

USE ☆ SHARE ☆ APPRECIATE

ARIZONA PROJECT

Table of Contents

EA NO. AZ-010-88-004

ENVIRONMENTAL ASSESSMENT
A Major Modification to Site No. 157
Plan of Operations for Uranium Ore Extraction
AS-010-84-78P/A, ARIZONA ONE

I. INTRODUCTION

Energy Fuels Nuclear, Inc., (EFN) has submitted a major modification to Site 157, an existing exploration plan of operation. The purpose of the modification is to allow EFN to expand the nature and duration of presently authorized activities to include ore extraction pursuant to 43 CFR 3809 regulations and BLM 3809 manuals.

The existing exploration plan was submitted on September 11, 1984 and subsequently approved on October 4, 1984 after a review during which the BLM prepared a Decision Record (DR 84-165) based on an Environmental Assessment (EA 81-208) to determine site specific impacts, reasonable alternatives and appropriate mitigation to limit conflicts and prevent undue or unnecessary degredation.

There have been two minor addendums submitted for this plan which included additional drilling requests in the immediate area of the original drill sites.

Until a decision is made on this proposal, all work conducted will be in accordance with the original approved plan of operations. If this modification is approved, the existing plan of operations will be superceded in all aspects.

To date approximately 24 holes have been drilled. Minor road maintenance has been allowed on the existing access which leads to the Hack's Canyon Mine vent shaft on Robinson Point.

II. PURPOSE AND SCOPE OF ENVIRONMENTAL ASSESSMENT

Pursuant to the Code of Federal Regulations (CFR), 43, Subpart 3809 (Surface Management), The Federal Land Policy and Management Act (FLPMA) and the National Environmental Policy Act (NEPA), the purpose and scope of this EA is to evaluate if the proposed action can take place in a manner that prevents undue and unnecessary degradation and provide for reasonable reclamation and the protection of non-mineral resources on federal lands. This EA will also include an analysis of the cumulative impacts of this proposal as well as exploration and mining impacts to date within the Arizona Strip District as well as an analysis of potential off site impacts.

This EA also has the responsibility to identify if feasible or reasonable alternatives exist to reduce or eliminate those impacts. In addition the EA will be used to assess mitigating measures that could be proposed to further prevent undue or unnecessary degredation pursuant to 43 CFR 3809, FLPMA and BLM 3809 Surface Management Manuals.

The EA is also the vehicle the Bureau will use to determine if there is a potential for any significant impacts on the quality of the human environment, and if so, whether or not an Environmental Impactment Statement is warranted.

III. PROPOSED ACTION AND ALTERNATIVES CONSIDERED

A. Proposed Action

EFN has submitted a major modification to Site 157, as follows:

During the next several years, EFN plans to develop and mine the

To date approximately 24 holes have been drilled. Minor road maintenance has been allowed on the existing access which leads to the Hack's Canyon Mine vent shaft on Robinson Point.

II. PURPOSE AND SCOPE OF ENVIRONMENTAL ASSESSMENT

Pursuant to the Code of Federal Regulations (CFR), 43, Subpart 3809 (Surface Management), The Federal Land Policy and Management Act (FLPMA) and the National Environmental Policy Act (NEPA), the purpose and scope of this EA is to evaluate if the proposed action can take place in a manner that prevents undue and unnecessary degradation and provide for reasonable reclamation and the protection of non-mineral resources on federal lands. This EA will also include an analysis of the cumulative impacts of this proposal as well as exploration and mining impacts to date within the Arizona Strip District as well as an analysis of potential off site impacts.

This EA also has the responsibility to identify if feasible or reasonable alternatives exist to reduce or eliminate those impacts. In addition the EA will be used to assess mitigating measures that could be proposed to further prevent undue or unnecessary degredation pursuant to 43 CFR 3809, FLPMA and BLM 3809 Surface Management Manuals.

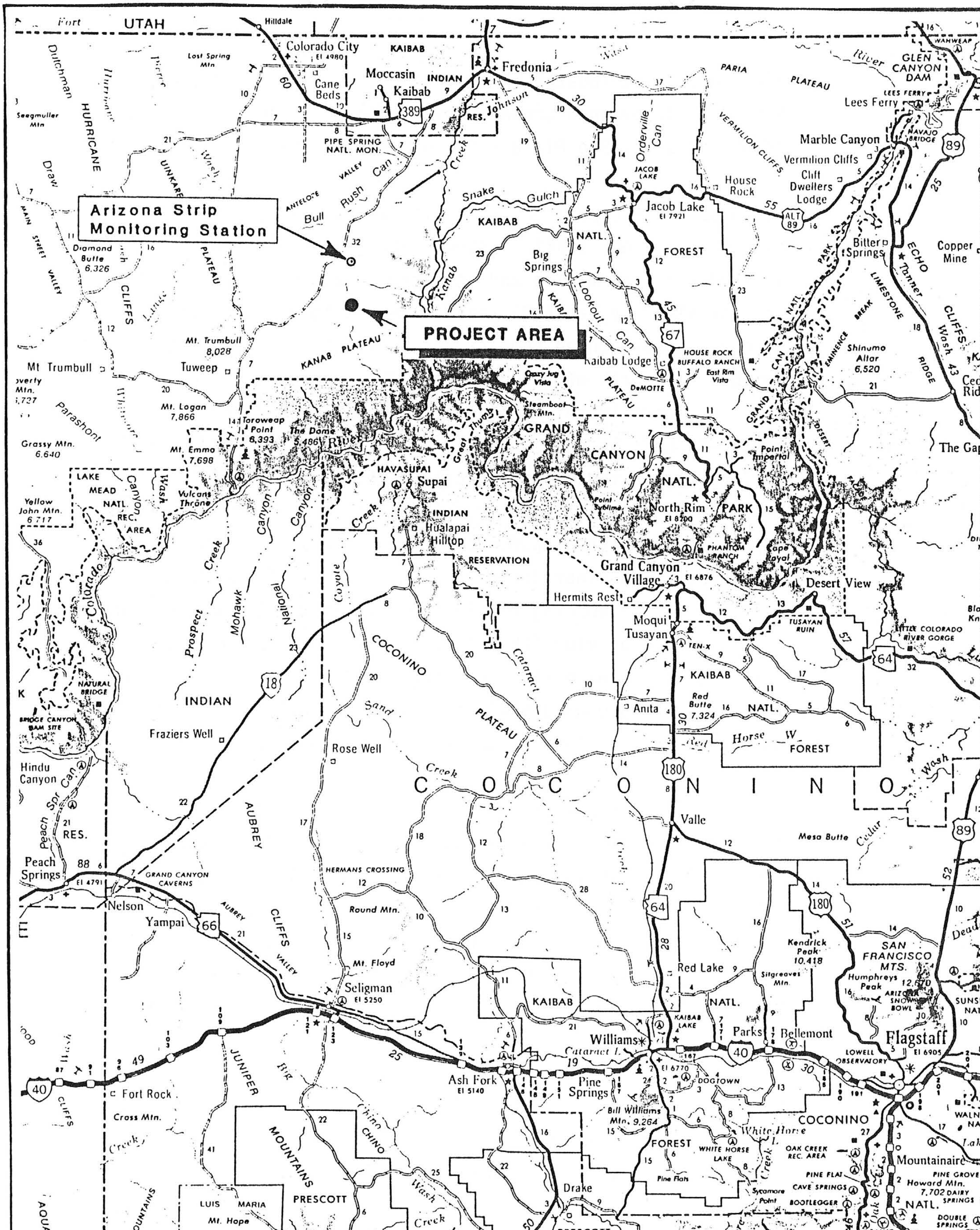
The EA is also the vehicle the Bureau will use to determine if there is a potential for any significant impacts on the quality of the human environment, and if so, whether or not an Environmental Impactment Statement is warranted.

III. PROPOSED ACTION AND ALTERNATIVES CONSIDERED

A. Proposed Action

EFN has submitted a major modification to Site 157, as follows:

During the next several years, EFN plans to develop and mine the



EnecoTech

PROJECT ARIZONA-1	General Location Map PLATE 1

uranium deposit located in the Project Area (T. 36 N., R. 5 W., Sec. 23, 23) by underground mining methods in two distinct phases of operations. See Plate 1 for general location.

Based upon its experience with similar deposits, EFN expects its site preparation, shaft sinking, underground drilling and development, and mining and reclamation activities to be completed in approximately ten (10) years. Access to the deposit will be by a conventional, three compartment, vertical shaft located immediately north of the deposit. The shaft will be excavated to a depth of approximately 1,650 feet below the surface. As the vertical shaft is sunk, horizontal workings will be driven at various levels toward the deposit. Thereafter, two to four underground drilling chambers will be excavated in or near the deposit. From these chambers, underground drilling will be undertaken to further define the full extent of the deposit. Portions of the working within the deposit and the underground drilling will provide EFN with adequate information to determine the most efficient mining sequence for recovery of the mineral reserve. The proposed shaft location, surface facilities, shaft and waste rock disposal area are identified on Plate 2.

During site preparation, shaft sinking and underground drilling and evaluation, employment will range from 12 to 22 personnel. Shaft sinking generally is conducted on a three-shift, seven day per week schedule. A three-shift, five day per week schedule is probable during underground drilling and development activities. During this phase, a majority of the employees will be skilled shaft miners, transferred from nearby mines presently operated by EFN or contractors hired locally.

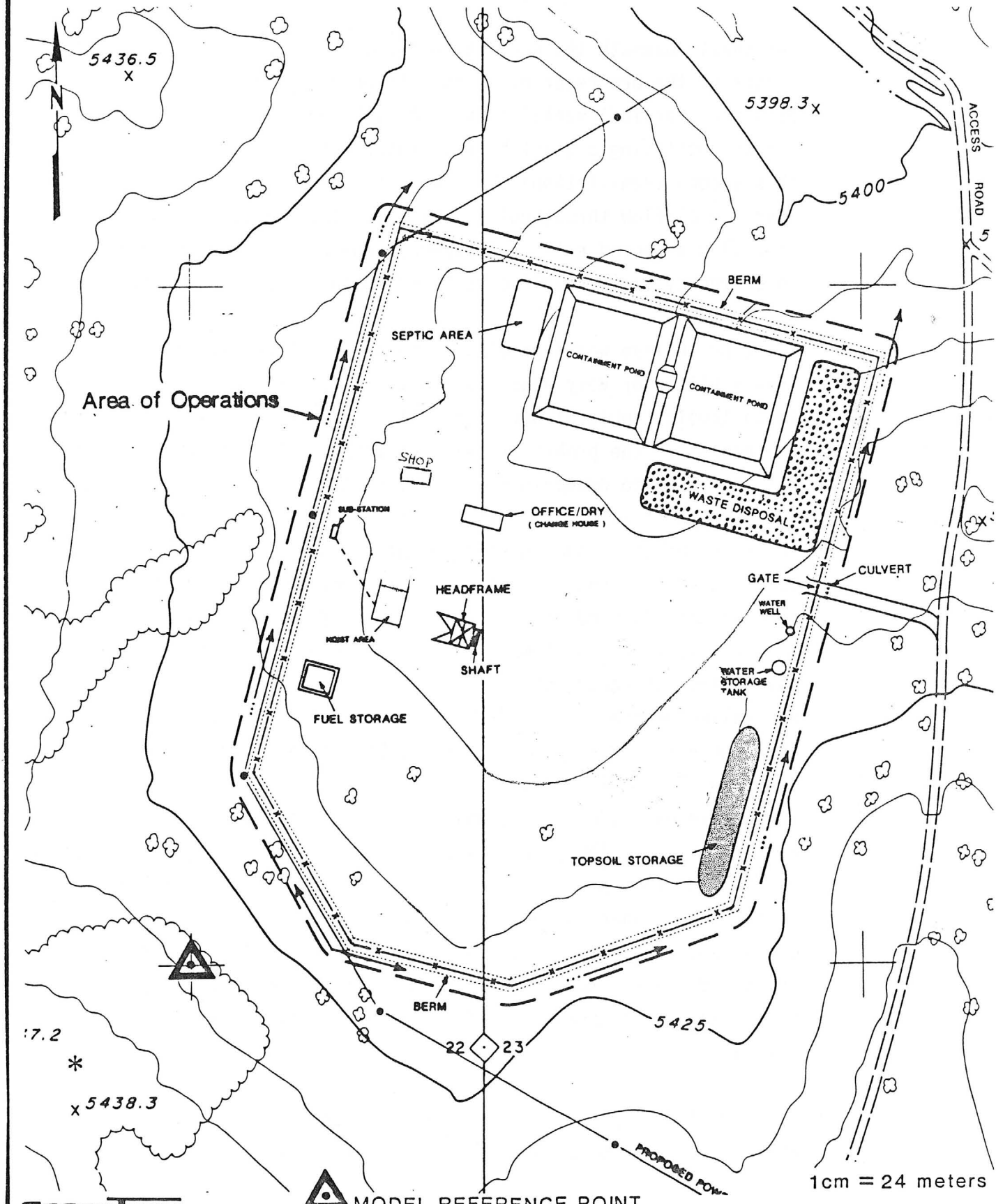
Once the initial underground drilling program has satisfactorialy confirmed the full extent and dimensions of the ore deposit, horizontal workings will then be driven from the lowest portion of

uranium deposit located in the Project Area (T. 36 N., R. 5 W., Sec. 23, 23) by underground mining methods in two distinct phases of operations. See Plate 1 for general location.

Based upon its experience with similar deposits, EFN expects its site preparation, shaft sinking, underground drilling and development, and mining and reclamation activities to be completed in approximately ten (10) years. Access to the deposit will be by a conventional, three compartment, vertical shaft located immediately north of the deposit. The shaft will be excavated to a depth of approximately 1,650 feet below the surface. As the vertical shaft is sunk, horizontal workings will be driven at various levels toward the deposit. Thereafter, two to four underground drilling chambers will be excavated in or near the deposit. From these chambers, underground drilling will be undertaken to further define the full extent of the deposit. Portions of the working within the deposit and the underground drilling will provide EFN with adequate information to determine the most efficient mining sequence for recovery of the mineral reserve. The proposed shaft location, surface facilities, shaft and waste rock disposal area are identified on Plate 2.

During site preparation, shaft sinking and underground drilling and evaluation, employment will range from 12 to 22 personnel. Shaft sinking generally is conducted on a three-shift, seven day per week schedule. A three-shift, five day per week schedule is probable during underground drilling and development activities. During this phase, a majority of the employees will be skilled shaft miners, transferred from nearby mines presently operated by EFN or contractors hired locally.

Once the initial underground drilling program has satisfactorialy confirmed the full extent and dimensions of the ore deposit, horizontal workings will then be driven from the lowest portion of



ENECOTECH

Denver Colorado

Project

ARIZONA - I

PROJECT AREA - PHASE I

PLATE 2

the shaft, beneath the deposit to a point just outside the farthest extent of the ore reserve. From this point, an eight foot diameter, vertical ventilation shaft will be upreamed to the surface utilizing a pilot hole to intersect the lowest workings. This second (ventilation) shaft will exhaust air, thereby creating adequate airflow throughout the mine workings, and, in addition, providing a second exit or escapeway from the mine in the event of an emergency as is required by Federal mine safety regulations.

Raise or incline workings within the mine will connect the various levels within or very near the deposit. At various elevations from these levels, sublevel workings will be driven to extract ore from the deposit. the broken ore will be dropped down raises, designed for such use, to drawpoints on the lowest level. The ore will then be hauled to the shaft, at which point it will be transferred to skips in the shaft and hoisted to the surface. Barren waste rock generated during shaft sinking, development and mining will be removed and disposed of on the surface in the waste disposal areas, to the extend that such material cannot be utilized for road maintenance or construction of the mine yard. Ore will be stockpiled on the surface near the shaft until shipment to the White Mesa Mill located in Blanding, Utah takes place.

After development work is completed (approximately three years after start-up), the mine will be operated at an average production rate fo 300 tons per day for approximately five years. EFN hoped that planned underground drilling will increase the tonnage to be mined and, consequently, extend the operation's life by a few years. However, experience to date at other operations suggests that a production phase significantly longer than five (5) years is unlikely.

Employment during the first few years of underground development will range from 15 to 30 personnel. As production capacity grows,

the shaft, beneath the deposit to a point just outside the farthest extent of the ore reserve. From this point, an eight foot diameter, vertical ventilation shaft will be upreamed to the surface utilizing a pilot hole to intersect the lowest workings. This second (ventilation) shaft will exhaust air, thereby creating adequate airflow throughout the mine workings, and, in addition, providing a second exit or escapeway from the mine in the event of an emergency as is required by Federal mine safety regulations.

Raise or incline workings within the mine will connect the various levels within or very near the deposit. At various elevations from these levels, sublevel workings will be driven to extract ore from the deposit. the broken ore will be dropped down raises, designed for such use, to drawpoints on the lowest level. The ore will then be hauled to the shaft, at which point it will be transferred to skips in the shaft and hoisted to the surface. Barren waste rock generated during shaft sinking, development and mining will be removed and disposed of on the surface in the waste disposal areas, to the extend that such material cannot be utilized for road maintenance or construction of the mine yard. Ore will be stockpiled on the surface near the shaft until shipment to the White Mesa Mill located in Blanding, Utah takes place.

After development work is completed (approximately three years after start-up), the mine will be operated at an average production rate fo 300 tons per day for approximately five years. EFN hoped that planned underground drilling will increase the tonnage to be mined and, consequently, extend the operation's life by a few years. However, experience to date at other operations suggests that a production phase significantly longer than five (5) years is unlikely.

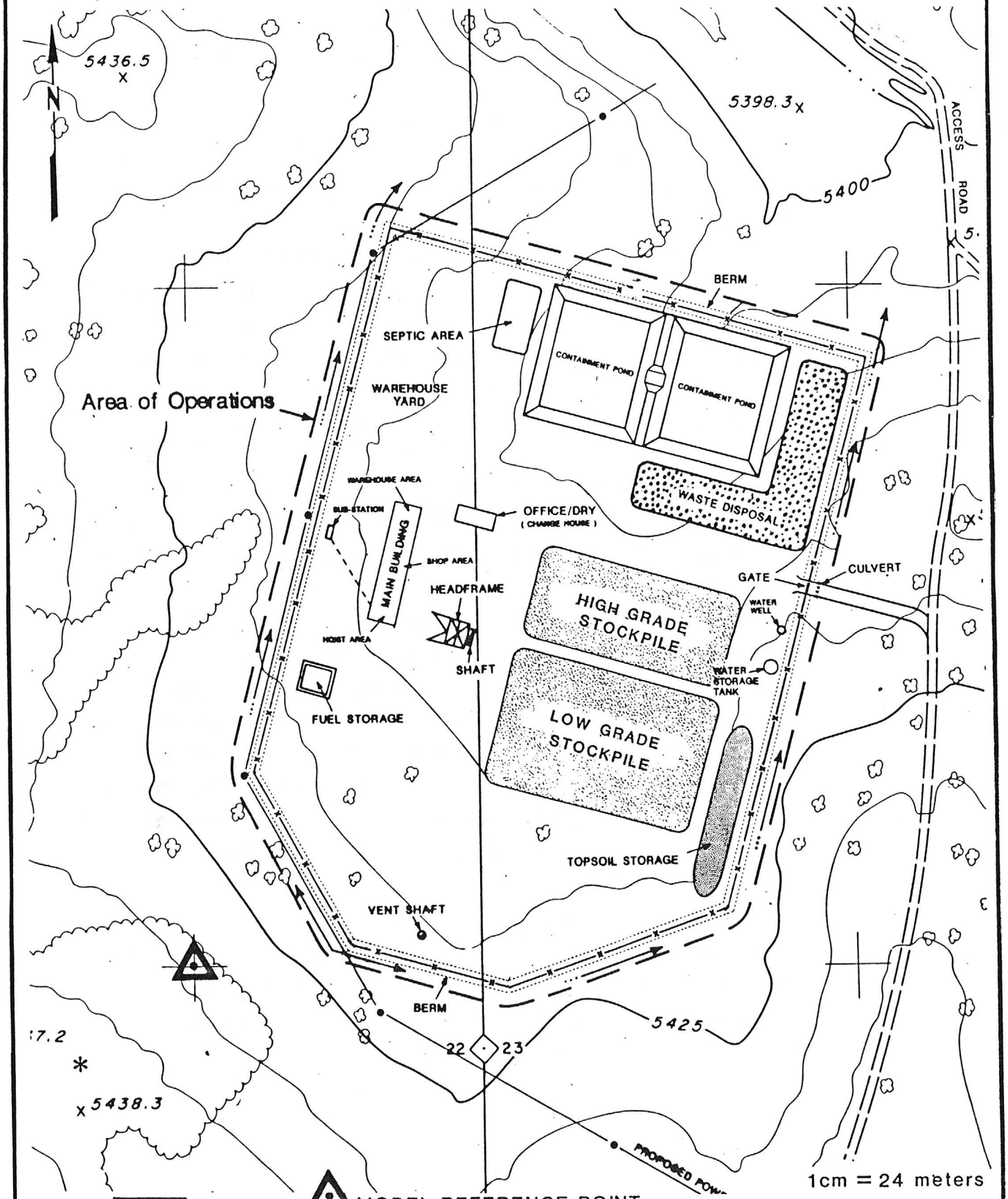
Employment during the first few years of underground development will range from 15 to 30 personnel. As production capacity grows,

employment could reach approximately 40 personnel at the 300 ton-per-day rate, working two to three shifts per day.

Most employees are expected to be drawn from existing residents of the area. Moreover, EFN hoped that the work force will consist mostly of employees currently working at the Pigeon Mine and other EFN mines whose activity level will have ceased prior to the time the production phase of the Arizona-I Project begins. If such is the case, EFN plans for the coordinated transfer of personnel as time allows. EFN will provide and operate buses to transport employees to and from the Project Area. Driving of individual vehicles is discouraged. Management and technical staff support will be based at the Fredonia Mine Operations office.

The Area of Operations that will be temporarily used and/or disturbed during the Project life covers an area of approximately 19.4 acres. The Area of Operations where all activities will take place, together with the planned surface facility, are shown on Plates 2 & 3. In designing this Plan of Operations, EFN has minimized the size of the Area of Operations as much as practicable to ensure adequate working area while minimizing disturbance. The locations of the shafts, office, hoist house, main building, waste rock storage area and ore stockpiles will all be generally located during each phase as shown on Plates 2 & 3. Of course, further engineering and unexpected problems encountered during construction could cause the actual layout to differ in minor detail from that shown on Plates 2 & 3.

During the first two to three years of the Project and/or during the underground evaluation phase, only the northern half or approximate 10 acre portion of the Area of Operations will be utilized. This initial yard is within the larger 19.4 acre Area of Operations to be occupied during the production phase.



ENECOTECH

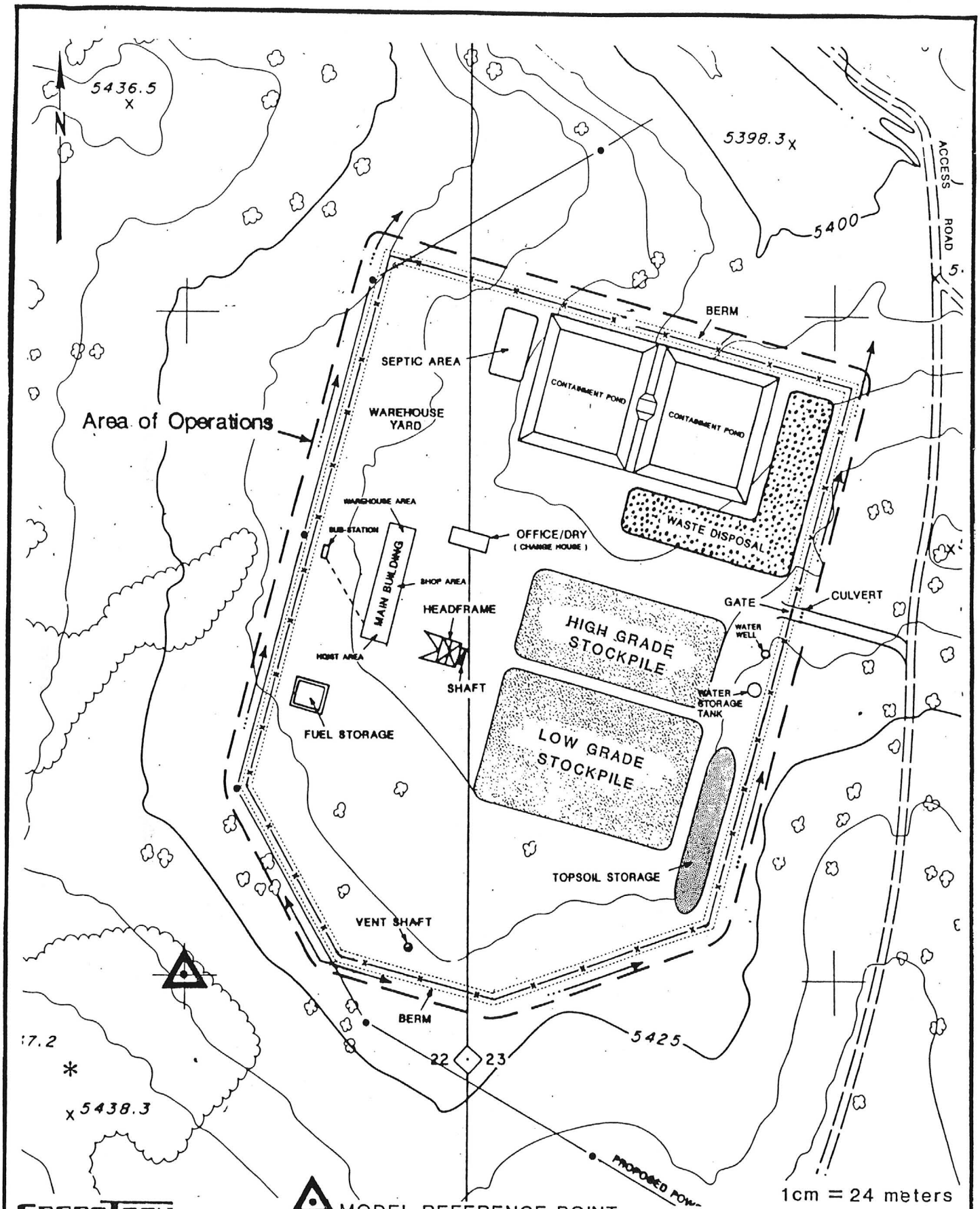
Denver Colorado

Project

ARIZONA - I

PROJECT AREA
PHASE II

PLATE 3



EnecoTech

Denver Colorado

Project

ARIZONA - I

PROJECT AREA
PHASE II

PLATE 3

A water source of a few gallons per minute is needed for underground drilling and sanitation during the first phase of activities. Consequently, a water well will be drilled on the eastern edge of the Area of Operations to a depth of 3,000 to 3,500 feet. Tankage to hold water will be located near the site of the water well. In the event EFN is not successful in locating water they will truck it from the nearby Pinenut Mine or the town of Fredonia, Az. In the area shown on Plate 1 at least two house trailers will be located during phase one which will serve as temporary lodging for the mine staff and a security guard as may be needed during phase one. No full-time resident other than a security guard is proposed.

Prior to construction of the mine yard, available topsoil from the initial areas to be disturbed will be removed and stored at the eastern edge of the Area of Operations (See: Plate 2).

In addition, a second topsoil storage area will be created at the southern edge of the Area of Operations (See: Plate 3). These locations will assure that topsoil will not be disturbed during mining activities and that it will be available for final reclamation. In addition, after construction of the water diversion facilities discussed below, the topsoil stockpiles will be protected from erosion due to surface run-off. The size and dimensions of the topsoil stockpiles will increase at the beginning of the production phase when additional topsoil is removed and stored prior to construction of the final mine yard.

During the first phase of activities, a temporary hoist to excavate the shaft will be located approximately 120 feet west of the shaft. A building will surround the temporary sinking hoist. The necessary air compressor, semi-trailers for shop, warehousing, office and showers will be located to the north of the temporary hoist building. In addition, a septic field will be located north

of the shaft to handle sewage from the showers and trailers contained within the Area of Operations.

During initial development activities at the beginning of phase two, only minimal ore is expected to be generated incidental to the underground development activities. Specifically, EFN estimates that no more than a few thousand tons of ore will be generated during the underground development phase of activities. This material will be stored at the location shown on Plate 3 until shipped to the Blanding mill for bulk sampling and amenability testing.

In order to ensure that no surface run-off from outside of the Area of Operations is allowed to enter, EFN will construct water diversion facilities on both the west, south and east perimeters of the Area of Operations as shown on Plates 2 & 3. Prior to the design of these surface water diversion facilities, it was necessary for EFN to analyze the watersheds involved and the potential of the area to experience severe storm events. EFN retained the services of an independent hydrological consultant to evaluate the surface run-off concerns and to advise EFN regarding proper design, location and capacities for the diversion facilities. The surface water diversion facilities which EFN will construct will conform with the recommendations of the independent consultant and will ensure that these facilities are capable of diverting around the areas of disturbance the surface run-off resulting from at least a 100-year, 24-hour storm event. Surface water diversion facilities will make maximum use of existing channels. The planned diversion facilities will be constructed during the first phase of activities and will be maintained throughout the life of the Project.

All rainfall which falls within the Area of Operations will be directed to and held in the surface containment/evaporation pond

of the shaft to handle sewage from the showers and trailers contained within the Area of Operations.

During initial development activities at the beginning of phase two, only minimal ore is expected to be generated incidental to the underground development activities. Specifically, EFN estimates that no more than a few thousand tons of ore will be generated during the underground development phase of activities. This material will be stored at the location shown on Plate 3 until shipped to the Blanding mill for bulk sampling and amenability testing.

In order to ensure that no surface run-off from outside of the Area of Operations is allowed to enter, EFN will construct water diversion facilities on both the west, south and east perimeters of the Area of Operations as shown on Plates 2 & 3. Prior to the design of these surface water diversion facilities, it was necessary for EFN to analyze the watersheds involved and the potential of the area to experience severe storm events. EFN retained the services of an independent hydrological consultant to evaluate the surface run-off concerns and to advise EFN regarding proper design, location and capacities for the diversion facilities. The surface water diversion facilities which EFN will construct will conform with the recommendations of the independent consultant and will ensure that these facilities are capable of diverting around the areas of disturbance the surface run-off resulting from at least a 100-year, 24-hour storm event. Surface water diversion facilities will make maximum use of existing channels. The planned diversion facilities will be constructed during the first phase of activities and will be maintained throughout the life of the Project.

All rainfall which falls within the Area of Operations will be directed to and held in the surface containment/evaporation pond

shown on Plates 2 & 3. The pond will be lined with hypalon to insure that leakage does not occur. It will be constructed during phase one and will be sized to hold all water which may be encountered during mining activities as well as the surface drainage within the disturbed areas resulting from a 100-year, 24-hour storm event.

After the deposit has been fully evaluated, as part of the next phase of activities the nature and extent of the surface facilities will be expanded as shown on Plate 3. Moreover, during this phase of activities the area of disturbance will be expanded to enable the efficient extraction of the ore reserve -- including construction of ore stockpile areas and an additional topsoil stockpile. Finally, as these activities proceed, some additional access road upgrading activities will be necessary to accommodate the ore haulage needs of the mine -- estimated to average 12 truck loads per day once full ore production is achieved.

Prior to beginning the surface expansion activities, available topsoil within the additional disturbed areas will be collected and stored for use in final reclamation in the additional topsoil stockpile area identified on Plate 3.

Barren waste rock from excavation of the underground workings will be used to bring the access roads, mine yard facilities and stockpile areas to the desired grade. Any excess barren waste rock will be disposed of in the area shown on Plate 3. This waste disposal area has the capacity to hold the expected barren waste rock to be generated from underground workings construction, without noticeably changing the original topographic appearance.

The largest and only major building in the surface plant will be the "Main Building" located as shown on Plate 3. This building will house the permanent hoist, air compressors, standby electric

generator, change house, shop warehouse and emergency medical facilities.

North of the main building, various supplies needed during the production phase will be stockpiled. Tankage for storage of gasoline and diesel fuel will be located as shown on Plates 2 & 3 in the area to the southwest of the main building.

Once the surface facilities needed during the production phase of activities have been installed, a six foot chain link security fence with lockable gates will be erected to enclose the Project Area as noted on Plate 3. The mine-use area will be posted with "Restricted Area" signs. The gates in the security fence will be closed and locked during periods of inactivity at the mine site.

MEASURES TO LIMIT DISTURBANCE

EFN has designed this Plan of Operations to minimize disturbances to the environment and to provide for complete reclamation of the surface after completion of the mining activities to the standards required by law. The areas proposed to be disturbed are as compact as practicable with surface facilities and stockpile and disposal areas clustered together where feasible.

In the design of this Plan of Operations, EFN recognized that one of the important aspects to assure protection for the environment at the project site is the proper handling of surface water run-off from adjacent watersheds. To address this issue, and to insure the integrity of the Area of Operations during activities, flood control measures have been built into the Plan of Operations consistent with the recommendations of an independent surface water hydrologist who evaluated the area. As per the design, surface water runoff from the 100-year, 24-hour storm event cannot enter the Area of Operations from any direction. In addition, rainfall

generator, change house, shop warehouse and emergency medical facilities.

North of the main building, various supplies needed during the production phase will be stockpiled. Tankage for storage of gasoline and diesel fuel will be located as shown on Plates 2 & 3 in the area to the southwest of the main building.

