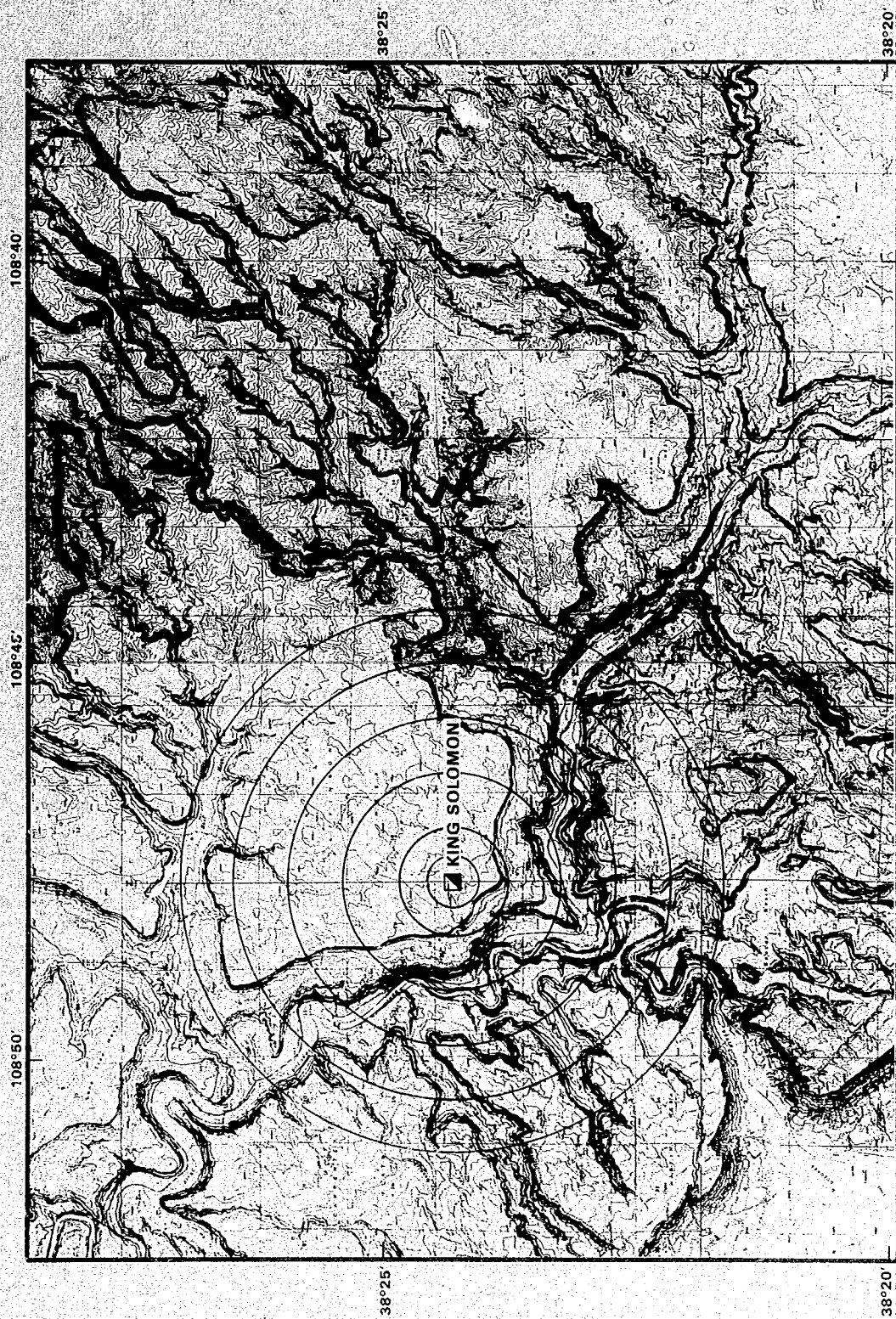


APPENDIX D

STUDY MINE LOCATION AND DATA MAPS



**KING SOLOMON MINE  
MONTROSE COUNTY, COLORADO**

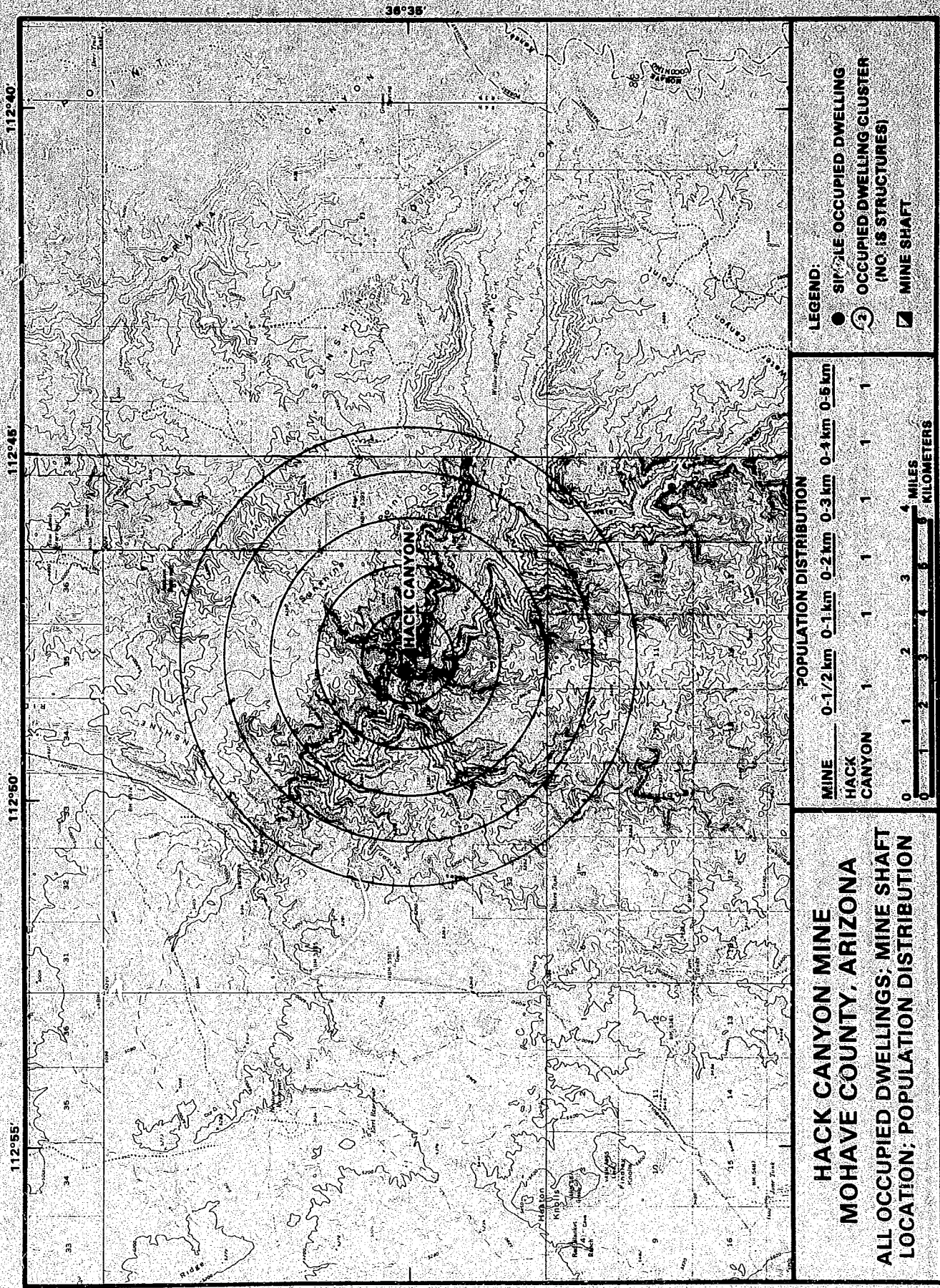
ALL OCCUPIED DWELLINGS; MINE SHAFT  
LOCATION; POPULATION DISTRIBUTION

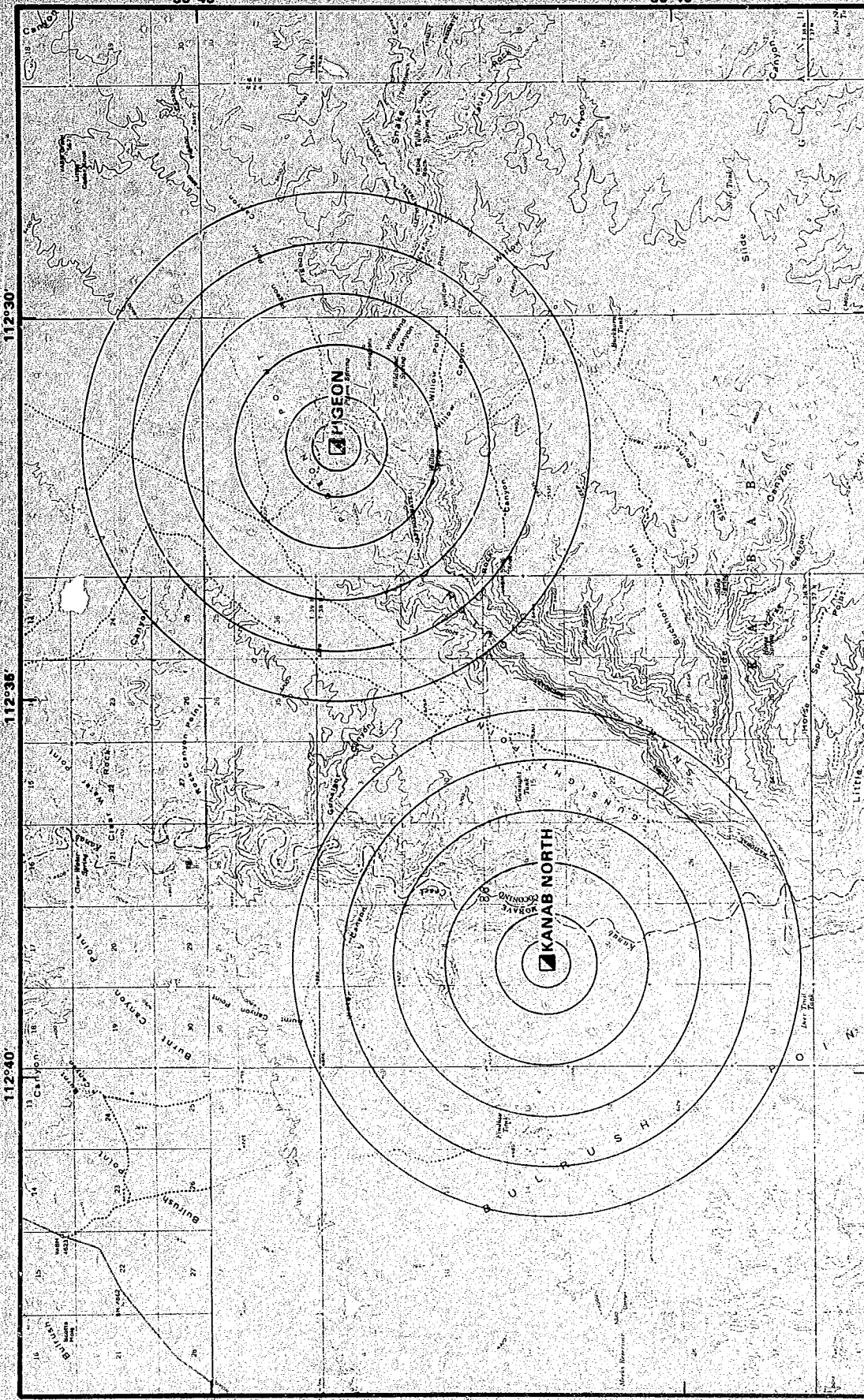
		POPULATION DISTRIBUTION					
		0-1/2 km	0-1 km	0-2 km	0-3 km	0-4 km	0-5 km
MINE							
KING							
SOLOMON		0	0	0	0	0	0

