August 25, 1975

Report #2

HIGHLIGHTS:

ENVIRONMENTAL REPORT

CHURCH ROCK, NEW MEXICO
URANIUM MILL AND MINE

UNITED NUCLEAR
CORPORATION

ESPECIALLY PREPARED FOR:

THE STATE OF NEW MEXICO

August 25, 1975

Report #2

HIGHLIGHTS:

ENVIRONMENTAL REPORT

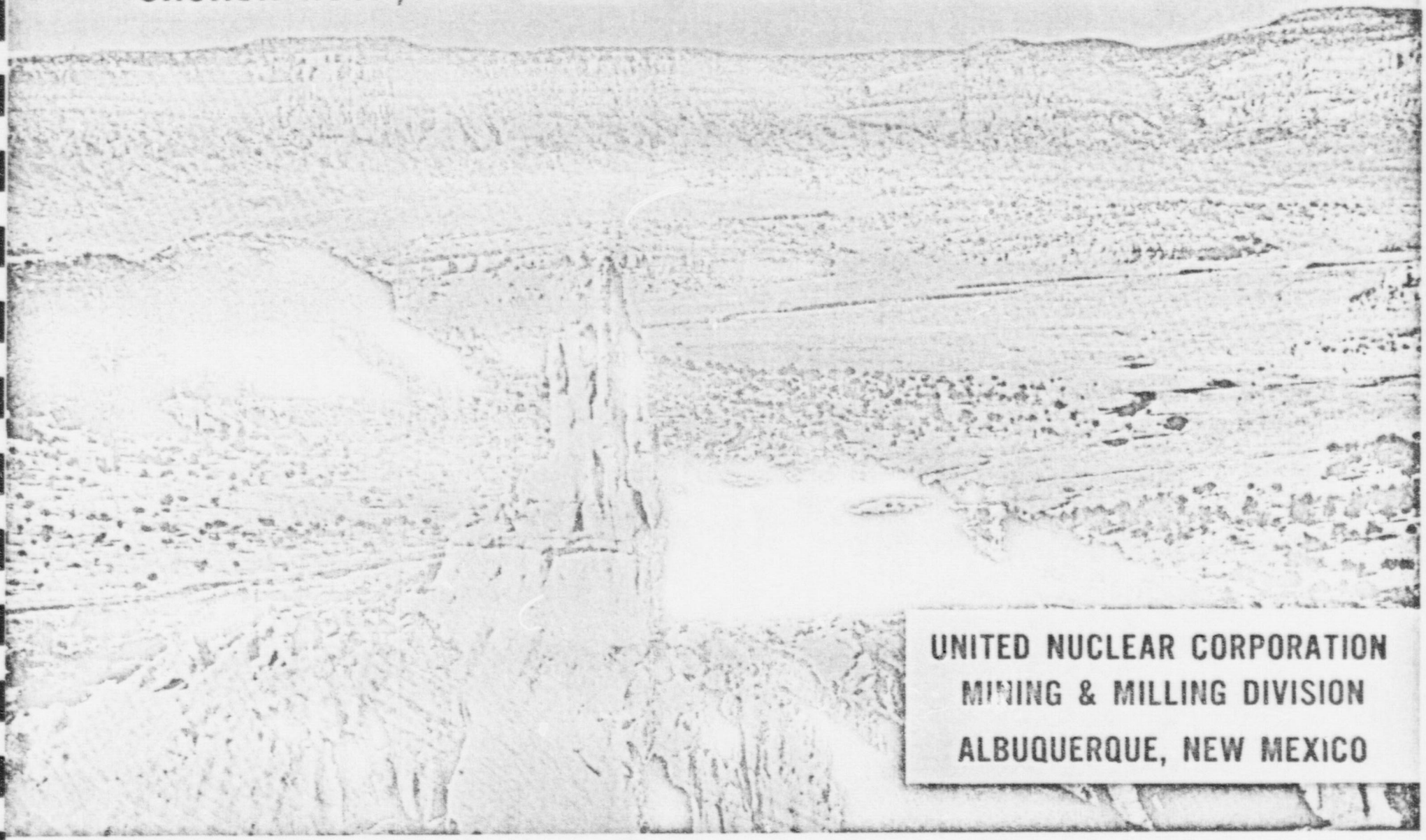
CHURCH ROCK, NEW MEXICO
URANIUM MILL AND MINE

UNITED NUCLEAR
CORPORATION

ESPECIALLY PREPARED FOR:

