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O F   C O L O R A D O

This current report has been prepared by the Bureau of Mines, U.S. Department of the Interior, to-

1. Provide the latest available data and information on the mineral industry of Colorado.
2. Invite comment, revisions, or additional information on the subject.

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## MINERALS IN THE ECONOMY OF COLORADO

### INTRODUCTION

The area of Colorado is 104,247 square miles, of which 59 percent is privately owned, 36 percent is Federally owned, 4 percent is State owned, and 1 percent is Indian owned. The population of Colorado on July 1, 1978, was 2,670,000, an increase of 21 percent from the 1970 census figure. The mining industry is the fourth largest private industry in the State behind manufacturing, agriculture, and construction. The value of minerals produced has risen from about \$425 million in 1972 to \$1.4 billion in 1978. Personal income from mining in the same period tripled from about \$160 million to over \$500 million. The \$1.4 billion worth of minerals produced in 1978 is a slight decrease, about 1 percent, from that of 1977. Colorado was first in the Nation in production of molybdenum, tin, and vanadium in 1978, second in tungsten, third in lead and silver, and fourth in uranium. The value of minerals produced in Colorado in 1978 was about \$519 per capita compared to about \$550 per capita in 1977 when the nationwide value of mineral production was about \$83 per person; the value per square mile was about \$13,300.

### GENERAL MINERAL SITUATION

Nonfuel minerals accounted for 45 percent of the mineral value produced in Colorado in 1978, about \$668 million. This is a 15-percent increase over that of 1977. Most of the increase in value is accounted for by molybdenum and uranium, which comprise about two-thirds of the nonfuel mineral value produced and nonmetallic mineral production. The quantity of gold, silver, copper, lead, and zinc produced declined from that of the preceding year. The value of production of gold, copper, lead, and zinc declined 44 percent, 26 percent, 13 percent, and 37 percent, respectively. The rise in price of silver more than offset the decline in production of that metal resulting in a slight increase in value of production of silver. Clays and lime among the nonmetallics also declined in quantity and value of production from 1977. Twelve metals and 13 nonmetals were produced in Colorado in 1978 in addition to mineral fuels. Mineral fuels--coal, crude petroleum, natural gas, natural gas liquids, and shale oil--represent more than one-half of the value of Colorado's mineral production in 1978. Coal production for 1978 is estimated at 14.4 million tons, a record high production for the State. The previous high production record was 12.6 million tons produced in 1918. Coal production will continue to increase as coal-burning powerplants under construction are completed and new projects under consideration are built. In contrast to coal, the volume and total value of crude petroleum, natural gas, and natural gas liquids produced in the State declined from the 1977 level.

Nonfuel mineral production in Colorado in 1978 and 1977 is shown in table 1. Mineral fuels production in the State in those years is estimated in table 2. Table 3 identifies Colorado's share of the Nation's mineral production, and the size of the State's mineral reserves.

U.S. Energy

Production (including consumption by producers)  
 Preliminary  
 NA Not available  
 XX Not applicable

thousand short tons  
 thousand 42-gallon barrels  
 thousand short tons  
 million cubic feet

Clays<sup>2</sup>.....  
 Coal (bituminous).....  
 Copper<sup>4</sup>.....  
 Gem stones.....  
 Gold<sup>4</sup>.....  
 Gypsum.....  
 Lead<sup>4</sup>.....  
 Lime.....  
 Natural gas.....  
 Natural gas liquids:  
 Natural gasoline and cycle products  
 thousand 42-gallon barrels.....  
 Liquefied petroleum gases.....  
 Peat.....  
 Petroleum (crude).....  
 Sand and gravel<sup>5</sup>.....  
 Silver<sup>4</sup>.....  
 Stone:  
 Crushed.....  
 Dimension.....  
 Zinc<sup>4</sup>.....  
 Combined value of carbon dioxide, cement (masonry and portland), clays (bentonite), feldspar, iron ore, molybdenum, perlite, pumice, pyrites, salt, sand and gravel (industrial), tin, tungsten, uranium, and vanadium.....  
 Total.....