0 1 2 3 4 5 6 MILES  
0 1 2 3 4 5 6 KILOMETERS

**LEGEND:**

- SINGLE OCCUPIED DWELLING
- ② OCCUPIED DWELLING CLUSTER (NO. IS STRUCTURES)
- ▣ MINE SHAFT





**KANAB NORTH/PIGEON MINES  
MOHAVE COUNTY AND COCONINO  
COUNTY, ARIZONA**

**ALL OCCUPIED DWELLINGS; MINE SHAFT  
LOCATIONS; POPULATION DISTRIBUTION**

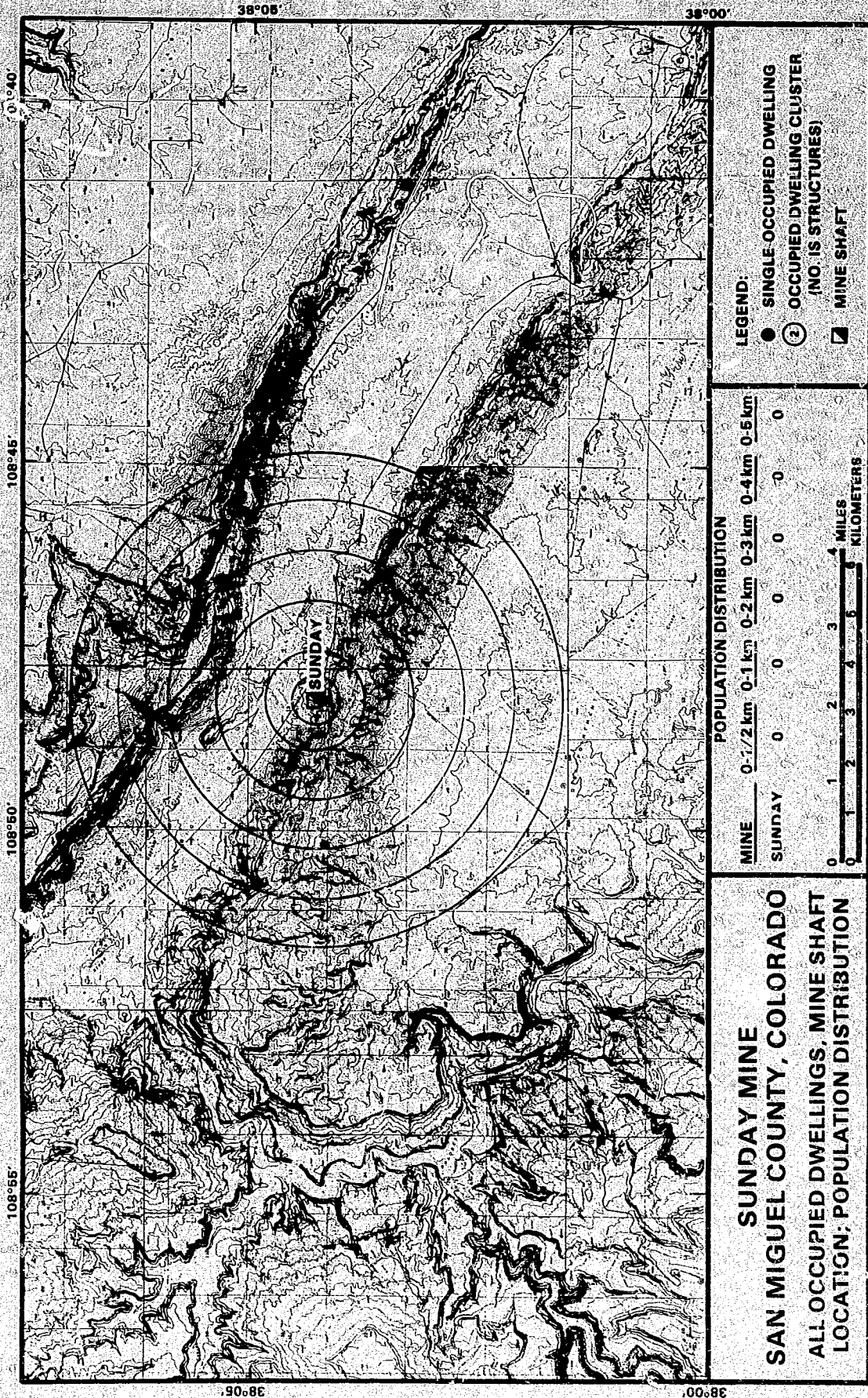
**POPULATION DISTRIBUTION**

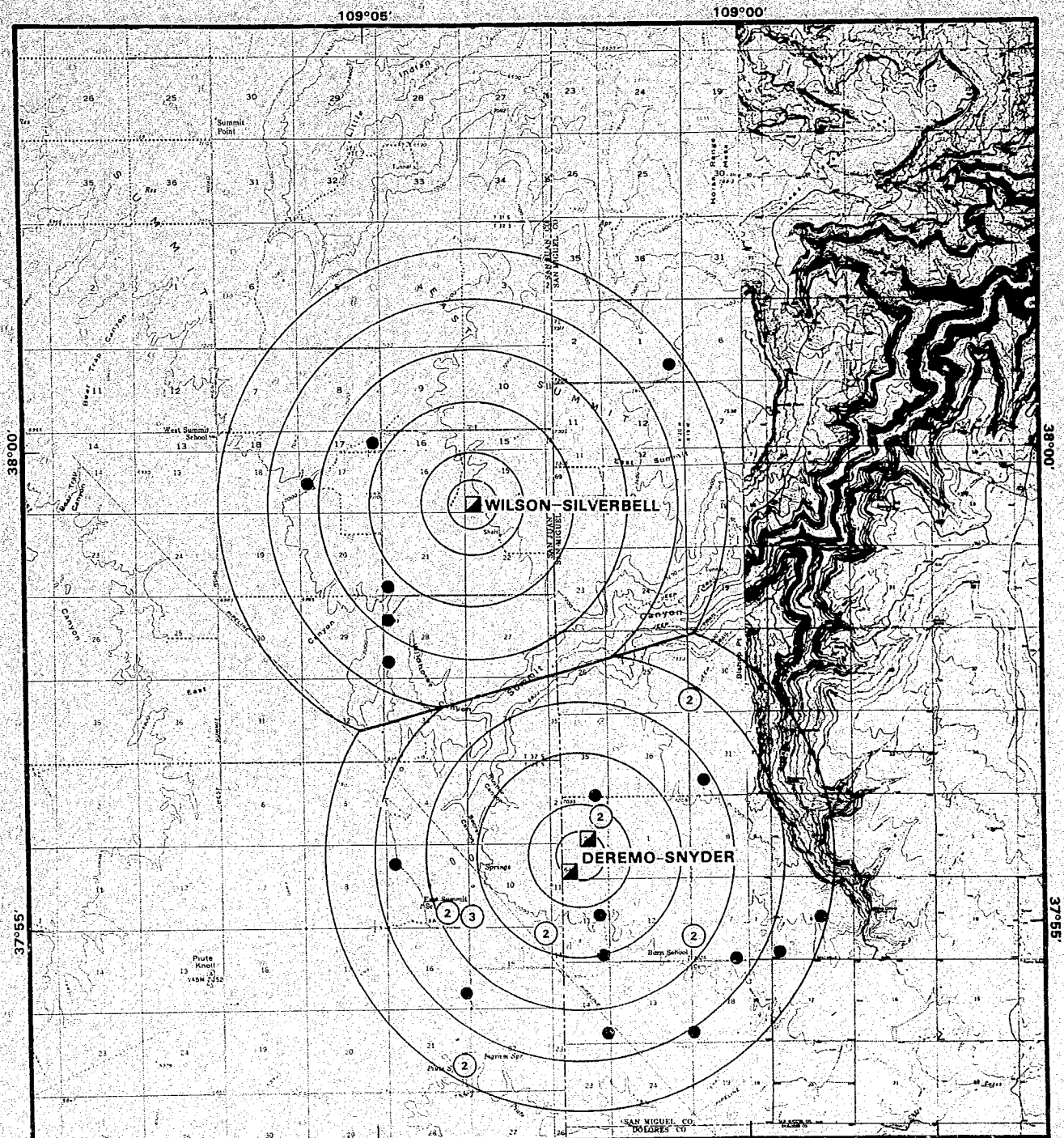
MINE	0-1/2 km	0-1 km	0-2 km	0-3 km	0-4 km	0-5 km
KANAB NORTH	0	0	0	0	0	0
PIGEON	0	0	0	0	0	0

**LEGEND:**

- SINGLE OCCUPIED DWELLING
- ⊙ OCCUPIED DWELLING CLUSTER (NO. IS STRUCTURES)
- ▣ MINE SHAFT







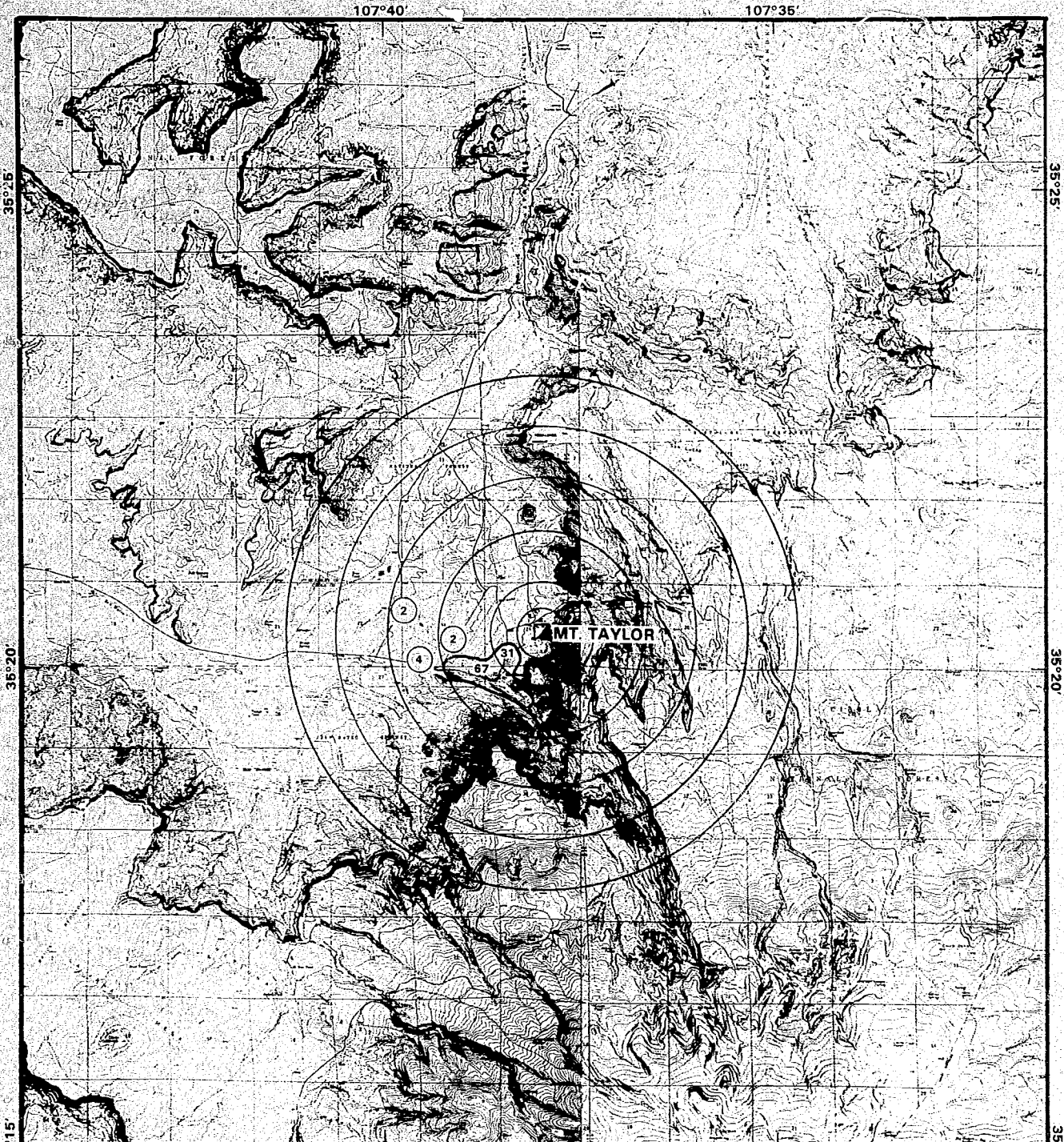
**DEREMO-SNYDER/WILSON-SILVERBELL MINES  
SAN JUAN COUNTY, UTAH, AND SAN MIGUEL COUNTY, COLORADO  
ALL OCCUPIED DWELLINGS; MINE SHAFT LOCATIONS; POPULATION DISTRIBUTION**

POPULATION DISTRIBUTION

MINE	0-1/2 km	0-1 km	0-2 km	0-3 km	0-4 km	0-5 km
DEREMO-SNYDER	0	5	21	49	67	83
WILSON-SILVERBELL	0	0	0	12	20	23