THE STATE OF NEW MEXICO

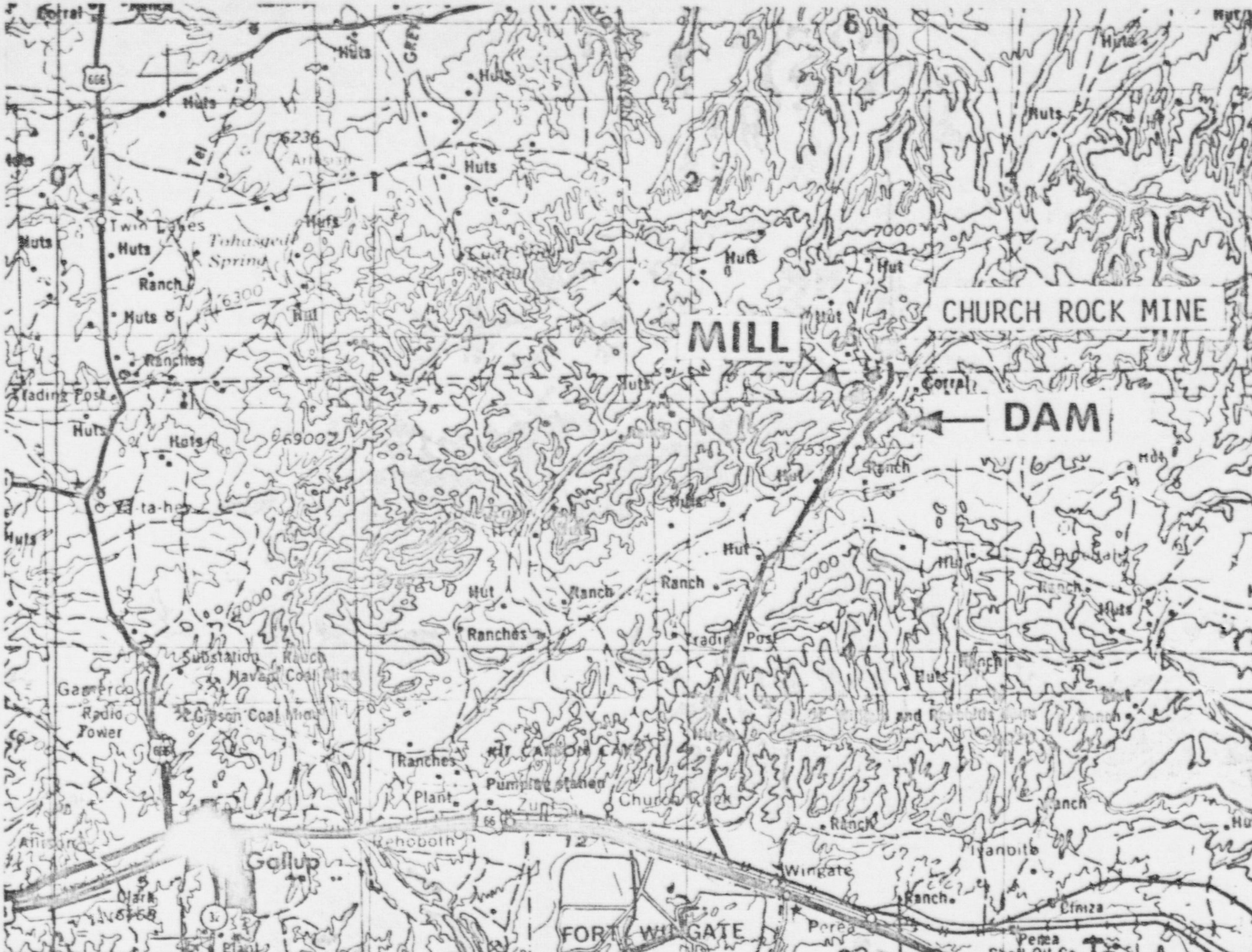
ENVIRONMENTAL REPORT
ON THE
CHURCH ROCK, NEW MEXICO URANIUM MILL AND MINE

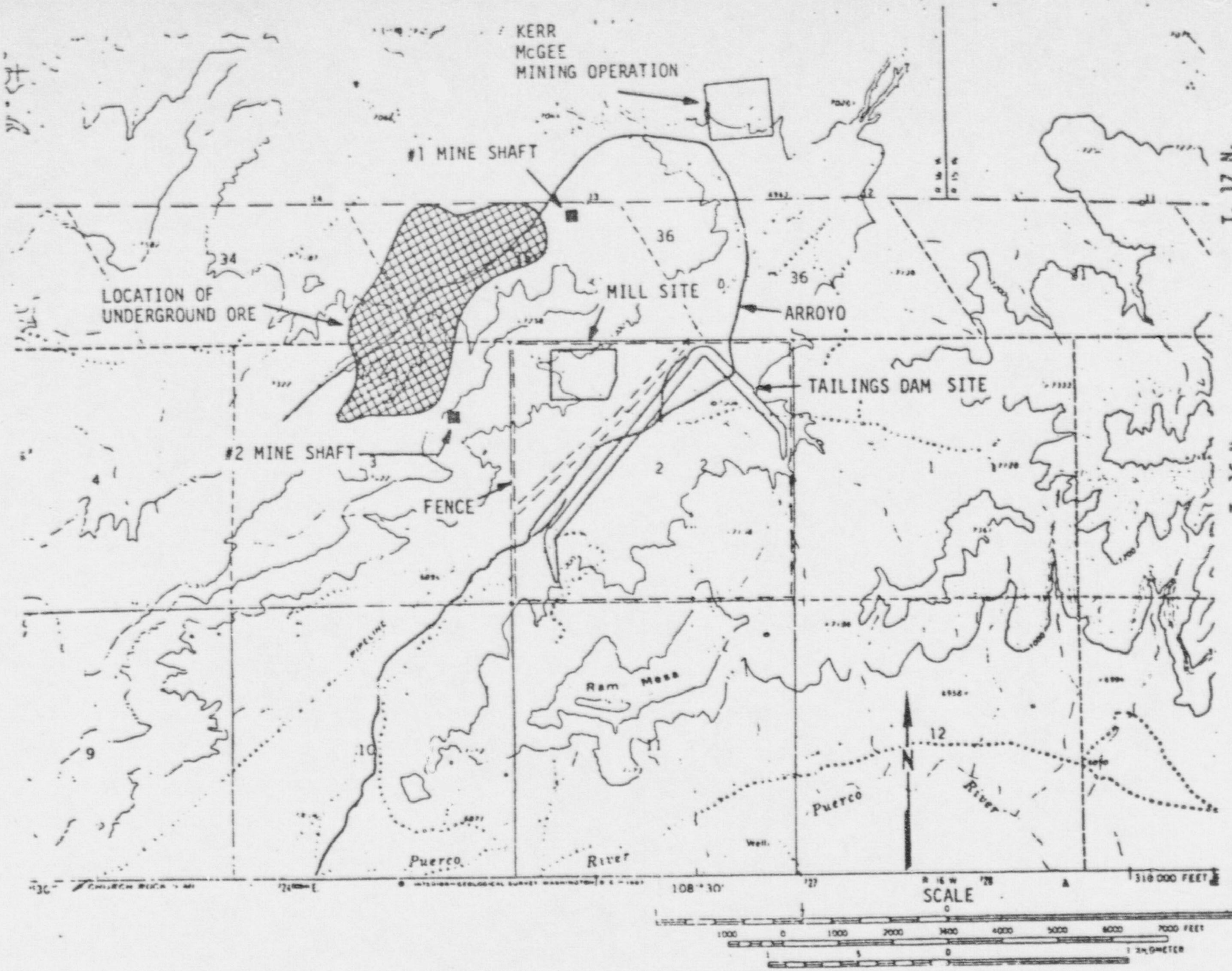


UNITED NUCLEAR CORPORATION
MINING & MILLING DIVISION
ALBUQUERQUE, NEW MEXICO

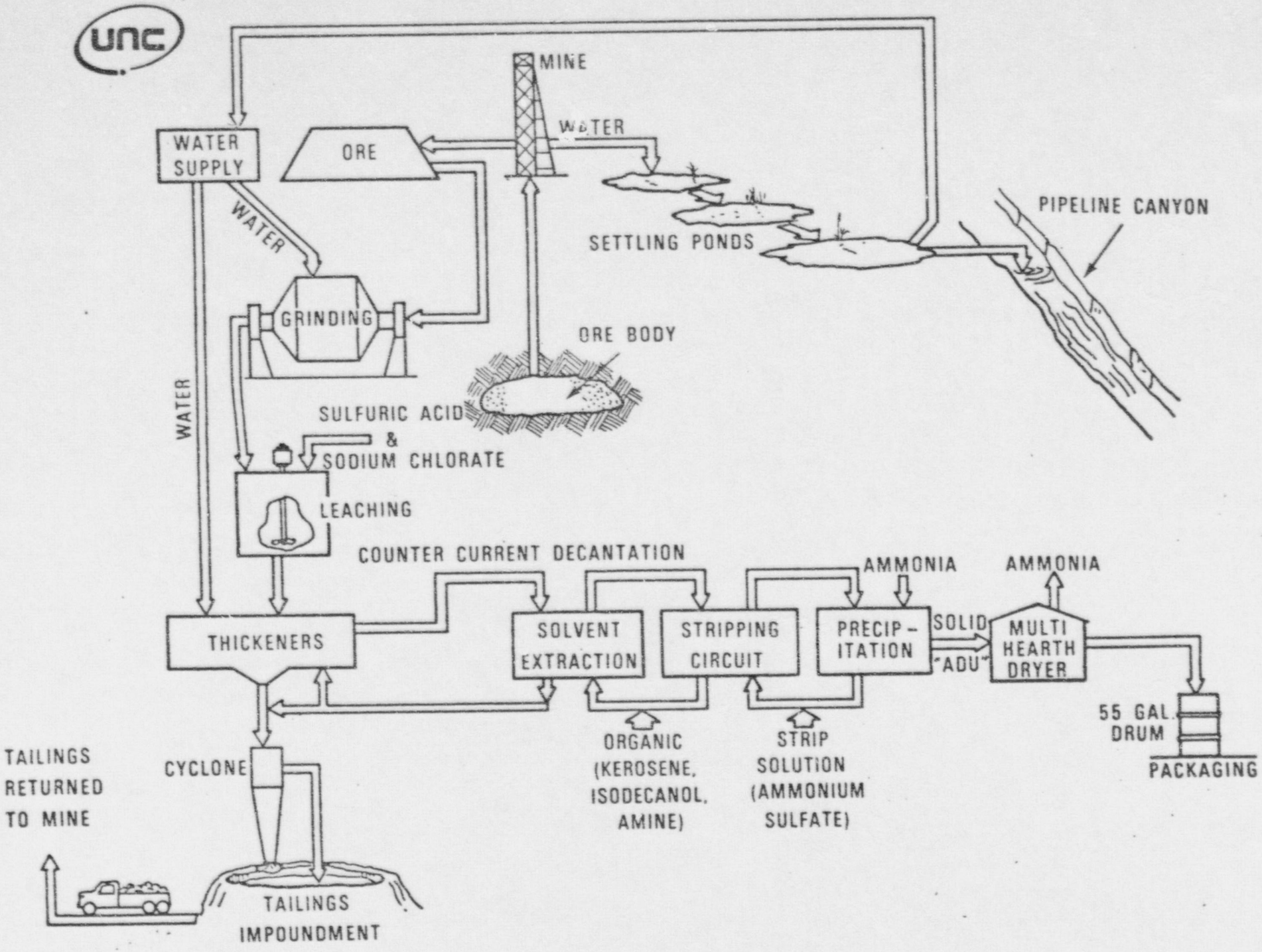
TOPIC OVERVIEW

- THE MILL, SITE LOCATION AND PROCESS
- ENERGY ALTERNATIVES
- HUMAN BENEFITS
- ENVIRONMENTAL IMPACT


CHURCH ROCK MINE
MILL
DAM
Twin Lakes
Tohasged Spring
Trading Post
Gamerco
Radio Tower
Gibson Coal Mine
Navajo Coal Mine
Substation
Ranches
Kit Carson Cave
Pumping station
Plant
Church Rock
Rehoboth
Gallup
Wingate
Fort Wingate
Iyanbito
Perea
Shell Oil Co.
Ciniza



KERR
McGEE
MINING OPERATION
#1 MINE SHAFT
LOCATION OF
UNDERGROUND ORE
MILL SITE
ARROYO
TAILINGS DAM SITE