Once the surface facilities needed during the production phase of activities have been installed, a six foot chain link security fence with lockable gates will be erected to enclose the Project Area as noted on Plate 3. The mine-use area will be posted with "Restricted Area" signs. The gates in the security fence will be closed and locked during periods of inactivity at the mine site.

MEASURES TO LIMIT DISTURBANCE

EFN has designed this Plan of Operations to minimize disturbances to the environment and to provide for complete reclamation of the surface after completion of the mining activities to the standards required by law. The areas proposed to be disturbed are as compact as practicable with surface facilities and stockpile and disposal areas clustered together where feasible.

In the design of this Plan of Operations, EFN recognized that one of the important aspects to assure protection for the environment at the project site is the proper handling of surface water run-off from adjacent watersheds. To address this issue, and to insure the integrity of the Area of Operations during activities, flood control measures have been built into the Plan of Operations consistent with the recommendations of an independent surface water hydrologist who evaluated the area. As per the design, surface water runoff from the 100-year, 24-hour storm event cannot enter the Area of Operations from any direction. In addition, rainfall

within the yard will be retained within the Area of Operations through control of the internal drainage. In addition, the designed containment/evaporation pond will be sized with sufficien capacity to retain the surface run-off which would be expected to fall within the disturbed area as a result of a 100-year, 24 hour storm event as well as any excess water encountered during mining activities which cannot otherwise be utilized in connection with ongoing mining activities.

Diversion channels to direct surface run-off around the Area of Operations will be constructed as one of the first activities. The small watersheds above the Area of Operations, approximately 58 acres, are designed to flow into the diversion channels rather than into the Area of Operations.

The eastern portion of the mine yard will be used to stockpile ore prior to shipment to the Blanding mill for processing. Prior to stockpiling ore grade material in the locations shown on Plate 3, EFN will determine if the underlining strata material contains the proper mixture of limestone and shale material to function as an effective ore pad intended to prevent the migration of mineral values into the underlying subsurface formation. If the characteristics of the in-situ material are not sufficient for use as an ore pad, EFN will construct an ore pad upon which all high grade and low grade material will be stockpiled pending removal from the Project Area. Each ore pad will be at least one foot thick and shall be constructed utilizing the proper mixture of limestone and shale material produced from the underground excavation of the mine.

Under the Plan, EFN will improve and maintain the existing access road from the Project Area to the Mount Trumbull Road in conformance with BLM specifications. Ore haulage from the site will be by independent truck contractors using 25-ton capacity

trucks which comply with Arizona Highway Department of Transportation requirements. To prevent loss of material from wind erosion and rough roads, each load will be covered with a tarpaulin lapping over the side about a foot and secured every few feet around the truck bed. In the event of a truck accident, EFN will take immediate aggressive action to clean up all spilled material.

MEASURES TO BE TAKEN DURING A PERIOD OF NON-OPERATION

EFN intends to operate the Arizona 1 Project until all economic ore reserves are exhausted. The federal regulations which require submittal of this Plan of Operations call for a statement of measures to be taken in the event of an "extended period of non-operation before mining is completed." While there is no definitive plan for a shutdown before exhaustion of the mineral reserve, this occurrence must be regarded as a possibility.

Two different types of scenarios would occur depending upon the anticipated length of non-operation. A short shutdown of a few months to a year would require only limited action. In this case, a few employees would be kept at the mine site for repair and maintenance work and a watchman would reside at the mine site. All inventory items that may deteriorate in a year's time, such as explosives, oil, gas and first-aid supplies, would be used or removed from the Project Area. Hardware, such as nuts, nails and pipe fittings, would be secured in place. All equipment would be checked and most of it stored in the shop building or in the mine workings. The limited amount of equipment that could be used at other EFN operations would be removed from the site. All stockpiles above economic grade would be shipped to a mill for processing or maintained at the site. There would likely be some stockpile of low grade ore which would also be maintained at the mine site during a shutdown. Ventilation fans, electric lines and transformers would be left in place. Steel gates on the mine shaft would be closed and locked.

trucks which comply with Arizona Highway Department of Transportation requirements. To prevent loss of material from wind erosion and rough roads, each load will be covered with a tarpaulin lapping over the side about a foot and secured every few feet around the truck bed. In the event of a truck accident, EFN will take immediate aggressive action to clean up all spilled material.

MEASURES TO BE TAKEN DURING A PERIOD OF NON-OPERATION

EFN intends to operate the Arizona 1 Project until all economic ore reserves are exhausted. The federal regulations which require submittal of this Plan of Operations call for a statement of measures to be taken in the event of an "extended period of non-operation before mining is completed." While there is no definitive plan for a shutdown before exhaustion of the mineral reserve, this occurrence must be regarded as a possibility.

Two different types of scenarios would occur depending upon the anticipated length of non-operation. A short shutdown of a few months to a year would require only limited action. In this case, a few employees would be kept at the mine site for repair and maintenance work and a watchman would reside at the mine site. All inventory items that may deteriorate in a year's time, such as explosives, oil, gas and first-aid supplies, would be used or removed from the Project Area. Hardware, such as nuts, nails and pipe fittings, would be secured in place. All equipment would be checked and most of it stored in the shop building or in the mine workings. The limited amount of equipment that could be used at other EFN operations would be removed from the site. All stockpiles above economic grade would be shipped to a mill for processing or maintained at the site. There would likely be some stockpile of low grade ore which would also be maintained at the mine site during a shutdown. Ventilation fans, electric lines and transformers would be left in place. Steel gates on the mine shaft would be closed and locked.

In the event of non-operation for more than a year, a different procedure would be followed. Nearly all mobile equipment and a portion of the fixed equipment would be removed from the Project Area. Fans would be removed and the ventilation shaft capped with perforated steel plates welded in place to allow natural ventilation but to prevent access to the working. The buildings, headframe and hoist would be left in place but secured and maintained in the same manner as a short term closure.

MEASURES TO RECLAIM AT THE END OF THE OPERATIONS

At the conclusion of mining activities, EFN will disassemble and remove all the surface plant equipment and buildings and bury all concrete footings and concrete slab materials within the mine yard or backfill the material into the shaft. All facilities, materials, supplies and mobile equipment will be removed. Low grade material will be removed from the site or backfilled into the mine shaft. The shaft entrance will be sealed to prevent entry by unauthorized members of the public, and the entire Area of Operations will be fully reclaimed. Specifically, the following reclamation activities will be implemented at the end of mining activities:

- The Area of Operations will be radiometrically surveyed and any material found which exceeds acceptable radiation standards will be either buried in the mine workings or removed from the site.

- Sediments accumulated in the holding pond, if any, will be excavated form the pond and either hauled from the Project Area or disposed of underground in the mined out workings.

- The potential usefulness of the water well will be evaluated as part of final site reclamation. If there is no other use for the well, it will be sealed and abandoned.

- After the removal of all equipment and backfilling of material, the shafts and venthole will be sealed in a manner approved by the appropriate regulatory agencies.

- All portions of the Area of Operations not previously reclaimed will be recontoured to the approximate original contour and re-topsoiled. All remaining topsoil will be spread over the Area of Operations to be uniform thickness.

- All ground surface which has been disturbed will be drill seeded using a seed mixture approved by the BLM prior to application.

- The diversion channels built at the start of the Project will be kept in place so as to divert surface run-off around the area of reseeding until revegetation has been adequately established. Thereafter, if requested by the BLM, these channels will be re-contoured and seeded.

- The upgraded and relocated portions of the access road to the site will be fully reclaimed unless the BLM requests that it be left in place as part of the regional road system under the jurisdiction of the BLM.

PROPOSED RADIOLOGICAL MONITORING PROGRAM

The proposed radiological monitoring program involves collection of appropriate baseline data before the mine is operational. Additional measurements will be made as needed during mine operation and in the event of an accidental release of liquids which might contain radioactivity. A final survey will be conducted at the time the mine is closed. Each part of the monitoring program will be described here.

- After the removal of all equipment and backfilling of material, the shafts and venthole will be sealed in a manner approved by the appropriate regulatory agencies.

- All portions of the Area of Operations not previously reclaimed will be recontoured to the approximate original contour and re-topsoiled. All remaining topsoil will be spread over the Area of Operations to be uniform thickness.

- All ground surface which has been disturbed will be drill seeded using a seed mixture approved by the BLM prior to application.

- The diversion channels built at the start of the Project will be kept in place so as to divert surface run-off around the area of reseeding until revegetation has been adequately established. Thereafter, if requested by the BLM, these channels will be re-contoured and seeded.

- The upgraded and relocated portions of the access road to the site will be fully reclaimed unless the BLM requests that it be left in place as part of the regional road system under the jurisdiction of the BLM.

PROPOSED RADIOLOGICAL MONITORING PROGRAM

The proposed radiological monitoring program involves collection of appropriate baseline data before the mine is operational. Additional measurements will be made as needed during mine operation and in the event of an accidental release of liquids which might contain radioactivity. A final survey will be conducted at the time the mine is closed. Each part of the monitoring program will be described here.

Preoperational Baseline Information

The preoperational baseline data collection program will last one year and will involve background measurements of direct gamma radiation, radon gas and progeny concentrations, and radioactivity concentrations in air, soil, and ground water.

Direct gamma radiation measurements are being obtained on a quarterly basis by at least two independent monitoring devices at four locations around the ARIZONA I site and at one site between the ARIZONA I and PINENUT mines. Passive thermoluminescent dosimeters will provide cumulative dose information. Readings from a pressurized ion chamber and/or two micro-R scintillometers will be recorded whenever the thermoluminescent dosimeters are exchanged.

Quarterly radon concentration measurements are being made at the five sites using Terradex alpha track-etch detectors. Passive radon measurements are also being made at the PINENUT, PIGEON, KANAB NORTH and the CANYON mine sites. Data can be used to determine the local variations in radon concentrations and to monitor for any cumulative impacts from increased uranium mining activities. To date, none of the data collected from any of the monitoring sites suggests that there has been any measureable change in the background radiation levels within a few hundred meters of any of the mining activities or ore transport to the mill. The measurements are consistent with computer modeling projections.

Water samples from Kanab Creek and the Colorado River have been analyzed and may be used to monitor for changes in radioactive material concentrations.

To date, the results of the ongoing study of radioactivity in the waters of the Colorado River indicate no impact from uranium mining activities.

A soil sample will be collected from an area downslope from the site. It will be assayed specifically for Ra-226 and gamma spectrometry performed to determine baseline concentrations of Th-232, Tl-208, K-40, and Cs-137 (from fallout).

Passive dust samples will be collected at the four monitoring sites to obtain background information on the amount of natural radioactivity in the dust around the mine.

Operational Measurements

The quarterly thermoluminescent dosimetry measurements and scintillometer measurements will continue at the four established monitoring sites around the site and the special site between ARIZONA I and PINENUT. Pressurized ion chamber measurements will be performed at least once per year to confirm the thermoluminescent dosimetry and scintillometer readings. Additional sites may be established at the mine and along the haulage route as deemed necessary.

Based on time and need, radon measurements will be performed in and around the mine site. The objective will be to collect sufficient radon information to ensure no noteworthy increase in radon gas occurs downwind from the site and to monitor for any cumulative impacts which might occur as a result of increased mining activities.

Passive dust monitoring will continue and will be used to monitor for significant changes in airborne radioactivity.

To date, the results of the ongoing study of radioactivity in the waters of the Colorado River indicate no impact from uranium mining activities.

A soil sample will be collected from an area downslope from the site. It will be assayed specifically for Ra-226 and gamma spectrometry performed to determine baseline concentrations of Th-232, Tl-208, K-40, and Cs-137 (from fallout).

Passive dust samples will be collected at the four monitoring sites to obtain background information on the amount of natural radioactivity in the dust around the mine.

Operational Measurements

The quarterly thermoluminescent dosimetry measurements and scintillometer measurements will continue at the four established monitoring sites around the site and the special site between ARIZONA I and PINENUT. Pressurized ion chamber measurements will be performed at least once per year to confirm the thermoluminescent dosimetry and scintillometer readings. Additional sites may be established at the mine and along the haulage route as deemed necessary.

Based on time and need, radon measurements will be performed in and around the mine site. The objective will be to collect sufficient radon information to ensure no noteworthy increase in radon gas occurs downwind from the site and to monitor for any cumulative impacts which might occur as a result of increased mining activities.

Passive dust monitoring will continue and will be used to monitor for significant changes in airborne radioactivity.

Soil samples will be obtained to delineate possible radionuclide increases from accidental releases or to ensure that ground water, if present, will not be adversely impacted.

Water samples will be collected annually at any operating on-site wells. The collection program will be integrated with the water sampling programs currently in progress at the other mining operations on the Arizona Strip. It is hoped that the water results and associated information may be used by the Bureau of Land Management, Forest Service and Park Service to assist with ongoing, long term assessments of water quality in the Grand Canyon area.

Whenever a haulage accident occurs a radiological report will be prepared. The report will contain such information as the amount of material spilled, the extent of area affected, measures taken to provide an adequate cleanup, results of the final radiological survey, and estimates of any possible non-occupational exposures.

B. Alternatives Considered

Alternative 1

No Action. The No Action alternative is a continuation of existing conditions. It is that situation which currently exists within the District and is described within the section on Affected Environment.

Under the No Action alternative, the Plan of Operations would be denied if it did not meet the criteria of 43 CFR 3809 Surface Management regulations to prevent undue or unnecessary degredation. The plan would be returned to Energy Fuels who would have the option to resubmit after it had been upgraded to meet the requirements of the law.

Alternative 2

Approved As Submitted. This alternative, if selected would approve the Plan of Operations with no additional mitigation.

Alternative 3

Approved Subject to Additional Mitigation. This alternative would involve approval of the Plan of Operations subject to various additional operating constraints or stipulations, including but not limited to the following.

- Use other forms of transportation for employees to access mine.
- Relocate surface facilities within the mine yard.
- Require use of existing access.
- Require use of existing facilities at Pinenut.

All alternatives and corresponding impacts are fully described in Section VI. A - C.

IV. THE AFFECTED ENVIRONMENT

As stated previously in Section III B (1), the affected environment is equivalent to that situation that existed in the District prior to EFN submitting the Arizona No. 1 Mining Plan of Operations. The affected environment includes all past uranium mining and exploration activities and is described in the cumulative analysis section at the end of IV. The proposed action and all the alternatives will be evaluated against the existing or affected environment.

Alternative 2

Approved As Submitted. This alternative, if selected would approve the Plan of Operations with no additional mitigation.

Alternative 3

Approved Subject to Additional Mitigation. This alternative would involve approval of the Plan of Operations subject to various additional operating constraints or stipulations, including but not limited to the following.

- Use other forms of transportation for employees to access mine.
- Relocate surface facilities within the mine yard.
- Require use of existing access.
- Require use of existing facilities at Pinenut.

All alternatives and corresponding impacts are fully described in Section VI. A - C.

IV. THE AFFECTED ENVIRONMENT

As stated previously in Section III B (1), the affected environment is equivalent to that situation that existed in the District prior to EFN submitting the Arizona No. 1 Mining Plan of Operations. The affected environment includes all past uranium mining and exploration activities and is described in the cumulative analysis section at the end of IV. The proposed action and all the alternatives will be evaluated against the existing or affected environment.

A. LAND STATUS

Plate 1 shows the land status and management boundaries in relationship to this project.

This project is located within T. 36 N., R. 5 W., Section 23, W½ Section 22, E½. Both surface and mineral estates are owned by the federal government under the administration of the Bureau of Land Management and are open to mineral entry under the General Mining Laws of the United States.

B. NON-LIVING COMPONENTS

CLIMATOLOGY/GENERAL

The general area is classified as a semi-arid continental climate. It is typified by cool winters, warm summers and light precipitation. Winter temperatures commonly drop below freezing at night while summer temperatures routinely rise above 90°F in the day.

PRECIPITATION

Twenty three years of meteorological data have been collected at the Fredonia, Arizona, weather observation station located approximately 33 miles northeast of the project area. Long term data from this station is representative of the project area. A summary of this data is presented in Figure 1.

The annual average rainfall in Fredonia is 10.1 inches. Spring is usually the driest season, while winter is usually the wettest. August is usually the wettest month.

FIGURE 1

CLIMATOLOGICAL SUMMARY FOR FREDONIA, ARIZONA[1]

	Temperature (°F)					Precipitation (inches)				
				Extremes		Totals		Snowfall		Mean No. Days Precipitation[2]
Month	Mean Monthly	Mean Daily Maximum	Mean Daily Minimum	High	Low	Mean	Maximum	Mean	Maximum2	0.1"
JAN	32.7	46.0	19.4	66	-18	1.17	3.28	8.1	13.6	4
FEB	36.2	50.6	21.7	71	-15	.89	1.65	4.2	11.0	3
MAR	42.4	58.6	26.2	79	5	1.09	3.56	4.2	14.5	2
APR	50.7	68.7	32.7	86	10	.68	1.87	.7	2.0	1
MAY	58.0	77.0	39.0	94	20	.44	1.33	0	0	2
JUN	66.5	86.7	46.2	104	26	.32	.96	0	0	1
JUL	73.8	92.8	54.7	105	37	.69	1.88	0	0	2
AUG	72.1	90.1	54.1	104	33	1.27	2.68	0	0	4
SEPT	65.1	84.6	45.6	99	26	1.04	2.82	T	T	2
OCT	53.8	72.4	35.4	96	17	.88	3.08	.3	1.5	2
NOV	41.6	58.3	24.9	76	0	.62	1.39	1.2	6.0	3
DEC	34.6	48.5	20.7	70	-15	1.00	2.30	4.6	6.0	2
ANN	52.3	69.5	35.1	105	-18	10.09	3.56	22.3	14.5	28

Source: Climatography of the United States No. 86-2 Arizona.

1 Unless otherwise specified, based upon period of record 1937-1960.

2 Period of record 1951-1960.

FIGURE 1

CLIMATOLOGICAL SUMMARY FOR FREDONIA, ARIZONA[1]

Month	Temperature (°F)					Precipitation (inches)				
	Mean Monthly	Mean Daily Maximum	Mean Daily Minimum	Extremes High	Extremes Low	Totals Mean	Totals Maximum	Snowfall Mean	Snowfall Maximum[2]	Mean No. Days Precipitation[2] 0.1"
JAN	32.7	46.0	19.4	66	-18	1.17	3.28	8.1	13.6	4
FEB	36.2	50.6	21.7	71	-15	.89	1.65	4.2	11.0	3
MAR	42.4	58.6	26.2	79	5	1.09	3.56	4.2	14.5	2
APR	50.7	68.7	32.7	86	10	.68	1.87	.7	2.0	1
MAY	58.0	77.0	39.0	94	20	.44	1.33	0	0	2
JUN	66.5	86.7	46.2	104	26	.32	.96	0	0	1
JUL	73.8	92.8	54.7	105	37	.69	1.88	0	0	2
AUG	72.1	90.1	54.1	104	33	1.27	2.68	0	0	4
SEPT	65.1	84.6	45.6	99	26	1.04	2.82	T	T	2
OCT	53.8	72.4	35.4	96	17	.88	3.08	.3	1.5	2
NOV	41.6	58.3	24.9	76	0	.62	1.39	1.2	6.0	3
DEC	34.6	48.5	20.7	70	-15	1.00	2.30	4.6	6.0	2
ANN	52.3	69.5	35.1	105	-18	10.09	3.56	22.3	14.5	28

Source: Climatography of the United States No. 86-2 Arizona.
1 Unless otherwise specified, based upon period of record 1937-1960.
2 Period of record 1951-1960.

BIG JACKSON (#21 NE¼SW¼ Sec. 27 T36N R5W)

YEAR	FALL	WINTER	SPRING	SUMMER	ANN. TOTA	FALL AVE.	WIN. AVE.	SPR. AVE.	SUM. AVE	ANN. AVE.
76-77	.90	.80	1.94	2.10	5.74	2.41	3.17	2.93	4.65	13.15
77-78	1.04	5.84	4.25	1.34	12.47	2.41	3.17	2.93	4.65	13.15
78-79	5.19	5.99	3.72	1.66	16.56	2.41	3.17	2.93	4.65	13.15
79-80	1.15	6.08	4.25	2.87	14.35	2.41	3.17	2.93	4.65	13.15
80-81	1.65	1.45	3.36	9.52	15.98	2.41	3.17	2.93	4.65	13.15
81-82	3.05	3.01	2.23	6.30	14.59	2.41	3.17	2.93	4.65	13.15
82-83	3.19	2.61	3.24	6.80	15.84	2.41	3.17	2.93	4.65	13.15
83-84	3.14	1.23	.42	7.93	12.72	2.41	3.17	2.93	4.65	13.15
84-85	1.60	3.61	2.56	3.34	11.11	2.41	3.17	2.93	4.65	13.15
85-86	3.21	1.06	3.31	4.60	12.18	2.41	3.17	2.93	4.65	13.15

Figure 2

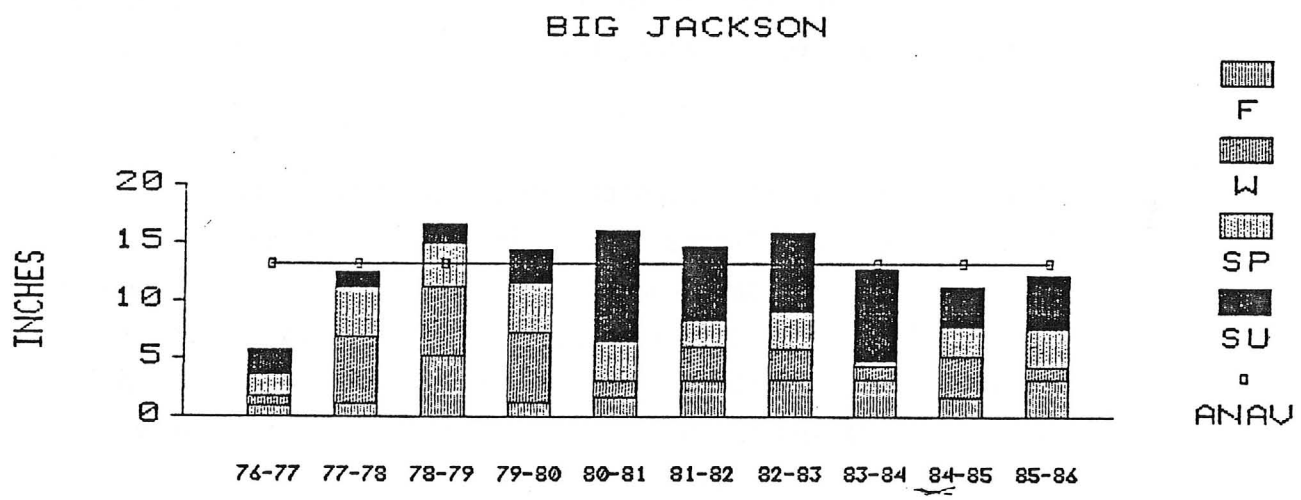


Figure 3

Summer showers can be very severe but are usually small, localized cells.

Additionally, the BLM has collected at least 8 years of rain gauge data from the Big Jackson gauge (1.5 miles south of the proposed action). This data is depicted in Figures 2 & 3.

b. WINDS

Long-term wind data are limited in the vicinity of the Project. However to better define the winds of the Arizona Strip Area, an independent consultant measured the wind patterns of the area. As a result, a continuous one year data set was collected from a meteorological station located near Sunshine Point, approximately seven miles north of the Project Area.

Wind data at this station were collected at the 10 meter height from March 1983 to March 1984. Because of the similarities in terrain and elevation and the close proximity of the meteorological station to the Project Area, these wind data are representative of the Project Area.

Figure 4 presents the graphical annual wind rose from the Sunshine Point station, and Figure 5 presents the tabular wind rose which also presents wind speed data. This collection of data shows that the prevailing wind direction at the Project Area is from the south-southwest, with south-southeast through southwest winds clearly dominating the wind patterns of the Area. (Nearly 40 percent of all winds blew from the south-southeast through southwest sectors.) East-southeast winds are the least frequently occurring at the Project Area, occurring less than 1.0 percent of the time.

Summer showers can be very severe but are usually small, localized cells.

Additionally, the BLM has collected at least 8 years of rain gauge data from the Big Jackson gauge (1.5 miles south of the proposed action). This data is depicted in Figures 2 & 3.

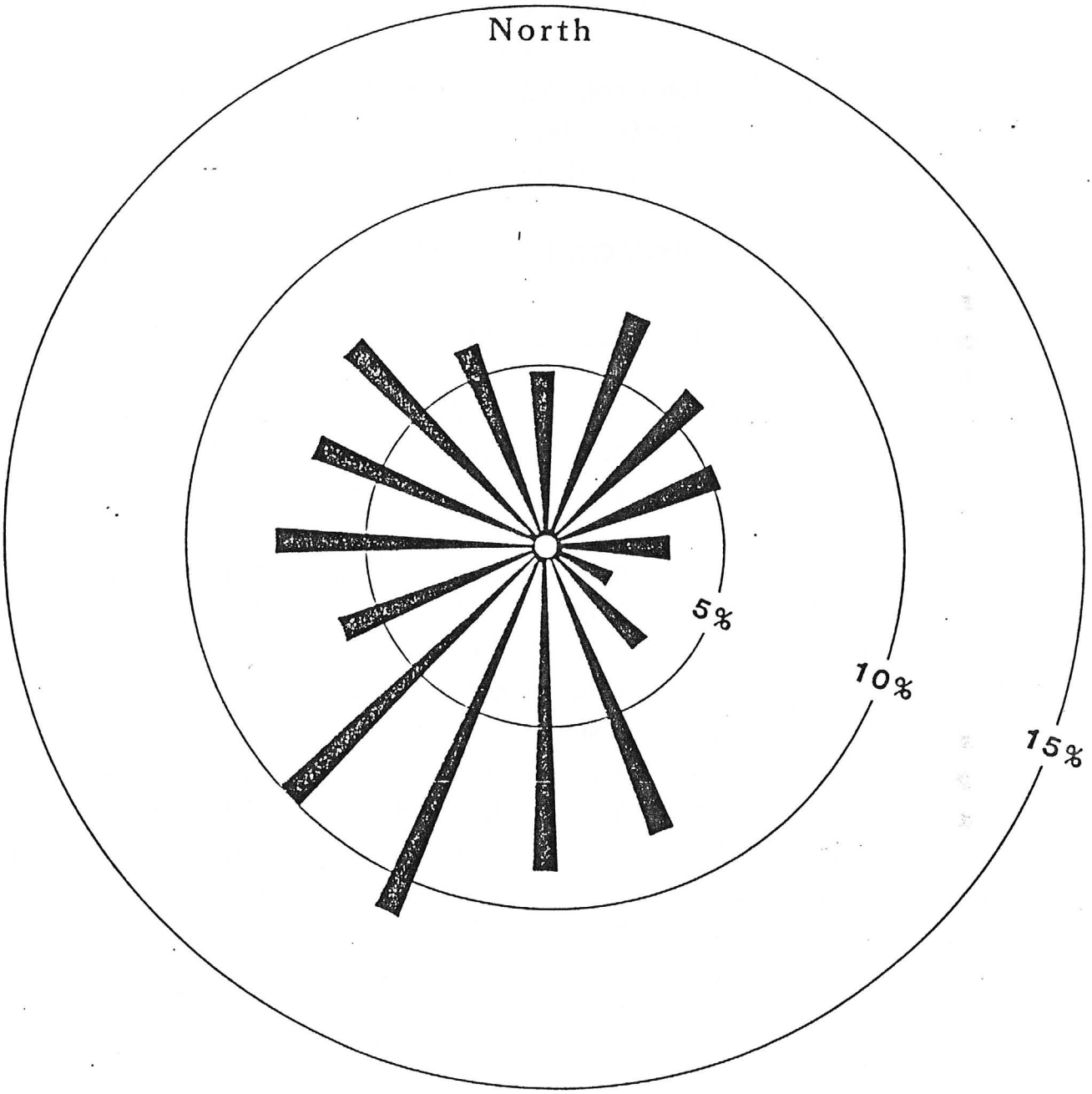
b. WINDS

Long-term wind data are limited in the vicinity of the Project. However to better define the winds of the Arizona Strip Area, an independent consultant measured the wind patterns of the area. As a result, a continuous one year data set was collected from a meteorological station located near Sunshine Point, approximately seven miles north of the Project Area.

Wind data at this station were collected at the 10 meter height from March 1983 to March 1984. Because of the similarities in terrain and elevation and the close proximity of the meteorological station to the Project Area, these wind data are representative of the Project Area.

Figure 4 presents the graphical annual wind rose from the Sunshine Point station, and Figure 5 presents the tabular wind rose which also presents wind speed data. This collection of data shows that the prevailing wind direction at the Project Area is from the south-southwest, with south-southeast through southwest winds clearly dominating the wind patterns of the Area. (Nearly 40 percent of all winds blew from the south-southeast through southwest sectors.) East-southeast winds are the least frequently occurring at the Project Area, occurring less than 1.0 percent of the time.

Percent Occurrence Of Winds By Direction
March 1983-March 1984
Arizona Strip Station



ENECOTECH
Denver, Colorado

PROJECT Arizona One	Wind Rose

FILE NO. 105-006 DATE 1/88 FIGURE NO. 4

FIGURE 5

FREQUENCY OF WINDS BY DIRECTION AND SPEED
FOR
MARCH 1983 THROUGH MARCH 1984
ENERGY FUELS - ARIZONA STRIP - TOP SITE
TIME (MST): 0100-2400

SPEED CLASS INTERVALS (M/S)

DIRECTION	1 1.5	1.5 3	3 5	8 11	11	ALL		MEAN SPEED
N	0.31	2.10	1.41	0.35	0.04	0.00	4.21	3.0
NNE	0.29	2.18	2.89	1.05	0.15	0.00	6.56	3.6
NE	0.39	2.89	1.61	0.47	0.09	0.01	5.46	3.0
ENE	0.19	1.53	1.46	1.10	0.19	0.04	4.51	4.0
E	0.31	1.45	0.75	0.19	0.00	0.00	2.69	2.7
ESE	0.17	0.64	0.16	0.00	0.00	0.00	0.97	2.2
SE	0.44	2.06	0.63	0.09	0.00	0.00	3.22	2.3
SSE	0.32	4.26	2.76	0.87	0.07	0.00	8.27	3.0
S	0.79	4.30	2.90	1.85	0.04	0.00	9.88	3.3
SSW	0.56	5.00	3.22	2.09	0.56	0.05	11.49	3.6
SW	0.63	3.30	2.78	2.61	0.49	0.07	9.88	4.0
WSW	0.23	2.70	1.42	1.32	0.19	0.04	5.90	3.7
W	0.49	3.41	1.76	1.10	0.21	0.04	7.01	3.4
WNW	0.45	2.28	2.20	1.30	0.09	0.03	6.35	3.6
NW	0.32	2.81	2.73	1.08	0.12	0.04	7.09	3.5
NNW	0.20	1.66	2.49	0.96	0.20	0.00	5.51	3.8
ALL	6.07	42.58	31.16	16.42	2.44	0.32	98.99	3.4

CALM (less than one meter per second) = 1.0
PERIOD MEAN WIND SPEED = 3.4 M/S

FIGURE 5

FREQUENCY OF WINDS BY DIRECTION AND SPEED
FOR
MARCH 1983 THROUGH MARCH 1984
ENERGY FUELS - ARIZONA STRIP - TOP SITE
TIME (MST): 0100-2400

SPEED CLASS INTERVALS (M/S)

DIRECTION	1	1.5	1.5	3	3	5	8	11	11	ALL		MEAN SPEED
N	0.31		2.10		1.41		0.35		0.04	0.00	4.21	3.0
NNE	0.29		2.18		2.89		1.05		0.15	0.00	6.56	3.6
NE	0.39		2.89		1.61		0.47		0.09	0.01	5.46	3.0
ENE	0.19		1.53		1.46		1.10		0.19	0.04	4.51	4.0
E	0.31		1.45		0.75		0.19		0.00	0.00	2.69	2.7
ESE	0.17		0.64		0.16		0.00		0.00	0.00	0.97	2.2
SE	0.44		2.06		0.63		0.09		0.00	0.00	3.22	2.3
SSE	0.32		4.26		2.76		0.87		0.07	0.00	8.27	3.0
S	0.79		4.30		2.90		1.85		0.04	0.00	9.88	3.3
SSW	0.56		5.00		3.22		2.09		0.56	0.05	11.49	3.6
SW	0.63		3.30		2.78		2.61		0.49	0.07	9.88	4.0
WSW	0.23		2.70		1.42		1.32		0.19	0.04	5.90	3.7
W	0.49		3.41		1.76		1.10		0.21	0.04	7.01	3.4
WNW	0.45		2.28		2.20		1.30		0.09	0.03	6.35	3.6
NW	0.32		2.81		2.73		1.08		0.12	0.04	7.09	3.5
NNW	0.20		1.66		2.49		0.96		0.20	0.00	5.51	3.8
ALL	6.07		42.58		31.16		16.42		2.44	0.32	98.99	3.4

CALM (less than one meter per second) = 1.0
PERIOD MEAN WIND SPEED = 3.4 M/S

As shown in Figure 5, wind speeds average 3.4 m/sec (7.6 mph) throughout the one year monitoring period, with higher average wind speeds more often associated with southerly component winds. However, high wind speeds were not common, as wind speeds in excess of 11 m/sec (24.6 mph) occurred only 0.32 percent of the time.