Clays <sup>2</sup> .....	15	0	0	0	0	0
Coal (bituminous).....	2	1	3	8	3	X
Copper <sup>4</sup> .....	1	0	1	1	1	8
Gem stones.....	1	0	0	0	0	0
Gold <sup>4</sup> .....	1	0	0	0	0	0
Gypsum.....	1	0	0	0	0	0
Lead <sup>4</sup> .....	1	0	0	0	0	0
Lime.....	1	0	0	0	0	0
Natural gas.....	1	0	0	0	0	0
Natural gas liquids: Natural gasoline and cycle products thousand 42-gallon barrels.....	9,381					
Liquefied petroleum gases.....	32					
Peat.....	39,460					
Petroleum (crude).....	23,910					
Sand and gravel <sup>5</sup> .....	4,663					
Silver <sup>4</sup> .....	5,597					
Stone: Crushed.....	40,267					
Dimension.....						
Zinc <sup>4</sup> .....						
Combined value of carbon dioxide, cement (masonry and portland), clays (bentonite), feldspar, iron ore, molybdenum, perlite, pumice, pyrites, salt, sand and gravel (industrial), tin, tungsten, uranium, and vanadium.....						
Total.....	424,210	XX	424,210	XX	532,487	
	61,195,750	XX	61,195,750	XX	667,968	

<sup>1</sup> Preliminary. NA Not available. XX Not applicable.  
<sup>2</sup> Production as measured by mine shipments, sales, or marketable production (including consumption by producers).  
<sup>3</sup> Includes natural gas liquids.  
<sup>4</sup> Includes natural gas liquids.  
<sup>5</sup> Includes natural gas liquids.

Value included in "Combined value" figure.  
 Value included in "Combined value" figure.  
 Value included in "Combined value" figure.



Mineral processing plants in Colorado treat a variety of products. There are 11 coal-burning power-generation plants in the State, 1 nuclear powerplant, 3 petroleum refineries, and 33 natural gas processing plants; 16 mills treat gold-silver and base metal ores, and there are 2 molybdenum mills, 1 steel mill, 2 uranium-vanadium processing plants, 1 tin and tungsten separating plant, 1 nonferrous metals smelter, and 1 vanadium finishing plant. In non-metallics, there are 3 cement plants, 11 brick plants, 4 perlite expanding plants, 1 gypsum board plant, 1 feldspar, and 1 vermiculite plant.

Although this report is generally optimistic about the health of Colorado's mining industry, the State's base metal sector is seriously depressed.

The Colorado lead-zinc industry has declined significantly with the closures of the Camp Bird mine, Eagle mine, and Idarado mine, and the American Tunnel production loss due to flooding. Although not among the mines closing down, the Leadville Unit (Black Cloud) was forced to temporarily stockpile part of its 1978 output because of the depressed market conditions for lead and zinc. The company is finding it difficult to compete for labor and to meet environmental requirements because prices for its products have not risen in proportion to their costs. Most of the copper, cadmium, silver, and gold produced in Colorado are byproducts of the lead-zinc mines. Nearly \$30 million in gross revenues and 400 jobs have been lost since 1977 because of these mine closures. An additional \$40 million in gross revenues and 800 jobs could be lost if depressed conditions continue. Nonmining people and businesses also have been and will be affected, causing serious dislocations in some local, mostly rural, economies in Colorado. If these closures are long term, the mining companies will be forced to dismantle the affected mines and sell the buildings and equipment. For some mines this could mean that reopening will be very difficult.

There are several reasons for these mine closures. Base metal prices have been depressed and have fluctuated more than 20 percent in the past several years. Although higher gold and silver prices have helped, these metals occur only as small amounts in most base metal ores, and their increased values are not enough to offset the low lead-zinc-copper prices. Much higher smelter and transportation charges have increased the cost of bringing these metals to market.

Daily production at AMAX, Inc.'s, Climax mine in Lake County averaged about 47,000 tons--18,000 tons from the open pit, 21,000 tons from the Storke level, and 8,000 tons from the 600 level--for a total of about 16.5 million tons for the year (fig. 1). Grade of the ore produced runs about 0.30 percent molybdenum disulfide, 0.021 percent tungsten, and 0.006 percent tin. Plant recovery averages about 87 percent of the molybdenum and 26 percent of the tungsten, resulting in a total of about 52 million pounds of molybdenum, 1.8 million pounds of tungsten, and 180,000 pounds of tin produced in the year. Three to five pounds of iron pyrites are also removed per ton of ore processed, most of which ends up in the tailings pond but must be removed before the tungsten can be removed. Added capital investment in the mine in 1978 was about \$15 million. The Mayflower tailings facility, a \$36.5 million



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project, essentially completed this year, has a design capacity of 525 million tons of waste. With the 70 million tons of capacity still in the existing tailings facility, this is expected to carry the mine to the year 2015, or through the 476 million tons of ore reserves believed remaining in the mine. A total of 2,960 persons were employed at the mine as of November 29, 1978, an increase of 196 over December 1977. Just over one-half of these workers live in Leadville; others commute from Buena Vista, Salida, Eagle, elsewhere in Summit County, and some from as far away as metropolitan Denver. Earnings of these workers exceeded \$53 million in 1978.