#2 MINE SHAFT
FENCE
T. 17 N.
T. 16 N.
34
36
36
4
3
2
1
9
10
11
12
Ram Mesa
Puerco River
Puerco River
Well
N
108°30'
SCALE


MINE
WATER
WATER SUPPLY
ORE
WATER
SETTLING PONDS
PIPELINE CANYON
GRINDING
ORE BODY
WATER
SULFURIC ACID
&
SODIUM CHLORATE
LEACHING
COUNTER CURRENT DECANTATION
AMMONIA
AMMONIA
THICKENERS
SOLVENT EXTRACTION
STRIPPING CIRCUIT
PRECIP - ITATION
SOLID
"ADU"
MULTI HEARTH DRYER
55 GAL. DRUM
PACKAGING
ORGANIC (KEROSENE, ISODECANOL, AMINE)
STRIP SOLUTION (AMMONIUM SULFATE)
TAILINGS RETURNED TO MINE
CYCLONE
TAILINGS IMPOUNDMENT

UNC

FROM TIME TO TIME, IT'S GOOD TO BACK AWAY FROM THE BUSINESS AT HAND AND SEE HOW THAT BUSINESS RELATES TO OTHER PARTS OF THE WHOLE.

... THERE ARE ALTERNATIVES

URANIUM AND OTHER ENERGY ALTERNATIVES

1000 MWe POWER PLANT EQUIVALENTS

LETS LOOK AT:

- ENERGY SOURCES
- RESOURCES COMMITTED
- ENVIRONMENTAL RELEASES

ENERGY SOURCES

(1000 MWe POWER PLANT @ 75% CAPACITY)

SOURCE	DESCRIPTION
WOOD	50,000 ACRES, REDWOODS/YR
GARBAGE	7 MILLION TONS/YR
SOLAR	40 SQ MILES, SOLAR CELLS
WIND	200,000, 5 KWe WINDMILLS ACROSS CASCADES FROM OREGON TO CANADA

ENERGY SOURCES (CONTINUED)

(1000 MWe POWER PLANT @ 75% CAPACITY)

SOURCE	FUEL CONSUMPTION RATE
COAL	2.5 MILLION TONS/YR
OIL	10.7 MILLION BARRELS/YR
URANIUM	30 TONS/YR*

ATOMIC INDUSTRIAL FORUM FIGURES. 1974.

*97% RECOVERABLE.

RESOURCES COMMITTED

(1000 MWe POWER PLANT @ 75% CAPACITY)

RESOURCE	FUEL USED FOR POWER		
	OIL	COAL	URANIUM
COOLING WATER (BILLIONS OF GAL/YR)	263	263	424
ACRES OF LAND (TOTAL)	1,600	22,400	1,000
PRODUCTION COSTS (1980 MILLS)	14.85	14.23	11.93

ATOMIC INDUSTRIAL FORUM, 1974.