0 1 2 3 4 MILES  
0 1 2 3 4 5 6 KILOMETERS

- LEGEND:**
- SINGLE OCCUPIED DWELLING
  - ⊙ OCCUPIED DWELLING CLUSTER (NO. IS STRUCTURES)
  - ▣ MINE SHAFT



**MT. TAYLOR MINE  
CIBOLA AND MCKINLEY COUNTIES, NEW MEXICO**

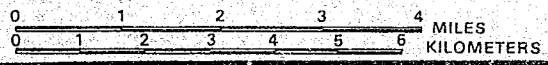
**ALL OCCUPIED DWELLINGS; MINE SHAFT LOCATION; POPULATION DISTRIBUTION**

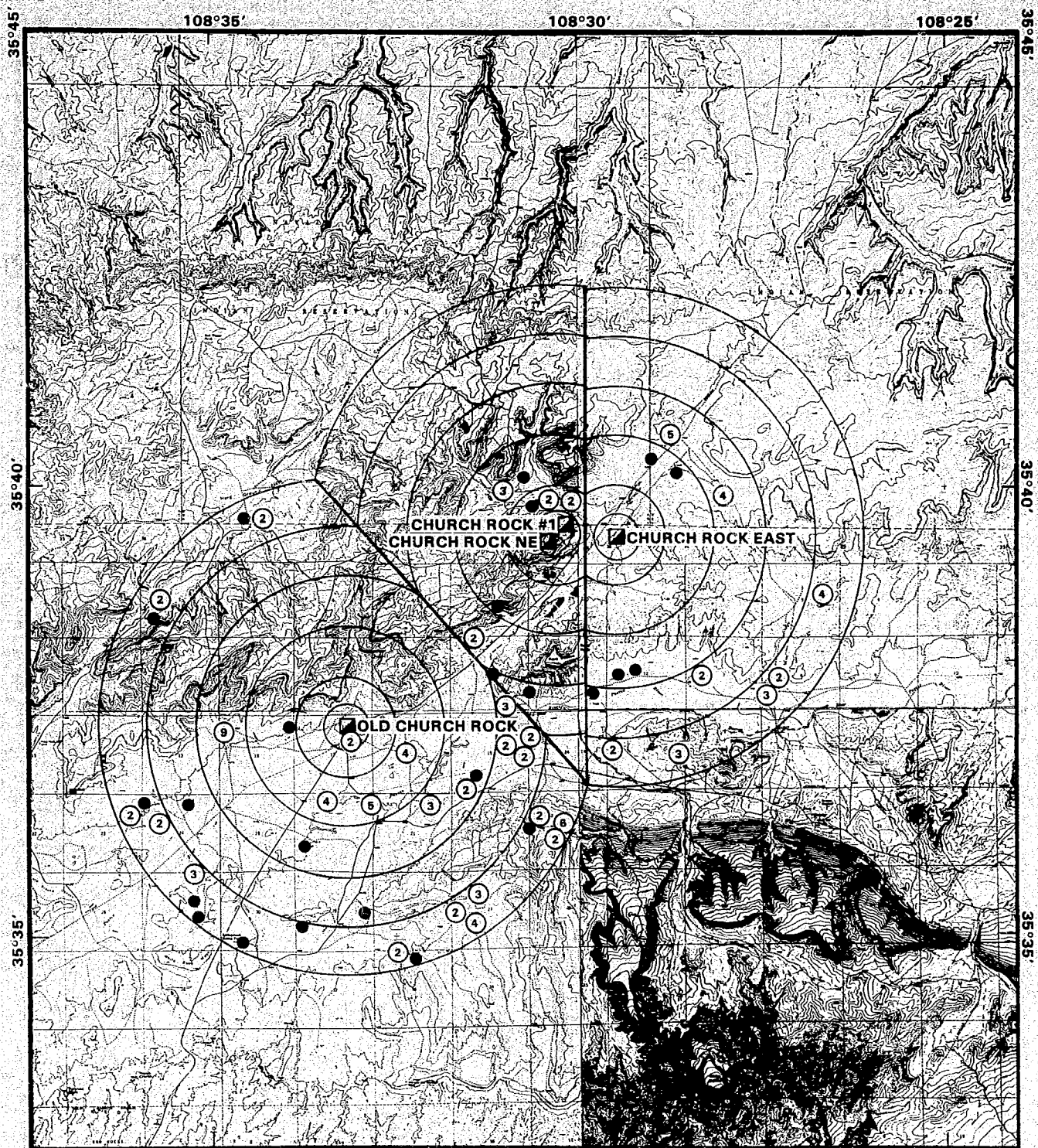
**POPULATION DISTRIBUTION**

MINE	0-1/2 km	0-1 km	0-2 km	0-3 km	0-4 km	0-5 km
MT. TAYLOR	0	100	317	336	336	336

**LEGEND:**

- SINGLE OCCUPIED DWELLING
- ② OCCUPIED DWELLING CLUSTER (NO. IS STRUCTURES)
- ▣ MINE SHAFT

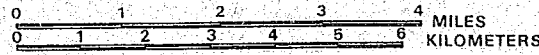




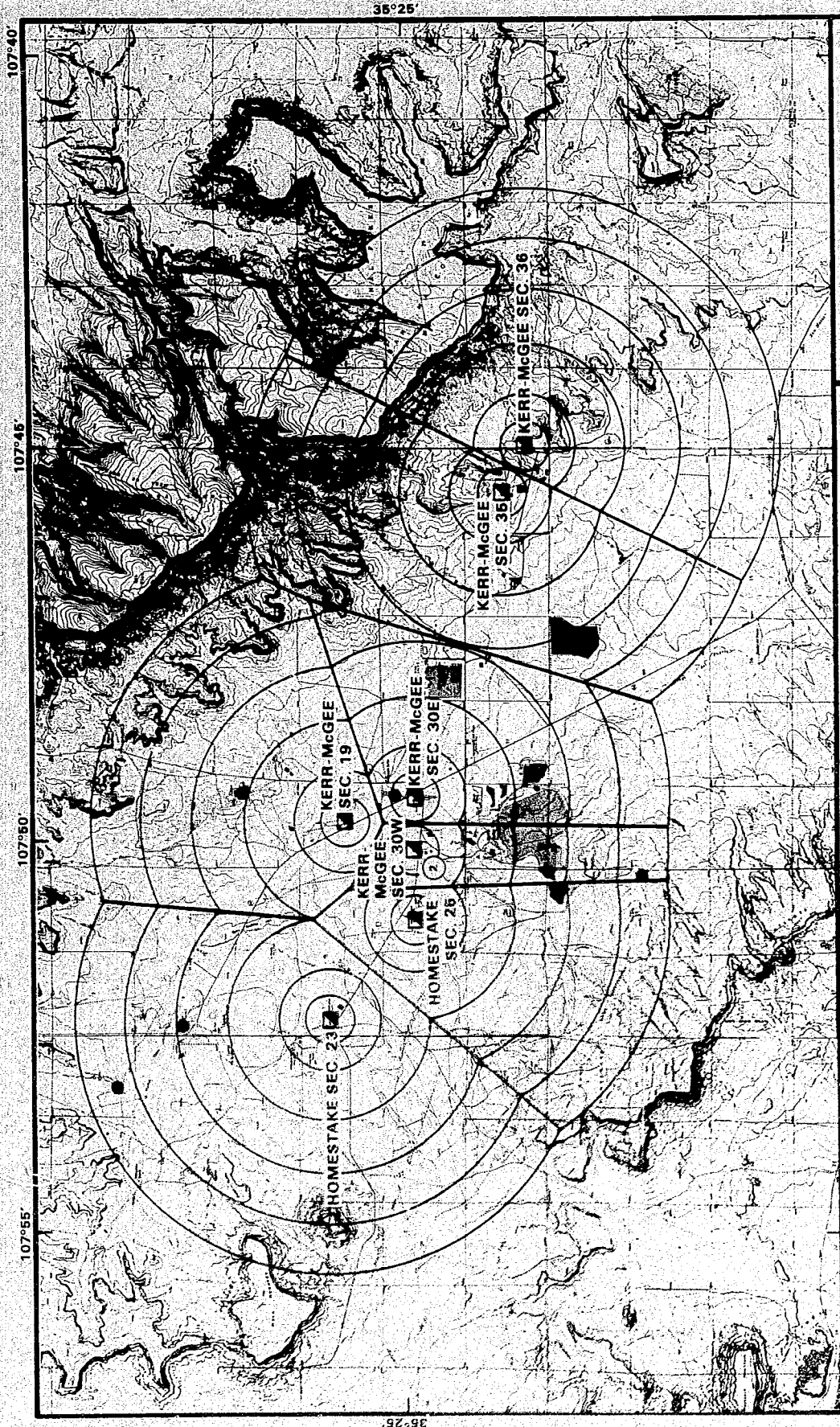
### CHURCH ROCK MINES, MCKINLEY COUNTY, NEW MEXICO

#### ALL OCCUPIED DWELLINGS; MINE SHAFT LOCATIONS; POPULATION DISTRIBUTION

MINE	POPULATION DISTRIBUTION					
	0-1/2 km	0-1 km	0-2 km	0-3 km	0-4 km	0-5 km
OLD CHURCH ROCK	9	9	70	139	187	364
CHURCH ROCK NE	0	11	22	26	31	31
CHURCH ROCK #1	0	11	22	27	31	31
CHURCH ROCK EAST	0	0	9	57	70	131



- LEGEND:**
- SINGLE OCCUPIED DWELLING
  - ⊙ OCCUPIED DWELLING CLUSTER (NO. IS STRUCTURES)
  - ▣ MINE SHAFT



**LEGEND:**

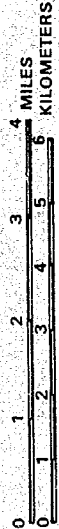
- SINGLE OCCUPIED DWELLING
- ② OCCUPIED DWELLING CLUSTER (NO. IS STRUCTURES)
- MINE SHAFT

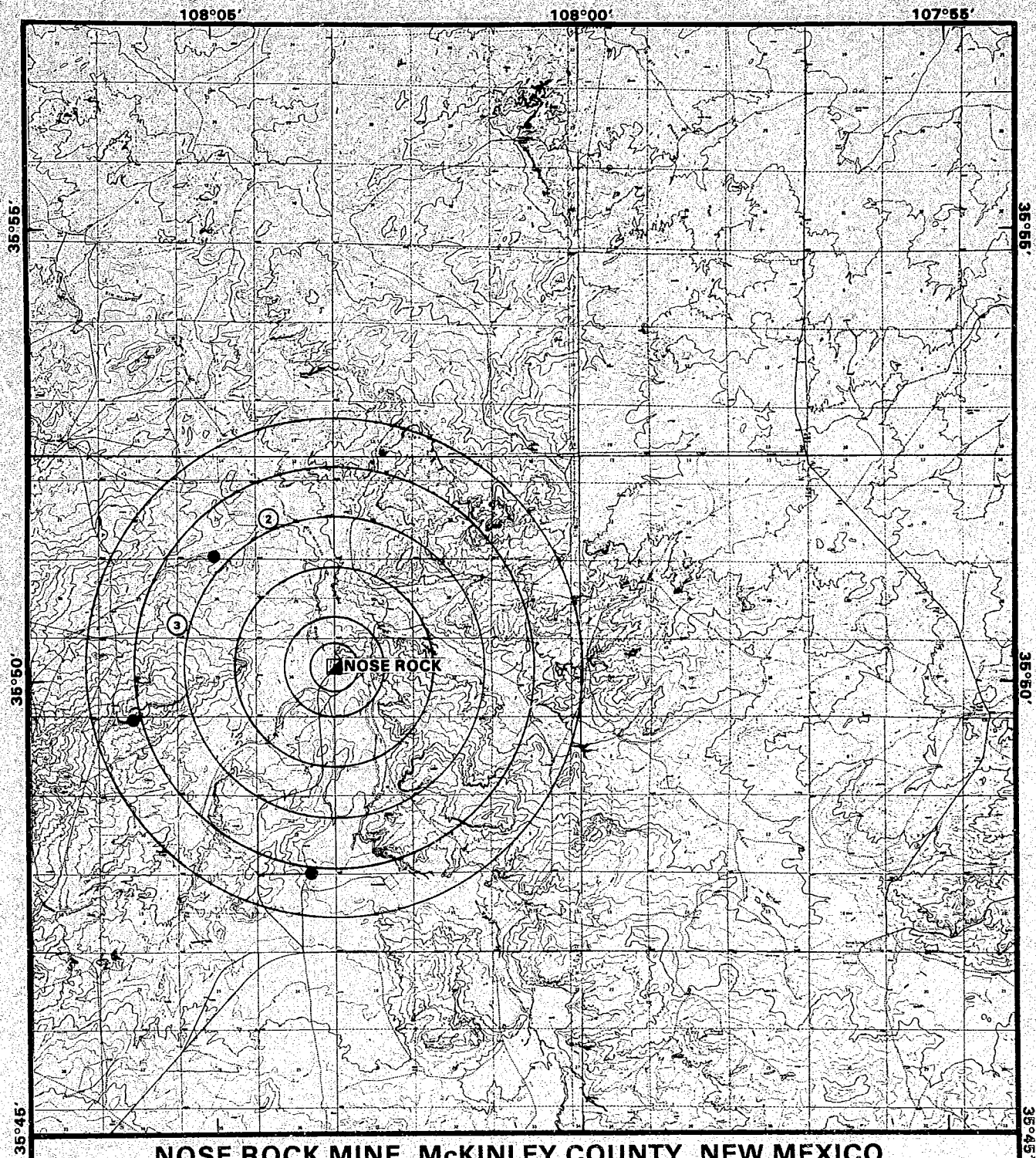
**POPULATION DISTRIBUTION**

MINE	0-1/2km	0-1 km	0-2 km	0-3 km	0-4 km	0-5 km
KERR-McGEE SEC. 30E	3	3	3	3	3	3
KERR-McGEE SEC. 30W	0	5	5	5	5	6
KERR-McGEE SEC. 19	0	0	0	4	4	4
KERR-McGEE SEC. 35	0	0	0	0	0	0
KERR-McGEE SEC. 36	0	0	0	0	0	0
HOMESTAKE SEC. 23	0	0	0	3	3	4
HOMESTAKE SEC. 25	0	0	0	0	0	0