AMAX, Inc.'s, Henderson molybdenum mine in Clear Creek County increased its productive capacity during 1978 from 8,000 tons per day to 24,000 tons per day with an eventual goal of about 35,000 tons per day by 1983. The mine work force increased about one-third to approximately 1,400 workers. The grade of ore produced is slightly lower than that of the preceding year. A fourth mill section is planned for 1979.

AMAX, Inc., continues to delineate and evaluate a major molybdenum deposit at Mt. Emmons, 2 miles northwest of Crested Butte in Gunnison County. It has been estimated that the deposit contains 165 million tons of ore with an average grade of 0.43 percent molybdenum disulfide, which would make it the third largest molybdenum deposit known. A decision by AMAX to mine the deposit could result in a mine employing 1,200 to 1,300 persons and producing 20,000 tons of ore and 50 tons of molybdenum per day. The deposit underlies public forest land. The scenic attractiveness of the area and the proximity of the deposit to the town of Crested Butte and the Crested Butte ski area have raised environmental and land-use concerns. AMAX is undertaking to conduct its planning in public through the Colorado Review Process, which includes citizens of the area and all levels of government in each stage of development. Location of tailings disposal sites and possible doubling of population of the county are major environmental concerns of residents of the county.

Standard Metal Corp.'s Sunnyside mine, the State's largest gold producer and one of the vein-mining operations not having cash-flow problems, was flooded out on June 4, 1978. An estimated 5 to 10 million gallons of silt- and tailings-laden water poured down through the workings to the American tunnel haulage level into Cement Creek when the lakebed of Lake Emma, which was above the mine at 12,300 feet elevation, collapsed into the present workings and an old stope. Standard had mined to within 85 feet of the bottom of Lake Emma but had ceased that operation pending draining of the lake after the spring runoff. The mine, north of Silverton in Cement Creek Canyon, employs about 200 persons working day and swing shifts, 5 days per week. The flooding occurred on a Sunday when no one was in the workings and resulted in no loss of life. The rush of water blocked the 2-mile-long American tunnel, which enters the mine from Cement Creek at 10,600 feet elevation, and the 1-mile-long Terry tunnel, which enters the mine from Eureka Creek at 11,500 feet elevation. A cleanup work force of about 118 had cleared the Terry tunnel to the top of the Washington incline shaft by yearend 1978 and had cleared out about 10,000 feet of the American tunnel. The full extent of the damage is not yet determined. The main hoisting equipment is completely buried and it

is believed that the Washington shaft timbers are all gone. Most of the mining equipment, including locomotives, ore cars, and digging equipment, however, was unharmed. A potential problem in financing reopening of the mine has apparently been resolved with announcement of a satisfactory claim settlement with the largest insurer of the mine. Broken ore in the mine amounts to 290,000 tons, only 85,000 tons of which are below the F level and likely to be affected by the flood. Cleanup of F level is necessary, however, for haulage access to upper levels. Standard Metals estimates the value of the available broken ore at more than \$20 million at current prices for gold, silver, lead, and zinc. Two-thirds of this value is in gold. Sunnyside mine grossed \$10 million in 1977.

The Idarado Mining Co., a subsidiary of Newmont Mining Corp. and others, closed its Idarado mine, which was located in Ouray and San Miguel Counties. Known by the name Idarado since 1953, it was one of the largest base metal mines in Colorado. Early claims at the site go back as far as 1880, and this closure ends nearly a century of production. The mine was an amalgamation of several old mines, including the Smuggler-Union, Tomboy, and Liberty Bell; it stretched 6-1/2 miles from Red Mountain Pass between Ouray and Silverton to the head of the box canyon that surrounds Telluride. Its headquarters was at Ouray, its mill at Telluride, and concentrates were shipped to Pennsylvania, British Columbia, and Arizona for smelting. The mine will be on indefinite care and maintenance status and its equipment removed. About 20 employees will remain. The mine produced gold, silver, lead, copper, cadmium, and zinc with zinc accounting for 60 percent of its production. Depressed lead and zinc prices and high smelter costs had made the Idarado increasingly unprofitable. The mine had a net loss of \$153,000 in 1976 and \$320,000 in 1977. Attempts to reduce operating expenses by limiting mining to the most accessible ore in the central part of the mine and reducing the work force to 150 were not successful in forestalling closure. In its last profitable year, 1974, the Idarado produced 400,000 tons of ore, employed nearly 500 people, and had a payroll of \$7 million.