COMPARATIVE ENVIRONMENTAL RELEASES

(1000 MWe POWER PLANT @ 75% CAPACITY)

MATERIAL RELEASED (TONS/YR)	FUEL USED FOR POWER		
	OIL	COAL	URANIUM
SO_2	21,000	24,000	720
NO_x	26,000	27,000	810
PARTICULATES	150	2,000	60
OTHER WASTES	NOT EVAL	657,000	2

HUMAN BENEFITS FROM PROPOSED OPERATIONS

- EMPLOYMENT OF LOCAL PEOPLE (1969-1993)
- STATE AND LOCAL TAX DOLLARS
- FUEL FOR PRODUCING 1.6 TRILLION KW-HRS ELECTRICITY PREVENTING:
  - A. CONSUMPTION OF 2.6 BILLION BARRELS OF OIL, OR
  - B. 0.6 BILLION TONS OF COAL
- SAVES 9 MILLION GAL DIESEL TRUCK FUEL
- LESS ENVIRONMENTAL IMPACT THAN WOULD OCCUR FROM THE COMBUSTION OF FOSSIL FUEL

ENVIRONMENTAL IMPACT FROM UNC MINING & MILLING ACTIVITIES

- 45 Ci FROM MINE WATER TO ARROYO SOIL
- 452 Ci FROM MILL TO 160 ACRES POND
- 5 Ci FROM ALL SOURCES TO ATMOSPHERE
- LESS THAN 1.2% AVERAGE INCREASE ABOVE BACKGROUND RADIATION RECEIVED BY LOCAL POPULATION
- EXPOSURE OF LOCAL POPULATION TO TRACE AMOUNTS OF COMBUSTION PRODUCTS AND PROCESS CHEMICALS

ENERGY SOURCE - CONCLUSIONS

- PRODUCTION OF ELECTRICAL POWER PRODUCES AN ENVIRONMENTAL IMPACT REGARDLESS OF THE CHOICE OF FUEL.
- URANIUM AS A SOURCE OF ENERGY COSTS LESS, USES LESS RESOURCES, AND HAS LESS ENVIRONMENTAL IMPACT THAN THE OTHER FUELS CONSIDERED.

. . . AS PART OF THE URANIUM FUEL CYCLE, CHURCH ROCK OPERATIONS WILL HAVE SOME ENVIRONMENTAL IMPACT.

BASIC CONSIDERATIONS FOR THE CHURCH ROCK ENVIRONMENTAL ASSESSMENT & REPORT

ENVIRONMENTAL ASSESSMENT SCOPE

- TECHNICAL CONTENT FROM AEC (NRC) REG. GUIDE 3.8
- REPORT OUTLINE FROM AEC (NRC) REG. GUIDE 3.8

STUDY & REPORT OUTLINE

1.0 PROPOSED ACTIVITIES

2.0 SITE

3.0 MINE & MILL

4.0 EFFECTS OF CONSTRUCTION

5.0 EFFECTS OF OPERATION

6.0 MONITORING

STUDY & REPORT OUTLINE
(CONTINUED)

7.0 ACCIDENTS

8.0 ECONOMIC & SOCIAL EFFECTS

9.0 RECLAMATION & RESTORATION

10.0 ALTERNATIVES

11.0 BENEFIT COST

12.0 ENVIRONMENTAL APPROVALS

13.0 REFERENCES

ENVIRONMENTAL ASSESSMENT FOCUS

- WHAT ARE THE EFFLUENTS?
- WHAT ARE THE RELEASE RATES?
- WHAT ARE THE ENVIRONMENTAL IMPACTS?

NONRADIOACTIVE EFFLUENTS TO ATMOSPHERE

SOURCE	SUBSTANCE	RATE	STANDARD
YELLOWCAKE DRYER	NH_3	9 lb/day	10 lb/hr
	PARTICULATES	TRACE	10 lb/hr
ORE GRINDER & LEACH TANKS	CO_2	62 lb/min	NONE
	ORE DUSTS	TRACE	10 lb/hr
	ACID MISTS	TRACE	10 lb/hr
BOILERS	PARTICULATES	11 lb/hr	10 lb/hr
	SO_2	38 lb/hr	10 lb/hr
	NO_x	39 lb/hr	10 lb/hr
	OTHERS	<10 lb/hr	10 lb/hr

NONRADIOACTIVE EFFLUENTS
(CONTINUED)

SOURCE	SUBSTANCE	RATE	STANDARD	DEPOSITION
MINE WATER FROM SETTLING POND #3	TSS	74 mg/liter (avg)	100 mg/liter (avg)	ARROYO SOIL
MILL SLURRY	TAILINGS	4000 tons/day	NONE	TAILINGS POND
	H_2O	700 gal/min	NONE	
	PROCESS CHEMICALS	18 lb/min	NONE	