**AMBROSIA LAKE AREA  
McKINLEY COUNTY, NEW MEXICO**

**ALL OCCUPIED DWELLINGS; MINE SHAFT  
LOCATIONS; POPULATION DISTRIBUTION**





**NOSE ROCK MINE, MCKINLEY COUNTY, NEW MEXICO**

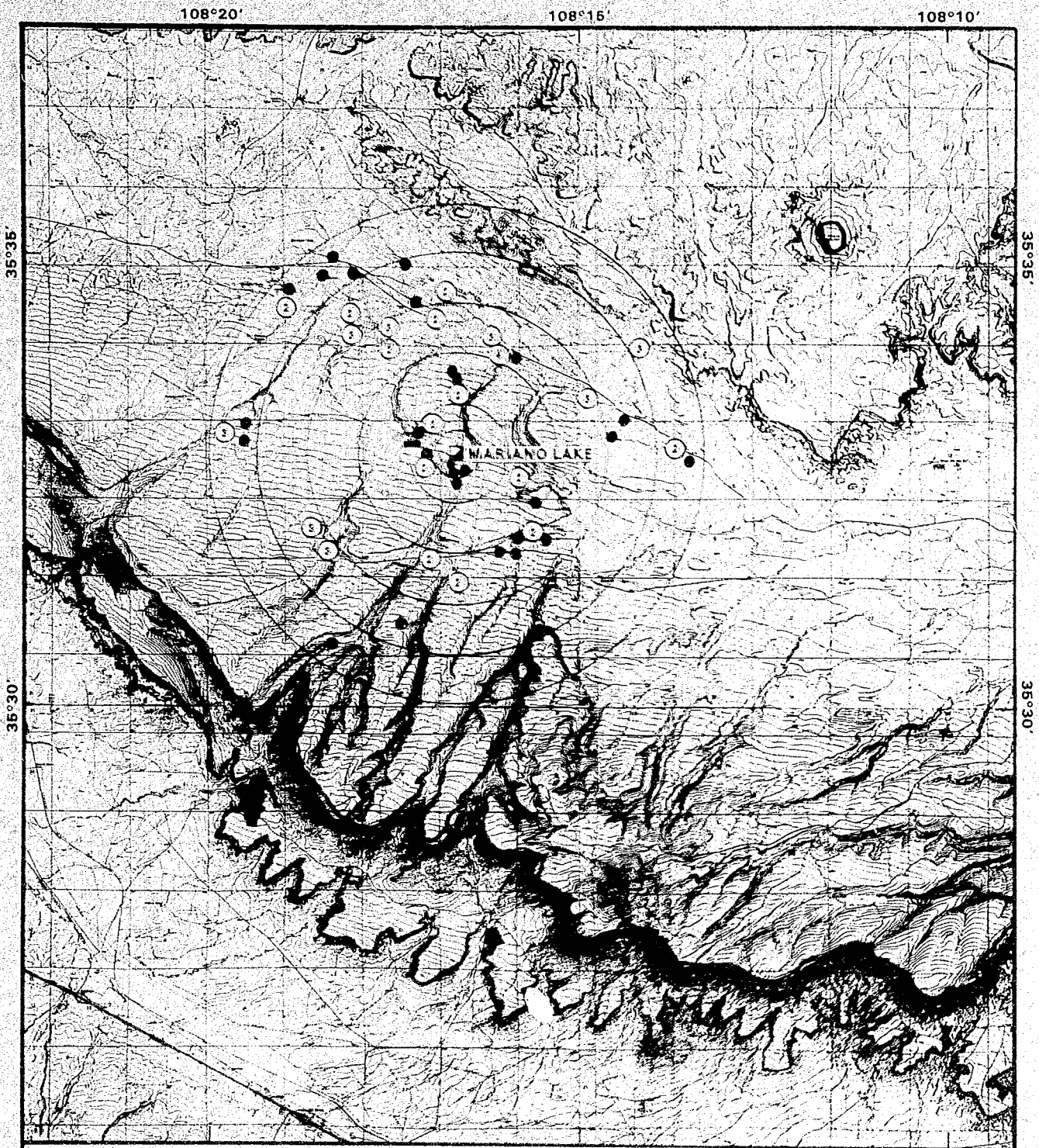
**ALL OCCUPIED DWELLINGS; MINE SHAFT LOCATION; POPULATION DISTRIBUTION**

POPULATION DISTRIBUTION						
MINE	0-1/2 km	0-1 km	0-2 km	0-3 km	0-4 km	0-5 km
NOSE ROCK	0	0	0	0	26	35



**LEGEND:**

- SINGLE OCCUPIED DWELLING
- ② OCCUPIED DWELLING CLUSTER (NO. IS STRUCTURES)
- ▣ MINE SHAFT

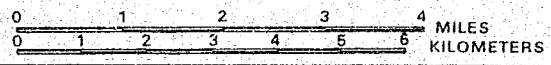


**MARIANO LAKE MINE, MCKINLEY COUNTY, NEW MEXICO**

**ALL OCCUPIED DWELLINGS; MINE SHAFT LOCATION; POPULATION DISTRIBUTION**

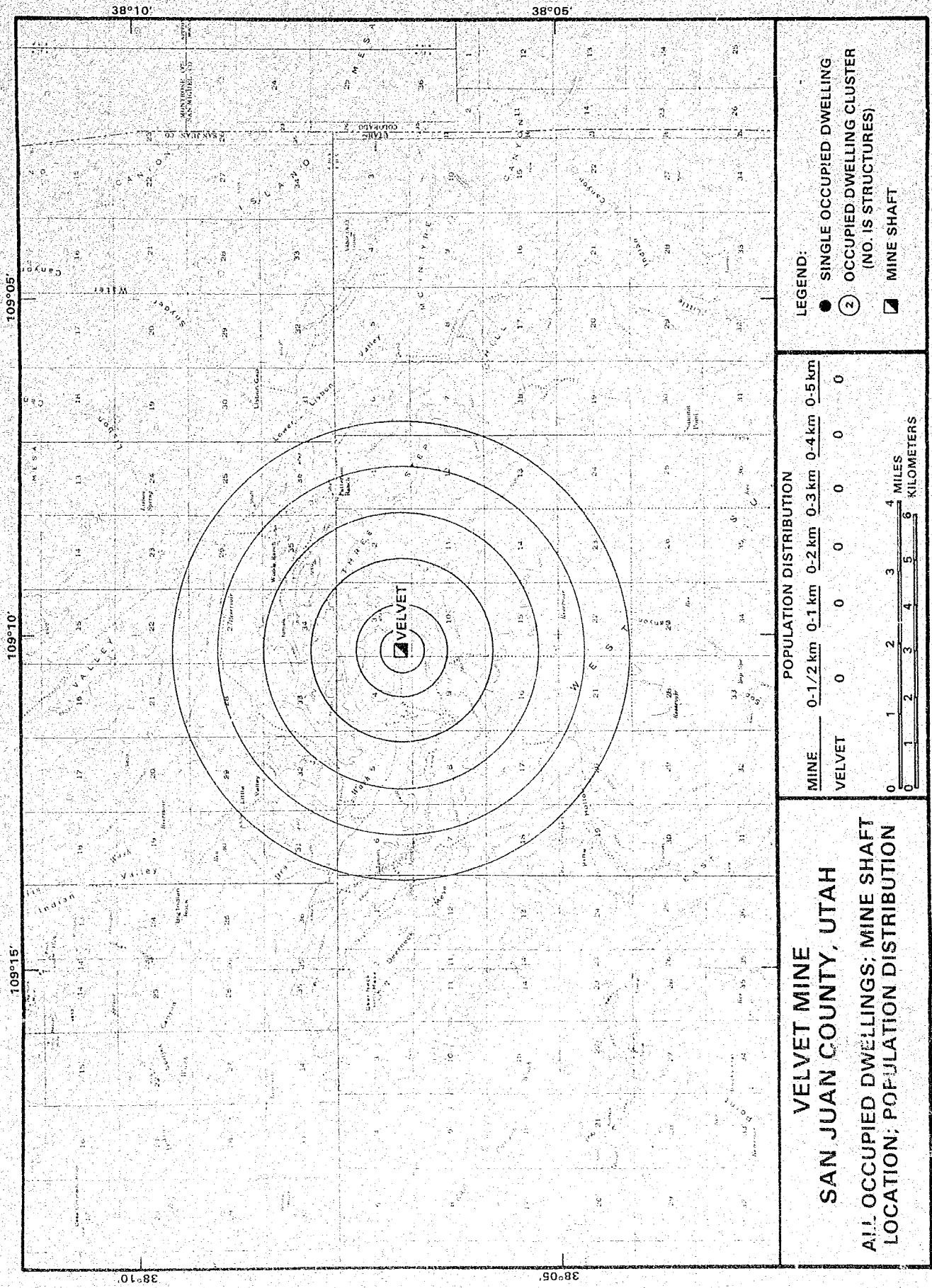
**POPULATION DISTRIBUTION**

MINE	0-1/2 km	0-1 km	0-2 km	0-3 km	0-4 km	0-5 km
MARIANO LAKE	13	44	75	196	274	352



**LEGEND:**

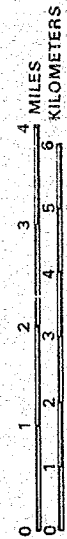
- SINGLE OCCUPIED DWELLING
- ⊙ OCCUPIED DWELLING CLUSTER (NO. IS STRUCTURES)
- ▣ MINE SHAFT



**VELVET MINE  
SAN JUAN COUNTY, UTAH**  
ALL OCCUPIED DWELLINGS; MINE SHAFT  
LOCATION; POPULATION DISTRIBUTION

**POPULATION DISTRIBUTION**

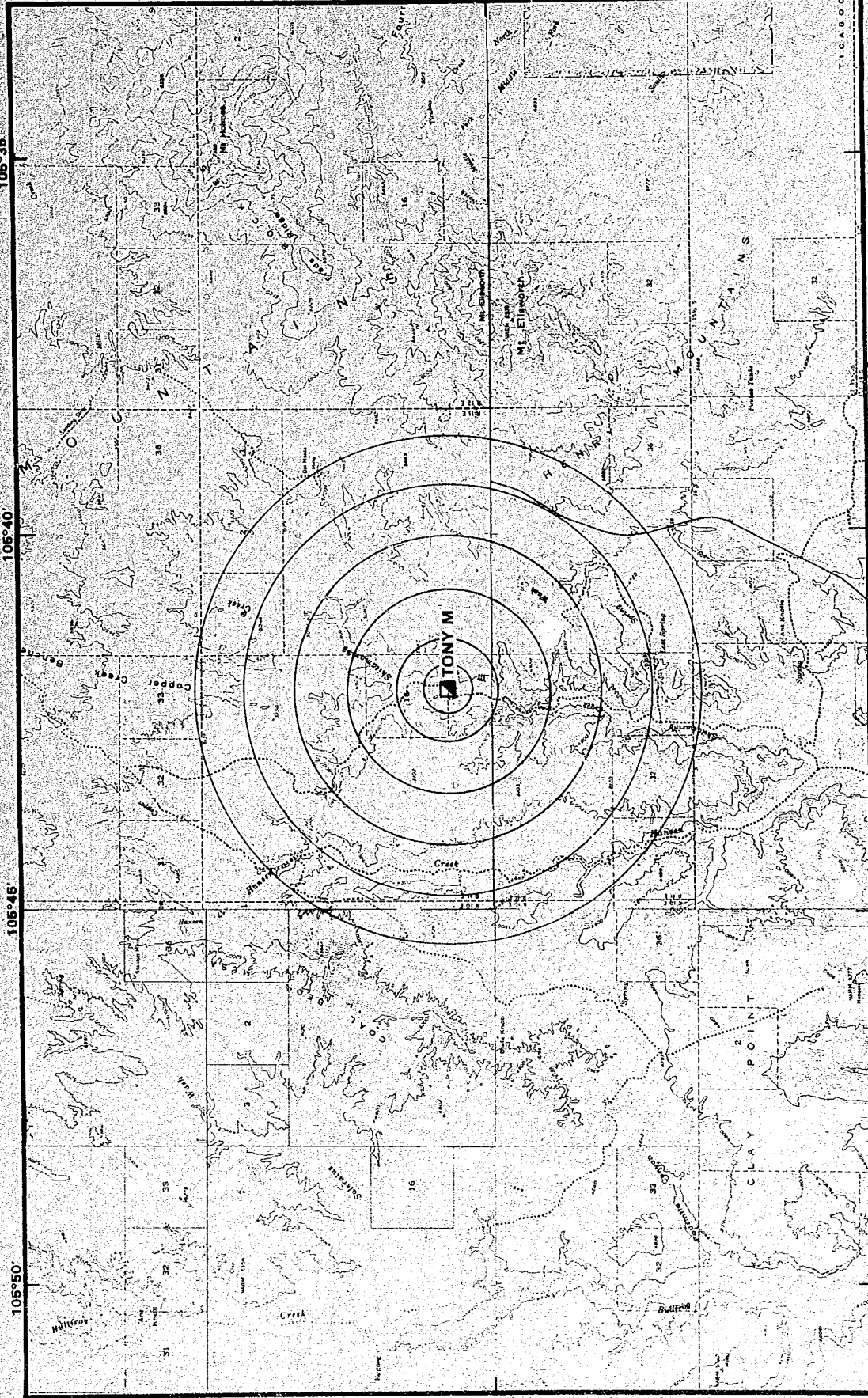
MINE	0-1/2 km	0-1 km	0-2 km	0-3 km	0-4 km	0-5 km
VELVET	0	0	0	0	0	0