AIR QUALITY

Associated with the Arizona Strip meteorological monitoring program, a TSP monitoring program was also conducted to establish the total suspended particulates (TSP) background in the relatively remote and undisturbed Arizona Strip region. This monitoring was also conducted at the Sunshine Point site (See Plate 1 for location). TSP data were collected at this station from March 1983 through March 1984 in accordance with Environmental Protection Agency (EPA) monitoring and Quality Assurance (QA) guidelines. As part of the QA procedures employed on this monitoring program, colocated samplers were operated to document the precision of the TSP measurements.

Summaries of the 1983-1984 TSP data collected at the Arizona Strip Air Quality Station are presented in Figure 6. These data show that the annual geometric mean at this location was 13.7 ug/m^3, and the highest single 24-hour concentration measured was 59 ug/m^3. Because of the close proximity of the Sunshine Point monitoring station to the Project Area, the similarities in climatology and the absence of nearby major industrial sources, this collection of data is representative of the baseline conditions at the Project Area.

3. WATER RESOURCES

A. Surface Water

Surface water in this areas is derived exclusively from

FIGURE 6

TSP SUMMARY FROM THE ARIZONA STRIP PROJECT*
SUNSHINE POINT STATION
March 1983 - March 1984

Concentrations (ug/m^3)

	Spring	Summer	Fall	Winter	Annual
Arithmetic Mean	19.0	27.3	12.0	8.1	16.6
Geometric Mean	16.9	25.5	11.2	6.3	13.7
First 24-hr Max	32	59	20	16	59
Second 24-hr Max	25	36	16	13	46

* Data collected on EPA one-day-in-six schedule.

Source: "Annual Air Quality and Meteorology Baseline Monitoring Report for the Arizona Strip Project: March 11, 1983 through March 10, 1984." Fox Consultants, Inc. July 1984.

FIGURE 6

TSP SUMMARY FROM THE ARIZONA STRIP PROJECT*
SUNSHINE POINT STATION
March 1983 - March 1984

Concentrations (ug/m^3)

	Spring	Summer	Fall	Winter	Annual
Arithmetic Mean	19.0	27.3	12.0	8.1	16.6
Geometric Mean	16.9	25.5	11.2	6.3	13.7
First 24-hr Max	32	59	20	16	59
Second 24-hr Max	25	36	16	13	46

---

* Data collected on EPA one-day-in-six schedule.

Source: "Annual Air Quality and Meteorology Baseline Monitoring Report for the Arizona Strip Project: March 11, 1983 through March 10, 1984." Fox Consultants, Inc. July 1984.

precipitation. Storm intensity can be quite severe due to small localized summer thunder showers.

Surface water exists only in the form of livestock impoundments constructed and designed for the capture of intermittant flows from localized and sporadic showers.

B. GROUND WATER

Through out much of this portion of the Colorado Plateau, the regional ground water table is very deep and controlled largely by the elevation of the Colorado River and its major tributaries (which have deeply incised the plateau and subsequently dewatered the area).

In the vicinity of the Arizona No. 1 Mine the regional water table is at a depth of approximately 3,000 - 3,500 feet and approximately 1,900 feet below the proposed depth of mining. Perched ground water conditions occur locally within the sedimentary sequence above the regional water table. Perched (alluvial) aquifers however, are typically discontinuous and not frequently capable of producing a sustainable yield due to low rates of natural ground water recharge and their limited lateral extent.

At the Arizona 1 mine yard, perched ground water conditions have not been identified during exploratory drilling but may be encountered during shaft/drift excavations. Other perched ground water zones may also be anticipated to occur as isolated or discontinuous lenses within the Toroweap and Kaibab limestones. These perched zones may yield small quantities to the mine workings as they are penetrated.

The experience at the Hacks and Pinenut mines, located in the general area, has been that the rates of ground water inflow to the mine workings decrease with time and generally cease within a period of months. Parametric studies have further shown that based on the observed rates of ground water flow at the Hacks mine the effective radius of the influence as a result of drainage into the mine workings will be small and is typically less than a few thousand feet.

The final depth of mining is nearly 1,900 feet above the regional ground water table within the Redwall-Muav limestone aquifer. The Redwall-Muav aquifer is the upper most aquifer of importance capable of supplying a continuous supply of water of a few gallons per minute.

EFN has described visual observations within the three Hacks mines and the Pigeon Mine to show the absence of open fractures or joints within the pipe and that all of the the voids within the rubblized collapse zone have essentialy been filled with a fine grained matrix of carbonaceous materials. As a result, the breccia pipe and the area immediately surrounding the pipe are effectively impermeable. This has been confirmed by laboratory tests on core samples taken from the same rock formation as the other similar projects as the Arizona mine. These tests indicate that the hydraulic conductivities of the rock mass within and adjacent to the pipe is less than the 1×10^{-8} cm/sec. This is consistent with the observed conditions in other operating mines on the North Rim specifically Hacks, Pigeon and Pinenut as well as the Hermit.

The experience at the Hacks and Pinenut mines, located in the general area, has been that the rates of ground water inflow to the mine workings decrease with time and generally cease within a period of months. Parametric studies have further shown that based on the observed rates of ground water flow at the Hacks mine the effective radius of the influence as a result of drainage into the mine workings will be small and is typically less than a few thousand feet.

The final depth of mining is nearly 1,900 feet above the regional ground water table within the Redwall-Muav limestone aquifer. The Redwall-Muav aquifer is the upper most aquifer of importance capable of supplying a continuous supply of water of a few gallons per minute.

EFN has described visual observations within the three Hacks mines and the Pigeon Mine to show the absence of open fractures or joints within the pipe and that all of the the voids within the rubblized collapse zone have essentialy been filled with a fine grained matrix of carbonaceous materials. As a result, the breccia pipe and the area immediately surrounding the pipe are effectively impermeable. This has been confirmed by laboratory tests on core samples taken from the same rock formation as the other similar projects as the Arizona mine. These tests indicate that the hydraulic conductivities of the rock mass within and adjacent to the pipe is less than the 1×10^{-8} cm/sec. This is consistent with the observed conditions in other operating mines on the North Rim specifically Hacks, Pigeon and Pinenut as well as the Hermit.

In general, the geology of the area in combination with the low precipitation and high evaporation losses lead to little water actually infiltrating and percolating downward into the regional water table. Although the actual rates of ground water recharge are not known, it is suggested that the rates of natural recharge are on the order of several hundredths to a few tenths of an inch per year.

A small potential exists for minor perched ground water conditions to occur above the regional water table wherever a permeability contrast exists; for example, immediately above the permeable Coconino Sandstone with the underlying low permeable Hermit Shale. Perched water may also be anticipated to occur as isolated or discontinuous lenses within the overlaying Toroweap and Kaibab limestones. The existence of the localized perched ground water zones above the regional water tables is manifested by the many seeps along the walls of the Grand Canyon.

4. SOILS

Soils in this area are alluvial derived from both Kaibab limestone and Moenkopi siltstone. These soils range from cobbly sandy loams to silt loams. Soils vary in depth from the shallowest deposits on the limestone ridges to the deepest Moenkopi soils in swales. The soils which will be disturbed at the mine yard are mostly derived from the Moenkopi. The soils around the realigned road section are derived mainly from Kaibab limestone. Erosion potential is low to moderate given the more subtle terrain features of the area. The productive potential of these soils are generally moderate, presently supporting only sagebrush and desert half shrub communities.

5. REGIONAL GEOLOGY

The Kaibab Plateau, on which the Arizona I Mine is located is underlain by thick sequences of horizontal to gently dipping Paleozoic rocks 570 to 220 million years old. The sedimentary sequences which are exposed on the walls of the Grand Canyon, range from about 3,500 to 4,500 feet thick and overlays the highly deformed Precambrian rocks. The Precambrian rocks form the basement complex which for practical purposes forms the lower limit of ground water occurrence.

While some ground water undoubtedly occurs within the Precambrian, the quantities and its significance are small compared to those within the overlying sedimentary deposits.

Stratigraphy

The generalized stratigraphy in the Arizona I mine area is shown on Figure 7. In the Arizona 1 mine site area the uppermost formation is the Moenkopi of the Triassic age. The Moenkopi consists of red siltstones and claystone which outcrop directly at the surface. The formation in the mine site is approximately 100 to 500 feet thick.

The Moenkopi is underlain by the Kaibab and Toroweap formations. These formations dip gently to the north and are exposed in the walls of the Grand Canyon. In the Arizona 1 mine area the aggregate thickness of the Kaibab and the Toroweap formations is 600 to 800 feet. The Kaibab Formation consists of a lower fossiliferous cherty limestone (Fossil Mountain Member) overlain by a sequence of thinly bedded limestone, shale and gypsiferous siltstone (Harrisburg Member).

5. REGIONAL GEOLOGY

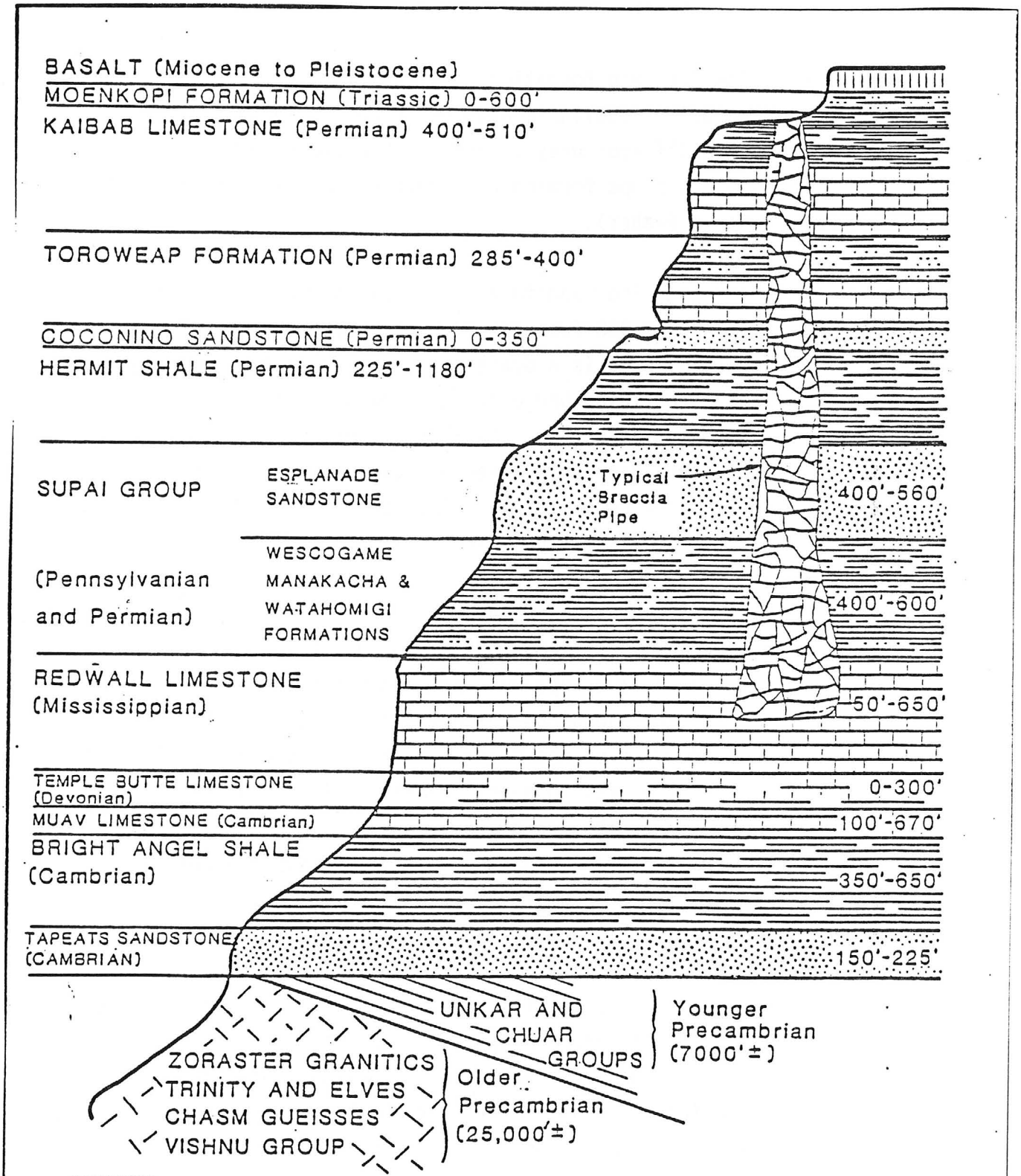
The Kaibab Plateau, on which the Arizona I Mine is located is underlain by thick sequences of horizontal to gently dipping Paleozoic rocks 570 to 220 million years old. The sedimentary sequences which are exposed on the walls of the Grand Canyon, range from about 3,500 to 4,500 feet thick and overlays the highly deformed Precambrian rocks. The Precambrian rocks form the basement complex which for practical purposes forms the lower limit of ground water occurrence.

While some ground water undoubtedly occurs within the Precambrian, the quantities and its significance are small compared to those within the overlying sedimentary deposits.

Stratigraphy

The generalized stratigraphy in the Arizona I mine area is shown on Figure 7. In the Arizona 1 mine site area the uppermost formation is the Moenkopi of the Triassic age. The Moenkopi consists of red siltstones and claystone which outcrop directly at the surface. The formation in the mine site is approximately 100 to 500 feet thick.

The Moenkopi is underlain by the Kaibab and Toroweap formations. These formations dip gently to the north and are exposed in the walls of the Grand Canyon. In the Arizona 1 mine area the aggregate thickness of the Kaibab and the Toroweap formations is 600 to 800 feet. The Kaibab Formation consists of a lower fossiliferous cherty limestone (Fossil Mountain Member) overlain by a sequence of thinly bedded limestone, shale and gypsiferous siltstone (Harrisburg Member).



SOURCES:

- DEPT. OF INTERIOR, 1976, DRAFT ENVIRONMENTAL STATEMENT, GRAND CANYON
- NUEXCO, REPORT 176, APRIL, 1983

Arizona Strip District
Generalized Stratigraphy

Dames & Moore

FIGURE 7

The Toroweap Formation consists of a thin basal unit of sandstone (Seligman Member), a thick middle unit of fossiliferous grey limestone (Brady Canyon Member) and an upper, slope forming gypsiferous shale and siltstone (Woods Ranch Member).

The Coconino Sandstone is underlain within the mine area at depths of 930 feet to 1,050 feet by the Hermit Shale. The Hermit Shale is a dense, clay cemented siltstone and behaves as a confining bed under the coarser and more permeable Coconino Sandstone. As a result of the permeability contrasts between these units, perches ground water may be found locally above the contact. Also the springs and seeps found along the canyon walls may be attributed to these contacts.

The Hermit Shale in turn is underlain by the Supai Formation which extends from about 1,050 to about 2,300 feet below the surface. The uppermost portion the Supai Formation is the resistant sandstone which results in the formation of the inner gorge of the Grand Canyon. The upper Supai Formation and the overlying Hermit Shale are the main host rocks for uranium at the Arizona 1 mine site. The lower portion of the Supai grades from a sandstone to a limestone which overlay the older limestones of the Redwall Formation.

The Redwall and the underlying Temple Butte and Muav Limestone collectively comprise the Redwall-Muav Limestone aquifer of northern Arizona. The Redwall Limestone is a thickly bedded, fine grained limestone that is usually considered to be a cliff former where exposed along the walls of the Grand Canyon. In this area of interest the Redwall Limestone is approximately 450 feet thick. The existing water supply at the area of operations of the Pinenut, Pigeon, Kanab North and Hacks mines are the proposed source of water for the Arizona 1 Mine.

The Toroweap Formation consists of a thin basal unit of sandstone (Seligman Member), a thick middle unit of fossiliferous grey limestone (Brady Canyon Member) and an upper, slope forming gypsiferous shale and siltstone (Woods Ranch Member).

The Coconino Sandstone is underlain within the mine area at depths of 930 feet to 1,050 feet by the Hermit Shale. The Hermit Shale is a dense, clay cemented siltstone and behaves as a confining bed under the coarser and more permeable Coconino Sandstone. As a result of the permeability contrasts between these units, perches ground water may be found locally above the contact. Also the springs and seeps found along the canyon walls may be attributed to these contacts.

The Hermit Shale in turn is underlain by the Supai Formation which extends from about 1,050 to about 2,300 feet below the surface. The uppermost portion the Supai Formation is the resistant sandstone which results in the formation of the inner gorge of the Grand Canyon. The upper Supai Formation and the overlying Hermit Shale are the main host rocks for uranium at the Arizona 1 mine site. The lower portion of the Supai grades from a sandstone to a limestone which overlay the older limestones of the Redwall Formation.

The Redwall and the underlying Temple Butte and Muav Limestone collectively comprise the Redwall-Muav Limestone aquifer of northern Arizona. The Redwall Limestone is a thickly bedded, fine grained limestone that is usually considered to be a cliff former where exposed along the walls of the Grand Canyon. In this area of interest the Redwall Limestone is approximately 450 feet thick. The existing water supply at the area of operations of the Pinenut, Pigeon, Kanab North and Hacks mines are the proposed source of water for the Arizona 1 Mine.

The Temple Butte Limestone which underlies the Redwall, consists of interbedded dolomites, dolomitic sandstones, sandy limestones, siltstone and sandstone. It outcrops in small ledges and cuts channels into underlying Muav-Limestone. The Muav-Limestone consists chiefly of dolomitic limestone and is gradational with the underlying Bright Angel Shale.

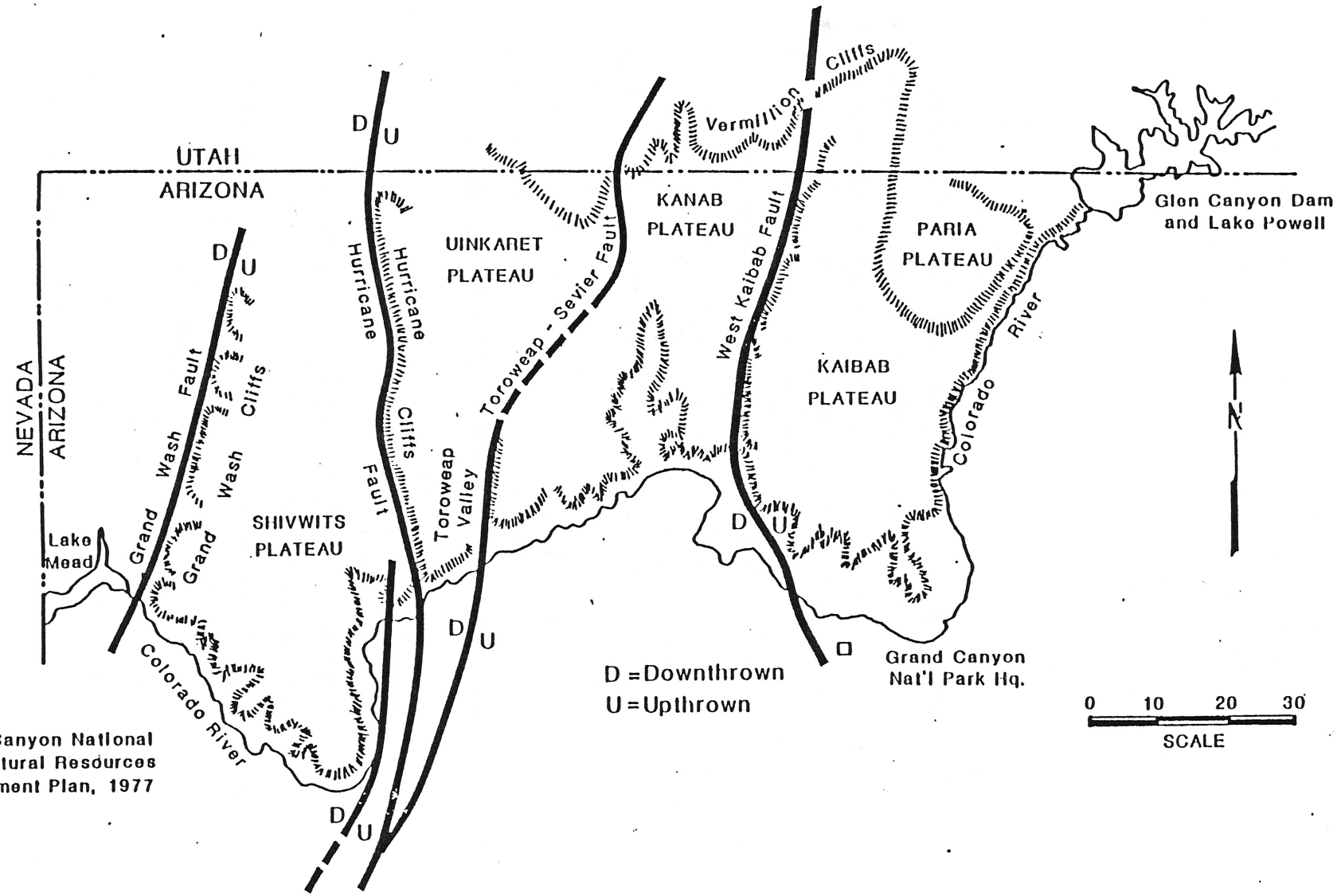
Structural Geology

Major north-south trending faults provide geologic and topographic boundaries to the many plateaus. The Kanab Plateau on which the Arizona mine is located lies between the Toroweap/Seveier fault on the west and the west Kaibab fault on the east. Both of these faults trend north-north east with movement on the order of hundreds of feet. The west Kaibab fault and the east Kaibab monocline form the boundaries of the Kaibab upwarp (Kaibab Plateau). Topographically the highest elevation in this area. Movements along many of the faults began in the Miocene, but much of the activity peaked during the Pliocene time. The faults are thought to be related to the underlying Precambrian zones weakness. Numerous smaller faults and folds are also present; these generally trend north northwest or north east. See Figure 8 for details.

Breccia Pipes

Roughly cylindrical, pipe like structures, termed breccia pipes, are common features across the Colorado Plateau. The breccia pipes are relatively small in diameter, generally less than 500 feet, but may be thousands of feet deep. The pipes contain broken rubbled rock from surrounding formations encircled by concentric ring fractures. The more permeable annular fault ring and debris within the center of the pipe once provided a vertical conduit for ascending or descending mineralizing fluids.

FIGURE 8

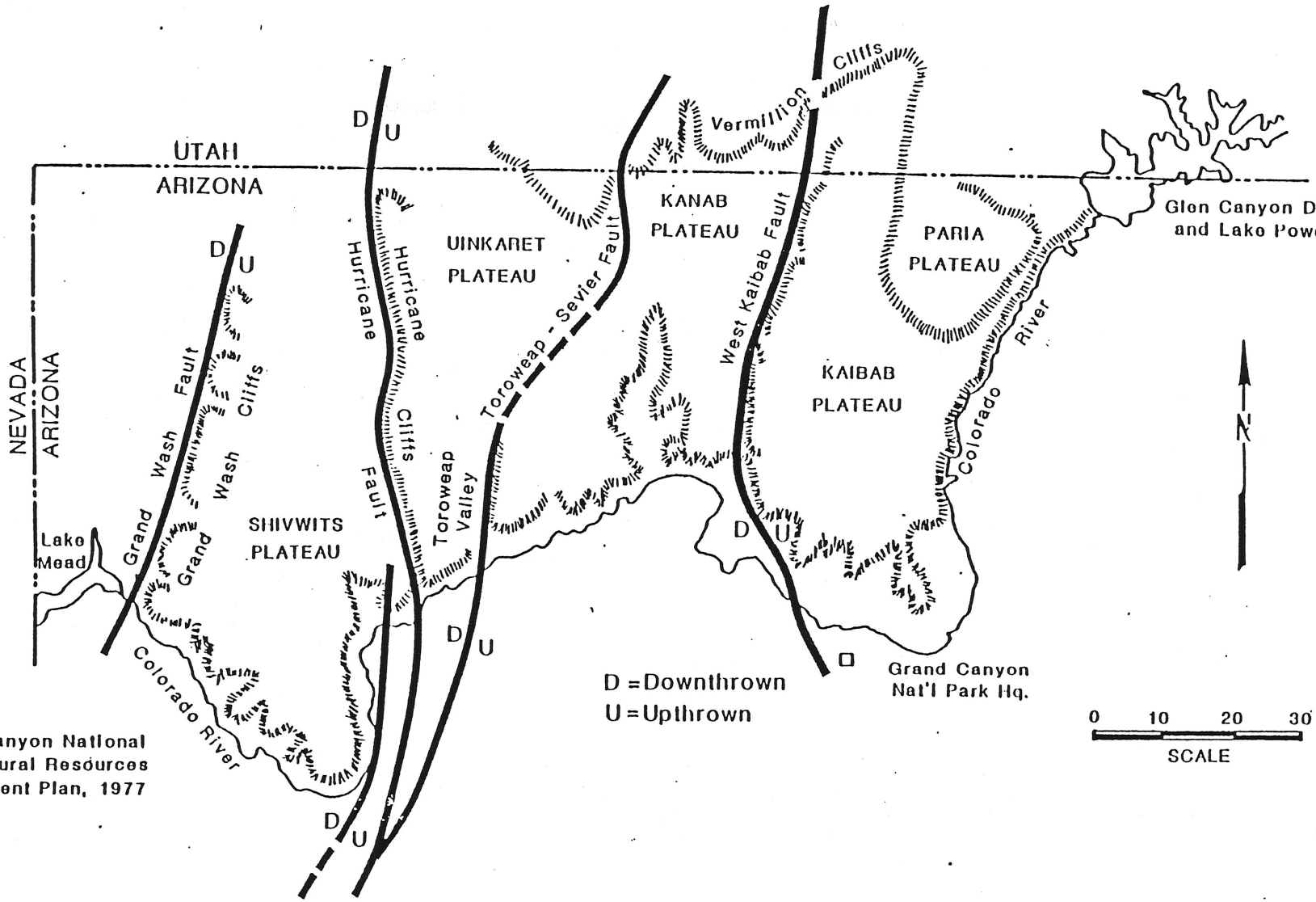


Source:
Grand Canyon National Park Natural Resources Management Plan, 1977

Arizona Strip District

Major Structural and Physiographic Features Map

Dames & Moore



Source:
Grand Canyon National Park Natural Resources Management Plan, 1977

Arizona Strip District

Major Structural and Physiographic Features Map

Dames & Moore

When mineable ore occurs in a pipe, it is typically located in both the annular fault ring and the central breccia matrix, principally in the Hermit and Supai formations. Because the pipes are not known to extend below the Redwall Limestone, it generally held that the pipes resulted from successive chimney collapse of the overlying formations into the solution caverns developed in the Redwall Limestone.

Geologists believe that cavities formed millions of years ago by disolving into solution portions of the Redwall Limestone which created a cavity or space into which the overlying strata collapsed. The collapsed zone propagated its way up hundreds and sometime thousands of feet in the form of a narrow cylinder cone. This broken rock or pipe created a favorable environment for mineral deposition.

Subsequent to the formation of the breccia pipes and mineralization, the materials within the pipe and adjacent rock were recemented and the void spaces filled with a fine grained matrix consisting mainly of carbonaceous materials. As a result the, breccia pipe and area surrounding the pipe are effectively impermeable. Laboratory tests for example, on core rock from the pipe areas have shown the rock mass hydraulic conductivities to be less than $1x10^{-9}$cm/sec.

6. RADIOLOGICAL ASSESSMENT

As described by Dr. John W. McKlveen, Director of the Radiation Research Center, Arizona State University, the natural radiation environment consists of cosmic radiation and many radioactive elements including Hydrogen-3, Carbon -14, Potassium-40, Rubdium-87, Uranium-235, Uranium-238 and Thorium-232. Importantly both Uranium-238 and Thorium are ubiquitous in both soils, air and water with average

concentrations of a few parts per million. Each are parent elements of a radioactive decay series. The thorium decay series is not significant in the Arizona I ore body so it will not be discussed here.

Natural Uranium is about 99.3% U-238 so the radiation contribution from the U-235 series is insignificant.

Radioactive materials are naturally present in air, water and soils. Typical concentrations of naturally occuring Uranium and Radium-226 in the area are on the order of 1 Pico-Curie per gram. A Pico-Curie is equivalent to 2.22 atoms of the radionuclide decaying each minute (a very small number).

Typically concentrations of Uranium and Ra-226 are on the order of 1, 2, and 3 pCi/L. Arizona's concentrations in water have been reported to be between 2.5 and 2.7 pCi/L. These values vary considerably depending on the extent of uranium mineralization in the area. The units of dose are the rem (roentgen equivalent man). Because this unit is large, it is useful to divide it by one thousand and discuss radiation dose in terms of 1/1000 rem, or millirem (mrem). The dose rates are described as mrem per hour or year.

Some typical radiation doses are as depicted on Figure 9:

Background

Monitoring stations which measure background gamma radiation were established at four locations around the Arizona-I on September 11, 1987. The sites are approximately ¼ mile (0.4 km) north, south, east and west of the proposed mine site.

concentrations of a few parts per million. Each are parent elements of a radioactive decay series. The thorium decay series is not significant in the Arizona I ore body so it will not be discussed here.

Natural Uranium is about 99.3% U-238 so the radiation contribution from the U-235 series is insignificant.

Radioactive materials are naturally present in air, water and soils. Typical concentrations of naturally occuring Uranium and Radium-226 in the area are on the order of 1 Pico-Curie per gram. A Pico-Curie is equivalent to 2.22 atoms of the radionuclide decaying each minute (a very small number).

Typically concentrations of Uranium and Ra-226 are on the order of 1, 2, and 3 pCi/L. Arizona's concentrations in water have been reported to be between 2.5 and 2.7 pCi/L. These values vary considerably depending on the extent of uranium mineralization in the area. The units of dose are the rem (roentgen equivalent man). Because this unit is large, it is useful to divide it by one thousand and discuss radiation dose in terms of 1/1000 rem, or millirem (mrem). The dose rates are described as mrem per hour or year.

Some typical radiation doses are as depicted on Figure 9:

Background

Monitoring stations which measure background gamma radiation were established at four locations around the Arizona-I on September 11, 1987. The sites are approximately ¼ mile (0.4 km) north, south, east and west of the proposed mine site.

Figure 9 Typical Radiation Doses

RADIATION SOURCE	DOSE (milli-rem) mrem
Cancer treatment (to specific organ)	5,000,000 per cancer
Lethal Dose	450,000 received immediately
First physiological effects	25,000 received immediately
Maximum allowable average occupational dose (medical and natural background excluded)	5,000 per year
Maximum allowable dose to individual member of general public (medical and natural background excluded)	500 per year
Cosmic ray doses to flight crew (McK 75)	380 per year
Average dose received by all workers in uranium mines, mills and power plants	365 per year
Vicinity of CANYON mine (McK 85)	70-125 per year
Arizona Strip near HERMIT mine (McK 85)	105 per year
Average dose, natural background	100 per year
Phoenix, Arizona (McK 85)	100-150 per year
Arizona Strip near PINENUT mine (McK 85)	90 per year
HACK CANYON & KANAB NORTH sites (McK 85)	70 per year
Window Rock/Cove/Red Valley, AZ. (McK 81)	70 per year
Average dose, diagnostic x-rays (McK 80)	70 per year
Control Room Operator, Nuclear Power Plant	50 per year
X-ray Technician	50 per year
Cigarettes does to lung (Po-210 from U-238 decay chain present)	30 per pack
Water and food; U.S. average	25 per year
Granite building like U.S. Capitol	20 per year

Figure 10 Background radiation measurements around the Arizona-I project

LOCATION	DATE	ION CHAMBER u/R hr	MICRO-R METER uR/hr	TLD uR/hr
North	9/11/87	10.2	8.5	****
	1/12/88	****	8.5	8.8
East	9/11/87	12.8	9.5	****
	1/12/88	****	8.0	10.4
South	9/11/87	10.3	8.0	****
	1/12/88	****	8.0	9.8
West	9/11/87	10.8	7.0	****
	1/12/88	****	8.5	10.1
Midway Between ARIZONA I & PINENUT				
	9/11/87	10.4	7.5	****
	1/12/88	****	7.0	10.2

**** No measurement made or available.

Radiologic Impacts of the Arizona 1 Uranium Mine, Dr. John McKlveen.

Figure 10 Background radiation measurements around the Arizona-I project

LOCATION	DATE	ION CHAMBER u/R hr	MICRO-R METER uR/hr	TLD uR/hr
North	9/11/87	10.2	8.5	****
	1/12/88	****	8.5	8.8
East	9/11/87	12.8	9.5	****
	1/12/88	****	8.0	10.4
South	9/11/87	10.3	8.0	****
	1/12/88	****	8.0	9.8
West	9/11/87	10.8	7.0	****
	1/12/88	****	8.5	10.1
Midway Between ARIZONA I & PINENUT				
	9/11/87	10.4	7.5	****
	1/12/88	****	7.0	10.2

**** No measurement made or available.

Radiologic Impacts of the Arizona 1 Uranium Mine, Dr. John McKlveen.

Because of the close proximity of the Arizona-I project to Pinenut, another site was established between the two mines.

Other monitoring stations are in place at all the other mines and along haul routes. Stations are using identical detection methods throughout the entire region which will allow any change from existing background to be obvious. At present more than 30 sample sites have been established throughout the Arizona Strip District.

The initial onsite radiation measurements were made at Arizona-I on September 11, 1987. The findings are presented in Figure 10. The data indicate that the background gamma radiation exposure rates are on the order of 70 mrem/yr. For comparison with other environments refer to Figure 9.