The Eagle mine at Gilman, operated by the New Jersey Zinc Co. of Bethlehem, Pa., a subsidiary of Gulf + Western Industries, Inc., considerably reduced its level of operations as of January 1, 1978. Its underground mill has ceased operations and has been partially dismantled. Pyritic ore containing copper, gold, and silver is being direct shipped to the ASARCO smelter at Tacoma, Wash., for processing. Because of the low price for zinc and because the timber mining method used in the mine is too expensive to be competitive, zinc ore reserves in the mine are not being mined. Some diamond-drilling exploration is being conducted underground. The mine is expected to continue at its current 43-employee, 500-ton-per-month level of output.

In other gold and silver activity, Golden Aura announced plans to build an \$8 million, 1,000-ton-per-day mill at Victor in Teller County. It would operate as a custom mill as well as process ore from a mine that Golden Aura has bought in the area. The only other mill in the area that is in working order is a 25-ton-per-day mill owned by Cripple Creek Gold Co. A partnership of Texasgulf, Inc., and Golden Cycle Mining Co. has spent more than \$3.6 million in exploratory drilling, both surface and underground, near Victor; about

6,800 feet of drilling had been completed by the end of June 1978. It has also done some rehabilitation of old mining property. Yellow Gold of Cripple Creek, Inc., recently raised \$500,000 through a public offering to finance exploratory work in the Cripple Creek district and has bought 17 acres of mining property that controls the entrance to the Moffat (Ophelia) tunnel in that district. Gold resources Joint Venture holds the Stratton Properties and is currently producing bullion during the warmer months of the year (approximately April through September).

Chevron Resources Co., a subsidiary of Standard Oil Co. of California, and Minerals Engineering Co. of Denver have been exploring 2,000 acres of patented mining claims including old mine dumps northwest of Creede in Mineral County in search of enough silver for a large open pit mine. The only producing silver property in the area is Homestake Mining Co.'s Bulldog mine, which is one of the largest silver producers in the country. Operating earnings before taxes from the Bulldog mine were \$3.2 million in the first 9 months of 1978 compared with \$2.2 million in the same period of 1977, as the result of both higher average sale prices and a higher volume of production.

The demand for cement strained production facilities in the State in 1978, reflecting a sustained level of new housing activity and increased commercial and industrial construction in Colorado. Prices and levels of production throughout the West and Southwest could continue at near-record levels for the next 3 years (fig. 2).

CF&I Steel Corp. reported total sales of \$475.1 million in 1978, an increase of 8 percent over that of 1977. Net income for the year, however, slipped to \$12.5 million from \$18.6 million the preceding year. This decrease was due to the 111-day coal strike during the year and startup expenses involved in an expansion of the company's rail mill, a 3-year, \$84 million project that has just been completed. CF&I is one of just three steel companies in the country that produce railroad rails. It is the only steel mill in the Nation producing the 82-foot-long rails. Although the standard 39-foot rails are still the most commonly used, there appears to be a trend towards longer rails, which require fewer welds and less handling. Rails accounted for 37 percent of CF&I's production in 1978, and seamless tubing used in the oil industry, 22 percent. CF&I is a fully integrated steel company, producing the raw materials of steel--iron ore, coal, limestone, and dolomite--as well as the finished steel products. The main plant at Pueblo employs 6,000 people. An additional 1,000 are employed in coal, iron ore, and other mines (some of which are in Wyoming and Utah) and other parts of the company's operation. CF&I is 12th in size among steel companies in the Nation, and predominates in the Western United States. During 1978, CF&I's two coal mines in Colorado, the Allen mine and the Maxwell mine, both in the Pueblo area, produced 495,120 tons and 86,883 tons, respectively, compared with 582,257 tons and 32,002 tons in 1977, respectively. Both are union mines and experienced a reduction in output during the 1978 labor strike. Maxwell is a newly developing mine, accounting for the increase in production there. The company's mines in Colorado also produced limestone and dolomite. Ganister (a mixture of ground quartz and fire clay used in lining steel converters) was produced by contract from mines near Canon City. The company purchased iron ore from the Pitkin Iron Corp.'s Cooper mine in Pitkin County.