- LEGEND:**
- SINGLE OCCUPIED DWELLING
  - ② OCCUPIED DWELLING CLUSTER (NO. IS STRUCTURES)
  - ▣ MINE SHAFT

37°50'

37°45'



**LEGEND:**

- SINGLE OCCUPIED DWELLING
- ⊙ OCCUPIED DWELLING CLUSTER (NO. IS STRUCTURES)
- ▣ MINE SHAFT

**POPULATION DISTRIBUTION**

MINE 0-1/2 km 0.1 km 0.2 km 0.3 km 0.4 km 0.5 km

TONY M 0 0 0 0 0 0



**TONY M MINE  
GARFIELD COUNTY, UTAH**

**ALL OCCUPIED DWELLINGS; MINE SHAFT  
LOCATIONS; POPULATION DISTRIBUTION**

106°50'

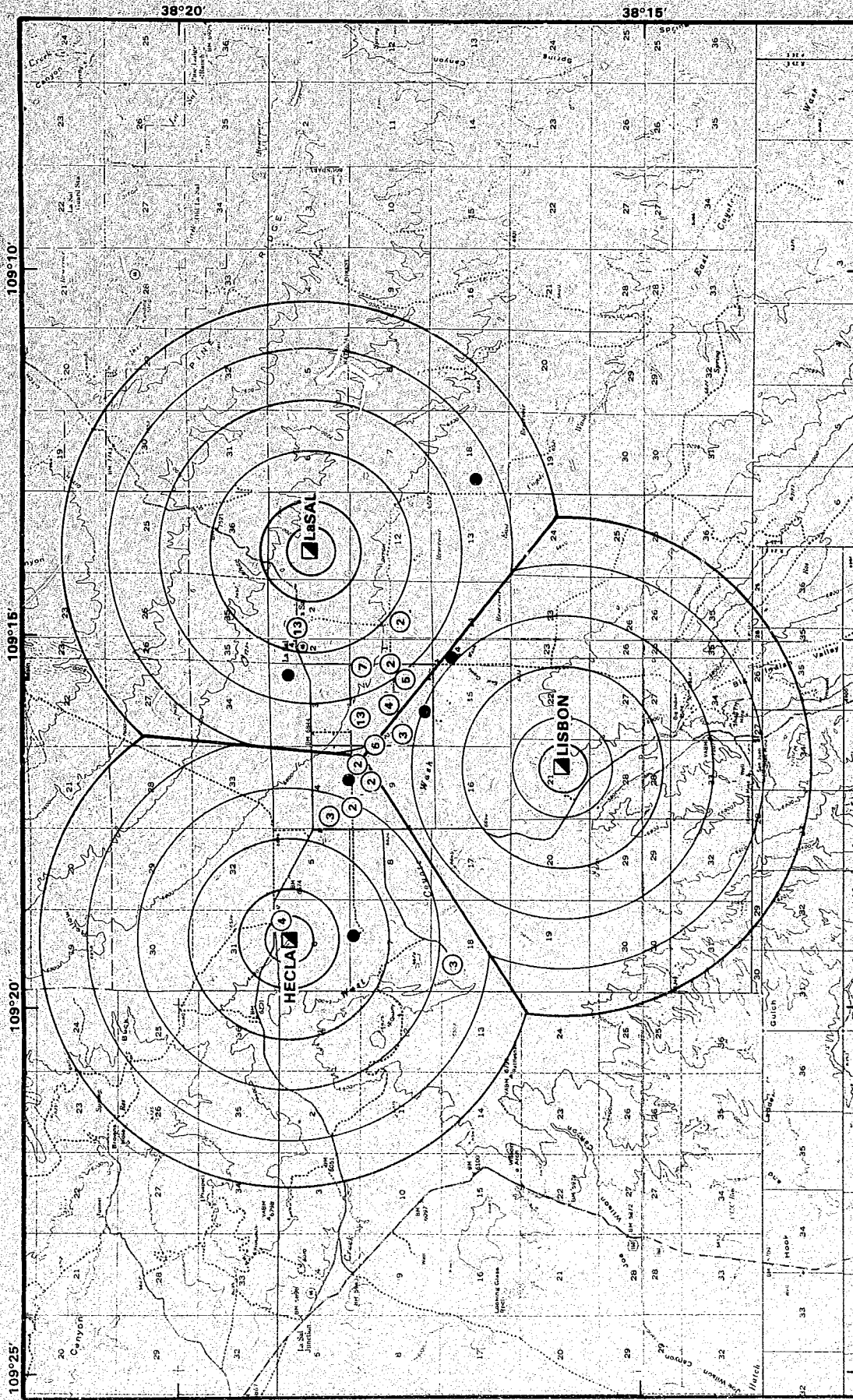
106°45'

106°40'

106°35'

37°50'

37°45'



**LISBON/LaSAL/HECLA MINES -  
SAN JUAN COUNTY, UTAH**

**ALL OCCUPIED DWELLINGS; MINE SHAFT  
LOCATIONS; POPULATION DISTRIBUTION**

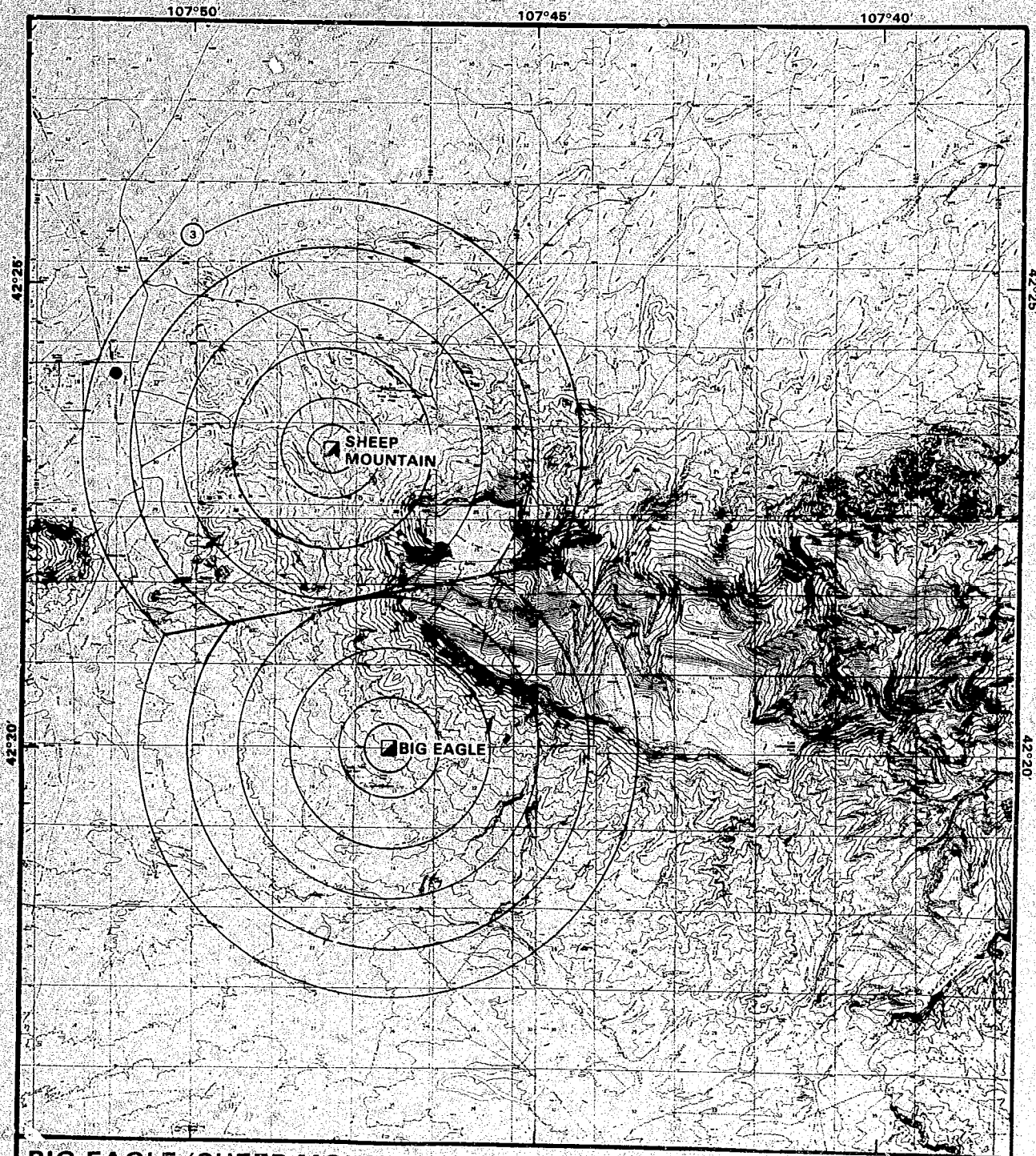
**POPULATION DISTRIBUTION**

MINE	0-1/2 km	0-1 km	0-2 km	0-3 km	0-4 km	0-5 km
LISBON	0	0	0	4	44	44
LaSAL	0	0	53	101	194	194
HECLA	15	16	20	40	73	73

0 1 2 3 4 5 6 MILES  
0 1 2 3 4 5 6 KILOMETERS

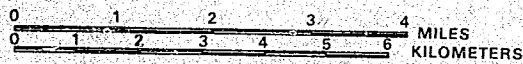
**LEGEND:**

- SINGLE OCCUPIED DWELLING
- ② OCCUPIED DWELLING CLUSTER (NO. IS STRUCTURES)
- ▣ MINE SHAFT



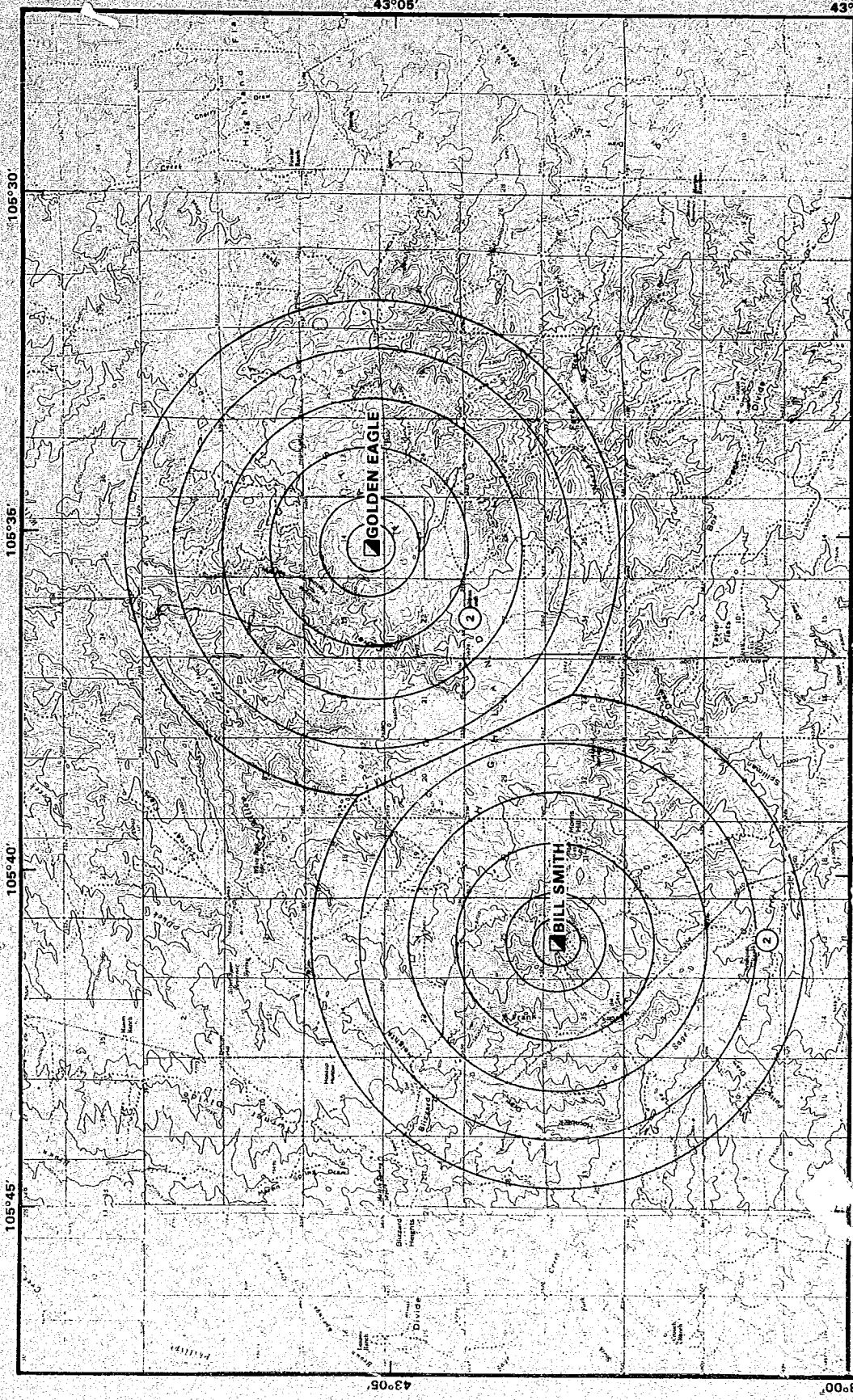
**BIG EAGLE/SHEEP MOUNTAIN MINES, FREMONT COUNTY, WYOMING**  
**ALL OCCUPIED DWELLINGS; MINE SHAFT LOCATIONS; POPULATION DISTRIBUTION**