RADIOACTIVE EFFLUENTS

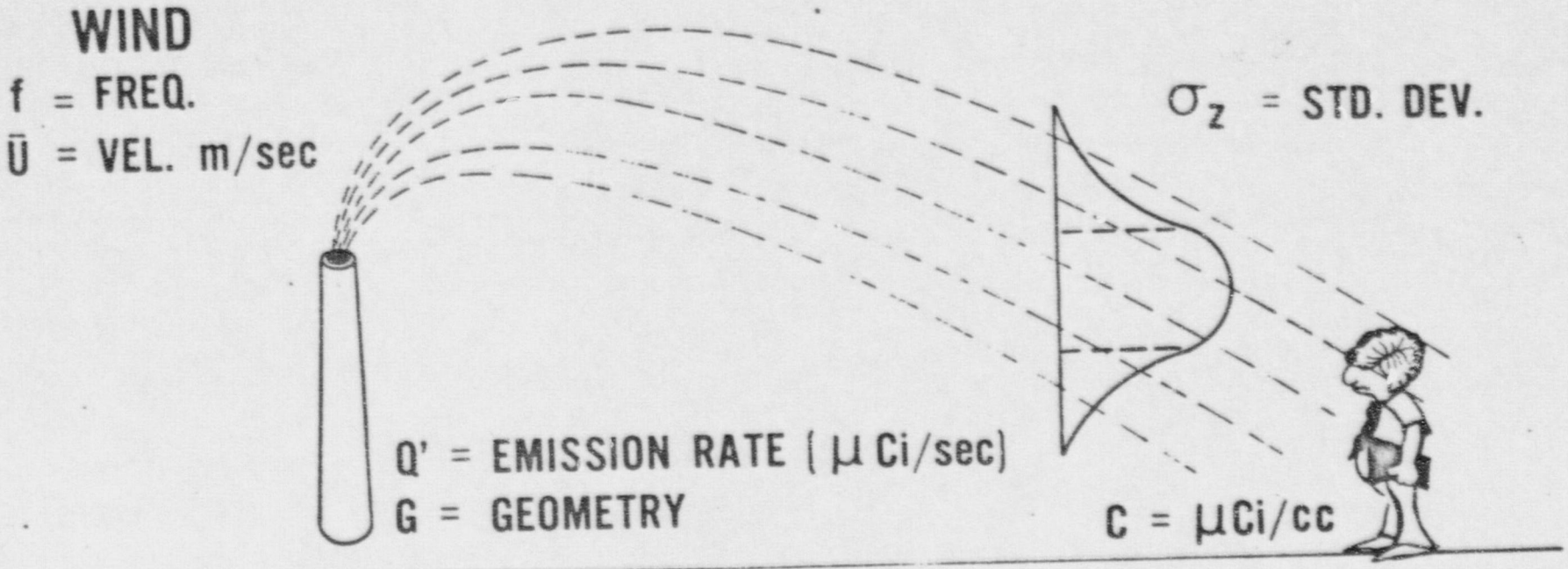
SOURCE	RADIONUCLIDE	ACCUMULATED CURIES	DEPOSITION
MINE WATER	NAT. URANIUM	42	ARROYO SOIL
	Th-230	2	
	Ra-226	1	
MILL SLURRY	NAT. URANIUM	16	TAILINGS
	Th-230	429	POND
	Ra-226	7	
GASEOUS RELEASES	NAT. URANIUM	3	SITE SOIL
	Th-230	1	
	Ra-226	1	
TOTAL LONG HALF-LIFE RADIONUCLIDES		502	

RADIOACTIVE SOURCES FOR POPULATION EXPOSURES

SOURCE	FORM	RADIONUCLIDES	RELEASE RATE (μCi/sec)
DRYER	YELLOWCAKE	NAT. URANIUM	0.0072
ORE	DUST*	Th-230	0.0022
ORE	DUST*	Ra-226	0.0022
TAILINGS & ORE	GAS	Rn-222	17.1