7. Acoustics

Background ambient sound levels on the Arizona Strip District vary depending on the proximity of receptors to human activities; particularly highways or local roads, aircraft flight paths and local meterological conditions. The most common noises resulting from mans activities in the Arizona Strip include off road vehicles such as jeeps, motorcycles and trucks (including lumber, oil and ore trucks) on U.S. Alternate 89, State routes 67 and 389 and other unpaved roads such as Ryan or Mt. Trumbull roads.

The Day-Night average sound levels (Ldn), for open unpopulated areas away from highways is expected to vary from 30-45 dB (decibels).

C. Living Components

1. Wildlife

A diversity of wildlife species has the potential to exist within the general project areas.

Big Game

Ground and aerial surveys to locate mule deer were conducted by a private contractor for the Arizona No. 1 Mine area. These surveys were designed to provide site specific baseline data, and to determine the extent and intensity of wildlife utilization. These contracted studies show currently low populations and generally confirm the data and observations of the BLM and the Arizona Game and Fish as described in both the Clayhole and the Paria-Kanab Creek Habitat Management Plans.

Mule deer use and occurrence in the area is minimal but the population is cyclic. Densities of mule deer are presently estimated to be below 0.5 deer per square mile. However adverse winter conditions may force deer from higher elevations and temporarily increase numbers slightly in the area of the proposed mine site. Early records indicate mule deer were uncommon. The population exploded in the 50's & 60's and has declined since then. Reasons for the decline are not well understood. The population is currently at an historic low point.

About 300 Pronghorn antelope presently occur in the Clayhole Valley area. The established herds or herd supplements have just begun to pioneer towards this area.

C. Living Components

1. Wildlife

A diversity of wildlife species has the potential to exist within the general project areas.

Big Game

Ground and aerial surveys to locate mule deer were conducted by a private contractor for the Arizona No. 1 Mine area. These surveys were designed to provide site specific baseline data, and to determine the extent and intensity of wildlife utilization. These contracted studies show currently low populations and generally confirm the data and observations of the BLM and the Arizona Game and Fish as described in both the Clayhole and the Paria-Kanab Creek Habitat Management Plans.

Mule deer use and occurrence in the area is minimal but the population is cyclic. Densities of mule deer are presently estimated to be below 0.5 deer per square mile. However adverse winter conditions may force deer from higher elevations and temporarily increase numbers slightly in the area of the proposed mine site. Early records indicate mule deer were uncommon. The population exploded in the 50's & 60's and has declined since then. Reasons for the decline are not well understood. The population is currently at an historic low point.

About 300 Pronghorn antelope presently occur in the Clayhole Valley area. The established herds or herd supplements have just begun to pioneer towards this area.

About 45 to 55 Big Horn sheep currently inhabit portions of the lower Kanab Creek area as well as parts of Hacks and Robinson Canyons. These animals are regularly sighted by EFN personnel at the Hacks Mine. Plans exist to manage these sheep throughout the Kanab Creek drainage in suitable habitat. This habitat is within 5.0 miles of the Arizona No. 1 mine yard.

Birds of Prey

The project area has potential for supporting a prey base for many raptors such as the red-tail hawk and grey horned owl. However, no birds of prey inhabit the immediate area given the lack of suitable nesting sites. The closest nesting habitat is located to the west, approximately 1.5 miles.

Small Game/Non-Game

The immediate area is habitat for a diverse number of non-game and small game species including rodents, rabbits, and reptiles. For example, the desert woodrat, antelope ground squirrel, desert cottontail, black-tailed jack rabbit, deer mouse, western harvest mouse, common pocket gopher, pallid bat, western fence lizard, gopher snake, common king snake and many other species would all be expected to occur in the subject area, in addition to such birdlife as the western meadowlark, various sparrows, juncos, several kinds of swallows, flycatchers, common ravens and crows, etc. Coyotes, bobcats, and an occasional mountain lion also inhabit the area.

2. Vegetation

The mine yard as well as the proposed access is located within sagebrush/desert half shrub type. The area supports 1 AUM per 11.7 acres and is considered in fair to good condition.

The dominent vegetation is:

Winterfat	Russian Thistle
Blue gramma	Eriogonum (annuals)
Dropseed	Wolfberry
Big Galleta	Rabbitbrush
Indian Rice Grass	Sagebrush
Needlegrass	Three-awn
Fourwing Saltbush	

3. Threatened or Endangered Species

The areas of direct surface impact were inventoried for all Threatened and Endangered (T&E) and Category 1 and 2 plant species. None were found.

Specifically, the Arizona No. 1 Mine site and access was cleared for Pediocactus peeblesianus var. ficheisenii a Category 1 species that occurs near the area. None were found. The soil and habitat of the area are not typical for this species. Transects through the area revealed no T&E species nor any other Category 1 & 2 species.

The area was reviewed for all Threatened and Endangered animal species and none were found or known to inhabit the area. Ellis (1979) identified some marginal to unsuitable peregrine falcon nesting habitat approximately 1.4 miles from the proposed mine site.

D. HUMAN VALUES

1. Cultural Resources

An archaeological survey was conducted by BLM prior to work commencing on the exploration plan of operations for this area in September 1984. Prior to submitting the Arizona 1 Mine Plan of Operations, EFN contracted Abajo Archaeology for a more detailed archaeological survey. This survey covered 40+ acres around the proposed mine

The dominent vegetation is:

Winterfat	Russian Thistle
Blue gramma	Eriogonum (annuals)
Dropseed	Wolfberry
Big Galleta	Rabbitbrush
Indian Rice Grass	Sagebrush
Needlegrass	Three-awn
Fourwing Saltbush	

3. Threatened or Endangered Species

The areas of direct surface impact were inventoried for all Threatened and Endangered (T&E) and Category 1 and 2 plant species. None were found.

Specifically, the Arizona No. 1 Mine site and access was cleared for Pediocactus peeblesianus var. ficheisenii a Category 1 species that occurs near the area. None were found. The soil and habitat of the area are not typical for this species. Transects through the area revealed no T&E species nor any other Category 1 & 2 species.

The area was reviewed for all Threatened and Endangered animal species and none were found or known to inhabit the area. Ellis (1979) identified some marginal to unsuitable peregrine falcon nesting habitat approximately 1.4 miles from the proposed mine site.

D. HUMAN VALUES

1. Cultural Resources

An archaeological survey was conducted by BLM prior to work commencing on the exploration plan of operations for this area in September 1984. Prior to submitting the Arizona 1 Mine Plan of Operations, EFN contracted Abajo Archaeology for a more detailed archaeological survey. This survey covered 40+ acres around the proposed mine

yard location. During this survey, 3 isolated artifacts were located that would be directly affected by the location of the mine yard. These artifacts have been recorded and collected.

Much of the pre-history of the area around the Arizona I mine site has been inventoried and studied as a result of EFN activities in the area. The most noteworthy effects are the Pinenut Mine yard inventory and site excavation, the Pinenut road and powerline inventories and the other inventories associated with their exploration activities. This information plus the 1988 cultural inventory underway through the Grand Canyon National Park Service comprises the bulk of the data known about the Kanab Plateau.

The new road realignment proposal has had a reconnaissance survey conducted. The initial findings were that no cultural properties occur along the proposed route.

Additionally, BLM has coordinated all findings with the Kaibab Paiutes and will continue to involve the tribe through the NHPA 106 process.

2. Socio-Economics

There are no new published census data since 1980, available for this socio-economic analysis. However, it was assumed that the previous summaries (1970-1980) are still reasonably accurate.

Four counties would be affected by uranium exploration and development at the Arizona No. 1 Site: Mohave and Coconino Counties, Arizona, Kane and San Juan County, Utah.

a. Population

The Bureau of Census subcounty population data are from units known as census county divisions (CCDs). The primary population areas consist of three CCDs, for which population data are summarized below in Figure 11.

It is reasonable to assume that at least the CCDs containing Kanab, Utah and Fredonia, Arizona have experienced a moderate increase in population, in the period from 1981-1985.

As of 1980, the three CCDs had two incorporated towns, Kanab, Utah and Fredonia, Arizona. Kanab had a 1987 population of 4,850 and Fredonia had a 1987 population of 1,844. The total population in these two towns represent approximately 50 percent of the 1980 populations for the three CCD north of the Grand Canyon National Park. The eastern portion of the Mohave North CCD contains most of the Kaibab Indian Reservation population as well as the small communities of Moccasin and Colorado City. These three population units represent an estimated 25 percent of the total population of the three CCDs north Grand Canyon National Park.

b. Employment

Figure 12 shows employment data for Mohave, Coconino and Kane Counties.

In addition to the above data, it is known that operations at the three Hack Canyon Mines (from 1980-1984) has generated at least $2,456,000 of severance, and property taxes for the state of Arizona.

a. Population

The Bureau of Census subcounty population data are from units known as census county divisions (CCDs). The primary population areas consist of three CCDs, for which population data are summarized below in Figure 11.

It is reasonable to assume that at least the CCDs containing Kanab, Utah and Fredonia, Arizona have experienced a moderate increase in population, in the period from 1981-1985.

As of 1980, the three CCDs had two incorporated towns, Kanab, Utah and Fredonia, Arizona. Kanab had a 1987 population of 4,850 and Fredonia had a 1987 population of 1,844. The total population in these two towns represent approximately 50 percent of the 1980 populations for the three CCD north of the Grand Canyon National Park. The eastern portion of the Mohave North CCD contains most of the Kaibab Indian Reservation population as well as the small communities of Moccasin and Colorado City. These three population units represent an estimated 25 percent of the total population of the three CCDs north Grand Canyon National Park.

b. Employment

Figure 12 shows employment data for Mohave, Coconino and Kane Counties.

In addition to the above data, it is known that operations at the three Hack Canyon Mines (from 1980-1984) has generated at least $2,456,000 of severance, and property taxes for the state of Arizona.

FIGURE 11

Census County Division Population Change: 1970-1980

CCD	Population 1970	- 1980	1987	Numerical Change	Percent Change
Mohave North (Co.)	950	1,786		836	88.0
Kaibab (Coconino Co.)	967	1,417		950	46.5
Kanab (Kane Co.)	1,621	3,116	(4800)*	2,781	92.2
Total:	3,538	6,319		4,067	78.6

Source: 1970 Census; 1980 Census of Population and Housing Arizona and Utah

*Source: Kane County Job Service 1987 estimate.

FIGURE 12

Selected Employment Data by County: 1980

Employment Category	Mohave*	Coconino**	Kane***
Manufacturing	1,925	2,150	65
Construction	225	50	15
Transportation/Public Utilities	875	1,025	15
Wholesale/Retail Trade	4,575	7,425	275
Finance/Insurance/Real Estate	675	750	40
Services	2,750	7,675	145
Government	2,625	8,925	275
Agricultural	4,075	1,100	435
Other	-	-	-
Total	18,625	31,275	1,370

*Arizona Statistical Review, Valley National Bank, Phoenix, Arizona 1982.
**Utah, County Economic Facts, 1980, Utah Industrial Development Information System, Salt Lake City, Utah.

As of July 1984, the following unemployment rates existed for the three counties:

	1984	1987 1st Quarter ****
*Mohave *(AZ)	7.3% unemployment	Feb. 10.9%
**Coconino (AZ)	9.0% unemployment	Feb. 10.9%
***Kane (UT).	10.0% unemployment	Feb. 7.2%

*Source: Mohave/Coconino County Job Services (Telephone Conversation)
***Source: Kane County Job Services (Telephone Conversation)
****Source: Arizona Department of Economic Security (Telephone Conversation)

(Both sources were named from quarterly unemployment bulletins.)

FIGURE 12

Selected Employment Data by County: 1980

Employment Category	Mohave*	Coconino**	Kane***
Manufacturing	1,925	2,150	65
Construction	225	50	15
Transportation/Public Utilities	875	1,025	15
Wholesale/Retail Trade	4,575	7,425	275
Finance/Insurance/Real Estate	675	750	40
Services	2,750	7,675	145
Government	2,625	8,925	275
Agricultural	4,075	1,100	435
Other	-	-	-
Total	18,625	31,275	1,370

*Arizona Statistical Review, Valley National Bank, Phoenix, Arizona 1982.
**Utah, County Economic Facts, 1980, Utah Industrial Development Information System, Salt Lake City, Utah.

As of July 1984, the following unemployment rates existed for the three counties:

	1984	1987 1st Quarter ****
*Mohave *(AZ)	7.3% unemployment	Feb. 10.9%
**Coconino (AZ)	9.0% unemployment	Feb. 10.9%
***Kane (UT).	10.0% unemployment	Feb. 7.2%

*Source: Mohave/Coconino County Job Services (Telephone Conversation)
***Source: Kane County Job Services (Telephone Conversation)
****Source: Arizona Department of Economic Security (Telephone Conversation)

(Both sources were named from quarterly unemployment bulletins.)

This figure will be actually higher when the other mines (Kanab North, Pigeon and Pinenut) are brought into production. EFNs presence in the communities of Kanab and Fredonia provides substantial employment opportunities and economic benefits.

3. PUBLIC ATTITUDES

Attitudes of the public can be classified as falling into one of three catagories; uninterested/uninformed, supportive and opposed.

THE UNINTERESTED/UNINFORMED CATEGORY

Within the present CCD's it can be assumed that the majority of people are marginally informed or interested in uranium mining activities and don't really want to participate in the mining proposals on the Arizona Strip.

THE SUPPORTIVE CATEGORY

Support for the proposed action exists on three levels. Many of the local county residents are generally supportive of mining activities and believe it to be an important part of the local economy. Such supporters are sympathetic to the concerns of the mining companies and are concerned about the Federal and State regulations which they view as curtailing or hampering mineral development.

On a more specific and localized level, past and present experience has demonstrated that the majority of Kanab and Fredonia residents strongly support the activities of EFN. They perceive the proposed action as potential

employment as well as an economic benefit. To many this action represents the kind of development necessary to broaden the economic base of the area beyond ranching, tourism and retirement.

Additionally, EFN is responsible for providing approximately 40% of all of the uranium now being produced within the United States and receives strong industry support for their operations. EFN is the tenth largest tax contributary in Mohave County and receives additional support, due to their large revenues generated on a local and regional basis (50 million per year).

THE OPPOSITION CATEGORY

Two specific groups oppose the proposed action. The main opposition comes from several environmental groups who believe significant irreparable damage is taking place due to mining on the District.

The second group of opponents are scattered individuals, and National Environmental organizations throughout the country. These individuals are opposed the development of uranium and/or the adverse impact on the area's natural values. Three distinct issues have been stated.

1. The Bureau is allowing mining to impact the Grand Canyon National Park.

2. That cumulative impacts are greater than those presented in the environmental assessment (EA's).

3. That significant regional degradation is occurring and that an Environmental Impact Statement is warranted.

employment as well as an economic benefit. To many this action represents the kind of development necessary to broaden the economic base of the area beyond ranching, tourism and retirement.

Additionally, EFN is responsible for providing approximately 40% of all of the uranium now being produced within the United States and receives strong industry support for their operations. EFN is the tenth largest tax contributary in Mohave County and receives additional support, due to their large revenues generated on a local and regional basis (50 million per year).

THE OPPOSITION CATEGORY

Two specific groups oppose the proposed action. The main opposition comes from several environmental groups who believe significant irreparable damage is taking place due to mining on the District.

The second group of opponents are scattered individuals, and National Environmental organizations throughout the country. These individuals are opposed the development of uranium and/or the adverse impact on the area's natural values. Three distinct issues have been stated.

1. The Bureau is allowing mining to impact the Grand Canyon National Park.

2. That cumulative impacts are greater than those presented in the environmental assessment (EA's).

3. That significant regional degradation is occurring and that an Environmental Impact Statement is warranted.

4. WILDERNESS

This area is approximately 5.25 miles west of the Kanab Creek designated wilderness area.

5. VISUAL RESOURCES

The proposed action is located on the lower reaches of Robinson point area. It is adjacent to the existing road that accesses the vent shaft to the Hacks Canyon mine on Robinson Canyon Point. The proposed action is also located adjacent to the newly installed Pinenut powerline.

This area was originally rated as a (low sensitivity) Class IV Visual Resource Management area, serving as background to more unique features. However due to the presence of the many mining and exploration impacts, the area has been temporarily downgraded into an interim management classification of Class V. This lower classification will continue until the area is no longer being explored or mined for locateable minerals.

6. BONDS

Energy Fuels has not established a Record of Non-Compliance, therefore surety bonds to insure reclamation are not mandatory. As EFN is in good standing under BLM's surface protection program and has demonstrated its abilities to conduct proper reclamation for both exploration and mining, a bond requirement is not anticipated.

7. OTHER VALUES

According to the Vermillion MFP, the main value of the Kanab Creek area is to provide for the recognition and enjoyment of

the scenic resource of Kanab Creek, as well as to provide for the continuation of the ranching operations. The area also provides open space and remoteness unique to the Arizona Strip. While the recreation potential of the immediate area is substantial, actual recreation use is nominal.

Mt. Trumbull road is a major travel influence zone heading into the Grand Canyon National Park Toroweap overlook.

E. CUMULATIVE IMPACTS-EXISTING SITUATION.

Uranium exploration has been ongoing within the Arizona Strip District since 1980. At present, the number of companies operating on the Arizona Strip has decreased by approximately 50% since 1980. Those companies still active in the uranium activities today are as follows:

Company	Comment
Energy Fuels Nuclear	Presently the only company that is operating a producing mine. Three mines are in the development stage prior to mining and three mines are in the reclamation stages. EFN has completed at least 88% of all reclamation requirements on all plans and notices that have been submitted.
Pathfinder Mines Corporation	Active in exploration only. One or two rigs active full time on BLM lands. Exploration is limited to specific claim blocks. PMC has completed approximately 60 percent of the reclamation on the exploration activities.
Union Pacific Resources	Active in exploration only. Present only a few months per year on the district. Only looked at 17 sites in 8 years. UPR has completed 20 percent of these reclamation on exploration activities.

the scenic resource of Kanab Creek, as well as to provide for the continuation of the ranching operations. The area also provides open space and remoteness unique to the Arizona Strip. While the recreation potential of the immediate area is substantial, actual recreation use is nominal.

Mt. Trumbull road is a major travel influence zone heading into the Grand Canyon National Park Toroweap overlook.

E. CUMULATIVE IMPACTS-EXISTING SITUATION.

Uranium exploration has been ongoing within the Arizona Strip District since 1980. At present, the number of companies operating on the Arizona Strip has decreased by approximately 50% since 1980. Those companies still active in the uranium activities today are as follows:

Company	Comment
Energy Fuels Nuclear	Presently the only company that is operating a producing mine. Three mines are in the development stage prior to mining and three mines are in the reclamation stages. EFN has completed at least 88% of all reclamation requirements on all plans and notices that have been submitted.
Pathfinder Mines Corporation	Active in exploration only. One or two rigs active full time on BLM lands. Exploration is limited to specific claim blocks. PMC has completed approximately 60 percent of the reclamation on the exploration activities.
Union Pacific Resources	Active in exploration only. Present only a few months per year on the district. Only looked at 17 sites in 8 years. UPR has completed 20 percent of these reclamation on exploration activities.

Uranerz Very limited activities mostly on older mines and prospects within the Shivwits Resource Area. Recent limited activities in the Vermillion RA. Isolated claim blocks throughout the district. Planning only 5-6 Notices for 1988 activity year. Uranerz has completed 82.3 percent of reclamation their past activities.

CUMULATIVE IMPACTS RESULTING FROM EXPLORATION ON THE DISTRICT

As of the last environmental assessment (Hermit) conducted for a uranium mine on this district (March of 1987), it was determined that the following impacts and disturbances existed as a result of exploration in an approximate 7 year period.

TOTAL SURFACE DISTURBANCE	TOTAL RECLAMATION	TOTAL UNRECLAIMED
648 acres	533.5 acres	45.1 acres

Since that period an additional amount of activities as well as reclamation have occurred resulting in the following:

EXPLORATION DISTURBANCE
AS OF 3/7/1987 to 2/1/1988

COMPANY	P	N	A	DISTURBED	RECLAIMED	UNRECLAIMED	COMMENT
EFN*	0	20	2	40.0 acres	40.0 acres	0.0 acres	All sites reclaimed
PMC**	0	2	25	45.3 acres	3.4 acres	41.9 acres	30 acres pending
UPR***	0	1	0	2.0 acres	0.0 acres	2.0 acres	
U****	0	14	0	14.0 acres	12.6 acres	2.4 acres	
TOTAL	0	40	25	101.3 acres	56.0 acres	46.3 acres	

* EFN Has reclaimed approximately 88% of all past exploration sites submitted. The two amendments were re-entries to existing disturbances (as yet unreclaimed). Approximately 23 sites are unreclaimed but are continuing operations to be re-entered. Also, much of the disturbance is common access that will not be reclaimed until more exploration is conducted in the future. Estimates are based on two acres per Notice which is very high.

** PMC Disturbance figures are very accurate and based on actual ground impacts. As such, a comparison with past estimates show far less actual disturbance than stated in previous EA's. The majority of disturbance is associated with overland road access.

*** UPR A significant amount of reclamation is pending for next seasons reclamation efforts in September - October. All of next years activities will be re-entries and no new distrubance is expected.

**** U Has reclaimed most NOI's, but plans to re-enter many sites.

The figures shown above represent only an approximate estimate of the disturbance that presently exists. As reclamation figures and disturbance figures are constantly fluctuating it is difficult to describe the actual situation at any one point in time. Pathfinder figures are based on the actual number of sites submitted but acreage figures are bases on one tenth of an acre per drill pad and all access is assumed to be ten feet wide. These figures include trenching impacts resulting from the Pathfinder operations. The majority of disturbance is either a site which has not completed operations, it will be re-entered or that involves use of a common access.

* EFN Has reclaimed approximately 88% of all past exploration sites submitted. The two amendments were re-entries to existing disturbances (as yet unreclaimed). Approximately 23 sites are unreclaimed but are continuing operations to be re-entered. Also, much of the disturbance is common access that will not be reclaimed until more exploration is conducted in the future. Estimates are based on two acres per Notice which is very high.

** PMC Disturbance figures are very accurate and based on actual ground impacts. As such, a comparison with past estimates show far less actual disturbance than stated in previous EA's. The majority of disturbance is associated with overland road access.

*** UPR A significant amount of reclamation is pending for next seasons reclamation efforts in September - October. All of next years activities will be re-entries and no new distrubance is expected.

**** U Has reclaimed most NOI's, but plans to re-enter many sites.

The figures shown above represent only an approximate estimate of the disturbance that presently exists. As reclamation figures and disturbance figures are constantly fluctuating it is difficult to describe the actual situation at any one point in time. Pathfinder figures are based on the actual number of sites submitted but acreage figures are bases on one tenth of an acre per drill pad and all access is assumed to be ten feet wide. These figures include trenching impacts resulting from the Pathfinder operations. The majority of disturbance is either a site which has not completed operations, it will be re-entered or that involves use of a common access.

Cumulative Surface Disturbance Resulting From Uranium Production

The uranium deposits in this area are typiclaly small breccia type deposits. They are short lived and generally result in limited disturbances with environmental impacts that are relatively confined.

Since 1980, the following cumulative surface impacts from mining have resulted.

Hack's 1, 2	Hack's 3	
9.1 acres disturbance	2.55 acres disturbance	=
4.5 miles existing access upgraded	.77 miles additional access	=

Total 11.66 ac + 10 acres buffer zone = 21.65 acres
Total 5.27 miles of access.

- original access was existing but upgraded to accomodate ore haulage
- 7-9 people are employed, but will soon be utilized at other mines
- EFN busses employees.
- All three mines are in the final phases of reclamation.
- Mt. Trumbull road is maintained by EFN and the county.
- 14.5 miles of powerline on public lands. This powerline will remain because of the Hermit and Pinenut Mine use.
- No more ore haulage and reclamation is complete.

Pigeon

- 40 acres
- 10 miles of existing access upgraded to accomodate ore haulage plus 1/4 mile new access.
- 38 people are employed.
- EFN busses employees.
- Hauling is approximately 10-15 trips per day on Ryan road.
- Life expectancy is approximately 1990-1991, reclamation is scheduled immediately afterwards.
- 8.0 miles of powerline.

Kanab North

- 28.0 (includes 10 acre buffer zone)
- 6.5 miles of existing access upgraded to accomodate ore haulage,2.0 miles of new access constructed.
- 8.0 miles of powerline
- Ore haulage will not take place until 1988.
- 42 people are employed.
- Life expectancy 1992, reclamation is scheduled immediately afterwards.

Pinenut

- 20.8 acres (for the mine yard)
- 17.0 miles of existing access upgraded (approximately (0.5 miles of new access resulting from realignment).
- Ore haulage not anticipated until 1989.
- Life expectancy approximately 9 years.
- Approximately 38 people employed.
- 8.3 miles of proposed powerlines

Pigeon

- 40 acres
- 10 miles of existing access upgraded to accomodate ore haulage plus 1/4 mile new access.
- 38 people are employed.
- EFN busses employees.
- Hauling is approximately 10-15 trips per day on Ryan road.
- Life expectancy is approximately 1990-1991, reclamation is scheduled immediately afterwards.
- 8.0 miles of powerline.

Kanab North

- 28.0 (includes 10 acre buffer zone)
- 6.5 miles of existing access upgraded to accomodate ore haulage,2.0 miles of new access constructed.
- 8.0 miles of powerline
- Ore haulage will not take place until 1988.
- 42 people are employed.
- Life expectancy 1992, reclamation is scheduled immediately afterwards.

Pinenut

- 20.8 acres (for the mine yard)
- 17.0 miles of existing access upgraded (approximately (0.5 miles of new access resulting from realignment).
- Ore haulage not anticipated until 1989.
- Life expectancy approximately 9 years.
- Approximately 38 people employed.
- 8.3 miles of proposed powerlines

Hermit

- 23.6 acres mine yard
- No new powerline needed
- 1.2 miles new road
- 2.3 miles of reclaimed road
- Approximately 38 people employed
- Mine life expectancy is 9 years
- Ore hauling projected to start 1989-1990

Total Disturbance Resultant from Production

Mine Yard Acreage	138.0 acres
Existing Access Upgraded	38.0 miles
New Access Constructed	4.22 miles
Miles of Powerline	38.8 (on Public Lands)

The total impact of mining disturbances is less than 0.0027% of the entire Strip District. Of special importance is that the three Hacks Canyon Mines will be reclaimed by mid-1988. There will be no further ore hauling on Mt. Trumbull Road until the Kanab North Mine commences ore production by mid 1988. In 1990, the Pigeon Mine will begin reclamation. The Pinenut Mine will haul on Mt. Trumbull road from mid 1989 through 1994. There has been a substantial net decrease in the amount of ore hauling in the area that will persist for at least 3 to 5 years.

By the time the Hermit Mine is producing, the Hack Canyon Mines will be fully reclaimed, the Pigeon Mine will also be under reclamation, the Kanab North mine will be gearing down for reclamation and the Pinenut Mine will still have several years of production left.

The Environmental Impact Statement (EIS) on the Canyon Mine proposal was prepared by the U.S. Forest Service and it states that the proposed mine would not have any environmental impacts on the Arizona Strip since the impacts from that kind of mine were also very localized.

1. Analysis of Cumulative Impacts from Exploration

Exploration has resulted in approximately 648 acres of surface disturbance within the Arizona Strip since 1980. Of this, 533.5 acres have been reclaimed or approximately 82%. The additional 114.5 acres that are at present unreclaimed represent ongoing activities or access that is used in common with several exploration areas. This unreclaimed acreage will eventually be rehabilitated.

The following impacts have occurred:

Vegetation

Generally vegetation is trampled by overland type vehicles. Damage is usually not severe where heavy equipment has not been used. Blading will destroy vegetation entirely.

Drill pads are generally not bladed unless on an excessive slope. However, revegetation is a requirement on plans, notices, amendments or modifications. It is a renewable resource. Reclamation is an ongoing activity.

It is a requirement that all areas to be disturbed will be in compliance with the Endangered Species Act. To date all T and E species have been avoided.

The Environmental Impact Statement (EIS) on the Canyon Mine proposal was prepared by the U.S. Forest Service and it states that the proposed mine would not have any environmental impacts on the Arizona Strip since the impacts from that kind of mine were also very localized.

1. Analysis of Cumulative Impacts from Exploration

Exploration has resulted in approximately 648 acres of surface disturbance within the Arizona Strip since 1980. Of this, 533.5 acres have been reclaimed or approximately 82%. The additional 114.5 acres that are at present unreclaimed represent ongoing activities or access that is used in common with several exploration areas. This unreclaimed acreage will eventually be rehabilitated.

The following impacts have occurred:

Vegetation

Generally vegetation is trampled by overland type vehicles. Damage is usually not severe where heavy equipment has not been used. Blading will destroy vegetation entirely.

Drill pads are generally not bladed unless on an excessive slope. However, revegetation is a requirement on plans, notices, amendments or modifications. It is a renewable resource. Reclamation is an ongoing activity.

It is a requirement that all areas to be disturbed will be in compliance with the Endangered Species Act. To date all T and E species have been avoided.

Wildlife

Generally, wildlife is affected by the loss of vegetation which provides food, cover and nesting sites. Loss of vegetation is not permanent. Given the total loss plus that which is rehabilitated, impacts are considered insignificant.

The presence of humans or machines and other foreign sites, sounds and smells associated with drilling activities are thought to have had a potentially greater impact on wildlife than the actual temporary loss of vegetation. However, the short duration of most exploration operations and the small areas affected generally do not pose significant impacts except, for example, to prevent reproduction of nesting birds in directly impacted areas if exploration activities coincide with the timing of nesting. Exploration activities generally are separated by great distances and most last less than 3-4 weeks, depending on drilling results.

Peregrine Falcons are provided strict legal protection during breeding and fledging periods pursuant to a Section 7 (ESA) consultation with U.S. Fish and Wildlife Service. No operations have been approved within 1.0 miles of the Kanab Creek rims in superior habitat during the period from March 1 to August 15th.

Soils

Soils are slightly affected by overland travel and where access or drill pads have been bladed. Significant erosion events are eliminated with proper mitigation and reclamation. Impacts are insignificant.

Vehicle travel is the largest contributor of dust. Historically there are normally less than four drill rigs operating within the entire district at any one time. Smaller support vehicles do most of the overland exploration activities (ie, casual use operations). The increase in dust resulting from exploration activities is short lived and local to the immediate area around occasional road blading to the exploration site.

Air Quality

Impacts to air quality (Class II) are negligible based on the amount of soils actually disturbed. Fugitive dust resulting from vehicle travel constitutes a line source that could be quantified via computer models but is considered insignificant given the amount of vehicle use, temporary duration on each site and the amount of disturbance during operations.

Water Quality

No impacts to surface water have been identified on the Strip District as a result of any mineral action. Ground water is protected and regulated by Arizona State Law which requires immediate plugging of drill holes when a hole is abandoned, in a manner that will preclude cross contamination between aquifers or from the surface. In any event, the probability of finding water in any single hole is extremely low. (The vast majority of holes are found to be barren).

No quantifiable impacts to the Kanab Creek Drainage has ever been observed. Sixty water/sediment parameters are measured regularly and there has never been a quantifiable change in the results obtained which has been attributed to mining activities.

Vehicle travel is the largest contributor of dust. Historically there are normally less than four drill rigs operating within the entire district at any one time. Smaller support vehicles do most of the overland exploration activities (ie, casual use operations). The increase in dust resulting from exploration activities is short lived and local to the immediate area around occasional road blading to the exploration site.

Air Quality

Impacts to air quality (Class II) are negligible based on the amount of soils actually disturbed. Fugitive dust resulting from vehicle travel constitutes a line source that could be quantified via computer models but is considered insignificant given the amount of vehicle use, temporary duration on each site and the amount of disturbance during operations.

Water Quality

No impacts to surface water have been identified on the Strip District as a result of any mineral action. Ground water is protected and regulated by Arizona State Law which requires immediate plugging of drill holes when a hole is abandoned, in a manner that will preclude cross contamination between aquifers or from the surface. In any event, the probability of finding water in any single hole is extremely low. (The vast majority of holes are found to be barren).

No quantifiable impacts to the Kanab Creek Drainage has ever been observed. Sixty water/sediment parameters are measured regularly and there has never been a quantifiable change in the results obtained which has been attributed to mining activities.

support of other local services that are not directly associated with exploration activity. Most people hired for exploration and mining are "locals" thus the influx of "outsiders" is very limited. It should be noted however that these activities can have negative impressions on those members of the public, that oppose this type of operation.

2. Analysis of Cumulative Impacts from Production

Impacts to soils and vegetation are directly related to the actual surface disturbance that occurs when mine areas, roads or powerlines are constructed. The total amount of surface disturbance associated with mining in the District is insignificant when compared to the total amount of land within the District. All operations are temporary and full reclamation is a mandatory requirement.

Visual Impacts

Visual impacts do occur as a result of mining, but such impacts are temporary and usually confined to local on site concerns. Examples: the Hack Canyon Mine complex can be observed only when one is at the mine site due to twisting canyon turns or at specific places on the rims atop the canyon. The Pigeon Mine is generally not observable from any portion of the access except for the evaporation pond and the yard enclosure atop the canyon. Pigeon Mine is observable from Forest Service lands across the Canyon but not directly visible from the bottom of the Canyon.