MINE	POPULATION DISTRIBUTION					
	0-1/2 km	0-1 km	0-2 km	0-3 km	0-4 km	0-5 km
BIG EAGLE	0	0	0	0	0	0
SHEEP MOUNTAIN	0	0	0	0	0	12



**LEGEND:**

- SINGLE OCCUPIED DWELLING
- ② OCCUPIED DWELLING CLUSTER (NO. IS STRUCTURES)
- ▣ MINE SHAFT



**BILL SMITH/GOLDEN EAGLE MINES  
CONVERSE COUNTY, WYOMING**  
ALL OCCUPIED DWELLINGS; MINE SHAFT  
LOCATIONS; POPULATION DISTRIBUTION

POPULATION DISTRIBUTION

MINE	0-1/2 km	0-1 km	0-2 km	0-3 km	0-4 km	0-5 km
BILL SMITH	0	0	0	0	0	6
GOLDEN EAGLE	0	0	0	0	6	6

0 1 2 3 4 5 6  
MILES  
0 1 2 3 4 5 6  
KILOMETERS

- LEGEND:
- SINGLE OCCUPIED DWELLING
  - ⊙ OCCUPIED DWELLING CLUSTER (NO. IS STRUCTURES)
  - ▣ MINE SHAFT

APPENDIX E

ASSOCIATED MINE FACILITIES DESCRIPTIONS

## APPENDIX E

### ARIZONA

Hack Canyon Mine  
Energy Fuels Nuclear, Inc.  
Mohave County, Arizona

The primary uses for the land in the vicinity are for mining, mineral exploration, stock range, and unconfined recreation. Vegetation consists of low shrubs, range grasses, and scattered groves of juniper. Cattle were evident on the mesa in the vicinity of Hack Canyon. There were also numerous claim markers in the area and mineral exploration activity was also evident. The mine property is bounded on three sides (West, South and East) by proposed Wilderness Study Areas (WSA's). These areas are designated as 1-34 and 1-33A as shown on the WSA's reference map for Arizona. These areas are also discussed in the Wilderness Review Arizona report (U.S. Dept. of Interior, BLM, Arizona State Office, 1980).

Pigeon Mine  
Energy Fuels Nuclear, Inc.  
Coconino County, Arizona

The primary uses for the land in the vicinity of the mine site are mineral exploration, stock range, and unconfined recreation. Logging operations are also conducted in the Kaibab National Forest, to the south of the property. Vegetation in the vicinity of the mine site consists of low shrubs, range grasses and groves of juniper. Cattle were evident in the vicinity of the mine site. Numerous claim markers were also evident in the area.

The nearest boundary of any proposed Wilderness Study Area (WSA) is about two miles (3.2 km) to the west, designated as 1-31 on the WSA's reference map for Arizona. This area is also discussed in the Wilderness Review Arizona report (U.S. Dept. of Interior, BLM, Arizona State Office, 1980).

Kanab North  
Energy Fuels Nuclear, Inc.  
Mohave County, Arizona

The primary uses for the land in the vicinity of the proposed mine site are mineral exploration, stock range, and unconfined recreation. Vegetation

consists of low shrubs and range grasses. The mine site is located within the proposed WSA unit 1-31. This unit is identified on the WSA reference map for Arizona. This study area is also discussed in the Wilderness Review Arizona report (U.S. Dept. of Interior, BLM, Arizona State Office, 1980). There is currently considerable opposition to this mining project by the environmental community (The National Wildlife Federation and the South West Regional Council).

## COLORADO

Sunday Mine  
Union Carbide Corporation  
San Miguel County, Colorado

The Sunday Mine is located in an area of NW-SE trending ridges and valleys in southwestern Colorado. The Big Gypsum and Disappointment Valleys traverse the study area with the Sunday Mine site situated in an intervening mountain ridge. The primary uses of the land are for mining, mineral exploration, stock grazing and unconfined recreation. Valleys contain mainly grasses and shrubs while mountain areas are tree covered.

The Hamm Canyon, a major feature after which the USGS quadrangle is named, drains southward into the Big Gypsum Valley. There is a pipeline traversing the study area north-south, passing within one mile (1.6 km) of the mine site. An airstrip is located in Section 35, T44N, R18W. Several other mining prospects occur in the northeast and eastern parts of the study area.

Three proposed Wilderness Study Areas (WSA's) surround the Sunday Mine study boundary. The Tabeguache Creek, Sewemup Mesa and Dolores River Canyon have their nearest boundaries at 12, 6 and 8 miles (19.2, 9.6, and 12.8 km) respectively, and are designated as 030-300, 030-310A/070-176 and 030-290 on the Colorado BLM Intensive Wilderness Inventories-Final Wilderness Study Areas map. These areas are discussed in the Intensive Wilderness Inventory report issued in November, 1980 (U.S. Dept. of Interior, BLM, Colorado State Office, 1980).

King Solomon Mine  
Union Carbide Corporation  
Montrose County, Colorado

The King Solomon Mine is located in a rugged mountain area of southwest Colorado. The west flowing San Miguel River meets the south flowing Dolores River within the study area and then exits to the south. The river drainages are deeply incised with valley walls rising up to 1000 feet high. Martin Mesa forms the southwestern portion of the area, Carpenter Flats the northwestern, while Atkinson Mesa lies central to northeast within the area. The primary

uses of the land are for mining, mining exploration, stock grazing and unconfined recreation. The area is mostly tree covered with grasses and shrubs growing on open mesas and valley floors.

Numerous mining prospects line the rims of the rivers with some old placer operations occurring along the main rivers. There is no private property within a five km radius of the mine while 97% of the land is publicly administrated.

The Dolores River Canyon proposed Wilderness Study Area (WSA) lies 8 miles (12.8 km) north of the King Solomon study boundary. It is designated as 030-290 on the Colorado BLM Intensive Wilderness Inventories-Final Wilderness Study Areas map. This area is discussed in the Intensive Wilderness Inventory report issued in November, 1980 (U.S. Dept. of Interior, BLM, Colorado State Office, 1980).

## NEW MEXICO

Mt. Taylor Mine  
Gulf Mineral Resources  
Cibola County, New Mexico

The primary uses of the land in the vicinity of the Mt. Taylor Mine are for mining, mineral exploration, stock grazing, residential living and unconfined recreation. The site is bounded to the north, west and south by private residential property and ranching land. The village of San Mateo, population about 311, is within 1/4 mile (0.4 km) to the southwest, lying within the four sections of 23, 24, 25, and 26. These residential properties are generally long, narrow parcels most of which border the San Mateo Creek which flows to the northwest through the area. The surrounding ranch land is largely owned by the Fernandez Company, Ltd., (9 to 10 sections) and the Michael Ranch, Inc. (less than 1/20 section).

The Lee Ranch dwelling complex is situated about 1 3/4 miles (2.8 km) to the west. The vegetation type in these areas is low shrubs and range grasses. Trees are scarce.

The Cibola National Forest boundary is 1/4 mile (0.4 km) east of the mine site. The flora here is mainly conifer trees, increasing in density with higher elevations. The San Lucas Dam and Reservoir are located about three miles (4.8 km) to the north, having a private access road. A main power distribution line runs NW-SE and is 2 1/2 miles (4 km) distant to the north.

There are no wilderness study areas within the greater mine vicinity in the Albuquerque BLM district as indicated in the New Mexico Wilderness Study Area Decisions report (U.S. Dept. of Interior, BLM, New Mexico State Office, 1980).

Church Rock #1 and Church Rock East  
Kerr-McGee Corporation  
McKinley County, New Mexico

Old Church Rock and Church Rock NE  
UNC Resources, Inc.  
McKinley County, New Mexico

In the Church Rock District, these four mines are clustered together and are located 10-15 miles (16-24 km) northeast of the city of Gallup, New Mexico.

The greatest distance between any mine in the group is about four miles (6.4 km) (Old Church Rock and Church Rock East). The primary uses of the land in the area are for mining, mineral exploration, and Indian usage for perhaps subsistence and stock grazing. A recreation site is available at the Red Rock State Park near the village of Church Rock (10 1/2 km) south of the Old Church Rock mine site. Any other unconfined recreation is probably limited due to Indian control of lands.

There are only three parcels of privately owned land within the encompassing five km radius of the mine cluster. The largest property is only about one section in size, with the other two being 1/4 sections each. The Navajo Indian Reservation border lies 1/2 mile (0.8 km) north of the Church Rock #1, Church Rock NE, and Church Rock East mines. Other than about 1 1/4 section of company owned property, all remaining lands are Navajo Indian allotted.

The vegetation type is mainly low shrubs and range grasses. Conifer trees occur above the 7000 foot elevation. One outstanding physiographic feature is the Ram Mesa in section 11.

The UNC uranium processing plant which is situated near the Church Rock #1 and Church Rock NE mines in section 2 and has associated tailings ponds. A major power transmission line runs east-west and passes one mile (1.6 km) south of the Old Church Rock mine.

There are no wilderness study areas within the greater mine vicinity of the Albuquerque BLM District as indicated in the New Mexico Wilderness Study Area Decisions report (U.S. Dept. of Interior BLM, New Mexico State Office, 1980).

Kerr-McGee Sections 19, 30E, 30W, 35 and 36 Mines  
Kerr-McGee Corporation  
McKinley County, New Mexico

Homestakes Sections 23 and 25 Mines  
Homestake Mining Company  
McKinley County, New Mexico

In the Ambrosia Lake District, these 7 mines are clustered together, centered roughly on the old Ambrosia townsite. The greatest distance between any mines in the cluster is 7 miles (11.2 km) (distance between Homestake section

23 and Kerr McGee section 36). The primary uses of the land in the vicinity of the Ambrosia Lake mine cluster are for mining, mineral exploration, stock grazing and minor unconfined recreation. In regards to mining, the Ambrosia Lake environs is literally peppered with both active and inactive mining operations. Many old hoist head frames dot the landscape along with mining equipment of all types. Security guards in the hire of the still active operations patrol the grounds. Little if any exploratory activity is presently underway.

Within the encompassing 5 km radii of the mines in the cluster, 8 major private property owners (owning greater than one section each) hold lands used mainly for ranching. These include the Harris, Roundy, Berryhill Enterprises, Marquez, Fernandez Co., Ltd and other properties. There are about 8 minor (owning less than one acre) private property owners within the same area. In addition, several sections are designated as Navajo Indian allotted lands. The vegetation on this ranching and Indian land is low shrubs and range grasses.

There are two uranium mills within the 7-mine cluster. These are the active Kermac Nuclear Fuels Processing Plant (Sec. 31, T14N, R9W) and the inactive Phillips Petroleum Ambrosia Mill (Sec. 28 T14N, R9W). Each facility has associated mill tailings ponds of different sizes--about one section total area for Kermac, and 1/4 section for Phillips. There is a power transmission line serving the Kermac Plant. This line runs approximately east-west and lies about 1/2 mile (0.8 km) north of and parallel to the T13 and 14N dividing line.

The Cibola National Forest boundary is 1 1/2 miles (2.4 km) north and 4 1/2 miles (7.2 km) south from the nearest mine(s) (Kerr McGee Section 35 and 36).

Conifer trees are present on the slopes and tops of the San Mateo Mesa and the La Jara Mesa (to the south) within the Cibola National Forest.

There are no wilderness study areas in the greater mine vicinity in the Albuquerque BLM District as indicated in the New Mexico Wilderness Study Area Decisions report (U.S. Dept. of Interior, BLM, New Mexico State Office, 1980).

Nose Rock Mine  
Phillips Petroleum Company  
McKinley County, New Mexico

The Nose Rock Mine is located in open, sparsely populated country about 13 miles (20.8 km) north of Crownpoint, New Mexico. The primary uses for the

land are for mining, mineral exploration and Indian usage for perhaps subsistence and stock grazing.

The Chaco Canyon National Park (an Indian Ruins) is the closest recreational site located roughly 20 miles (32 km) to the northeast. Any other unconfined recreation in the immediate mine area is probably limited due to Indian property.

Phillips owns or has surface rights to 35% of the area within 5 km of its mine site. Of the 13 sections encompassed in full or part by this 5 km radius, 11 sections have been acquired by Phillips as part of a land exchange with the Navajo Indian Tribe. The other 2 sections are Phillips property acquired by other means.

The only physiographic feature is the Nose Rock land formation just north of the 5 km radius. Two north flowing drainages run through the area, the Kim-me-ni-oli and Seven Lakes Washes. Several small stock watering reservoirs lie peripheral to the study area. And finally, a power transmission line runs NW-SE about 1 mile (1.6 km) west of the mine site with a substation located in Sec. 18, T18N, R11W.