* CONTROLLED VIA SPRINKLERS

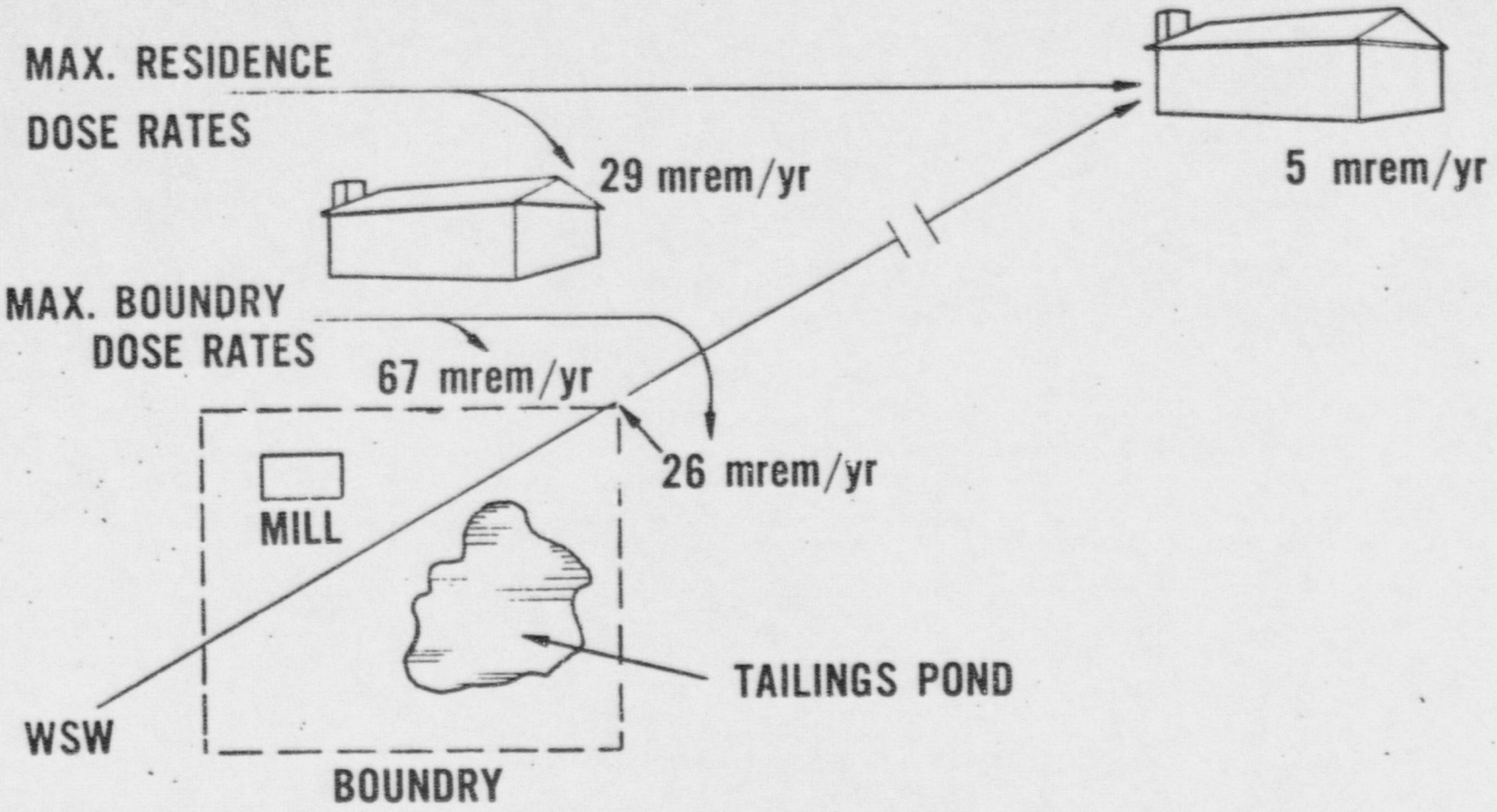
DOSE RATE MODEL



$$C = 2.03 \times 10^{-8} \frac{f\ Q'\ G}{\sigma_z\ \bar{U}\ X}$$

$$D = \left(\frac{C}{MPC_a}\right)\left(\frac{1500\ \text{mrem}}{\text{yr}}\right)$$

CALCULATED DOSE RATES



AREA DOSE COMMITMENTS

(5 MILE RADIUS & 1195 PEOPLE)

SOURCE	DOSE /YR INDIVIDUALS	POPULATION
NATURAL BACKGROUND	189 MREM	226 MAN-REM
MINE & MILL OPERATION	2.2 MREM (AVE)	2.7 MAN-REM
TOTAL COMMITMENT	191.2 MREM	228.7 MAN-REM

1.2% INCREASE ABOVE BACKGROUND

COMPARATIVE RADIONUCLIDE IMPACTS

FROM OPERATIONAL RELEASES

RADIONUCLIDE	MAN-REM/YR
Th-230	1.3
Rn-222	0.7
NAT. URANIUM	0.5
Ra-226	0.2
TOTAL	2.7

SAMPLING & MONITORING PROGRAM DESIGN

- KNOW RELEASE POINTS
- KNOW EFFLUENTS
- KNOW RELEASE RATES
- PREDICT ENVIRONMENTAL DISPERSIONS
- PREDICT ULTIMATE FATE OF EFFLUENT
  - KNOW HALF-LIVES OF RADIONUCLIDES
  - KNOW DECAY CHAINS OF RADIONUCLIDES
  - KNOW ECOLOGY

SAMPLING AND MONITORING CRITERIA

FACTOR	CRITERIA
LOCATION	• MUST BE REPRESENTATIVE
FREQUENCY	• FREQUENT FOR ERRATIC RELEASES • INFREQUENT FOR STEADY STATE RELEASES
MEASUREMENTS	• MUST RELATE TO EFFLUENTS
METHODS	• SUFFICIENT MATERIAL FOR ANALYSIS • ADHERANCE TO PROCEDURES FOR CONSISTENCY • DETECTION OF REGULATORY VALUES

SAMPLING AND MONITORING CRITERIA
(CONTINUED)