The Kanab North Mine is located on the rim of Kanab Creek. It is not visible on the West side of the creek except at an approximate distance of .5 miles when the head frame first becomes visible. Kanab North is visible from a wide area on

Remoteness

The remote and isolated nature of the district can be said to have been affected to some degree by the increase in exploration activities over the last 5 years. However, the level of frequency of the activities within the district has not been of a magnitude to alter the fundamentably remote character of the district. In order for this fundamental character to be changed, activities would have to expand tremendously. The affect of exploration activities are considered to be limited by the following factors:

1. The probability of being in the vicinity of a drill rig during operations is extremely low given the great distances that usually separate these activities and the short duration of time (less than 3-4 weeks) that exploration activities persist on any single site.

2. There are less than 4 drill rigs operating simultaneously on the Arizona Strip's 3.5 million acres. Visual impacts are usually screened by topography and vegetation.

3. No permanent adverse impacts are allowed from any operation pursuant to requirements that provide for mandatory reclamation (including all access).

Social/Economic Structure

Economic impacts from exploration and production activities are positive from the standpoint of local employment and support needs for exploration and mining equipment. These operations provide significant economic revenues to local and state agencies as well as infuse 50 million dollars a year into the 4 local counties. Additional benefits are added by

support of other local services that are not directly associated with exploration activity. Most people hired for exploration and mining are "locals" thus the influx of "outsiders" is very limited. It should be noted however that these activities can have negative impressions on those members of the public, that oppose this type of operation.

2. Analysis of Cumulative Impacts from Production

Impacts to soils and vegetation are directly related to the actual surface disturbance that occurs when mine areas, roads or powerlines are constructed. The total amount of surface disturbance associated with mining in the District is insignificant when compared to the total amount of land within the District. All operations are temporary and full reclamation is a mandatory requirement.

Visual Impacts

Visual impacts do occur as a result of mining, but such impacts are temporary and usually confined to local on site concerns. Examples: the Hack Canyon Mine complex can be observed only when one is at the mine site due to twisting canyon turns or at specific places on the rims atop the canyon. The Pigeon Mine is generally not observable from any portion of the access except for the evaporation pond and the yard enclosure atop the canyon. Pigeon Mine is observable from Forest Service lands across the Canyon but not directly visible from the bottom of the Canyon.

The Kanab North Mine is located on the rim of Kanab Creek. It is not visible on the West side of the creek except at an approximate distance of .5 miles when the head frame first becomes visible. Kanab North is visible from a wide area on

the east side of Kanab Creek approximately 2.0 miles away, but it is not visible from within the canyon.

The Pinenut Mine is within a small localized basin and can generally not be seen for more than a ½ mile away.

The Hermit Mine head frame is visible from the travel influence zone and can be seen from Highway 389 but not recognized as a mine unless the viewers already know.

Wildlife

Wildlife is potentially affected by ongoing mining operations. Impacts occur due to temporary loss of habitat change of habitats, and increased vehicle use on roads and human activities. The extent of anticipated impacts are limited to those impacts that occur within a close proximity to the mine yard or haul route. Impacts overall are considered insignificant due to the small amount of habitat that is temporarily lost, short duration of activities and the vast acreages of similar habitat available in the district. However, with the increased vehicle traffic some mortality, especially of small mammals and reptiles can be expected. This may increase the food supply of ravens and other birds of prey.

No adverse impacts to resident deer, pronghorn antelope or bighorn sheep have been documented as a result of mining activities. There have been no documented cases of mortality to deer, pronghorn or sheep from any hauling operation. The other existing mining operations have not resulted in any recorded impacts to terrestrial or avian wildlife species from the water impoundments and thus none is expected.

Monitoring for falcons and eagles has occurred. To date there is no evidence that either species has been adversely affected.

Air Quality

Analysis of cumulative impacts on the air quality within the district from mining activities has showed no significant adverse impacts. The small impact areas resulting from mines like the Pigeon Mine and Kanab North Mine and the relatively large distances between operations, make any cumulative impacts highly unlikely. Utilization of haul roads by the operations similarly are not likely to generate levels of TSP which approach the air quality standard of 260 ug/m^3.

Morever, if such a level were to be approached, mitigation measures are available to reduced the impact. For additional analysis see the proposed action and the Air Quality Impact Analysis for the Arizona No. 1 Project.

Water Quality

No measureable impacts to surface waters have been documented as a result of mining operations.

In August of 1984 a minor discharge of uranium ore into the watershed of Kanab Creek occurred at the Hack Canyon No. 1 mine as a result of a 120-year, 3-hour storm event. This accidental discharge is the only discharge of water from a uranium mining operation which has occurred within the Arizona Strip District since EFN began mining operations in 1980. Moreover, as shown in information previously made available to the BLM, independent evaluations of the potential effects of this discharge on the water quality of the area, and prior and subsequent semi-annual monitoring of Kanab Creek by EFN, have

Monitoring for falcons and eagles has occurred. To date there is no evidence that either species has been adversely affected.

Air Quality

Analysis of cumulative impacts on the air quality within the district from mining activities has showed no significant adverse impacts. The small impact areas resulting from mines like the Pigeon Mine and Kanab North Mine and the relatively large distances between operations, make any cumulative impacts highly unlikely. Utilization of haul roads by the operations similarly are not likely to generate levels of TSP which approach the air quality standard of 260 ug/m^3.

Morever, if such a level were to be approached, mitigation measures are available to reduced the impact. For additional analysis see the proposed action and the Air Quality Impact Analysis for the Arizona No. 1 Project.

Water Quality

No measureable impacts to surface waters have been documented as a result of mining operations.

In August of 1984 a minor discharge of uranium ore into the watershed of Kanab Creek occurred at the Hack Canyon No. 1 mine as a result of a 120-year, 3-hour storm event. This accidental discharge is the only discharge of water from a uranium mining operation which has occurred within the Arizona Strip District since EFN began mining operations in 1980. Moreover, as shown in information previously made available to the BLM, independent evaluations of the potential effects of this discharge on the water quality of the area, and prior and subsequent semi-annual monitoring of Kanab Creek by EFN, have

verified that this small discharge did not have any measurable adverse impact on the water quality of Kanab Creek watershed.

V. THE ANTICIPATED IMPACTS OF PROPOSED ACTION

A. Land Status

Since EFN has not applied for patent, there would be no affect on land status as a result of the proposed mine plan of operation.

B. Non Living Environment

1. Air Shed

The proposed action would have no significant impacts, on the immediate air shed of the Arizona Strip or the Class I airshed of the Grand Canyon National Park.

For thorough discussion of the computer dispersion models, methods and an analysis of the anticipated impacts of the proposed action (including worst case analysis). See Section V. B.3. below.

2. Climatology

The proposed action would have no affect on local or regional climatological patterns.

Precipitation

The proposed action would not affect local or regional precipitation.

Winds

The proposed action would not affect local or regional wind patterns.

3. Air Quality

Since it is the purpose of the air quality study to assess the potential "worst-case" air quality impacts from the Project, a "worst-case" emissions inventory for the Project was developed for use in this assessment (Air Quality Impacts Analysis of Arizona I, Mine Eneco-Tech). This emissions inventory quantified all significant emissions from operations and activities to be conducted in the Project Area during a maximum production year. Further, as part of this "worst-case" assessment, with the exception of covered haul trucks, no emission controls nor mitigation techniques were assumed to be in effect on any potential source.

The only pollutant to be released in any measureable amount into the atmosphere, as a result of the Project, would be particulates, and much of these particulate emissions would be natural dust. Current ambient particulate standards exist only for fine particulate matter less than ten microns in size - PM_{10}. Because of the relative newness of the PM_{10} standard, and to provide a better evaluation of the Project's potential particulate emissions, emissions inventories for both TSP and PM_{10} were generated for the Project.

A summary of the expected particulate emissions sources and the calculated TSP and PM_{10} emission rate in tons per year (based upon maximum activity and assuming no controls) for the Arizona-I Project is presented in Figure 13. While haul road activities, in reality, are off-site emissions (occurring

Winds

The proposed action would not affect local or regional wind patterns.

3. Air Quality

Since it is the purpose of the air quality study to assess the potential "worst-case" air quality impacts from the Project, a "worst-case" emissions inventory for the Project was developed for use in this assessment (Air Quality Impacts Analysis of Arizona I, Mine Eneco-Tech). This emissions inventory quantified all significant emissions from operations and activities to be conducted in the Project Area during a maximum production year. Further, as part of this "worst-case" assessment, with the exception of covered haul trucks, no emission controls nor mitigation techniques were assumed to be in effect on any potential source.

The only pollutant to be released in any measureable amount into the atmosphere, as a result of the Project, would be particulates, and much of these particulate emissions would be natural dust. Current ambient particulate standards exist only for fine particulate matter less than ten microns in size - PM_{10}. Because of the relative newness of the PM_{10} standard, and to provide a better evaluation of the Project's potential particulate emissions, emissions inventories for both TSP and PM_{10} were generated for the Project.

A summary of the expected particulate emissions sources and the calculated TSP and PM_{10} emission rate in tons per year (based upon maximum activity and assuming no controls) for the Arizona-I Project is presented in Figure 13. While haul road activities, in reality, are off-site emissions (occurring

miles from the Project Area), they have been included in the Project emissions inventory so that their potential impact on the local air quality can also be assessed.

Figure 14 presents a summary of the TSP and PM_{10} emission factors used in generating the emissions inventory. The emission factors presented in these tables and used in the emissions calculations are those recommended by the EPA for this type of Project. In cases where the EPA has not recommended a specific emissions factor for an individual emission source, currently accepted emission factors are used.

As shown in Figure 13, during a maximum production year a total of 23.3 tons per year of TSP emissions could potentially be released from the Project Area. Figure 13 shows that by far the largest source of particulate emissions form the Project Area will be the mine vent. Potentially PM_{10} emissions from this source could total 16.5 tons per year. However, the reader should be cautioned as to the extremely conservative nature of this PM_{10} emissions inventory. That is, since no data on the ratio of PM_{10} to TSP exist for this source (and in keeping with the desired conservative nature of this study), all of the mine vent particulates were assumed to be PM_{10}.

Also from Figure 13, it is shown that haul road traffic has, as a maximum, the potential to release 7.2 pounds of PM_{10} (16.0 pounds of TSP) per vehicle for each mile traveled on unpaved haul roads. Since haul trucks would be tightly covered with tarpaulins, haul road emissions would result exclusively from natural dust from the road surface.

As shown in Figure 14, particulate emissions from haul roads are dependent upon the number of haul trucks, vehicle speed,

number of wheels, vehicle weight, the silt content of the road surface and the number of natural precipitation occurrences. Based on the factors expected for the Project, the resultant emissions of PM_{10} and TSP from each one mile section of unpaved haul road is calculated to be 22.46 and 49.92 tons per year, respectively.

With the exception of the mine vent, all Project Area and haul road emissions will be surface released. Emissions from the mine vent will be an elevated release due to the mechanical buoyancy caused by the ventilation fan.

MODELING PARAMETERS

Model Selection

To assess the TSP and PM_{10} impacts potentially resulting from the Project Area sources, the Industrial Source Complex (ISC) dispersion model was used. The Long-Term version (ISCLT) and the Short-Term version (ISCST) of ISC were used to calculate the annual average and 24-hour "worst-case" concentrations, respectively.

The ISC dispersion model is a state-of-the-art, EPA generated and approved air quality, gaussian dispersion model. Because the model can accommodate a large number of point (elevated or stack) and area emission sources, and the resultant concentrations can be computed at selected distances from the emission sources, it is routinely utilized in impact analyses such as this one.

number of wheels, vehicle weight, the silt content of the road surface and the number of natural precipitation occurrences. Based on the factors expected for the Project, the resultant emissions of PM_{10} and TSP from each one mile section of unpaved haul road is calculated to be 22.46 and 49.92 tons per year, respectively.

With the exception of the mine vent, all Project Area and haul road emissions will be surface released. Emissions from the mine vent will be an elevated release due to the mechanical buoyancy caused by the ventilation fan.

MODELING PARAMETERS

Model Selection

To assess the TSP and PM_{10} impacts potentially resulting from the Project Area sources, the Industrial Source Complex (ISC) dispersion model was used. The Long-Term version (ISCLT) and the Short-Term version (ISCST) of ISC were used to calculate the annual average and 24-hour "worst-case" concentrations, respectively.

The ISC dispersion model is a state-of-the-art, EPA generated and approved air quality, gaussian dispersion model. Because the model can accommodate a large number of point (elevated or stack) and area emission sources, and the resultant concentrations can be computed at selected distances from the emission sources, it is routinely utilized in impact analyses such as this one.

TABLE 13

EMISSIONS INVENTORY SUMMARY*
ARIZONA I PROJECT

Source	Annual Emissions (TPY) TSP	PM_{10}
Project Area		
Ore Loadout to Stockpile	0.020	0.008
Ore Loading from Stockpile to Truck	0.020	0.008
Waste Rock Dumping	0.010	0.004
Wind Erosions, Disturbed Areas and Stockpiles	6.760	3.334
Mine Vent**	16.510	16.510
PROJECT AREA TOTAL	23.320	19.864
Product Transport (Off-Site)		
Haul Road Emissions:		
Per truck, per mile	16.0 lbs/mi	7.2 lbs/mi
Annual assuming 12 round trips/day		

* This emission inventory assumes no emissions controls will be in place on any source.

** It is assumed, since no data are available, that the PM_{10} emissions are equal to the TSP emissions.

Air Quality Impact Analysis of the Arizona 1 Uranium Mine
EnecoTech

TABLE 14

EMISSION FACTORS
ARIZONA I PROJECT

Source Type	Emission Factor	Reference
Haul Road, Unpaved	$k*5.9*(s/12)*(S/30)*(W/3)^{0.7}*(w/4)^{0.5}*((365-P)/365)$	EPA-AP42 pp. 11.2.1-1
Ore and Rock Loadout Ore and Rock Loading 11.2.3-3	$k1*0.0018*\frac{(s1/5)*(U/5)*(H/5)}{(M/2^2*(Y/6)^{0.33}}$	EPA-AP42 pp.
Wind Erosion Disturbed Areas and Active Storage Piles	$1.7*(s1/1.5)*((365-P)/235)*(F/15)$	EPA-AP42 pp. 11.2.3-5
Mine Vent	0.002 grains/SCFM	AMAX 1980*

Where:
- s is silt content of road surface (12%)
- sl is silt content of aggregate material (rock and ore)(1.6%)
- P is number of days with precipitation greater than 0.01 inches (60)
- k is fraction of material below 30 microns (0.8) or 10 microns (0.36)
- kl is fraction of material below 30 microns (0.73) or 10 microns (0.36)
- S is average speed of haul truck (25 mph)
- W is average weight of haul truck (15 tons)
- w is number of wheels on haul truck (10)
- U is average wind speed (5.8 mph)
- H is drop height for loading/unloading (5 feet)
- M is moisture content of aggregate material (2%)
- Y is loading device capacity (5 yd^3)
- F is frequency of winds greater than 12 mph (18)

---

* AMAX 1980 - State of Colorado air permit for Mount Emmons. Factor derived from mine vent tests on AMAX'S Henderson underground Molydenum mine in Henderson, Colorado. During testing this mine's annual production was a factor of 10 higher than the proposed Arizona-I Project's annual production. Consequently, this factor should be higher than what would be expected at this Project, but is used here for lack of better data.

TABLE 14

EMISSION FACTORS
ARIZONA I PROJECT

Source Type	Emission Factor	Reference
Haul Road, Unpaved	$k*5.9*(s/12)*(S/30)*(W/3)^{0.7}*(w/4)^{0.5}*((365-P)/365)$	EPA-AP42 pp. 11.2.1-1
Ore and Rock Loadout Ore and Rock Loading 11.2.3-3	$kl*0.0018*\frac{(sl/5)*(U/5)*(H/5)}{(M/2^2)*(Y/6)^{0.33}}$	EPA-AP42 pp.
Wind Erosion Disturbed Areas and Active Storage Piles	$1.7*(sl/1.5)*((365-P)/235)*(F/15)$	EPA-AP42 pp. 11.2.3-5
Mine Vent	0.002 grains/SCFM	AMAX 1980*

Where:
- s is silt content of road surface (12%)
- sl is silt content of aggregate material (rock and ore)(1.6%)
- P is number of days with precipitation greater than 0.01 inches (60)
- k is fraction of material below 30 microns (0.8) or 10 microns (0.36)
- kl is fraction of material below 30 microns (0.73) or 10 microns (0.36)
- S is average speed of haul truck (25 mph)
- W is average weight of haul truck (15 tons)
- w is number of wheels on haul truck (10)
- U is average wind speed (5.8 mph)
- H is drop height for loading/unloading (5 feet)
- M is moisture content of aggregate material (2%)
- Y is loading device capacity (5 yd^3)
- F is frequency of winds greater than 12 mph (18)

* AMAX 1980 - State of Colorado air permit for Mount Emmons. Factor derived from mine vent tests on AMAX'S Henderson underground Molydenum mine in Henderson, Colorado. During testing this mine's annual production was a factor of 10 higher than the proposed Arizona-I Project's annual production. Consequently, this factor should be higher than what would be expected at this Project, but is used here for lack of better data.

For use in predicting TSP concentrations, the ISC model contains particulate deposition and settling algorithms which more closely approximate particle dispersion by allowing the larger particles to settle out (fall to the surface). This is done by dividing the emissions into particle size class, each with its own settling velocity, mass fraction and reflection coefficient. The three particle size classes used in the TSP ISC model runs are presented in Figure 15 below.

Input Meteorology

ISCLT utilizes, as input, meteorological data (specifically wind speed, wind direction and atmospheric stability) in the standard Joint Frequency Distribution (JFD) format. The input JFD was obtained from the hourly meteorological data collected at the Arizona Strip (Sunshine Point) Air Monitoring Station from March 1983 through March 1984.

The observations taken at the Arizona Strip Station consisted of wind speed and wind direction. Concurrent hourly sigma theta (a stability indicator) values were abstracted from the continuous wind direction strip chart trace. These hourly values, in turn, were converted to standard atmospheric stability classes using the Mitchell-timbre technique. From the hourly wind speed, wind direction and atmospheric stability, a JFD was generated for the one year data set.

ISCST requires as input sequential hourly meteorological data consisting of wind speed, wind direction and stability values. For the ISCST model runs, the sequential hourly data collected from the Arizona Strip Air Monitoring Station were used for the ISCST modeling analysis.

TABLE 15

ISC PARTICLE SIZE CLASSES

Particle Diameter*	Mass Mean Diameter	Mass Fraction	Settling Velocity** m/sec	Reflection Coefficient***
10 um	7.4 um	0.22	0.004	0.80
10 - 20 um	15.4 um	0.44	0.018	0.74
20 - 30 um	25.3 um	0.34	0.048	0.62

---

* Particle size in microns (um).

** Settling velocity in meters per second.

*** Reflection coefficient taken from ICS User's Manual.

For PM_{10} modeling the particulate disposition and settling algorithms were not used.

TABLE 15

ISC PARTICLE SIZE CLASSES

Particle Diameter*	Mass Mean Diameter	Mass Fraction	Settling Velocity m/sec	Reflection Coefficient***
10 um	7.4 um	0.22	0.004	0.80
10 - 20 um	15.4 um	0.44	0.018	0.74
20 - 30 um	25.3 um	0.34	0.048	0.62

* Particle size in microns (um).

** Settling velocity in meters per second.

*** Reflection coefficient taken from ICS User's Manual.

For PM_{10} modeling the particulate disposition and settling algorithms were not used.

Emissions Input

Emission source locations and emission rates are required input to the ISC model. Plate 3 shows the expected locations of each emission source within the Project Area. The emission rates were calculated using the emission factors described in the previous section. All emissions, except the mine vent and the off-site hauling of the ore, are represented by area sources.

The mine vent is located to the south of the main shaft (see Plate 3) and, in the modeling analyses, is represented by a point source. While the mine vent is shown to be approximately 400 feet to the south of the main shaft, relocating the mine vent would only minimally affect the modeling results presented in Section 5.0. The vent's exit velocity was calculated given the ventilation rate and the mine vent size. The temperature was assumed to be ambient and, as a result, the plume was assumed to have no thermal buoyancy.

For modeling, the haul roads were considered to be a line source with a TSP emission rate of 49.92 tons per mile and PM_{10} emission rate of 22.46 tons per mile.

Modeling Grid

The ISC modeling or receptor grid is presented in Figure 16. The receptor grid is basically a 1000 meter rectangular grid around the Project Area. To allow assessment of concentrations at the property boundary, the origin of the receptor grid has been situated just southeast of the southern point of the Project Area. (See 0,0 point in Figure 16.)

DISPERSION MODELING RESULTS

Air Quality Standards

Only particulates are expected to be emitted from the proposed Project in noticeable enough quantities to result in an air quality impact. The current PM_{10} standards are 150 ug/m^3 expressed as a 24-hour average and 50 ug/m^3 expressed as an annual arithmetic mean. Thus, modeling was conducted to address these standards.

However, to provide as comprehensive particulate analysis as possible, TSP modeling was also performed to address the previous TSP standards. These standards were 260 ug/m^3 as a 24-hour average and 75 ug/m^3 as an annual average, expressed as a geometric mean.

Because the proposed Project is located approximately 6.5 miles from the closest boundary to the Grand Canyon National Park, it is extremely doubtful that Project-related emissions could impact the Park, a mandatory Class 1 area. However, to confirm this expectation, an analysis was performed to assess whether or not emissions from the Project potentially could result in a significant air quality impact in the Park. For use in this assessment the EPA's designated levels or concentrations of significance, as established for Prevention of Significant Deterioration evaluations, were used to define the area of impact. The levels of significance, as established for particulates, are 1 ug/m^3 for an annual average and 5 ug/m^3 for a 24-hour average. Modeling was conducted to determine the location of these levels, and thus, to determine if any significant air quality impact could potentially occur within the Grand Canyon National Park.

DISPERSION MODELING RESULTS

Air Quality Standards

Only particulates are expected to be emitted from the proposed Project in noticeable enough quantities to result in an air quality impact. The current PM_{10} standards are 150 ug/m^3 expressed as a 24-hour average and 50 ug/m^3 expressed as an annual arithmetic mean. Thus, modeling was conducted to address these standards.

However, to provide as comprehensive particulate analysis as possible, TSP modeling was also performed to address the previous TSP standards. These standards were 260 ug/m^3 as a 24-hour average and 75 ug/m^3 as an annual average, expressed as a geometric mean.

Because the proposed Project is located approximately 6.5 miles from the closest boundary to the Grand Canyon National Park, it is extremely doubtful that Project-related emissions could impact the Park, a mandatory Class 1 area. However, to confirm this expectation, an analysis was performed to assess whether or not emissions from the Project potentially could result in a significant air quality impact in the Park. For use in this assessment the EPA's designated levels or concentrations of significance, as established for Prevention of Significant Deterioration evaluations, were used to define the area of impact. The levels of significance, as established for particulates, are 1 ug/m^3 for an annual average and 5 ug/m^3 for a 24-hour average. Modeling was conducted to determine the location of these levels, and thus, to determine if any significant air quality impact could potentially occur within the Grand Canyon National Park.

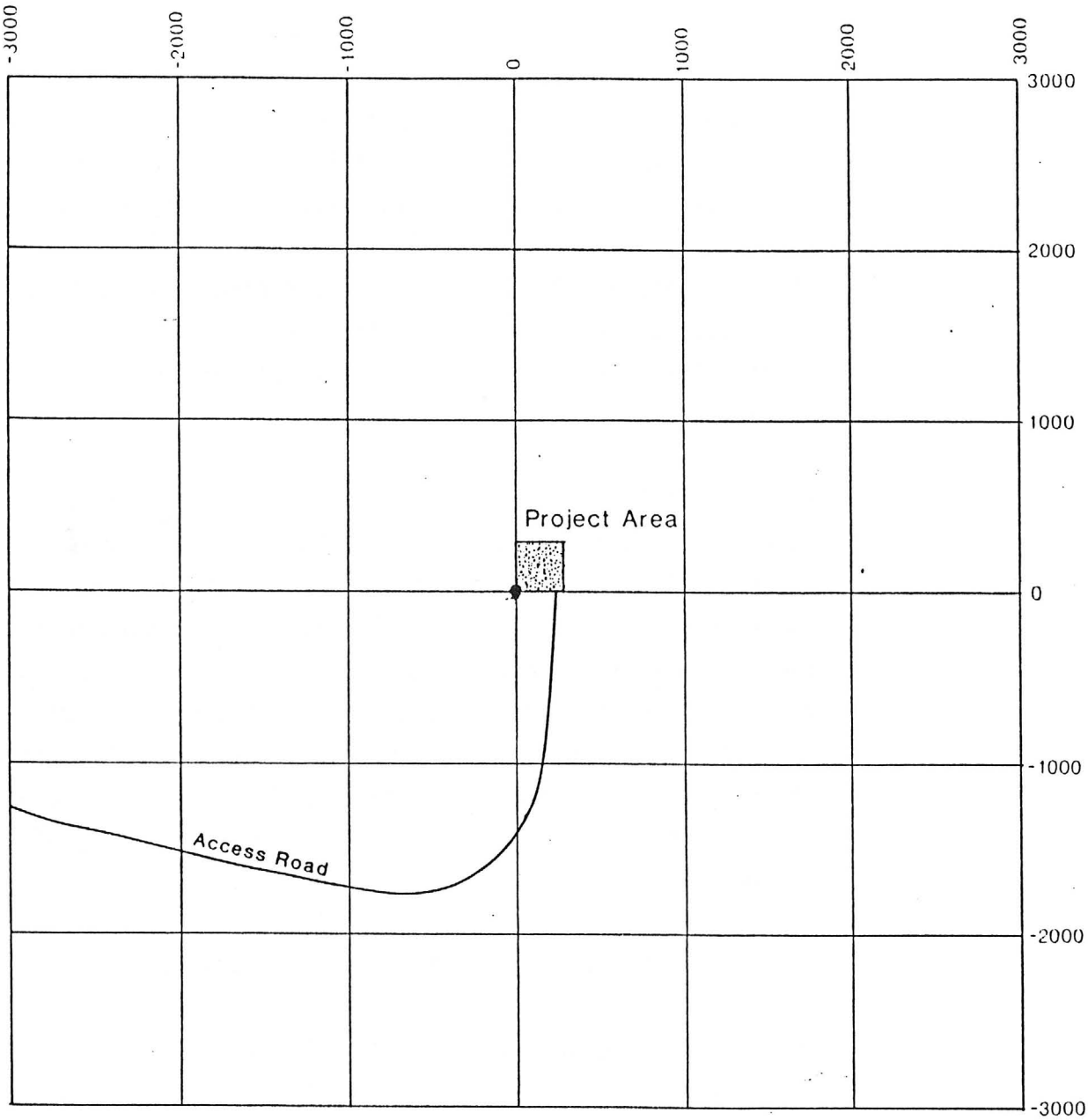
Annual Results

The Project PM_{10} and TSP emissions as presented in Figure 13, including the haul road emissions f m the upgraded access road, and the one year Arizona Strip meteorological data were input into the ISCLT model. The results of the annual ISCLT computer model run for PM_{10} are presented graphically in Figure 17 and the TSP results are presented in Figure 18. The predicted particulate concentrations resulting from the Project Area are shown as lines of equal concentration or isopleths.

As shown in Figures 16 and 17, the maximum PM_{10} and TSP concentrations are predicted to be 15.5 and 23.5 ug/m^3, respectively, and occur to the east of the Project Area. These concentrations are due primarily to the upgraded access road which runs south of the Project for about 0.75 miles and then to the west of the Project area to the Mt. Trumbull Road (approximately seven miles). As can be seen from Figures 16 and 17 the particulate concentrations decrease very rapidly from the Project Area, dropping off to less than 1 ug/m^3 within 2,000 meters (1.25 miles).

As previously discussed, the annual TSP background in the vicinity of the Project is, at a maximum, approximately 14 ug/m^3. Assuming that the PM_{10} to TSP ratio is 0.7 then the maximum PM_{10} baseline concentration should be 10 ug/m^3. Even adding these background concentrations to the modeled TSP and PM_{10} impacts, the resulting concentrations are predicted to be quite low and well below the applicable standards.

Figure 18 also shows that the 1 ug/m^3 significance level isopleth, at its furthest distance in the direction of the Grand Canyon National Park (south through southeast), extends