There are no wilderness study areas within the greater mine vicinity in the Albuquerque District, as indicated in the New Mexico Wilderness Study Area Decisions report (U.S. Dept. of Interior, BLM, New Mexico State Office, 1980).

Mariano Lake  
Gulf Mineral Resources  
McKinley County, New Mexico

The Mariano Lake is located on 100% Indian and publicly owned land. In the vicinity of the mine, the major land uses are for mining, mineral exploration, and Indian usage. Recreational uses are probably minimal. The continental Divide is 4 3/4 mi (7.6 km) to the east, while to the north 1.9 miles (3 km) is a Bureau Mission and northwest 3 miles (4.8 km) is Mariano Lake and the Mariano Lake Village. Hosta Butte, a major physiographic landmark, lies 5 3/4 miles (9.2 km) to the northeast. A power distribution line passes 1 mile (0.8 km) to the north of the mine area, traversing E-W through the district.

The primary vegetation type is low shrubs, range grasses, and sparse conifer trees in the valleys with increasing tree density at higher elevations.

There are no wilderness study areas within the greater mine vicinity in the Albuquerque BLM District, as indicated in the New Mexico Wilderness Study Area Decisions report (U.S. Dept. of Interior, BLM, New Mexico State Office, 1980).

## UTAH

Velvet Mine  
Atlas Corporation  
San Juan County, Utah

The primary uses of the land in the vicinity of the Velvet Mine are for mining, mineral exploration, stock grazing and unconfined recreation. The area lies midway between the Lisbon and Wilson-Silverbell study areas, in a high mountain park called the West Summit. The vegetation type is range grasses, shrubs, and conifer stands.

The Lisbon Valley and Lower Lisbon Valley border the study area to the north and northeast while the Three Step Hill range forms the central part of the area. Mining prospects occur in the north and west portion of the area. The Colorado border lies four miles (16.4 km) to the east.

There are no wilderness study areas (WSA's) in the greater vicinity on the Utah side of the Utah/Colorado border. Approximately 12 miles (19.2 km) to the east is the boundary of the Dolores River Canyon WSA in Colorado. This is designated as 030-290 on the Colorado BLM Intensive Wilderness Inventories-Final Wilderness Areas map. This area is discussed in the Intensive Wilderness Inventory report issued in November, 1980 (U.S. Dept. of Interior, BLM, Colorado State Office, 1980).

Tony M (Lucky Strike) Mine  
Plateau Resources, Ltd.  
Garfield County, Utah

The primary uses for the land in the vicinity of the Tony M Mine are for mining, mineral exploration, stock range land, and unconfined recreation. The Starr Ranch is located about six miles (9.6 km) northeast of the mine property. The Starr Springs campground is also located in the same area. There are no campsites closer than this to the mine property. Vegetation in the vicinity is mainly low shrubs and range grasses.

The nearest boundaries of the Mt. Pennell, Mt. Ellsworth, and Mt. Hillers proposed Wilderness Study Areas (WSA's) are approximately six miles (9.5 km) from the mine property. These areas are designated as 050-247, 050-248, and

050-249 on the Wilderness Inventory reference map for the State of Utah. These areas are discussed in the Utah Intensive Wilderness Inventory report (U.S. Dept. of Interior, BLM, Utah State Office, 1980).

Wilson-Silverbell/Deremo-Snyder  
Union Carbide Corporation  
San Juan County, Utah and San Miguel County, Colorado

This mining area is located on the Utah/Colorado border in a high mountainous area called the East Summit. The elevation is about 7000 feet and above. The primary uses of the land in the vicinity are for mining, mineral exploration, stock grazing, and unconfined recreation. The vegetation type is range grasses, low shrubs, and conifer stands. The Summit Cannon lies midway between the two sites, draining the countryside to the northeast.

A pipeline passes about one mile, southwest of the Deremo-Snyder site, running in a NW-SE direction. Overall, 81% of the land is privately owned with only 9% being in public administration.

There are no wilderness study areas/(WSA's) in the greater vicinity on the Utah side of the Utah/Colorado border. Approximately 12 miles (19.2 km) to the northeast is the boundary of the Dolores River Canyon WSA in Colorado. This is designated as 030-290 on the Colorado BLM Intensive Wilderness Inventories-Final Wilderness Study Areas map. This area is discussed in the Intensive Wilderness Inventory report issued in November, 1980 (U.S. Dept. of Interior, BLM, Colorado State Office, 1980).

Lisbon/LaSal/Hecla Mines  
Rio Algom Limited/Union Carbide Corporation/Union Carbide Corporation  
San Juan County, Utah

The primary uses of the land in the vicinity of these three adjoining mine areas are for mining, mineral exploration, stock grazing, and unconfined recreation. The vegetation type varies from range grasses and sagebrush to stands of conifer trees. The Manti-LaSal National Forest borders the Hecla/LaSal areas to the north and east. The Mt. Tukuhnikivatz, Mt. Peale, Mt. Mellenthin trio lie within this forest about 6-8 miles (9.6-12.8 km) north of the study areas.

The West Coyote Creek drains the areas to the west, passing through the LaSal Junction site at about 1 1/2 miles (2.4 km) west of the Hecla area. The town of LaSal lies in Section 2, T29S, R24E, within the LaSal mine area.

The Lisbon and Big Indian Valleys trend NW-SE, entering the three site areas from the south. The Colorado border lies 6 miles (9.6 km) to the east of the LaSal area. Overall, 74-83% of the land is publicly administered.

The Mill Creek and Behind the Rock Wilderness Study Areas (WSA's) each have their boundaries about 10 miles (16 km) to the northwest of the study areas' boundary. These are designated as 060-139 and 060-140 on the Wilderness Inventory reference map for the State of Utah. These areas are discussed in the Utah Intensive Wilderness Inventory report, (U.S. Dept. of Interior, BLM, Utah State Office, 1980).

## WYOMING

Sheep Mountain Mine and Big Eagle Mine  
Western Nuclear, Inc., and Pathfinder Mines Corporation  
Fremont County, Wyoming

These two adjoining areas are located in sparsely populated country about 7 1/2 miles (12 km) and 12 miles (19.2 km) respectively southeast of Jeffrey City. The primary uses of the land are for mining, mineral exploration, ranching, and unconfined recreation. The vegetation type is mainly range grasses and sagebrush. Pockets of more dense sagebrush, grasses, aspen, and juniper trees occur with higher elevations and along the drainages.

In describing the Sheep Mountain mine area, there is the Sheep Creek which flows northerly and passes by the site. Sheep Mountain, which is part of the larger Green Mountain Range, rises to the west and south of the site, both forming the major physiographic landforms of the region. Numerous mining prospects dot the mountain slopes. A strip mined area lies 2 to 2 1/2 miles (3.2-4 km) to the southwest. The Sheep Creek Oil Field is located 1 mile (1.6 km) to the northeast.

In describing the Big Eagle mine area, there are the Fourth and Jost Creeks which feed the larger Crooks Creek. These all form the major drainage flowing east to west across the southern part of the study areas. Crooks Creek is surrounded by State land along most of its course through the area. There are four public water resource blocks of land totalling 5/16 section within the Big Eagle Area. Crooks Creek reservoir lies 3/4 mile (1.2 km) to the southwest. Green mountain rises to the north.

The closest boundaries of any proposed Wilderness Study Areas (WSA's) are the Sweetwater Rocks' areas which lie about 15 miles (24 km) to the northeast. They are designated as 030-120 and 030-122 on the Wyoming Wilderness Study map. These areas are discussed in the Wyoming Wilderness Study Areas-Final Inventory Report, (U.S. Dept. of Interior, BLM, Wyoming State Office, 1981).

Bill Smith and Golden Eagle Mines  
Kerr-McGee Corp. and Silver King Mines Company  
Converse County, Wyoming

The primary uses of the land in the vicinity of these two adjoining areas are for mining, mineral exploration, ranching, and unconfined recreation. Vegetation is sparse, consisting of only low shrubs and range grasses with trees only around ranch dwellings areas or in wet drainages. Many small seasonal watering reservoirs dot the areas between the two mine sites. Most drainages and creeks are seasonal as well. There are no outstanding land features. Also, there are no wilderness study areas in this Platte River Resource areas of the Casper BLM District as indicated in the Wyoming Wilderness Study Areas - Final Inventory Report (U.S. Dept. of Interior, BLM, Wyoming State Office, 1981).

Three uranium mills surround the sites. The active Exxon mill is 6 miles (19.6 km) east of the Golden Eagle mine site. The inactive Spook mill site is about 8 miles (12.8 km) north while the active Bear Creek mill lies 10 miles (16 km) north.

APPENDIX F

PRESIDENT REAGAN'S STATEMENT OF NUCLEAR ENERGY POLICY

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PRESIDENT REAGAN'S STATEMENT OF NUCLEAR ENERGY POLICY

A more abundant, affordable, and secure energy future for all Americans is a critical element of this Administration's economic recovery program. While homeowners and business firms have shown remarkable ingenuity and resourcefulness in meeting their energy needs at lower cost through conservation, it is evident that sustained economic growth over the decades ahead will require additional energy supplies. This is particularly true of electricity, which will supply an increasing share of our energy.

If we are to meet this need for new energy supplies, we must move rapidly to eliminate unnecessary government barriers to efficient utilization of our abundant, economical resources of coal and uranium. It is equally vital that the utilities--investor-owned, public, and co-ops--be able to develop new generating capacity that will permit them to supply their customers at the lowest cost, be it coal, nuclear, hydro, or new technologies such as fuel cells.

One of the best potential sources of new electrical energy supplies in the coming decades is nuclear power. The U.S. has developed a strong technological base in the production of electricity from nuclear energy. Unfortunately, the federal government has created a regulatory environment that is forcing many utilities to rule out nuclear power as a source of new generating capacity, even when their consumers may face unnecessarily high electric rates as a result. Nuclear power has become entangled in a morass of regulations that do not enhance safety but that do cause extensive licensing delays and economic uncertainty. Government has also failed in meeting its responsibility to work with industry to develop an acceptable system for commercial waste disposal, which has further hampered nuclear power development.

To correct present government deficiencies and to enable nuclear power to make its essential contribution to our future energy needs, I am announcing today a series of policy initiatives:

1. I am directing the secretary of energy to give immediate priority attention to recommending improvements in the nuclear regulatory and licensing process. I anticipate that the chairman of the Nuclear Regulatory Commission will take steps to facilitate the licensing of plants under construction and those awaiting licenses. Consistent with public health and safety, we must remove unnecessary obstacles to deployment of the current generation of nuclear power reactors. The time involved to proceed from the planning stage to an operating license for new nuclear power plants has more than doubled since the mid-1970s and is presently some 10-14 years. This process must be streamlined, with the objective of shortening the time involved to 6-8 years, as is typical in some other countries.
2. I am directing that government agencies proceed with the demonstration of breeder reactor technology, including completion of the Clinch River Breeder Reactor. This is essential to ensure our preparedness for longer-term nuclear power needs.
3. I am lifting the indefinite ban which previous Administrations placed on commercial reprocessing activities in the United States. In addition, we will pursue consistent, long-term policies concerning reprocessing of spent fuel from nuclear power reactors and eliminate regulatory impediments to commercial interest in this technology, while ensuring adequate safeguards.

It is important that the private sector take the lead in developing commercial reprocessing services. Thus I am also requesting the director of the Office of Science & Technology Policy, working with the secretary of energy, to undertake a study of the feasibility of obtaining economical plutonium supplies for the Department of Energy by means of a competitive procurement. By encouraging private firms to supply fuel for the breeder program at a cost that does not exceed that of government-produced plutonium, we may be able to provide a stable market for private sector reprocessing, and simultaneously reduce the funding needs of the U.S. breeder demonstration program.

4. I am instructing the secretary of energy, working closely with industry and state governments, to proceed swiftly toward deployment of means of storing and disposing of commercial high-level radioactive waste. We must take steps now to accomplish this objective and demonstrate to the public that problems associated with management of nuclear waste can be resolved.
5. I recognize that some of the problems besetting the nuclear option are of a deep-seated nature and may not be quickly resolved. Therefore, I am directing the secretary of energy and the director of the Office of Science & Technology Policy to meet with representatives from the universities, private industry and the utilities and requesting them to report to me on the obstacles which stand in the way of increased use of nuclear energy and the steps needed to overcome them in order to assure the continued availability of nuclear power to meet America's future energy needs not later than Sept. 30, 1982.

Eliminating the regulatory problems that have burdened nuclear power will be of little use if the utility sector cannot raise the capital necessary to fund construction of new generating facilities. We have already taken significant steps to improve the climate for capital formation with the passage of my program for economic recovery. The tax bill contains substantial incentives designed to attract new capital into industry.

Safe, commercial nuclear power can help meet America's future energy needs. The policies and actions that I am announcing today will permit a revitalization of the U.S. industry's efforts to develop nuclear power. In this way, native American genius--not arbitrary federal policy--will be free to provide for our energy future.