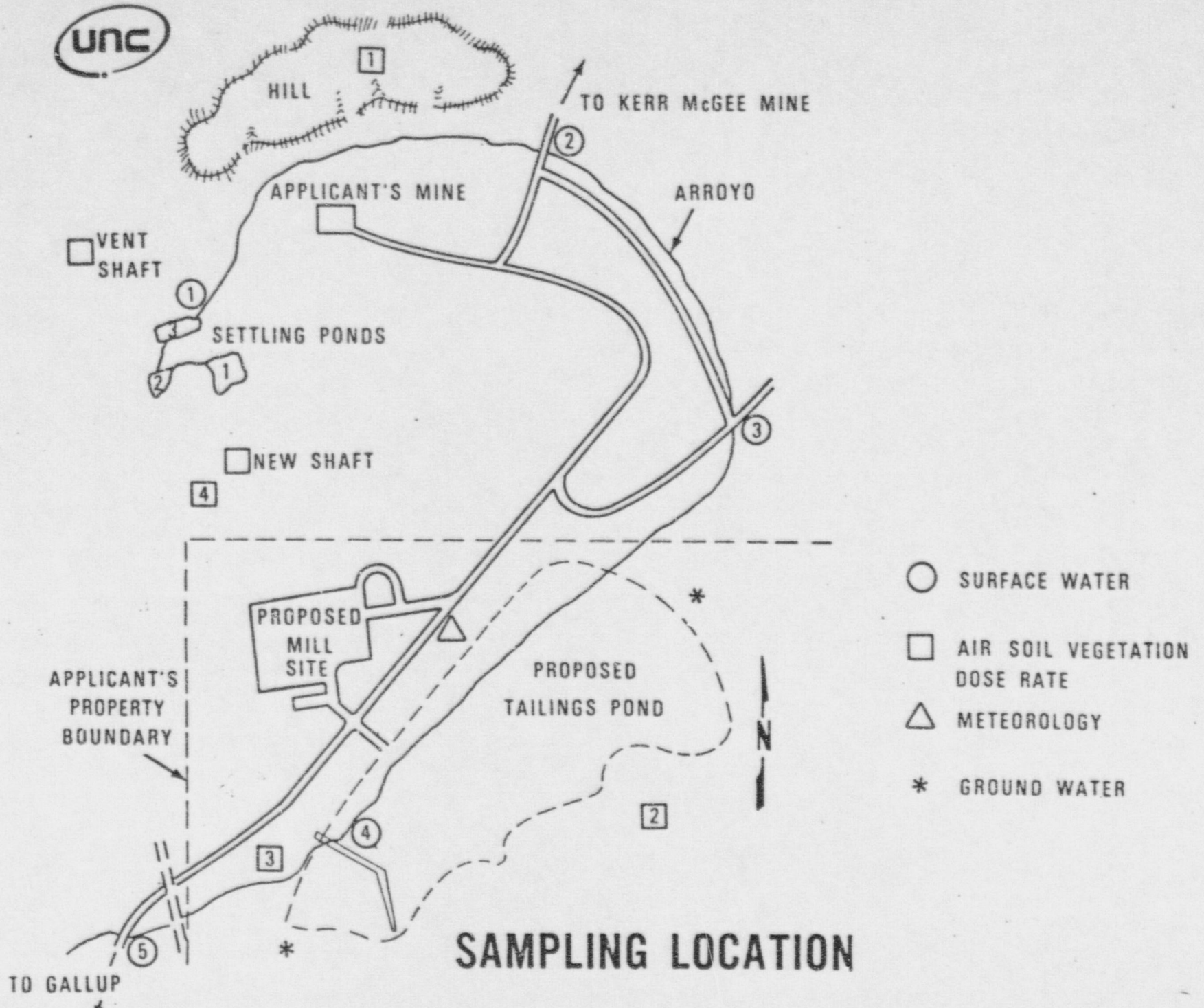
FACTOR	CRITERIA
LAB ANALYSIS/ MONITORING	• SENSITIVITY-MUST BE ABLE TO DETECT SAMPLED CONSTITUENTS
	• QUALITY CONTROL PROCEDURES MUST BE FOLLOWED
DATA ANALYSIS	• SENSITIVITY AND NATURAL VARIATIONS MUST BE KNOWN
	• REASONS FOR HIGH/LOW VALUES
	• INTERRELATIONSHIPS
COST/BENEFIT	• DATA MUST BE USEFUL
	• GREATER OR FEWER NUMBER OF SAMPLES
	• GREATER OR FEWER NUMBER OR QUANTITY OF EFFLUENTS
	• EVALUATION OF TECHNOLOGICAL CHANGES

SAMPLING & MONITORING PROGRAM

MEDIUM	PARAMETERS	FREQUENCY
SURFACE WATER	FLOW RATE	CONTINUOUS
	TEMP., TSS	WEEKLY
	U, Ra, Mo, Se, V	MONTHLY
	α, β, U, Th, Ra, CHEM. SERIES	SEMIANNUALLY
GROUND WATER	α, β, U, Th, Ra, CHEM. SERIES	SEMIANNUALLY
AIR PARTICULATES	α, β, U, Th, Ra	SEMIANNUALLY
BREATHING AIR IN MILL	α β, γ,	MONTHLY
	Rn + DAUGHTERS	QUARTERLY
SOIL	α, β, U, Th, Ra	SEMIANNUALLY
VEGETATION	α, β, U, Th, Ra	SEMIANNUALLY

SAMPLING & MONITORING PROGRAM
(CONTINUED)

MEDIUM	PARAMETERS	FREQUENCY
DOSE RATES	Y	SEMIANNUALLY
TAILINGS POND WATER	pH, U, Th, Ra,	OPERATIONALLY DETERMINED
METEOROLOGY	WIND SPEED & DIRECTION, TEMP., HUMIDITY, PPT	CONTINUOUS


unc
HILL
1
TO KERR McGEE MINE
2
APPLICANT'S MINE
ARROYO
VENT SHAFT
1
SETTLING PONDS
2
1
NEW SHAFT
4
3
PROPOSED MILL SITE
PROPOSED TAILINGS POND
APPLICANT'S PROPERTY BOUNDARY
N
2
3
4
5
TO GALLUP
SURFACE WATER
AIR SOIL VEGETATION DOSE RATE
METEOROLOGY
GROUND WATER
SAMPLING LOCATION