● Model Reference (0,0) Point

N = 2005000

E = 777000

N

1 inch = 3333.3 feet

1 cm = 400 meters

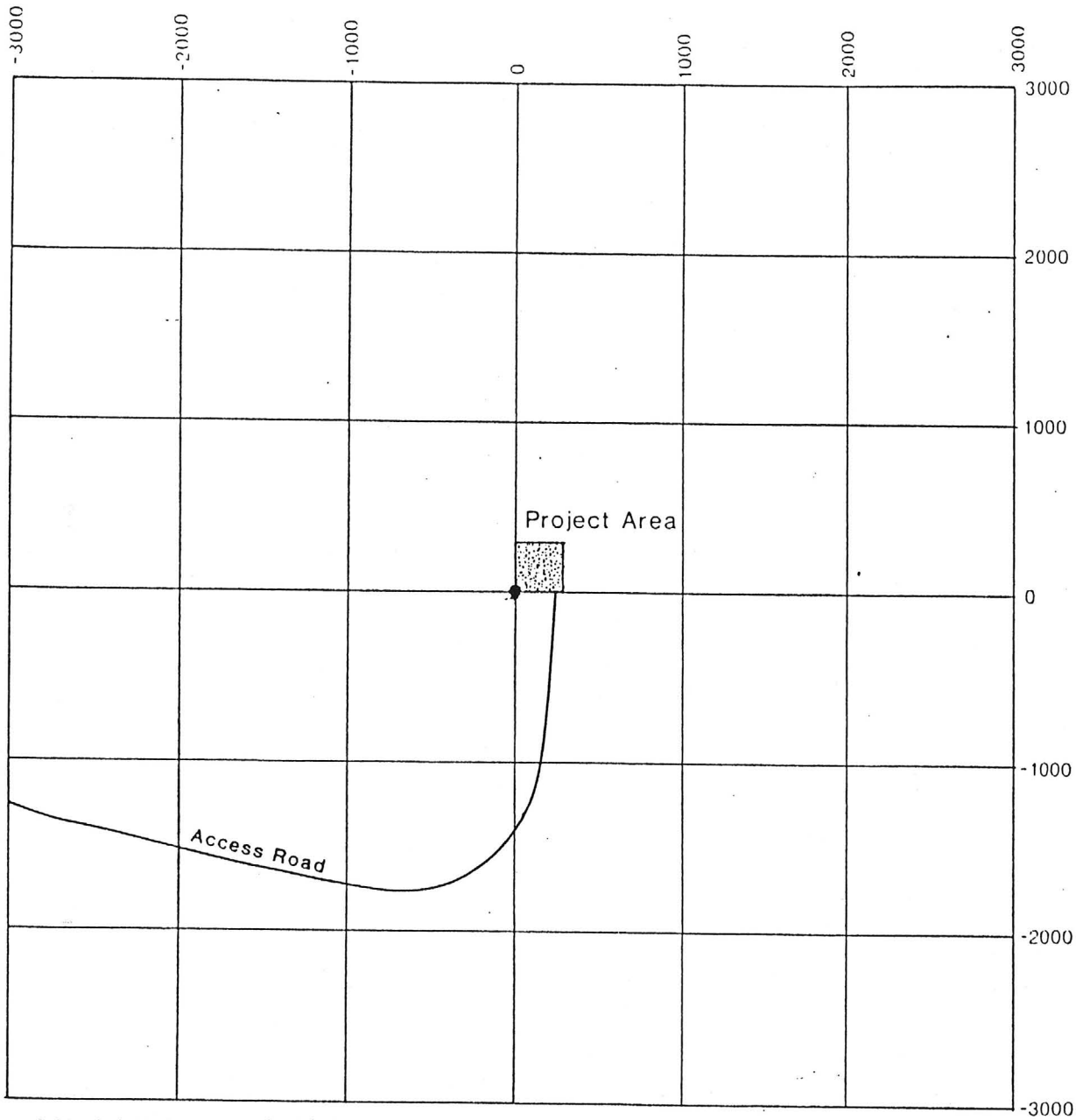
ENECOTECH

Denver Colorado

Project ARIZONA - I

MODELING GRID

File No.: 105-006 Date: January 5, 1988 Figure No.: 16



● Model Reference (0.0) Point

N = 2005000

E = 777000

N

1 inch = 3333.3 feet

1 cm = 400 meters

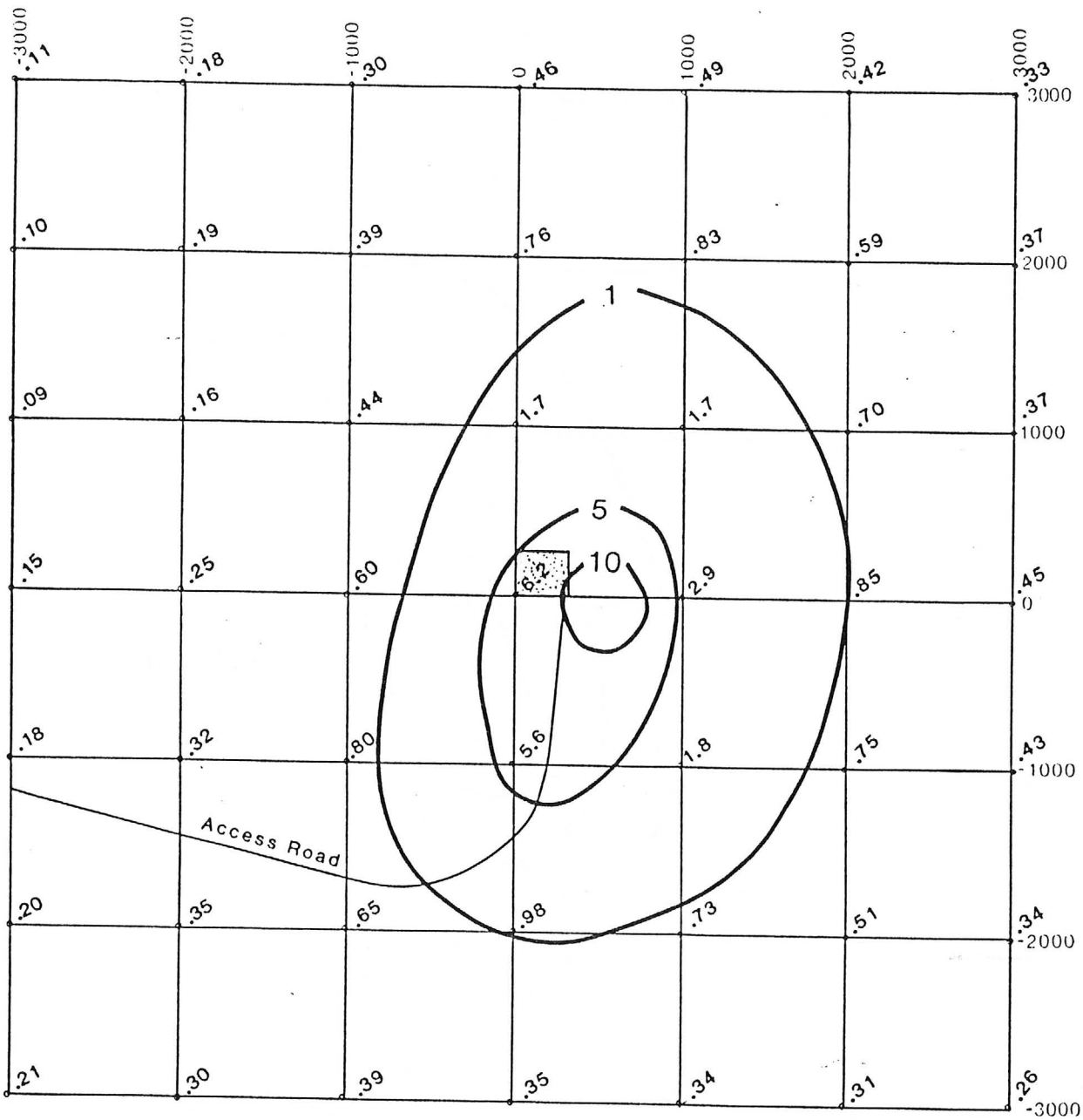
EnecoTech

Denver Colorado

Project ARIZONA - I

MODELING GRID

File No.: 105-006 Date: January 5, 1988 Figure No.: 16



Project Area

Data Points

Units in Micrograms per Cubic Meter

N

1 inch = 3333.3 feet
1 cm = 400 meters

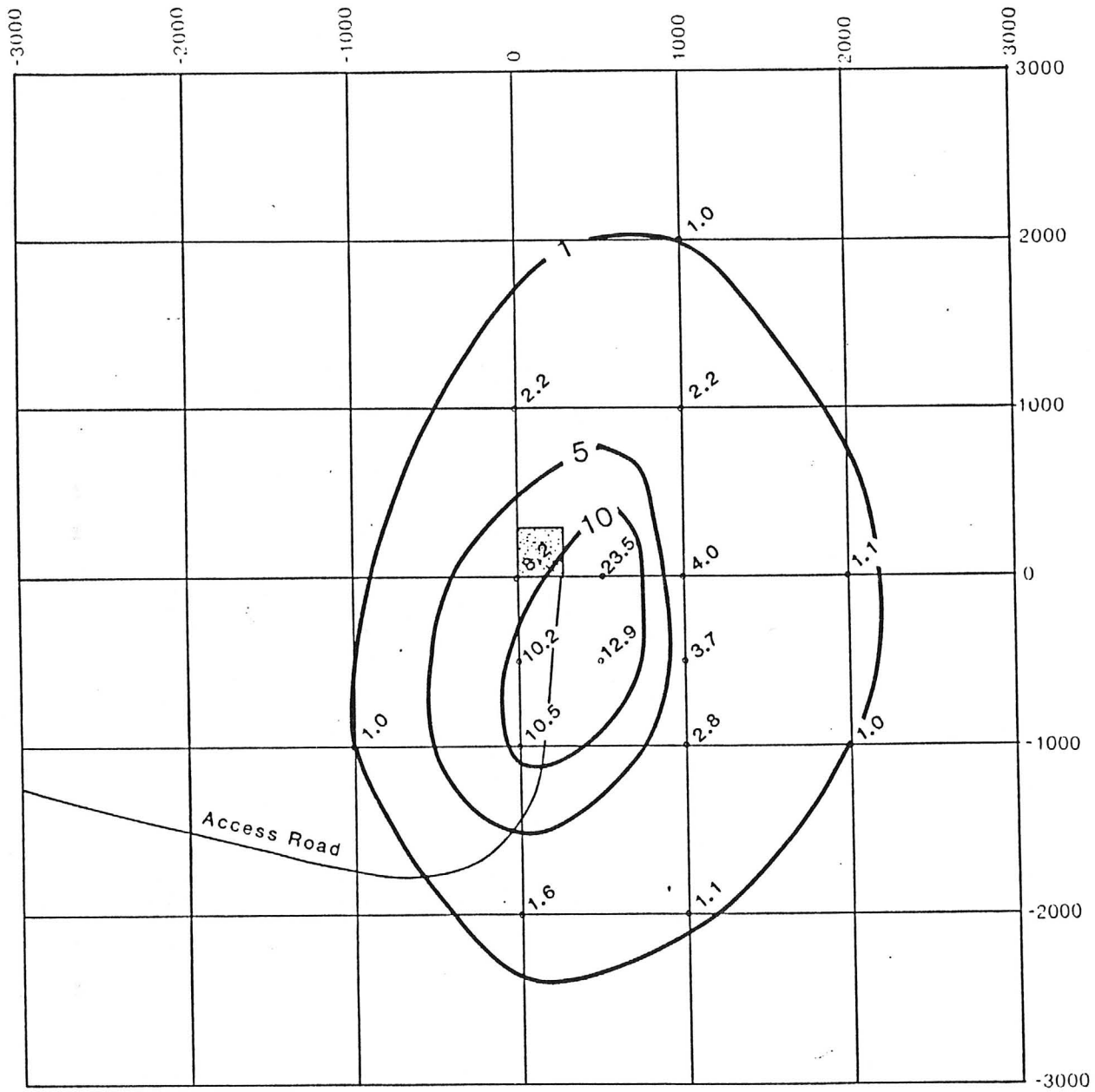
ENECOTECH

Denver Colorado

Project: ARIZONA - I

ANNUAL AVERAGE - PM_{10}

File No.: 105-006 Date: January 5, 1988 Figure No.: 17



Project Area

Data Points

Units in Micrograms per Cubic Meter

N

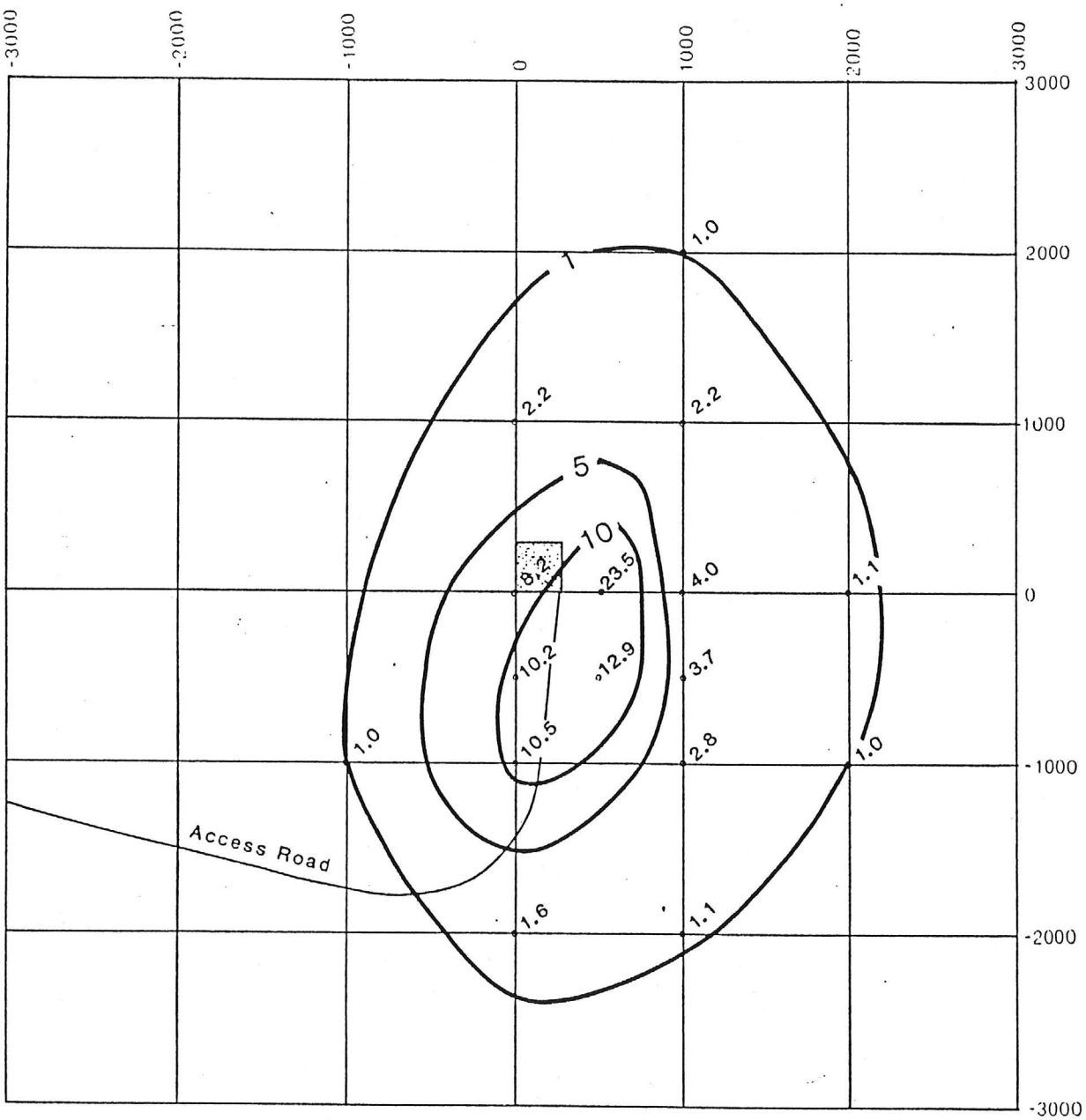
1 inch = 3333.3 feet
1 cm = 400 meters

EnecoTech
Denver Colorado

Project
ARIZONA - I

ANNUAL AVERAGE
TSP CONCENTRATION

File No.: 105-006 Date: January 5, 1988 Figure No.: 18



Project Area

Data Points

Units in Micrograms per Cubic Meter

N

1 inch = 3333.3 feet
1 cm = 400 meters

EnecoTech Denver Colorado	ANNUAL AVERAGE TSP CONCENTRATION
Project ARIZONA - I	
File No.: 105-006	Date: January 5, 1988 Figure No.: 18

only about 2,000 meters (1.25 miles) from the Project Area or at least five miles short of the Park. Thus, there should be no impact from the Project on the air quality of Grand Canyon National Park.

24-Hour Results - "Worst Case" Analysis

Project Area

To assess the short-term, or 24-hour, air quality impacts which might result from operations at the Project Area, potential maximum PM_{10} and TSP emissions, including emissions from the proposed upgraded access road, were input into the ISCST version of the ISC model, and resultant PM_{10} and TSP concentrations were computed for each day (24-hour period) contained in the 1983-1984 Arizona Strip meteorological data and computed the individual daily PM_{10} and TSP concentrations that would result if the proposed Project were in full operation during each day of the 1983-1984 data set. By using actual meteorological data in conjunction with the expected maximum emissions releases from the various project emission sources, a realistic assessment of the potential maximum air quality impacts from the project can be made. These impacts, in turn, can be compared to the applicable standards to determine if the proposed Project may pose a threat to air quality of the area.

In addition, in the modeling analysis, project emissions were assumed to be continuous throughout the one year meteorological data set, not withstanding the fact that actual mining activities are scheduled for only two eight hour shifts per day, five days per week. The purpose of allowing emissions to be released continuously in the modeling analysis

was to establish the outside limits or "worst-case" of any air quality impact potentially resulting from the Project.

The "worst-case" day (24-hour period) PM_{10} and TSP concentrations computed in the ISCST modeling analysis are presented graphically in Figures 19 and 20. In these Figures, the predicted 24-hour concentrations resulting from the Project Area are shown for each receptor point and are plotted as isopleths.

From Figure 19 it can be seen that the maximum off-site PM_{10} concentration occurring on the actual "worst-case" day was just over 27 ug/m^3, and from Figure 8 the maximum 24-hour TSP concentration on the "worst-case" day was 43.8 ug/m^3. Also shown in Figures 19 and 20, the 5 ug/m^3 level of significance extended, at its furthest point from the Project Area (to the east), to just over 1,500 meters (0.9 miles) for PM_{10} and just over 2,000 meters (1.25 miles) for TSP.

The maximum 24-hour TSP background concentration measured in the area was 59 ug/m^3. Assuming that the PM_{10} to TSP ratio is 0.7, the 24-hour maximum PM_{10} background concentration is estimated at 41 ug/m^3. Thus, the predicted "worst-case" 24-hour PM_{10} maximum of 27 ug/m^3 is well below the current PM_{10} standard (150 ug/m^3) even when the assumed background concentration of 41 ug/m^3 is added to it. Likewise the predicted 24-hour TSP concentration of 43.8 would also be well below the old TSP standard (260 ug/m^3) even with the maximum 24-hour background TSP value of 59 ug/m^3 added to it.

Again, the 5 ug/m^3 level of insignificance is reached within 1.5 miles of the Project Area, well short of the Grand Canyon National Park. Thus, the operation of the Project should not result in any measureable impact on the Park.

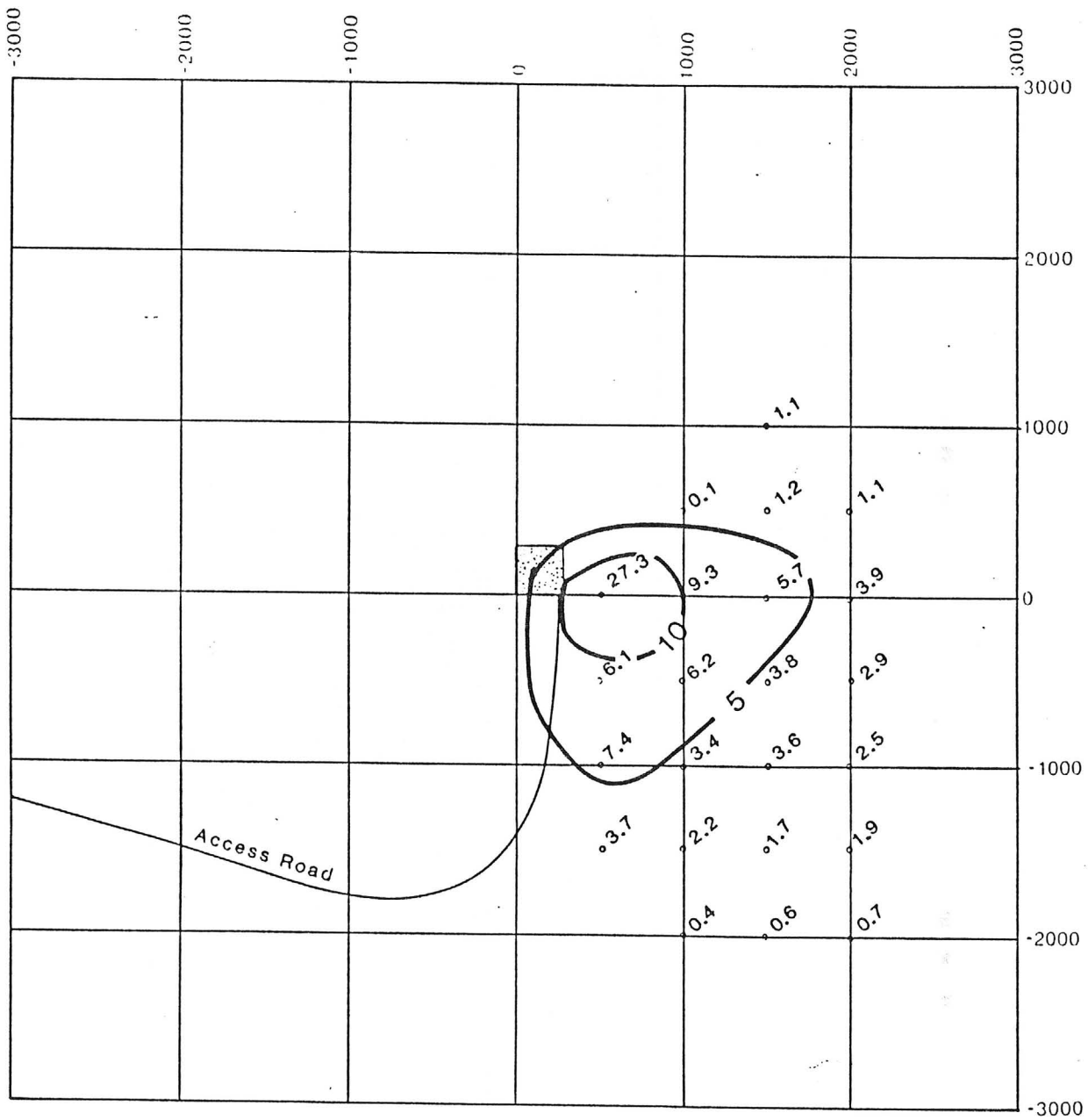
was to establish the outside limits or "worst-case" of any air quality impact potentially resulting from the Project.

The "worst-case" day (24-hour period) PM_{10} and TSP concentrations computed in the ISCST modeling analysis are presented graphically in Figures 19 and 20. In these Figures, the predicted 24-hour concentrations resulting from the Project Area are shown for each receptor point and are plotted as isopleths.

From Figure 19 it can be seen that the maximum off-site PM_{10} concentration occurring on the actual "worst-case" day was just over 27 ug/m^3, and from Figure 8 the maximum 24-hour TSP concentration on the "worst-case" day was 43.8 ug/m^3. Also shown in Figures 19 and 20, the 5 ug/m^3 level of significance extended, at its furthest point from the Project Area (to the east), to just over 1,500 meters (0.9 miles) for PM_{10} and just over 2,000 meters (1.25 miles) for TSP.

The maximum 24-hour TSP background concentration measured in the area was 59 ug/m^3. Assuming that the PM_{10} to TSP ratio is 0.7, the 24-hour maximum PM_{10} background concentration is estimated at 41 ug/m^3. Thus, the predicted "worst-case" 24-hour PM_{10} maximum of 27 ug/m^3 is well below the current PM_{10} standard (150 ug/m^3) even when the assumed background concentration of 41 ug/m^3 is added to it. Likewise the predicted 24-hour TSP concentration of 43.8 would also be well below the old TSP standard (260 ug/m^3) even with the maximum 24-hour background TSP value of 59 ug/m^3 added to it.

Again, the 5 ug/m^3 level of insignificance is reached within 1.5 miles of the Project Area, well short of the Grand Canyon National Park. Thus, the operation of the Project should not result in any measureable impact on the Park.



Project Area

Data Points

Units in Micrograms per Cubic Meter

N

1 inch = 3333.3 feet
1 cm = 400 meters

EnecoTech

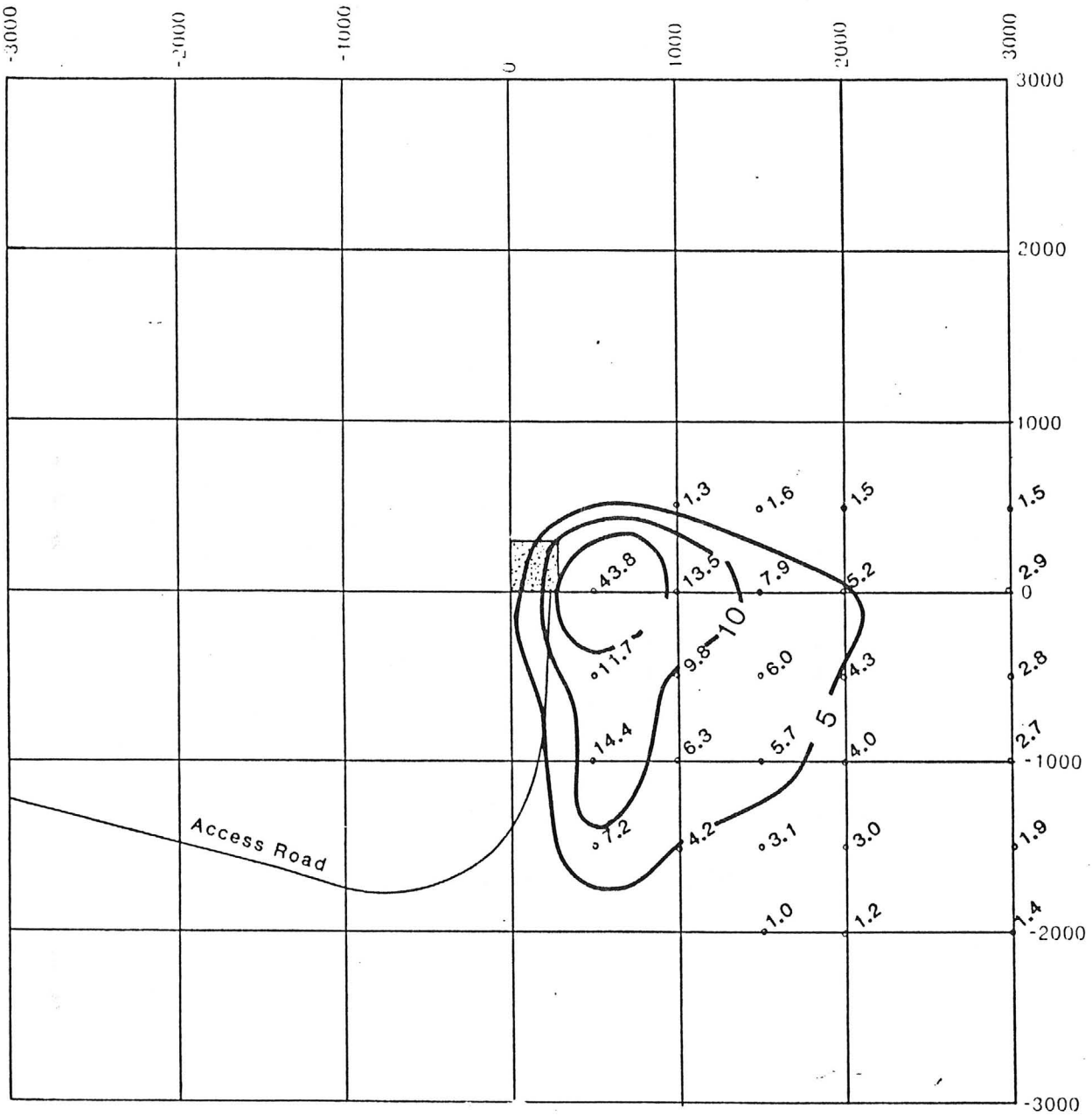
Denver Colorado

Project: ARIZONA - I

"WORST-CASE"

24-HOUR AVERAGE PM_{10}

File No.: 105-006 Date: January 5, 1988 Figure No.: 19



Project Area

° Data Points

Units in Micrograms per Cubic Meter

N

1 inch = 3333.3 feet
1 cm = 400 meters

ENECOTECH

Denver Colorado

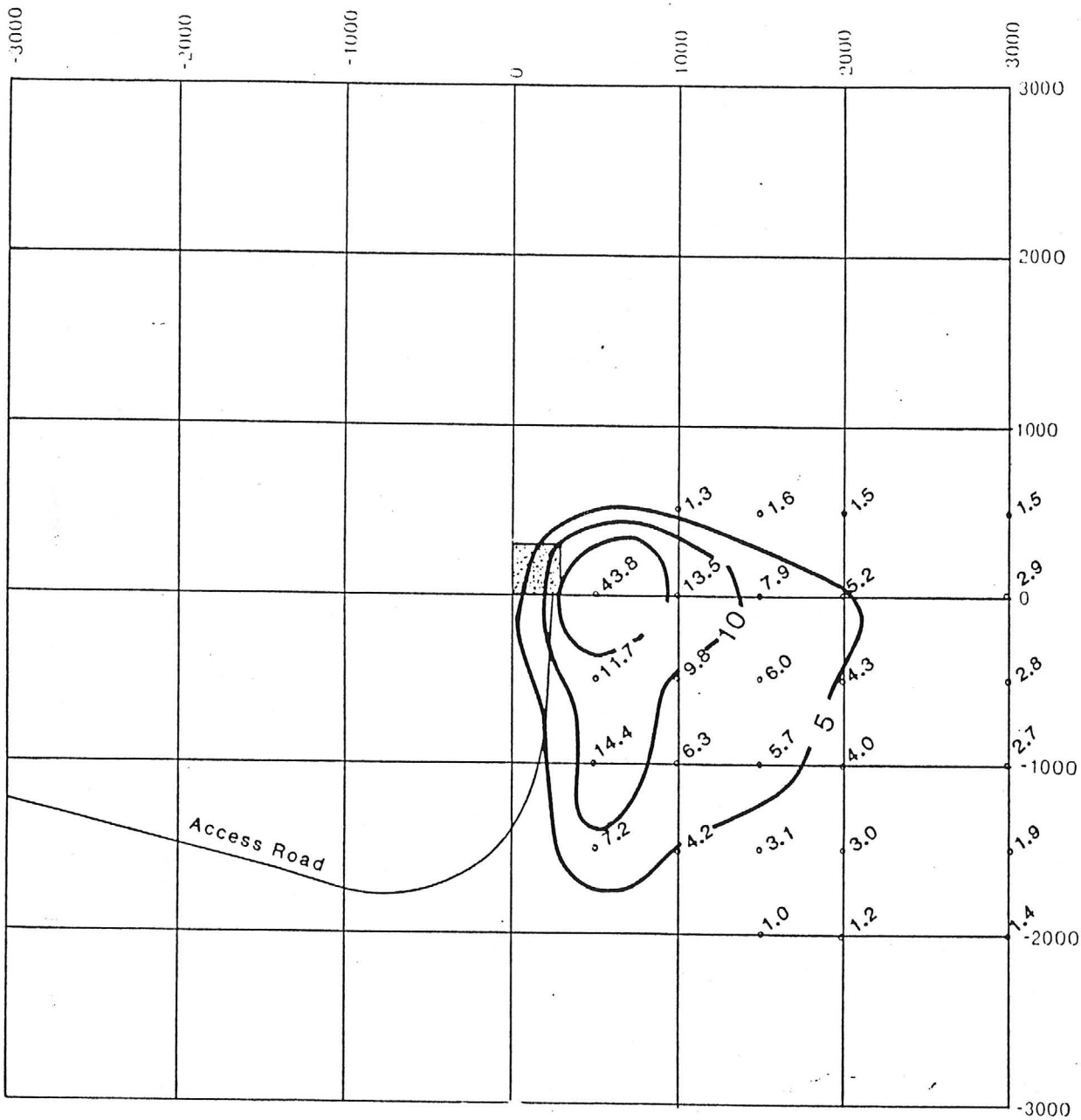
Project

ARIZONA - I

"WORST-CASE"

24-HOUR TSP IMPACT

File No.: 105-006 Date: January 5, 1988 Figure No.: **20**



Project Area

° Data Points

Units in Micrograms per Cubic Meter

N

1 inch = 3333.3 feet
1 cm = 400 meters

EnecoTech

Denver Colorado

Project

ARIZONA - I

"WORST-CASE"

24-HOUR TSP IMPACT

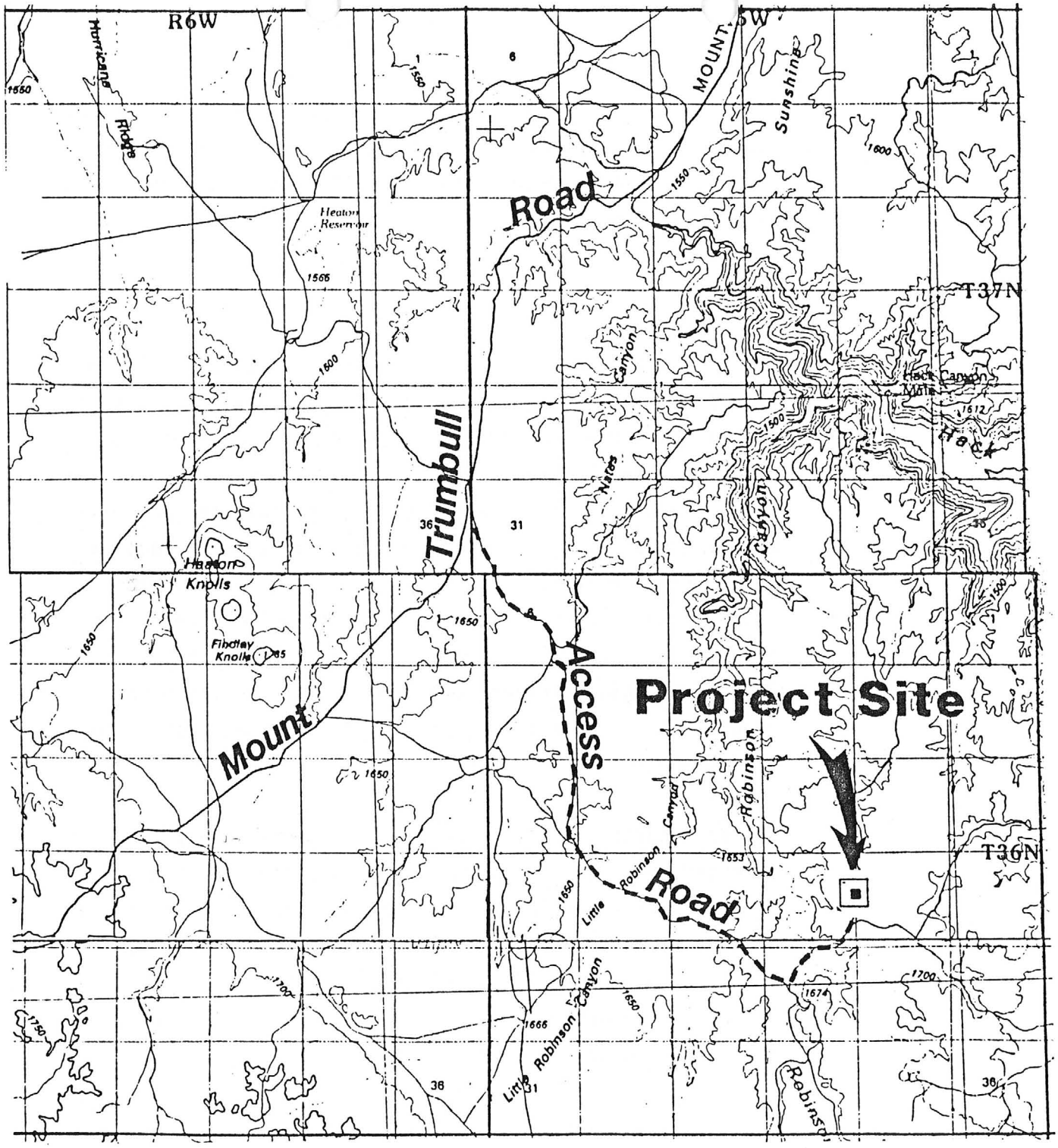
File No.: 105-006 Date: January 5, 1988 Figure No.: 20

Thus, this modeling study which employed actual meteorological data and highly conservative Project emissions assumptions shows that there would be no significant air quality impact resulting from the Project.

Haul Roads

While the haul roads and, consequently, haul road emissions would primarily be outside of the Project Area, it is useful to determine what impact, if any, the haul road emissions would have on the area's air quality. Ore haulage from the Project would involve traveling over approximately 33 miles of unpaved road. Immediately from the Project Area, haul trucks would traverse the 7.0 miles (approximately) of upgraded access road running from the south and west of the Project Area to Mt. Trumbull Road for about 26 miles to State Route 389. From this point on, ore haulage will be via paved roads. Figure 21 shows the proposed haul road route from the Project Area.

The particulate emissions resulting from haul traffic on the proposed upgraded access road were modeled as part of the Project Area impact analyses. These emissions were included as part of the Project Area analyses so that the combined "worst-case" effect of the direct Project-related emissions and haul road activity could be computed. Results of the long-term (annual) and short-term (24-hour) analyses are presented graphically in Figure 17 through Figure 20. As discussed in the previous sections, the combined impact of the direct Project-related emissions and the access road emissions are so low that it can be concluded that they do not pose any threat to the particulate standards.