APPENDIX G

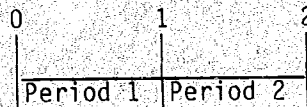
FINANCIAL ANALYSIS

## APPENDIX G

### FINANCIAL ANALYSIS

A life-cycle cost analysis was done to determine the cost of installing 20 meter stacks on exhaust boreholes. The model that was developed considers only those incremental costs that are incurred as a direct result of the stacks. For example, the cost of existing ventilation would not be considered, but the increased cost of ventilation due to the addition of the stack would be included.

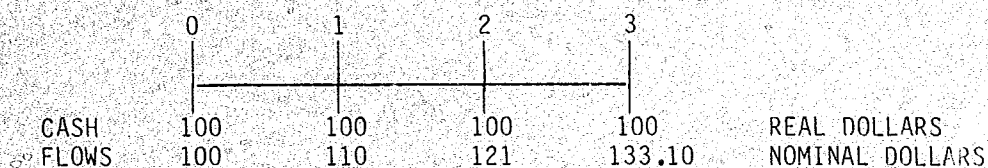
The analysis was done on a cash flow basis and a standard cash flow convention was used. All cash flows are assumed to occur at the end of the period except for capital investments which occur at the beginning of the period. For example, if the year 1983 is period 1 on the timeline below, then all capital investments made during 1983 are assumed to occur at time 0 and all other cash flows during the year as assumed to occur at time 1. This is equivalent to saying that investments occur on January 1st and all other cash flows (operating costs, taxes, etc.) happen on the last day of December.



The reason for using a life-cycle cost analysis is that the results are analogous. Mines with different lifetimes and production rates are comparable under this method when real costs, as opposed to nominal costs, are used. The levelized cost that the analysis results in is the additional real dollar amount per unit of production that would have to be received to offset the added investment and operating costs as well as compensate the investors for the opportunity cost of their committed funds. This levelized cost is given in terms of dollars per ton of ore and dollars per pound of  $U_3O_8$ .

This analysis can be done in different ways depending on its purpose. The production life can be considered as the full-life of the mine or the remaining life. Also the analysis can assume an inflation rate or no inflation.

- Full Life versus Remaining Life - If the levelized cost is derived over the full life of the mine, it is equivalent to saying that the stacks were in place at the beginning of the mine's life. Thus, the cost of the stacks is spread over the entire life of the mine, and the levelized cost is applied to every unit of production. Conversely, if the levelized cost is derived over the mine's remaining production life, this implies that the stacks are new and that the cost should only apply to future production. The full life and remaining life methods are equivalent when applied to new mines.
- Inflation versus No Inflation - Including inflation or real cost escalation in the analysis does not undermine the validity of the analysis, but it does make the results less easily understood. For example, on the time line below two cash flow streams are shown. The top stream is given in real dollars (inflation adjusted), and the bottom stream is nominal dollars (not adjusted for inflation).



The resulting levelized cost for the real dollar stream is \$100.00. This means that to recover this cost, a charge of \$100.00 per period would be required (assuming no inflation); or a charge of \$100.00 per period in real terms (i.e., escalate the \$100.00 charge by the inflation rate). The levelized cost for the nominal dollar stream is \$114.72 assuming a discount rate equal to the escalation rate. If one charged \$114.72 per period, the cost would be recovered. The difference may seem small here, however, if there had been twenty cash flows instead of four the levelized cost of the uninflated stream would still be \$100.00, but the levelized

cost of the inflated stream would be \$213.56. Thus, if the cost did escalate at 10% per year, and one charged \$213.56 per period, the cost would be fully recovered. This number is not easy to get an intuitive feel for, whereas \$100.00 per period in real terms is a number with more practical appeal.

The life-cycle cost analysis, as mentioned before, gives comparable results for mines with different lifetimes and production rates when real costs are used. For the results to be completely analogous, the mine lives must be of the same length if there are any costs escalating at a real rate or if inflation is included. In the example above when real costs were used, it did not make any difference if the time horizon was three or nineteen periods, the cost remained at \$100.00. However, when the nominal cost stream was used, the levelized costs were vastly different and not easily compared.

If the analysis is done assuming no inflation, then cash flows fixed in nominal terms tend to be over stated. For example, the value of the depreciation tax shield is greatest when the inflation rate is lowest. This causes the levelized costs to be stated slightly lower than their actual values, but still allows the results between mines to be easily compared.

### LEVELIZED LIFE-CYCLE COST MODEL

The model developed here is consistent with current DOE and EPRI requirements for evaluation methodologies, and it resembles the approach used by investor-owned utilities to estimate the cost of power from new sources (Jet Propulsion Laboratory, 1976 and Electric Power Research Institute, 1982).

The intent of life-cycle costing is to find the price that all expected output would have to be sold to result in the exact revenue required to fully recover the costs over the mine's lifetime. These costs implicitly include a return on the investments of stockholders and creditors through the use of a discount rate equal to the firm's cost of capital.

In this model all costs are stated in first quarter 1983 dollars. The present value of these costs is then converted into an annuity over the production lifetime in the same manner as a home mortgage payment. This levelized annual cost is divided by the yearly production rate to give a levelized life cycle cost in terms of dollars per pound of  $U_3O_8$  or dollars per ton of ore.

Specifically, the levelized annual cost is expressed mathematically by the following equation:

$$LAC = \sum_{i=0}^m (FCR_i)(CI_i) + CRF (FPL + HOC) \quad (G.1)$$

where FPL and HOC are the present values of the additional fan power costs, and heater operating costs, respectively. Each of these values is calculated using the following equation:

$$PV(X) = \sum_{i=1}^N X \left( \frac{1 + g_x}{1 + k} \right)^i \quad (G.2)$$

where X is the estimated first year cost (in 1983 dollars) and  $g_x$  is the appropriate escalation rate. The rest of the variables are defined later in the financial parameters section. The capital recovery factor is given by the following:

$$CRF = \frac{k'}{1 - (1 + k)^{-N}} \quad (G.3)$$

and it levelizes the present value of the annual operating costs. The present value of each capital investment (CI, in 1983 dollars) is multiplied by the fixed charge rate appropriate for the year of that investment. The equation for the fixed charge rate is given below:

$$FCR = CRF \left[ \frac{1 - \tau (DPF) - TC}{1 - \tau} \right] + TF + IF \quad (G.4)$$

and the variables are defined in the following section.

#### Financial Parameters

For the life-cycle cost analysis, the following financial parameters have been determined or assumed:

- Constant Dollars - All levelized cost values will be expressed in constant 1983 dollars. Also, all other dollar values will be in 1983 dollars except where specifically noted.
- Size of Firm - It is assumed that the financial entity making the investments is profitable enough to take full advantage of the maximum allowable depreciation, amortization, and investment tax credits. It is also assumed that the firm is profitable enough to pay the maximum marginal corporate tax rates.
- Federal Tax Rate - The current maximum marginal federal corporate tax rate is 46%.
- State Tax - A weighted average state income (or franchise) tax was used. The states and their respective maximum rates are: Colorado - 5%, Utah - 4%, Wyoming - none, and New Mexico - 6%. The weightings correspond to the number of active underground uranium mines. Specifically, the analysis will assume a 4.6% state income tax rate.
- $\tau$  = Effective Corporate Income Tax Rate - This rate is applied to gross profits to determine the corporate income tax liability. It takes into account the deduction from gross profits, of state income tax liabilities, when computing the federal tax liability. Specifically the value of 48.5% is used.

- TC = Federal Tax Credit - Investment tax credits will be 10% on all depreciable assets classified as five-year ACRS property.
- DPF = Depreciation Factor - This value is the present value of the future depreciation charges as a fraction of the original value of the capital investment. Depreciation expenses will be computed according to the 1982 tax act. Specifically, new equipment eligible for the investment tax credit (heaters) will be depreciated using the five-year ACRS schedule for property placed in service between 1981-1984. As per the 1982 law revision, this schedule will be applied to 95% of the equipments original cost. Ventilation stacks are depreciable, but not eligible for the investment tax credit, will be depreciated according to the 10-year ACRS schedule at 100% of the cost of development. In any case in which the stack or heater life is longer than the mine life, the unit production method will be used. Here it will be assumed that production will remain level over the life of the mine. Thus, depreciation will be a straight line over the mine life for this situation. Depreciation will be assumed to be the same for state and federal income tax purpose.
- TF = "Other" Tax Fraction - This value is assumed to be 2% of the present value of the total capital investment. It represents all non-income annual taxes and license fees. These "other" taxes are assumed to be deductible for income tax purposes and, as an approximation, assumed to be constant.
- IF = Insurance Fraction - This value is assumed to be one-quarter of one percent of the present value of the total capital investment. As an approximation, this fraction is assumed to be constant.
- $g_C$  = Capital Cost Escalation Rate - This value is also assumed to be equal to the general inflation rate. The analysis will be done in two ways; with and without inflation. Specifically values of 0% and 5% will be used.
- $g_E$  = Real Escalation Rate for Energy Costs - This rate is to be added to the inflation rate to get the nominal electricity cost escalation rate. A value of 2% will be used in this study, which was the electricity cost

escalation rate estimated by Brookhaven National Laboratory for the period 1975 to 1990 (Weissbrod and Barron 1979). This rate is to be applied to ventilation power costs and fuel costs for heater operation.

- N = Mine Life in Years - This value can represent either the remaining years of production or the total mine life depending on the type of analysis being done.
- Salvage Value - All capital items are assumed to have zero salvage value at the end of their depreciable life. Equipment life is assumed to equal or exceed the mine life in all cases.
- K = The Discount Rate - To determine the appropriate discount rate the Capital Asset Pricing Model was used. Discount rates for six of the major uranium producers were calculate and an average value of 5.73% (real) was found. The equity betas were calculated by Value Line Investment Survey and the historical market average was used for the debt betas. The method is shown below and historical values were used for the average market return and real riskless rate of return.

#### The Capital Asset Pricing Model

General equation for calculation of discount rates for projects of risk similar to the company's current business.

$$r_f + \beta_{\text{Assets}} [E(r_m) - r_f] = E(r_A) = \text{Company cost of capital hurdle rate for capital- budgeting decisions.} \quad (G.5)$$

where:

$E(r_A)$  = Expected return on assets.

$r_f$  = Risk-free rate of return.

$E(r_m)$  = Expected return on the entire market portfolio (i.e., all assets).

$$\beta_{\text{Assets}} = \beta_{\text{Debt}} \left( \frac{\text{Debt}}{\text{Debt} + \text{Equity}} \right) + \beta_{\text{Equity}} \left( \frac{\text{Equity}}{\text{Debt} + \text{Equity}} \right) \quad (G.6)$$

$\beta_{\text{Debt}}$  = Covariance of return on debt (company specific) with the market return.

$\beta_{\text{Equity}}$  = Covariance of return on equity (company specific) with the market return. A measure of volatility of the individual security relative to the market.

Debt = market value of the company's outstanding debt.

Equity = Market value of the company's outstanding equity.

Since it is almost impossible to measure expectations, historical values are used as a proxy for the expected return on the market portfolio and the real risk-free rate of return. Historical data is also used to calculate an average corporate debt beta. This data was compiled by the Financial Analysts Research Foundation (Ibbotson and Sinquefeld 1977). The rates of return listed below are for the period 1926 through 1976, and they are inflation adjusted geometric mean values.

Real Return on Long-term Government Bonds = 1.0%

Real Return on Long-term Corporate Bonds = 1.7%

Real Return on Common Stocks = 6.7%

From the above data the following values can be calculated or surmised:

$\bar{r}_f$  = Average Real Riskless Rate of Return = 1.0%

$E(r_m)$  = Expected Return on the Market Portfolio = 6.7%

$(\overline{r_m - r_f})$  = Average Market Risk Premium = 5.7%

$E(r_{CB})$  = Expected Return on Corporate Bonds = 1.7%

$$E(r_{CB}) = \bar{r}_f + \bar{\beta}_{Debt} (\overline{r_m - r_f}) = 1.7\% \quad (G.7)$$

$\bar{\beta}_{Debt}$  = Average Beta for Corporate Bonds = 0.1228

For each of the six firms that were used in the calculation of the discount rate, the asset beta was first calculated using equation (G.6). As mentioned before, the equity betas were calculated by Value Line and the average beta for corporate bonds was used as a proxy for each firm's debt beta. With the calculated asset beta and the values above, equation (G.5) was used to compute the discount rate for each firm and an average was taken.

The average discount rate computed above assumes no inflation and there is no assumption made as to the amount of debt. The discount rate is the minimum acceptable rate of return on an investment. To adjust this value for inflation, one simply adds to it the inflation rate. For this study, values being calculated assume zero or five percent inflation. Thus the discount rates would be 5.73% and 10.73% respectively.

If this analysis was being done on the basis of invested equity capital, then a debt/equity ratio would need to be assumed. The appropriate discount rate would then be calculated using the following expression:

$$E(r_E) = r_f + \beta_{\text{Equity}} [E(r_m) - r_f]. \quad (G.8)$$

This will give equivalent results however. The return on invested equity capital will be greater than the return on assets and the return on the debt will be less. But the total return will be the same. Since the debt/equity ratio of the major uranium producers varies between about 0 and 1, it is not fair to select a particular value. Thus to avoid this problem and still maintain the validity of the analysis, the return on assets method (Equation G.5) is used.

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