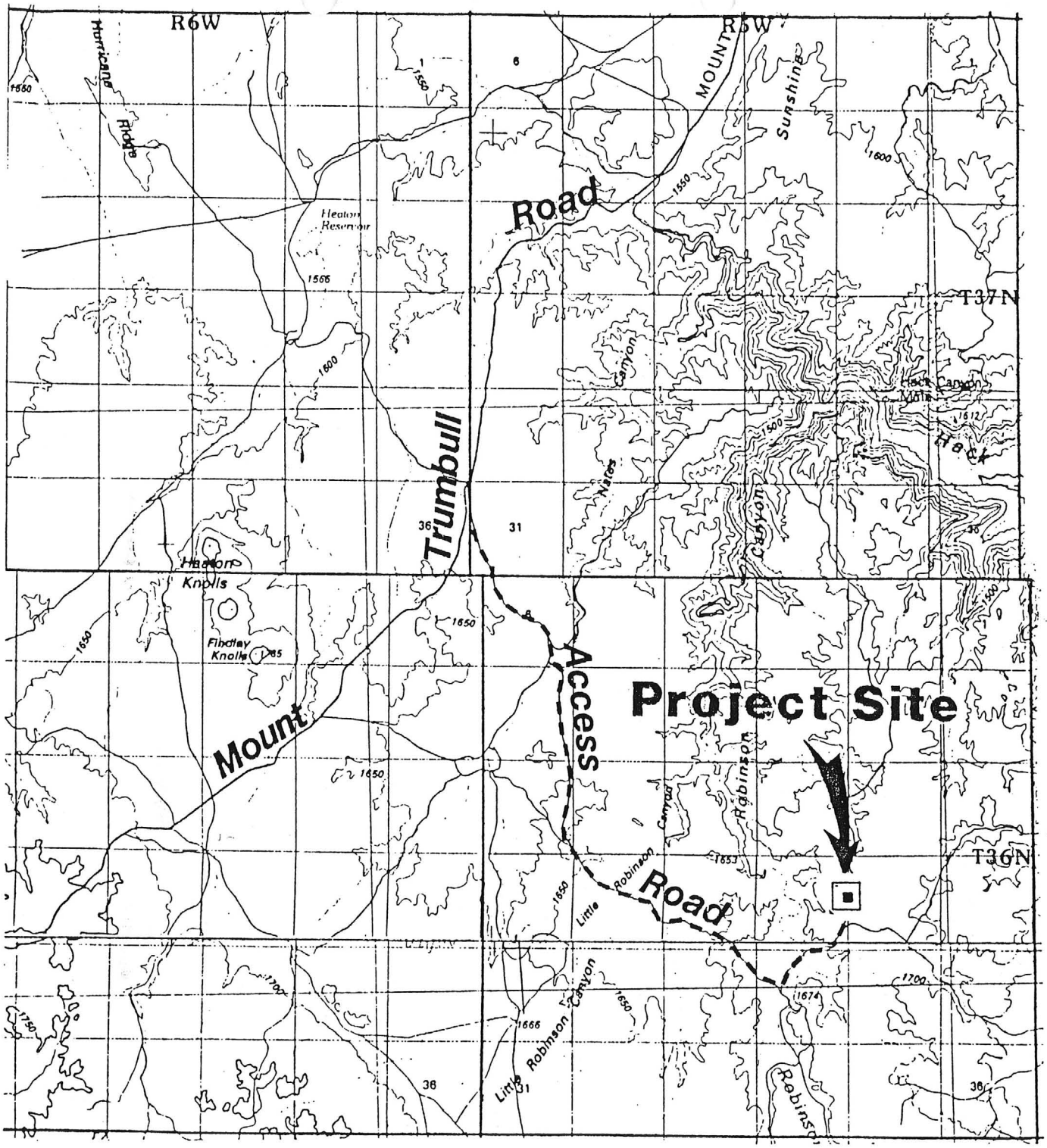
ENECOTECH

Denver Colorado

Project: ARIZONA - I

HAUL ROAD CONFIGURATION

File No.: 105-006 Date: January 5, 1988 Figure No.: 21



1:100 00

MILES
0 2
0 4
KILOMETERS

ENECOTECH
Denver Colorado

Project
ARIZONA – I

HAUL ROAD CONFIGURATION

File No.: 105-006 Date: January 5, 1988 Figure No.: 21

However, after the haul trucks leave the access road they would travel north along Mt. Trumbull Road to State Route 389. As they progress along Mt. Trumbull Road, additional haul traffic from other EFN mines could merge with the haul traffic from the Arizona-I Project. Obviously, the highest potential air quality impacts from the haul road traffic would be along sections of the road carrying the largest amount of traffic. This scenario and analysis of the potential impacts is discussed in the "Cumulative Impacts" section below.

Cumulative Impacts

Once haulage activities at the Arizona-I Project begin in late 1991, there will be two other operating mining projects in the Arizona Strip District - the Pinenut and Hermit projects. (Two other Arizona Strip District mining projects - Kanab North and the Pigeon Projects will also exist but will be engaged in final reclamation activities, thus, will not be producing nor hauling ore). The closest operation to the Arizona-I Project would be the Pinenut Project, located approximately 4.3 miles to the east, with the Hermit Project located more than 12 miles to the northeast. (The Kanab North Project will be more than 14 miles to the northeast, and the Pigeon Project will be more than 22 miles away).

The impact analysis results for the Arizona-I Project presented previously show that the particulate concentrations of both PM_{10} and TSP resulting from the proposed Arizona-I Project are well below the applicable standards. Further, these results show that the Project Impact Area does not extend beyond 2,000 meters (1.25 miles) in any direction around the Project. (Resultant particulate concentrations fall below the level of significance within 2,000 meters.) Thus, with the extremely small impact area associated with the

proposed Arizona-I Project and the relatively great distances between the other existing and planned mining operations in the area, there is virtually no potential for overlap of Project-related impacts from the Arizona-I Project Area.

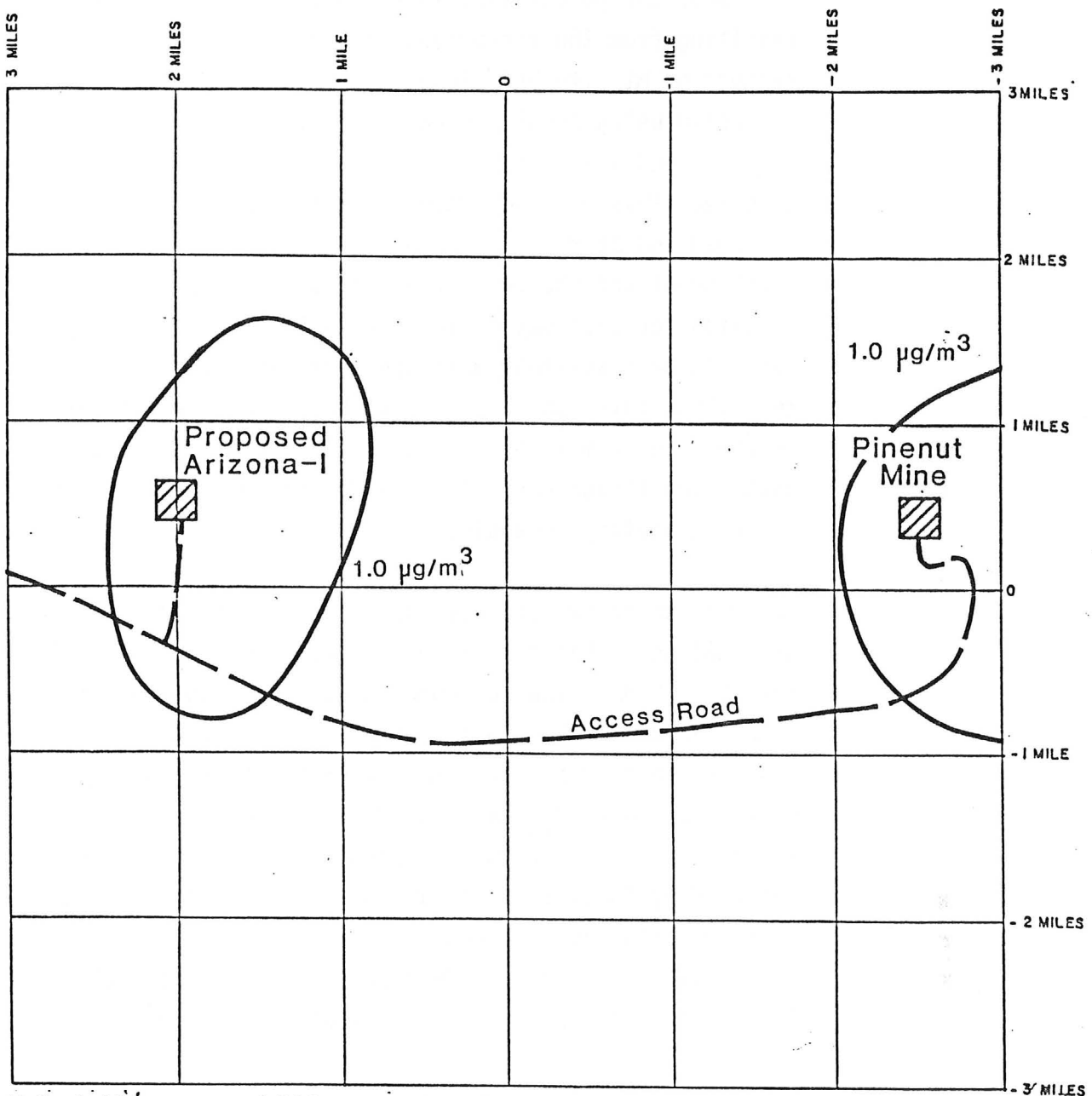
To better illustrate this conclusion, Figure 22 shows the respective areas of impact, as defined by the ISC modeled 1.0 ug/m^3 annual TSP isopleth, of the Arizona-I Project and the Pinenut Project (see Air Quality Impact Analysis of the Pinenut Project (ENECOTECH, 1985)). Figure 22 graphically demonstrates that no cumulative air quality impacts from the simultaneous operation of the Arizona-I Project and the Pinenut Project is reasonably anticipated.

Since the Pinenut, Hermit and Arizona-I Projects will utilize common segments of Mt. Trumbull road for ore haulage, there is a potential for cumulative impacts from ore haulage on these common segments. During the ore production phase, each of these operations would utilize a common eleven mile section of Mt. Trumbull Road for ore haulage (from the Hermit Project turnoff onto Mt. Trumbull Road north to State Route 389). Thus, the maximum cumulative air quality impacts from the concurrent operation of the three Projects would result from the simultaneous use of this common road segment. The Pinenut, Hermit and Arizona-I Projects each expects ore haulage rates to average ten to twelve truck trips (round trip) per day, five days per week. During the period when all three mines would be in ore production phase of operations (1991), there is a potential for a total of 72 haul trucks (36 round trips) to traverse the common segment of Mt. Trumbull Road each haulage day.

proposed Arizona-I Project and the relatively great distances between the other existing and planned mining operations in the area, there is virtually no potential for overlap of Project-related impacts from the Arizona-I Project Area.

To better illustrate this conclusion, Figure 22 shows the respective areas of impact, as defined by the ISC modeled 1.0 ug/m^3 annual TSP isopleth, of the Arizona-I Project and the Pinenut Project (see Air Quality Impact Analysis of the Pinenut Project (ENECOTECH, 1985)). Figure 22 graphically demonstrates that no cumulative air quality impacts from the simultaneous operation of the Arizona-I Project and the Pinenut Project is reasonably anticipated.

Since the Pinenut, Hermit and Arizona-I Projects will utilize common segments of Mt. Trumbull road for ore haulage, there is a potential for cumulative impacts from ore haulage on these common segments. During the ore production phase, each of these operations would utilize a common eleven mile section of Mt. Trumbull Road for ore haulage (from the Hermit Project turnoff onto Mt. Trumbull Road north to State Route 389). Thus, the maximum cumulative air quality impacts from the concurrent operation of the three Projects would result from the simultaneous use of this common road segment. The Pinenut, Hermit and Arizona-I Projects each expects ore haulage rates to average ten to twelve truck trips (round trip) per day, five days per week. During the period when all three mines would be in ore production phase of operations (1991), there is a potential for a total of 72 haul trucks (36 round trips) to traverse the common segment of Mt. Trumbull Road each haulage day.



Units in Micrograms of TSP per Cubic Meter

N

1 inch = 5280 feet
1 cm 633 meters

ENECOTECH

Denver Colorado

Project

ARIZONA-I

AREA OF IMPACTS

Arizona-I and Pinenut Mine

File No.: 105-006

Date: January 18, 1988

Figure No.: 22

To assess the potential cumulative PM_{10} and TSP impacts resulting from the concurrent ore haulage on the common segment of Mt. Trumbull Road, dispersion modeling was conducted using ISCST. A PM_{10} emission rate of 21.6 pounds per mile and a TSP emission rate of 48.0 pounds per mile traveled (this emission rate assumes no emission controls on the road and 36 round trips per day) were each input into the ISCST model and the 24-hour particulate concentrations were computed for each day in the 1983 - 1984 meteorological data set. To be consistent with the conservative approach used throughout this impact analysis, haul road traffic was assumed to continue from 7:00 a.m. until 11:00 p.m., seven days a week, even though current plans do not anticipate a seven day per week hauling schedule.

The maximum or "worst-case" day PM_{10} concentrations computed by ISCST show that the maximum 24-hour PM_{10} concentration resulting from actual meteorological conditions and 36 round trips was 27 ug/m^3. This value is well below the allowable 24-hour standard of 150 ug/m^3, even after the assumed maximum 24-hour PM_{10} background concentration of 41 ug/m^3 is added to it. The maximum 24-hour TSP concentration computed by ISCST for the same meteorological conditions and 36 round trips per day was only 60 ug/m^3. This value is also well below the old TSP standards, even after the maximum 24-hour background TSP concentration of 59 ug/m^3 is added to it.

In fact, when carrying the analysis further the modeling shows that even doubling the haul road traffic on the common road segment to 72 round trips per day would only result in a maximum 24-hour PM_{10} concentration of 54 ug/m^3. This value plus the assumed background is still well below the allowable 24-hour standard of 150 ug/m^3.

To assess the potential cumulative PM_{10} and TSP impacts resulting from the concurrent ore haulage on the common segment of Mt. Trumbull Road, dispersion modeling was conducted using ISCST. A PM_{10} emission rate of 21.6 pounds per mile and a TSP emission rate of 48.0 pounds per mile traveled (this emission rate assumes no emission controls on the road and 36 round trips per day) were each input into the ISCST model and the 24-hour particulate concentrations were computed for each day in the 1983 - 1984 meteorological data set. To be consistent with the conservative approach used throughout this impact analysis, haul road traffic was assumed to continue from 7:00 a.m. until 11:00 p.m., seven days a week, even though current plans do not anticipate a seven day per week hauling schedule.

The maximum or "worst-case" day PM_{10} concentrations computed by ISCST show that the maximum 24-hour PM_{10} concentration resulting from actual meteorological conditions and 36 round trips was 27 ug/m^3. This value is well below the allowable 24-hour standard of 150 ug/m^3, even after the assumed maximum 24-hour PM_{10} background concentration of 41 ug/m^3 is added to it. The maximum 24-hour TSP concentration computed by ISCST for the same meteorological conditions and 36 round trips per day was only 60 ug/m^3. This value is also well below the old TSP standards, even after the maximum 24-hour background TSP concentration of 59 ug/m^3 is added to it.

In fact, when carrying the analysis further the modeling shows that even doubling the haul road traffic on the common road segment to 72 round trips per day would only result in a maximum 24-hour PM_{10} concentration of 54 ug/m^3. This value plus the assumed background is still well below the allowable 24-hour standard of 150 ug/m^3.

Thus, it can be concluded that the cumulative impacts resulting from the concurrent utilization of Mt. Trumbull Road poses no threat to the local air quality, even if haulage is substantially increased from the levels presently anticipated. Moreover, because of the relatively short period of ore production from the operations (3 to 5 years), in order for the assumed level of 72 round trips per day to be achieved, the historical pace of mining discoveries and development since 1980 in the Arizona Strip would have to more than double.

IMPACTS ON SENSITIVE RECEPTORS

The closest sensitive receptor to the proposed Arizona-I Project is the Grand Canyon National Park - a mandatory Class I area. At its closest point, the proposed Arizona-I Project is approximately 6.5 miles north of the Park boundary.

The "worst-case" impact analysis presented in Section 5.0 shows that the maximum area of impact, as defined by the EPA concentrations or levels of significance, affected by the Arizona 1 Project is at a maximum of 2,000 meters (1.25 miles) surrounding the Project Area. This is over five miles short of the nearest Park boundary.

With such a small area of impact and with such a great distance to the Park boundary, it can be concluded with a great degree of certainty that the proposed Arizona-I Project will have a negligible air quality impact on the Grand Canyon National Park (and no detectable impact on the visibility within the Park).

4. SURFACE HYDROLOGIC IMPACTS

Flooding Potential

The diversion ditch has been designed to pass the 100-year flood peak based on the calculated depth of flow. With the additional 0.3 feet of freeboard provided in the channel design and the 2.0 feet of freeboard provided by the proposed berm, no flood damage is expected to any facility at the mine site. Because of available freeboard, the mine site facilities would be protected from floods in excess of 100-year event. Some overland and overbank flooding may occur, during the 500-year storm event on the natural channel down gradient form the site boundary. However, this overbank flooding is not expected to be more severe than that expected under the existing conditions. The maximum head expected for the drainage crossing (culverts) for the 100-year, 24-hour storm is 3.75 feet, which is 0.75 feet below the proposed elevation of the mine haul road. Therefore, no flood damage is expected to the drainage crossing or haul road. At present, the entire storm run-off from the watersheds above the mine yard runs north-northeast through the natural drainage directly through the proposed mine site and west of the county access road. The construction of the proposed ditch(es) would channelize flood flows around the undisturbed area and would convey them back to the natural drainage course. Any overbank flows spilling over the channel banks would be much less than the overland flows without the ditches (i.e., under existing conditions).

The on-site two-cell retention pond has a capacity to store more than the volume of the 500-year 24-hour storm run-off from the Project Area. Therefore, the flooding potential downstream of the mine site would be somewhat attenuated and

4. SURFACE HYDROLOGIC IMPACTS

Flooding Potential

The diversion ditch has been designed to pass the 100-year flood peak based on the calculated depth of flow. With the additional 0.3 feet of freeboard provided in the channel design and the 2.0 feet of freeboard provided by the proposed berm, no flood damage is expected to any facility at the mine site. Because of available freeboard, the mine site facilities would be protected from floods in excess of 100-year event. Some overland and overbank flooding may occur, during the 500-year storm event on the natural channel down gradient form the site boundary. However, this overbank flooding is not expected to be more severe than that expected under the existing conditions. The maximum head expected for the drainage crossing (culverts) for the 100-year, 24-hour storm is 3.75 feet, which is 0.75 feet below the proposed elevation of the mine haul road. Therefore, no flood damage is expected to the drainage crossing or haul road. At present, the entire storm run-off from the watersheds above the mine yard runs north-northeast through the natural drainage directly through the proposed mine site and west of the county access road. The construction of the proposed ditch(es) would channelize flood flows around the undisturbed area and would convey them back to the natural drainage course. Any overbank flows spilling over the channel banks would be much less than the overland flows without the ditches (i.e., under existing conditions).

The on-site two-cell retention pond has a capacity to store more than the volume of the 500-year 24-hour storm run-off from the Project Area. Therefore, the flooding potential downstream of the mine site would be somewhat attenuated and

the streamflows would be somewhat reduced. In addition, the disturbed area of 16.01 acres represents only 27.4 percent of the entire watershed contributing run-off to the point immediately downstream of the Project Area. The disturbed area would, therefore, have an insignificant impact at points farther downstream.

Erosion Potential

With vegetation proposed along the inner banks of the diversion ditches and riprap installed at strategic locations, the potential for bank erosion would be minimized. Some erosion would be expected on the outer (unprotected) banks of these diversion ditches. Corrective measures would be taken in the event that excess scouring of the channel takes place during the development phase of the mining operation. However, the erosion potential during most flood events would be expected to be minimal.

Any flood induced erosion within the Project boundary would be contained and therefore the impact of this erosion on the surrounding surface water environment would be insignificant.

Accidental Release of Contaminants

As described in the previous sections and in the consideration of the proposed design criteria, the probability of any eroded or accidentally released contaminant getting out of the site area would be extremely remote. In the event that a volume of contaminated liquid gets released into the surrounding environment, a dilution factor in excess of 24,000 can be expected between the concentrations in the effluent from the Arizona-I Mine site and the effluent flowing down Kanab Creek.

The receiving point at Kanab Creek for the Arizona-I Mine is approximately eighteen miles downstream from the confluence of Bulrush Canyon. Effluent from the Arizona-I Mine is expected to flow into the Hack Canyon drainage which is a minor tributary of Kanab Creek. As mentioned above, the two receiving points on Kanab Creek are approximately eighteen miles apart. In between these points the contributing flows of Snake gulch, Slide Canyon, Grama Canyon and Hack Canyon would greatly increase the assumed dilution factor of 24,000. Therefore, a dilution factor in excess of 24,000 should provide an adequate factor of safety for any harmful constituents released into the environment.

5. Groundwater Impacts

EFN's experience to date has shown that the rates of ground-water inflow to the existing mines in the Kanab Plateau decrease with time and are small (generally less than 5 gallons per minute). The proposed depth of mining within the mineralized portion of the breccia pipe at the Arizona-I site would be approximately 2000 - 2500 feet above the regional ground-water table within the Redwall-Mauv aquifer. Laboratory tests on rock core from within the breccia pipe but below the depth of uranium mineralization have shown the rock mass to be effectively impermeable. Measured hydraulic conductivities for the non-mineralized portions of the breccia pipe below the depth of mining were less than $1x\ 10^{-8}$ cm/sec. This compares measured hydraulic conductivities of less than 1×10^{-9} cm/sec for the altered sandstone and siltstone units adjacent to, but outside of the breccia pipe and measured values of 2.0×10^{-8} to 1.4×10^{-6} cm/sec for non-mineralized portions of the pipe within the zone of mining.

The receiving point at Kanab Creek for the Arizona-I Mine is approximately eighteen miles downstream from the confluence of Bulrush Canyon. Effluent from the Arizona-I Mine is expected to flow into the Hack Canyon drainage which is a minor tributary of Kanab Creek. As mentioned above, the two receiving points on Kanab Creek are approximately eighteen miles apart. In between these points the contributing flows of Snake gulch, Slide Canyon, Grama Canyon and Hack Canyon would greatly increase the assumed dilution factor of 24,000. Therefore, a dilution factor in excess of 24,000 should provide an adequate factor of safety for any harmful constituents released into the environment.

5. Groundwater Impacts

EFN's experience to date has shown that the rates of ground-water inflow to the existing mines in the Kanab Plateau decrease with time and are small (generally less than 5 gallons per minute). The proposed depth of mining within the mineralized portion of the breccia pipe at the Arizona-I site would be approximately 2000 - 2500 feet above the regional ground-water table within the Redwall-Mauv aquifer. Laboratory tests on rock core from within the breccia pipe but below the depth of uranium mineralization have shown the rock mass to be effectively impermeable. Measured hydraulic conductivities for the non-mineralized portions of the breccia pipe below the depth of mining were less than $1x\ 10^{-8}$ cm/sec. This compares measured hydraulic conductivities of less than 1×10^{-9} cm/sec for the altered sandstone and siltstone units adjacent to, but outside of the breccia pipe and measured values of 2.0×10^{-8} to 1.4×10^{-6} cm/sec for non-mineralized portions of the pipe within the zone of mining.

Recementation of the collapse breccia within the pipe and the alteration and recementation of the sedimentary units immediately around the pipe have resulted in very low permeability. Because of the very low permeabilities and the physical separation, the potential for any direct impact on water quality or quantity within the Redwall-Mauv limestone aquifer is negligible.

In addition to these physical factors which limit the potential for water quality or quantity impacts with the Redwall-Mauv aquifer, absorption of heavy metals and radioactive constituents on the surfaces of clays as well as chemical reactions with the rock strata would tend to minimize or eliminate any short-term or long-term potential water quality impacts. Thick sequences of agrillaceous mudstones and limestones with high absorptive capacities physically separate the uppermost aquifer within the Redwall-Mauv limestones and the proposed depth of mining.

It can be expected that mine development may locally dewater perched ground water systems which exist within the thick unsaturated zone above the regional water table. Any effect on these perched systems, however, would be limited to the immediate mine area.

6. Soils

Soil disturbance at the mine yard would consist of minor recontouring to internally drain the area towards the holding pond and the channelizing of the watershed around the mine yard. Topsoil would be stockpiled causing some adverse changes in the microbial community. Once the area is reclaimed it is believed that due to the small size (19.4 acres) of disturbance that the microbial population would restore itself rather quickly.

Soil erosion rates would increase during construction but considering the drainage plan proposed, soil loss from the surrounding area is anticipated to be insignificant. If soil erosion rates or soil loss from the site becomes a problem EFN would be required to correct it immediately.

On haul routes, soils would be compacted by the use of heavy equipment and other vehicle activities. Runoff from the road may increase soil erosion rates during periods of intense storm activities. The use of culverts and fill material should greatly reduce this risk and therefore the anticipated adverse impacts should be minimal and temporary.

7. Geology/Topography

During Phase I and II, there would be some change in relief (19.4 acres) of the project area. To accommodate full internal drainage of the mine yard, minor grading of the mine yard itself is necessary. Upon cessation of operations, only minor changes in the premining contours would occur. As revegetation proceeds, these changes should be unnoticeable to the average visitor.

Additionally, given the stable nature of the local stratigraphy, there is an extremely low probability that the mined out cavities would collapse and affect the surface topography.

8. Radiological Assessment

Background

During mine operation the radiation levels in the vicinity of the uranium ore stockpile would be on the order of 1 mrem/hr.

Soil erosion rates would increase during construction but considering the drainage plan proposed, soil loss from the surrounding area is anticipated to be insignificant. If soil erosion rates or soil loss from the site becomes a problem EFN would be required to correct it immediately.

On haul routes, soils would be compacted by the use of heavy equipment and other vehicle activities. Runoff from the road may increase soil erosion rates during periods of intense storm activities. The use of culverts and fill material should greatly reduce this risk and therefore the anticipated adverse impacts should be minimal and temporary.

7. Geology/Topography

During Phase I and II, there would be some change in relief (19.4 acres) of the project area. To accommodate full internal drainage of the mine yard, minor grading of the mine yard itself is necessary. Upon cessation of operations, only minor changes in the premining contours would occur. As revegetation proceeds, these changes should be unnoticeable to the average visitor.

Additionally, given the stable nature of the local stratigraphy, there is an extremely low probability that the mined out cavities would collapse and affect the surface topography.

8. Radiological Assessment

Background

During mine operation the radiation levels in the vicinity of the uranium ore stockpile would be on the order of 1 mrem/hr.

Since radiation levels around the ore decrease to background at a distance of a few hundred meters from the pile, the levels at the Arizona-I mine should do the same. Thus, it is anticipated that gamma radiation would remain unchanged at the monitoring stations during mine operation.

Airborne Radioactivity

Radon gas would diffuse from the ore stockpiles and be exhausted from the mine vent. Once airborne the gas would be transported away from the area by prevailing winds and would decay to its progeny. Radon progeny would be exhausted from the mine vent also. However, they would quickly decay and become negligible.

Uranium and all progeny would be present in dust blown off the ore stockpiles and in dust released from the mine vent.

The potential impact from these radionuclides may be determined based on the magnitude of each release and the prevailing meteorological conditions. Several computer codes are available which model the atmospheric dispersion of radionuclides. The MIDLOS Code, developed to study releases from uranium mills, was selected to quantify the radon gas releases while the Industrial Source Code was used to generate isopleths of the potentially radioactive dust.

The natural background radon gas concentrations in the vicinity of the Arizona I Project are on the order of 0.2 pCi/L. Calculated increases in radon gas concentrations from the mining operations are presented in Figure 23. Baseline radon concentrations at ARIZONA I would be the same.

Figure 23 pCi/L Increase in Radon Gas Levels from the ARIZONA I Mine

Distance from Site (km)	North	East	South	West
1.5	0.17	0.16	0.09	0.05
2.5	0.08	0.08	0.04	0.03
3.5	0.05	0.04	0.03	0.02

Assuming that all the potentially radioactive dust is 1% uranium (rather than the anticipated 0.7% in the high grade and 0.2% in the low grade ore piles), the 0.5 ug/m^3 dust isopleth has a natural uranium concentration of 0.005 ug/m^3. For comparison purposes only, this concentration may be compared with the 10 CFR 20 regulation of 3.0 ug/m^3 for natural airborne uranium releases to an uncontrolled area at facilities which possess a radioactive source materials license. Although the uranium mine is not governed by 10CFR20 regulations the releases are, nevertheless, on the order of 600 times below this limit.

In summary there would be no significant radiological impact on the environment from the release of radon gas or dust from the mine site.

Groundwater

A water well is to be drilled at the ARIZONA I project. Water samples would be collected annually from the well and radiological assays performed to determine if radiochemistry changes occur during mining operations.

Figure 23 pCi/L Increase in Radon Gas Levels from the ARIZONA I Mine

Distance from Site (km)	North	East	South	West
1.5	0.17	0.16	0.09	0.05
2.5	0.08	0.08	0.04	0.03
3.5	0.05	0.04	0.03	0.02

Assuming that all the potentially radioactive dust is 1% uranium (rather than the anticipated 0.7% in the high grade and 0.2% in the low grade ore piles), the 0.5 ug/m^3 dust isopleth has a natural uranium concentration of 0.005 ug/m^3. For comparison purposes only, this concentration may be compared with the 10 CFR 20 regulation of 3.0 ug/m^3 for natural airborne uranium releases to an uncontrolled area at facilities which possess a radioactive source materials license. Although the uranium mine is not governed by 10 CFR 20 regulations the releases are, nevertheless, on the order of 600 times below this limit.

In summary there would be no significant radiological impact on the environment from the release of radon gas or dust from the mine site.

Groundwater

A water well is to be drilled at the ARIZONA I project. Water samples would be collected annually from the well and radiological assays performed to determine if radiochemistry changes occur during mining operations.

Surface Water

Surface rainfall runoff falling within the mine area would be collected in an evaporation pond. The pond would be located just inside the mine yard and would be sized to hold mine yard runoff from a 100 year - 24 hour storm event.

Water diversion berms around the mine perimeter would be constructed to ensure that any surface runoff from the unslope watershed would be diverted around the site and would not be allowed to enter the mine area of operations. Thus no radiological impacts are anticipated.

Cumulative Radiological Impacts

The proximity of the ARIZONA I mine site to the PINENUT mine site presents an opportunity to evaluate the potential for cumulative impacts from multiple mining operations.

Based on background radiation measurements around the ore piles on top of the ridge at the PIGEON mine, direct gamma radiation should decrease to background within a few hundred meters of the ore piles. Consequently, there would be no cumulative impact from gamma emitting radiation.

Based on MILDOS computer code predictions, radon concentrations would increase slightly around the mines. The MILDOS results for Arizona I are presented in Figure 23. Thus, at a point midway between the sites the radon concentration may increase on the order of 0.2 pCi/L. Since background concentrations in the area vary from 0.1 pCi/L to approximately 1.0 pCi/L, any change would not be detectable above the normal fluctuations in the natural radon environment. Therefore, there would be no measureable cumulative impact from radon.

The potential for a cumulative impact on airborne radioactivity in dust emissions from the ore piles and the mine vents was modeled using the Industrial Source Code. It was conservatively assumed that both mines achieved maximum ore production at the same time. Results are presented in Figure 24. The figure show a 0.5 ug/m^3 dust. The isopleth represents a radioactivity concentration in the dust which is about 6000 times below the limits expressed in 10CFR20 for natural airborne uranium releases to an uncontrolled area at facilities which posses a radioactive source materials license. Although uranium mining activities are not governed by these regulations, the comparison is noteworthy because it can be used to show that the individual and cumulative impact from radioactive dust emissions would be insignificant.

To assess the actual radiological impact from the Arizona I and Pinenut mining operations, a special monitoring site was established at a point which is approximately midway between the two sites. As with the other permanent monitoring sites, measurements of direct radiation, radon, and radioactivity in airborne dust would be collected on a quarterly basis.

Ore Transport Radiation and Radioactivity

Ore would be shipped via independent truck contractors using double-trailer trucks of 25-ton capacity. Each load would be covered with a tarpaulin, lapping over the side about a foot and secured every few feet around the truck bed. Thus, wind erosion, storms, and uneven roads should not cause loss of material during transit.

Direct radiation from an ore truck would be about 2 mrem/hr at the truck bed, about 0.3 mrem/hr on the shoulder of the roadbed and normal background at about 60 m (96 ft) from the

The potential for a cumulative impact on airborne radioactivity in dust emissions from the ore piles and the mine vents was modeled using the Industrial Source Code. It was conservatively assumed that both mines achieved maximum ore production at the same time. Results are presented in Figure 24. The figure show a 0.5 ug/m^3 dust. The isopleth represents a radioactivity concentration in the dust which is about 6000 times below the limits expressed in 10CFR20 for natural airborne uranium releases to an uncontrolled area at facilities which posses a radioactive source materials license. Although uranium mining activities are not governed by these regulations, the comparison is noteworthy because it can be used to show that the individual and cumulative impact from radioactive dust emissions would be insignificant.

To assess the actual radiological impact from the Arizona I and Pinenut mining operations, a special monitoring site was established at a point which is approximately midway between the two sites. As with the other permanent monitoring sites, measurements of direct radiation, radon, and radioactivity in airborne dust would be collected on a quarterly basis.

Ore Transport Radiation and Radioactivity

Ore would be shipped via independent truck contractors using double-trailer trucks of 25-ton capacity. Each load would be covered with a tarpaulin, lapping over the side about a foot and secured every few feet around the truck bed. Thus, wind erosion, storms, and uneven roads should not cause loss of material during transit.

Direct radiation from an ore truck would be about 2 mrem/hr at the truck bed, about 0.3 mrem/hr on the shoulder of the roadbed and normal background at about 60 m (96 ft) from the

trailer. As a truck passes, individuals standing on the shoulder of the highway would receive a dose of radiation too small to quantify. Thermoluminescent dosimeters have been placed at several sites along existing haul routes, but have not detected any changes in radiation levels from the actual radiation environment.

The truck driver would receive measureable radiation and doses to about 500 mrem/yr may be expected. As shown in Figure 9, this dose is only slightly higher than that received by airline flight crews.

Truck accident statistics include three categories of events: collisions, noncollisions, and other events. "Collisions" are between the transport vehicle and other objects, whether moving vehicles or fixed objects. "Noncollisions" are accidents involving only the one vehicle, such as when it leaves the road and rolls over. Accidents classified as "other events" include personal injuries suffered on the vehicle, persons falling from or being thrown against a standing vehicle, cases of stolen vehicles, and fire occurring on a standing vehicle. The probability of a truck accident of any kind is about 1.3E-06/km.

The mine would ship an average of 12 truck loads per day to the mill in Blanding, Utah. The mill is about 360 miles (576 km) away. Thus, the probability of an accident is about 9.0E-03 per day OR about one accident of some type every 111 days. It should be noted that only a fraction of all accidents would result in ore spillage. Nevertheless, a couple of spillage accidents should be anticipated during the operational life of the mine.

The ore from the mine is moist, uncrushed rocks and contains

only a small percentage of respirable dust which might be released during an accident. For an ore truck accident it is reasonable to assume that about 2.1 kg (4.6 lbs) of ore dust might be released to the atmosphere. If all the dust were in the respirable range then a maximum individual 50 year lung dose commitment would be on the order of 130 mrem at 500 m (1600 ft) and 14 mrem at 2000 m (6500 ft) from the accident scene. Direct radiation would be the same whether or not the ore were in the truck. Thus, an individual must remain on top of the ore for approximately 50 hours per week in order to receive the suggested weekly occupational exposure limit, OR, remain atop the ore pile for approximately 80 hours before receiving the suggested, yearly non-occupational exposure limit. The remoteness of the haulage route, the low specific activity of the material (amount of radioactivity per gram of ore) and the ease with which the contamination can be removed (shovel ore into another truck) results in a potential impact which should not be considered significant.

Energy Fuels Nuclear, Inc. (EFN) has committed to a timely, aggressive, and thorough clean up of any spillage (EFN 84, EFN 87). During the summer of 1987, EFN and the Navajo Nation developed and emergency plan to handle ore truck accidents.

In November, 1987 two unrelated truck accidents which involved ore spillage occurred on highways within the Navajo Nation. Clean up efforts at both locations were rapid and thorough. The radiological levels at both sites have been returned to normal and acceptable ranges. No long or short term adverse health or environmental effects occurred.

Radiation in an Underground Mine Environment

The miners can expect direct radiation levels to be on the

only a small percentage of respirable dust which might be released during an accident. For an ore truck accident it is reasonable to assume that about 2.1 kg (4.6 lbs) of ore dust might be released to the atmosphere. If all the dust were in the respirable range then a maximum individual 50 year lung dose commitment would be on the order of 130 mrem at 500 m (1600 ft) and 14 mrem at 2000 m (6500 ft) from the accident scene. Direct radiation would be the same whether or not the ore were in the truck. Thus, an individual must remain on top of the ore for approximately 50 hours per week in order to receive the suggested weekly occupational exposure limit, OR, remain atop the ore pile for approximately 80 hours before receiving the suggested, yearly non-occupational exposure limit. The remoteness of the haulage route, the low specific activity of the material (amount of radioactivity per gram of ore) and the ease with which the contamination can be removed (shovel ore into another truck) results in a potential impact which should not be considered significant.

Energy Fuels Nuclear, Inc. (EFN) has committed to a timely, aggressive, and thorough clean up of any spillage (EFN 84, EFN 87). During the summer of 1987, EFN and the Navajo Nation developed and emergency plan to handle ore truck accidents.

In November, 1987 two unrelated truck accidents which involved ore spillage occurred on highways within the Navajo Nation. Clean up efforts at both locations were rapid and thorough. The radiological levels at both sites have been returned to normal and acceptable ranges. No long or short term adverse health or environmental effects occurred.

Radiation in an Underground Mine Environment

The miners can expect direct radiation levels to be on the

order of 1.0 mrem/hr in the orebody . The direct radiation limits, dosimetry, and record keeping requirements are mandated by 30 CRF 57. Theoretically, a miner can remain at or near the high grade ore body during entire work period and not exceed the weekly guidelines (100 mrem) or the annual limit (5,000 mrem).

Radon gas and progeny would be flushed from the mine with a 275,000 cfm (maximum) vent fan. Based on measurements atop the Hack Canyon mine vent, radon gas concentrations would be on the order of 2400 pCi/L and 1600 mWL. Thus, the daughters would be present at approximately 10% of their potential equilibrium values. Therefore, much of the radon gas would be removed from the mine before it is able to decay to its hazardous daughter products. The occupational radon progeny limit is 4 WLM/yr. Miners at Hack Canyon received an average of about 2.2 WLM/yr.

Currently, uranium miners work an average of 10 years underground ; thus the cumulative 10 to 25 WLM is well below the 100 WLM value where studies indicate possible increases in lung cancer might appear.

9. ACCOUSTICAL IMPACTS

Based on similar studies in proximate areas to the Arizona 1 Project (Pinenut and Hacks Canyon), significant audio impacts are not anticipated. Those impacts that are anticipated are within applicable limits set for safety standards.

Nor is it anticipated that accoustical effects would have significant negative impacts on recreation due to extremely low use of the area and the fact that higher recreation values are found elsewhere.

Based on similar operations by the U.S. Forest Service at the Canyon Mine and hauling operations on the Kaibab Forest, noise from hauling is not expected to have significant impacts on wildlife species.

C. LIVING ENVIRONMENT

1. Wildlife

Big Game

It is anticipated that impacts caused by Phase I would be slightly negative only for mule deer. The increased sights, sounds and smells of human activity and the development of the mine yard would interupt daily movement/use of the immediate area.

Impacts will increase in magnitude during Phase II. These impacts will be associated with the realignment of the haul road and construction activities as well as eventual hauling. Impacts to habitat and daily movement are anticipated to be insignificant since deer numbers are extremely low and there is a vast amount of similar habitat available. Further, none of the anticipated impacts would be permanent.

There is a remote chance for road kill nvolving mule deer and antelope. No adverse impacts to Antelope habitat are anticipated.

Birds of Prey

This project is not expected to have adverse impacts on raptors as this area is not suitable nesting habitat.

Based on similar operations by the U.S. Forest Service at the Canyon Mine and hauling operations on the Kaibab Forest, noise from hauling is not expected to have significant impacts on wildlife species.

C. LIVING ENVIRONMENT

1. Wildlife

Big Game

It is anticipated that impacts caused by Phase I would be slightly negative only for mule deer. The increased sights, sounds and smells of human activity and the development of the mine yard would interupt daily movement/use of the immediate area.

Impacts will increase in magnitude during Phase II. These impacts will be associated with the realignment of the haul road and construction activities as well as eventual hauling. Impacts to habitat and daily movement are anticipated to be insignificant since deer numbers are extremely low and there is a vast amount of similar habitat available. Further, none of the anticipated impacts would be permanent.

There is a remote chance for road kill nvolving mule deer and antelope. No adverse impacts to Antelope habitat are anticipated.

Birds of Prey

This project is not expected to have adverse impacts on raptors as this area is not suitable nesting habitat.

A minor adverse impact could occur when 19.4 acres of the mine yard and haul routes are removed from the primary food source.

Non-Game

Non-game animals will be affected by loss of food source during mine yard construction and haul road development. There are also opportunities for direct mortality as a result of constructions. The above activities are insignificant as well as temporary.

2. Vegetation

Negative impacts would result when the mine yard is cleared to final grade to insure internal drainage. This impact would involve 19.4 acres of revegetation in the mine yard and any additional areas of disturbance due to road construction.

Vegetation will be entirely destroyed where bladed.

3. Threatened & Endangered

Based upon prior inventories, there would be no anticipated impacts (direct or indirect) to any Threatened or Endangered Species as a result of this project.

D. HUMAN VALUES

1. Cultural Resources

The proposed Arizona 1 mine yard is not anticipated to have any adverse affects on the archaeological resource because the three isolated artifacts are considered non-significant and do

not have additional archeological data to offer beyond what has already been obtained through recordation.

The road realignment would be reinventoried for archaeological resources once it is staked. Any unexpected cultural resources found would be avoided through road relocation or would be mitigated through Section 106 of the National Historic Preservation Act.

As part of the past committments made in the Pinenut Decision Record's archaeological surveilance and site monitoring efforts will continue in this area and should provide BLM with current information on the status and protection needs of the archaeological resources in the local area.

2. Socio-Economic

Population, Social Conditions, and Employment

This proposal should have no direct effect on the actual population in the local communities. EFN plans to utilize employees from the soon to be rehabilitated Hack's Canyon complex. Positive benefits would acrue, when additional local residents are hired to supplement the work force during Phase II. In addition, increased employment translates into continued support of local services not associated with mining (i.e., manufacturing, construction, public utilities and wholesale/retail trades and local tax base also). Local business and community leaders voice strong support for EFN and Arizona No. 1. Further benefits would be gained by the State of Arizona through taxes on EFNs new properties.

3. Public Attitudes

Implementing the proposed action would not create significant

not have additional archeological data to offer beyond what has already been obtained through recordation.

The road realignment would be reinventoried for archaeological resources once it is staked. Any unexpected cultural resources found would be avoided through road relocation or would be mitigated through Section 106 of the National Historic Preservation Act.

As part of the past committments made in the Pinenut Decision Record's archaeological surveilance and site monitoring efforts will continue in this area and should provide BLM with current information on the status and protection needs of the archaeological resources in the local area.

2. Socio-Economic

Population, Social Conditions, and Employment

This proposal should have no direct effect on the actual population in the local communities. EFN plans to utilize employees from the soon to be rehabilitated Hack's Canyon complex. Positive benefits would acrue, when additional local residents are hired to supplement the work force during Phase II. In addition, increased employment translates into continued support of local services not associated with mining (i.e., manufacturing, construction, public utilities and wholesale/retail trades and local tax base also). Local business and community leaders voice strong support for EFN and Arizona No. 1. Further benefits would be gained by the State of Arizona through taxes on EFNs new properties.

3. Public Attitudes

Implementing the proposed action would not create significant

changes in public attitudes. The intensity and extent to which opponents of uranium mining express their opinions is expected to increase, however this should have little effect on the prevailing local and regional attitudes.

Although the rate at which opponents are voicing their opinions is increasing, past and present experience in analyzing public comments from EFN production operations have shown the majority of commentators to fully support EFN and their operations.

4. Wilderness Resources

The proposed action is not expected to have any direct effects on the Kanab Creek Wilderness Area. It would not be visible or audible from any portion of the wilderness area.

This action would not cut off any access to wilderness. Water Canyon Point is a good viewing area, but the wilderness area is not easlily accessible from the point.

Some secondary impacts to the wilderness area my occur in the form of increased accessibility to the viewing area. However, presently existing roads to the view area have shown no noticeable increase in use. Opinions vary as to whether this would be a positive or negative impact.

5. Visual Resources

a. General. Visual disturbance would be expected to increase in the immediate area of the mine yard.

The magnitude of disturbance would increase as this project proceeds from Phase I to Phase II. Visual

contrast would be expected to be moderate and limited only to the immediate area of operations. Negative impacts from road upgrading and the powerline would occur, but with appropriate mitigation they would be insignificant.

6. Other Values

Ranching

It is anticipated that the proposed action would have a nominal effect on livestock operations. The loss of 19.4 acres (mine yard) of habitat translates into approximately 1 AUM.

There would be an increased risk for a livestock/vehicle accident but the affect on the grazing program is insignificant.

Recreation

The increase in mining activity around Arizona No. 1 would result in the reduction of primitive recreation values and opportunities. While such a loss is considered a due or necessary impact of mining it is noteworthy. People seeking back country recreational experiences are strongly opposed to these activities.

While the potential is still present for "primitive" experiences throughout much of the area, actual recreation use is minimal given more unique and popular areas in the region. (i.e., Kanab Creek, Grand Canyon, Mt. Trumbull, Zion, etc.). Improved access into this area would be considered a benefit to some as it increases access for sight seeing.

contrast would be expected to be moderate and limited only to the immediate area of operations. Negative impacts from road upgrading and the powerline would occur, but with appropriate mitigation they would be insignificant.

6. Other Values

Ranching

It is anticipated that the proposed action would have a nominal effect on livestock operations. The loss of 19.4 acres (mine yard) of habitat translates into approximately 1 AUM.

There would be an increased risk for a livestock/vehicle accident but the affect on the grazing program is insignificant.

Recreation

The increase in mining activity around Arizona No. 1 would result in the reduction of primitive recreation values and opportunities. While such a loss is considered a due or necessary impact of mining it is noteworthy. People seeking back country recreational experiences are strongly opposed to these activities.

While the potential is still present for "primitive" experiences throughout much of the area, actual recreation use is minimal given more unique and popular areas in the region. (i.e., Kanab Creek, Grand Canyon, Mt. Trumbull, Zion, etc.). Improved access into this area would be considered a benefit to some as it increases access for sight seeing.

E. Cumulative Impacts - Production

With the addition of Arizona 1 Mine, the total cumulative surface disturbance resulting from mining operations would be increased by 19.4 acres. Approximately 0.7 miles of new road would be constructed, and 0.7 miles of existing road would be reclaimed.

Total mining disturbance would equal the following:

Mine yard access:	157.4 acres
Miles of powerline:	38.8 miles
New access constructed:	4.92 miles
Access upgraded:	38.7 miles

Based on the above, total cumulative disturbance from mining operation results in approximately 0.0047% of the entire Arizona Strip. It is not anticipated that the Arizona 1 Mine would cause any form of cumulative impacts that would correlate with any other uranium mines based on the data provided in this Environmental Assessment.

For example, fugitive dust and radiological impacts are limited in extent and decrease rapidly with increasing distance from the mine yard and haul routes to the level of insignificance (air quality within 1.9 miles and radiological with 1,000 meters). Thus those impacts do not translate into area wide air quality impacts.

Hauling would cause a short term impact on the Mt. Trumbull road for the duration that the Arizona 1 Mine is in development or production and is hauling concurrently with other mines. This amount of hauling would be less than that which occurred when the three Hack Canyon Mines were in production.

No environmental threshold or standards would be exceeded under normal operations.

Based on the analysis presented in this document, the Pinenut and Hermit EA's and the information EFN has provided BLM, there is a very low probability for a future additional mines to have cumulative or synergistic impact on the Arizona 1 proposal except that of using common haul roads.

VI. IMPACTS RESULTING FROM PROPOSED ALTERNATIVES

A. The No Action Alternative is a continuation of existing conditions. The impacts would be those resultant from the original exploration plan of operation and none of the impacts described in Section V (Anticipated Impacts) would take place.

The environmental impacts would be those resulting from the previously approved plan of operation and the existing exploration activities. Rehabilitation requirements would be those described in the original environmental assessment for exploration. Resulting Impacts would be those described in Section IV.

B. Alternative 2. The Proposed Action would be approved as submitted. The resulting impacts would be those described in Section V above.

C. Alternative 3. The proposed action would be approved subject to additional modifications, mitigation or stipulations, including but not limited to the following.

This Alternative would require alternate forms of transportation of employees to the project area.

No environmental threshold or standards would be exceeded under normal operations.

Based on the analysis presented in this document, the Pinenut and Hermit EA's and the information EFN has provided BLM, there is a very low probability for a future additional mines to have cumulative or synergistic impact on the Arizona 1 proposal except that of using common haul roads.

VI. IMPACTS RESULTING FROM PROPOSED ALTERNATIVES

A. The No Action Alternative is a continuation of existing conditions. The impacts would be those resultant from the original exploration plan of operation and none of the impacts described in Section V (Anticipated Impacts) would take place.

The environmental impacts would be those resulting from the previously approved plan of operation and the existing exploration activities. Rehabilitation requirements would be those described in the original environmental assessment for exploration. Resulting Impacts would be those described in Section IV.

B. Alternative 2. The Proposed Action would be approved as submitted. The resulting impacts would be those described in Section V above.

C. Alternative 3. The proposed action would be approved subject to additional modifications, mitigation or stipulations, including but not limited to the following.

This Alternative would require alternate forms of transportation of employees to the project area.

a. Deny bussing of employees and require use of private vehicles.

This alternative could result in 160 vehicle trips per day if EFN personnel (estimated at 40/shift/day Phase I) were to drive individual vehicles.

Additionally a parking lot would be required that would add additional surface disturbance and associated adverse impacts to visual resources, vegetation removal, soil compaction runoff, erosion, wildlife and air quality due to dust.

In effect this alternative defeats the objectives of reducing traffic volumes, eliminating surface disturbance and reducing air quality impacts. Increased vehicle use would potentially increase the amount of liter along the roadways and would increase the probability for vehicle accidents.

b. Require personnel to be transported by aircraft.

This alternative would result in the need for additional surface disturbance to accomodate an air strip. The use of aircraft would potentially adversely effect recreation user, Peregrine falcon re-establishment, livestock, safety and wildlife. It is also doubtful that this alternative could be required as it would most likely violate the "reasonable access" provisions of the General Mining Laws. (Maley).

<u>This Alternative would require relocation of surface facilities within the mine yard</u>.

Because the ore body is stationary there are not many viable alternatives to evaluate regarding the mine yard. However some options were analyzed within the scope of this alternative.

a. Require ore piles to be located at the northern part of the mine yard. This alternative would result in ore storage at the lowest part of the mine yard. The area would be subject to runoff from within the yard and would preclude placement of the evaporation/holding pond where it would be most effective in gathering surface runoff. The potential for slightly more contamination of holding pond water would increase. In effect, this alternative would defeat the objective of keeping the ore piles in a topographically high part of the yard.

b. Require surface construction facilities to be placed along the east and/or west perimeters of the mine yard. This would preclude proper placement of ore piles and would also possibly effect the placement of barren waste rock. It would affect proper storage of topsoils which must be protected throughout the duration of operations. Buildings that would not be in the higher areas of the yard would be subject to impacts from run off within the mine yard. This alternative would defeat the objectives of requiring surface facilities to be located in a limited compact area to reduce surface disturbance and would effectively cut down on the useable space in which heavy equipment could operate (ie, ore stock piling, loading areas, turn around areas, etc.).

c. Move the mine yard facilities within the surrounding area to the best suitable locations, (ie, ridge tops, flat area, etc.).

This would increase the size of the yard significantly making security and safety much less efficient. The beneficial impacts from reducing cut and fill operations would be off set by the disturbance from normal operations between the selected areas. The resulting impact would be greater in extent to all of the environmental parameters; surface disturbance, water,

a. Require ore piles to be located at the northern part of the mine yard. This alternative would result in ore storage at the lowest part of the mine yard. The area would be subject to runoff from within the yard and would preclude placement of the evaporation/holding pond where it would be most effective in gathering surface runoff. The potential for slightly more contamination of holding pond water would increase. In effect, this alternative would defeat the objective of keeping the ore piles in a topographically high part of the yard.

b. Require surface construction facilities to be placed along the east and/or west perimeters of the mine yard. This would preclude proper placement of ore piles and would also possibly effect the placement of barren waste rock. It would affect proper storage of topsoils which must be protected throughout the duration of operations. Buildings that would not be in the higher areas of the yard would be subject to impacts from run off within the mine yard. This alternative would defeat the objectives of requiring surface facilities to be located in a limited compact area to reduce surface disturbance and would effectively cut down on the useable space in which heavy equipment could operate (ie, ore stock piling, loading areas, turn around areas, etc.).

c. Move the mine yard facilities within the surrounding area to the best suitable locations, (ie, ridge tops, flat area, etc.).

This would increase the size of the yard significantly making security and safety much less efficient. The beneficial impacts from reducing cut and fill operations would be off set by the disturbance from normal operations between the selected areas. The resulting impact would be greater in extent to all of the environmental parameters; surface disturbance, water,

wildlife, noise, flooding, vegetative, air quality, soils, cultural resources and visual impacts. It would be less cost effective and increase the potential for accidents and environmental contamination through the sheer increase in the size of the mine yard area.

This alternative requires use of the existing access.

This alternative would eliminate the need for realigning approximately 0.7 miles of road between the Pinenut haul road and the Arizona 1 mine yard. The existing access has two engineering concerns. First, a large portion of the road is located in a bottom bog area and second there is one short steep grade that would be difficult to upgrade and require the ore trucks to travel very slow.

This alternative would require 2 to 3 times the amount of gravel and fill than the realignment proposal to upgrade the road through the bog. The bog area would most likely require continual maintenance throughout the life of the mine to assure safe winter access. Since good gravel sources do not occur in the local area, EFN and BLM would have to find a source of gravel.

This alternative would reduce the visual impact in the immediate road area by not allowing the additional surface disturbance from the realigned sections. There should be no real difference to the recreational or remoteness character of the area since both the upgrade or the realignment is in the same localized basin. Long term impacts to wildlife may be more adverse under this alternative in that the bottom soils are far more productive and once rehabilitated would provide much better habitat and forage value. EFN has stated informally that the road upgrade would be more expensive than the realignment proposal. Both road alternatives are not anticipated to have any adverse impact on T&E species or

cultural resources. Upgrading the existing road in the bog has a greater potential for affecting water flow to the Robinson livestock Reservoir.

Require EFN to utilize existing facilities at Pinenut rather than duplicating the same facilities at Arizona 1.

While this alternative has the potential to eliminate some surface facilities and therefore surface disturbance, the following has been determined:

- The Pinenut facilities are not large enough to accommodate additional workers for sanitation purposed (i.e., showers, change rooms, rest rooms).
- Utilizing the existing warehouses, machine shops, diesel storage areas etc., would create the necessity of more travel between the two mines and would result in more impacts to recreational users and wildlife, and would defeat the objective of bussing to reduce travel impacts. Additionally it would be extremely burdensome economically and functionally, for EFN to make continual trips back and forth between mines.

VII. Recommended Mitigating Measures to Enhance Environmental Protection

A. Mine Yard

1. If the protection of topsoil stockpiles becomes warranted in the future, EFN will use water, tacktifier or asphalt emulsion to prevent wind erosion.

2. During reclamation EFN will ensure that topsoils are equally distributed over the disturbed area to better insure proper reclamation.

cultural resources. Upgrading the existing road in the bog has a greater potential for affecting water flow to the Robinson livestock Reservoir.

Require EFN to utilize existing facilities at Pinenut rather than duplicating the same facilities at Arizona 1.

While this alternative has the potential to eliminate some surface facilities and therefore surface disturbance, the following has been determined:

- The Pinenut facilities are not large enough to accommodate additional workers for sanitation purposed (i.e., showers, change rooms, rest rooms).
- Utilizing the existing warehouses, machine shops, diesel storage areas etc., would create the necessity of more travel between the two mines and would result in more impacts to recreational users and wildlife, and would defeat the objective of bussing to reduce travel impacts. Additionally it would be extremely burdensome economically and functionally, for EFN to make continual trips back and forth between mines.

VII. Recommended Mitigating Measures to Enhance Environmental Protection

A. Mine Yard

1. If the protection of topsoil stockpiles becomes warranted in the future, EFN will use water, tacktifier or asphalt emulsion to prevent wind erosion.

2. During reclamation EFN will ensure that topsoils are equally distributed over the disturbed area to better insure proper reclamation.

3. Should periods of prolonged drought occur, and dust become an environmental and safety issue, EFN will implement a daytime dust abatement program within the mine yard as approved by the authorized officer.

4. Signs will be installed at the entrance of the mine yard to inform visitors and other land users that a uranium operation is in progress, in addition to the "No Trespassing" sign on the mine yard fences.

5. EFN will dispose of all concrete pads by breaking them up and back filling them into the mine shaft.

6. To be successfully rehabilitated, ground cover will be established to at least the prevailing conditions (i.e., 20 - 30% canopy cover) and approved by the authorized officer.

The following seeding mixtures and rates would be recommended:

Smooth Brome	1.0 lb./acre
Fourwing saltbush	2.0 lb./acre
Indian rice grass	2.0 lb./acre
Sand dropseed	0.5 lb./acre
Yellow Sweet Clover	0.5 lb./acre
Pubescent Wheatgrass	2.0 lb./acre
Russian Wildrye	1.0 lb./acre
TOTAL	9.0 lb./acre

This area would be expected to respond favorable to harrowing, seeding and chain dragging to cover seeds or drill seeding. Seedings should be planned to take advantage of optimum seasonal moisture conditions.

7. EFN will report local sightings of falcon or eagle to BLM. Upon such a sighting, no employee will harass, harm or injure the species.

8. EFN will ensure that the uranium ore stockpiles will not exceed the size of the ore pads.

9. Fuels and solvent storage area will be bermed to prevent accidental release of contaminated liquids.

10. The evaporation pond, dike, and diversion ditches will be routinely maintained to insure their integrity at all times during the operation of the mine with appropriate modifications during reclamation.

11. The roads and road crossings will be monitored for signs of erosion. If any erosional damage is detected, it will be repaired by riprap or other erosion control measures.

12. All disturbed areas and channel banks (when required) will be properly vegetated to establish satisfactory vegetation cover.

B. <u>Access</u>

1. All road upgrading or construction must at least conform to BLM standards.

2. Any culverts necessary must be sized according to the expected maximum drainage flow and installed according to at least BLM standards.

3. All abandoned sections of the existing road will be rehabitated by harrowing and reestablishment of vegetation. The seed mix would be the same as recommended for the mine yard.

7. EFN will report local sightings of falcon or eagle to BLM. Upon such a sighting, no employee will harass, harm or injure the species.

8. EFN will ensure that the uranium ore stockpiles will not exceed the size of the ore pads.

9. Fuels and solvent storage area will be bermed to prevent accidental release of contaminated liquids.

10. The evaporation pond, dike, and diversion ditches will be routinely maintained to insure their integrity at all times during the operation of the mine with appropriate modifications during reclamation.

11. The roads and road crossings will be monitored for signs of erosion. If any erosional damage is detected, it will be repaired by riprap or other erosion control measures.

12. All disturbed areas and channel banks (when required) will be properly vegetated to establish satisfactory vegetation cover.

B. Access

1. All road upgrading or construction must at least conform to BLM standards.

2. Any culverts necessary must be sized according to the expected maximum drainage flow and installed according to at least BLM standards.

3. All abandoned sections of the existing road will be rehabitated by harrowing and reestablishment of vegetation. The seed mix would be the same as recommended for the mine yard.

4. The proposed access will be rehabilitated to the original road dimensions upon completion of mining.

5. During road construction or upgrading, no actions will be allowed that will impact down wash flow or existing reservoirs.

6. The haul route will be appropriately graveled to reduce air quality impacts. If absolutely necessary, EFN will conduct dust abatement on the access to the mine site.

7. Road upgrading on that portion of the access road visible from Mt. Trumbull road will be limited to the minimum necessary to meet safety standards. This will help discourage visitor use of the access road that leads exclusively to the mine yard.

8. Archaeological surveys must be completed once the final road realignment is completed. All cultural resource must be avoided or in compliance with Section 106 of the National Historic Preservation Act.

9. As part of the past commitments made by BLM, archaeological site monitoring and surveilance efforts will continue in this area in order to keep BLM informed on the status and protection needs.

10. Engineering standards must be approved by BLM District Engineer prior to construction activities.

C. <u>Aircraft Use</u>

1. EFN will not utilize Kanab Creek or Hacks Canyon as a flight path to the Arizona 1 Mine yard.

D. Visual

1. Buildings and head frames will be painted a flat earth tone to be more harmonious with the existing environment.

2. Impacts of noticeable "night lights" will be "hooded and directed" to throw light within the area of operations.

E. Accidental Release

1. In the remote event that any liquid from within the mine yard is released off site, EFN will take immediate actions for cleanup, including a final radiological assessment of the impacted area that will be submitted to BLM.

   If additional reports are required by the State of Arizona (i.e., Best management Practices Plan or Best Available Technology Plan), they should be forwarded to BLM.

2. In the remote event that ore is spilled within the Arizona Strip District, EFN will immediately contact BLM and provide them with applicable reports on the incident.

3. Any unauthorized release, discharge or spill of any hazardous material or petroleum product must be immediately cleaned up to appropriate standards and reported to BLM and DEQ as appropriate.

VIII. Residual Impacts

Until reclamation efforts prove successful, the following residual impacts are expected.

D. Visual

1. Buildings and head frames will be painted a flat earth tone to be more harmonious with the existing environment.

2. Impacts of noticeable "night lights" will be "hooded and directed" to throw light within the area of operations.

E. Accidental Release

1. In the remote event that any liquid from within the mine yard is released off site, EFN will take immediate actions for cleanup, including a final radiological assessment of the impacted area that will be submitted to BLM.

   If additional reports are required by the State of Arizona (i.e., Best management Practices Plan or Best Available Technology Plan), they should be forwarded to BLM.

2. In the remote event that ore is spilled within the Arizona Strip District, EFN will immediately contact BLM and provide them with applicable reports on the incident.

3. Any unauthorized release, discharge or spill of any hazardous material or petroleum product must be immediately cleaned up to appropriate standards and reported to BLM and DEQ as appropriate.

VIII. Residual Impacts

Until reclamation efforts prove successful, the following residual impacts are expected.

Mine yard: A small amount of soil loss is expected until revegetation efforts become established.

Access: Minor or insignificant amounts of erosion are expected until revegetation is successful. Visual impacts of the access are mostly limited to the road area itself or when passing the access on Trumbull road.

Visual Resources: Results of human activity will be noticeable for several years, until reclamation is successful.

IX. Relationship Between Short Term Use and Long Term Productivity

This project is not expected to have any adverse impact on the long term productivity of the area as reclamation efforts are designed to return the area to approximately the prevailing conditions.

X. Irreversible and Irretrievable Commitments

As a result of this project, uranium ore will be extracted and processed thus constituting an irretrievable and irreversible commitment.

XI. Agencies and People Consulted

A. Mailing List Soliciting Comments

Approximately 180 individuals, groups, organizations and agencies were solicited or provided input to the Arizona 1 proposal.

B. Agencies/Groups Consulted

On February 5, 1988, BLM and EFN presented the Arizona 1 mine

plan-of-operations, on site, to all of the agencies and interest groups listed below.

BLM - Arizona

District Staff Consulted

Ken Moore - Environmental coordinator
Julian Anderson - Assist., D.M., Resources
Bob Smith - Hydrologist
Lee Hughes - Supervisory Range Con/T&E Specialist
Rob Roudabush - Area Manager
Mike Small - Wildlife management Biologist
Ilene Anderson - Lands and Realty
Tom Folks - Recreation/Wilderness
Bob Sandberg - Lead Range Conservationist

State Office Staff Consulted

Alan Rabinoff - Minerals
Gary Stumpf - Archeologist

Other Federal Agencies

Grand Canyon National Park, John Ray - Resource Manager
U.S. Forest Service (N.K.R.D.) Brian Avery

Kaibab Paiutes

Deloris Savala

State Agencies

Arizona Game and Fish Dept.

plan-of-operations, on site, to all of the agencies and interest groups listed below.

BLM - Arizona

District Staff Consulted

Ken Moore - Environmental coordinator
Julian Anderson - Assist., D.M., Resources
Bob Smith - Hydrologist
Lee Hughes - Supervisory Range Con/T&E Specialist
Rob Roudabush - Area Manager
Mike Small - Wildlife management Biologist
Ilene Anderson - Lands and Realty
Tom Folks - Recreation/Wilderness
Bob Sandberg - Lead Range Conservationist

State Office Staff Consulted

Alan Rabinoff - Minerals
Gary Stumpf - Archeologist

Other Federal Agencies

Grand Canyon National Park, John Ray - Resource Manager
U.S. Forest Service (N.K.R.D.) Brian Avery

Kaibab Paiutes

Deloris Savala

State Agencies

Arizona Game and Fish Dept.

Don Randall - Wildlife Manager

Arizona Department of Health Services

Grazing Permittee

Fred Heaton

BLM will utilize the Arizona State Clearing House to ensure the review of this document by all appropriate Arizona State Agencies and Regional Council's of Government occurred pursuant to Executive Order 12372.

XII. Source Materials

Pinenut EA and DR
Hermit EA, Appendix Document and DR
Radiological Assessment of the Arizona 1 Project
Dr. John W. McKlveen - Radiation and Environmental Monitoring, Inc.

Hydrologic Evaluations for the Proposed
Arizona 1 Uranium Mine - EnecoTech

Air Quality Impact Analysis of the Arizona 1 Mine
EnecoTech

All references are available at the Arizona Strip District Office, (801)673-3545