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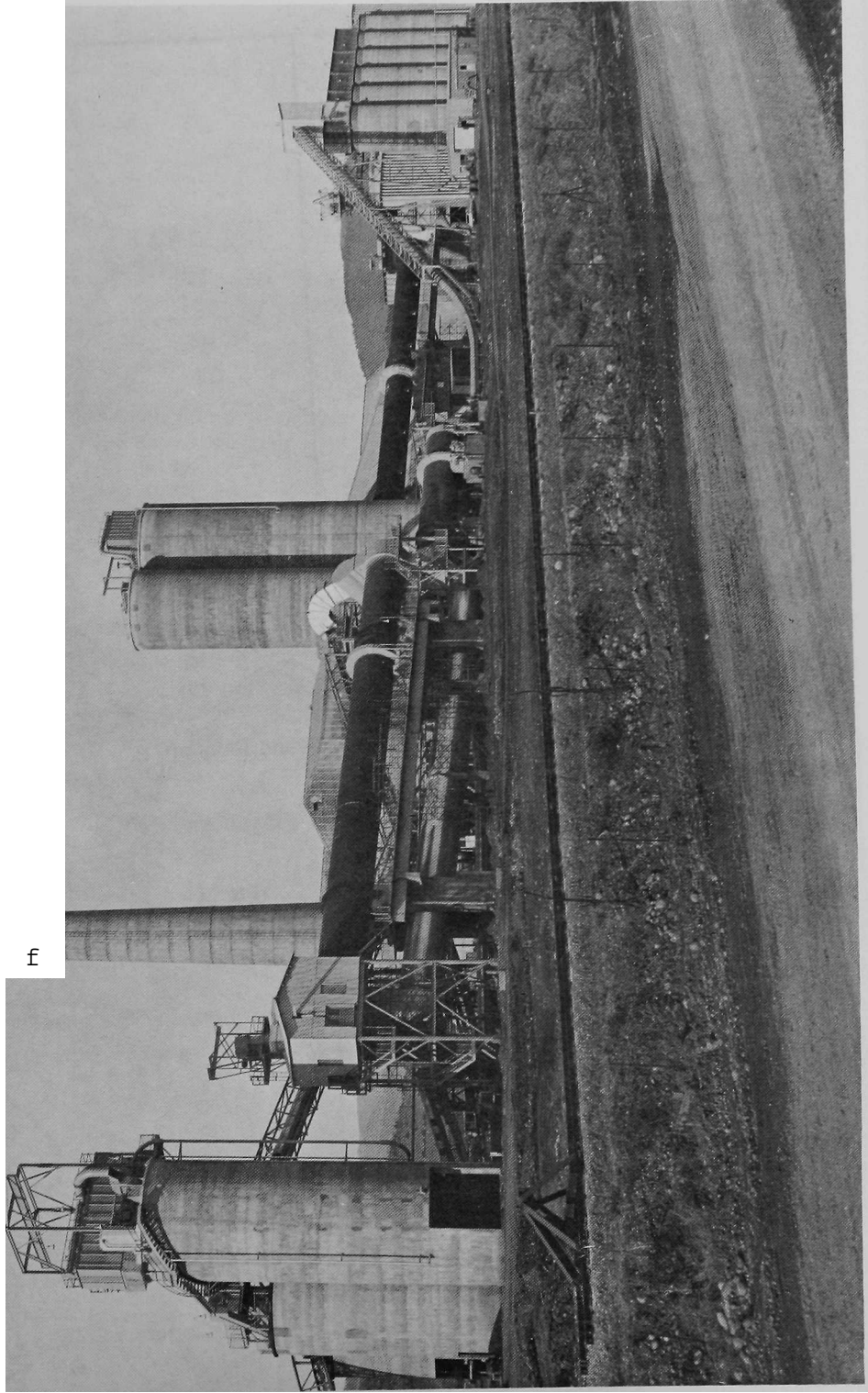
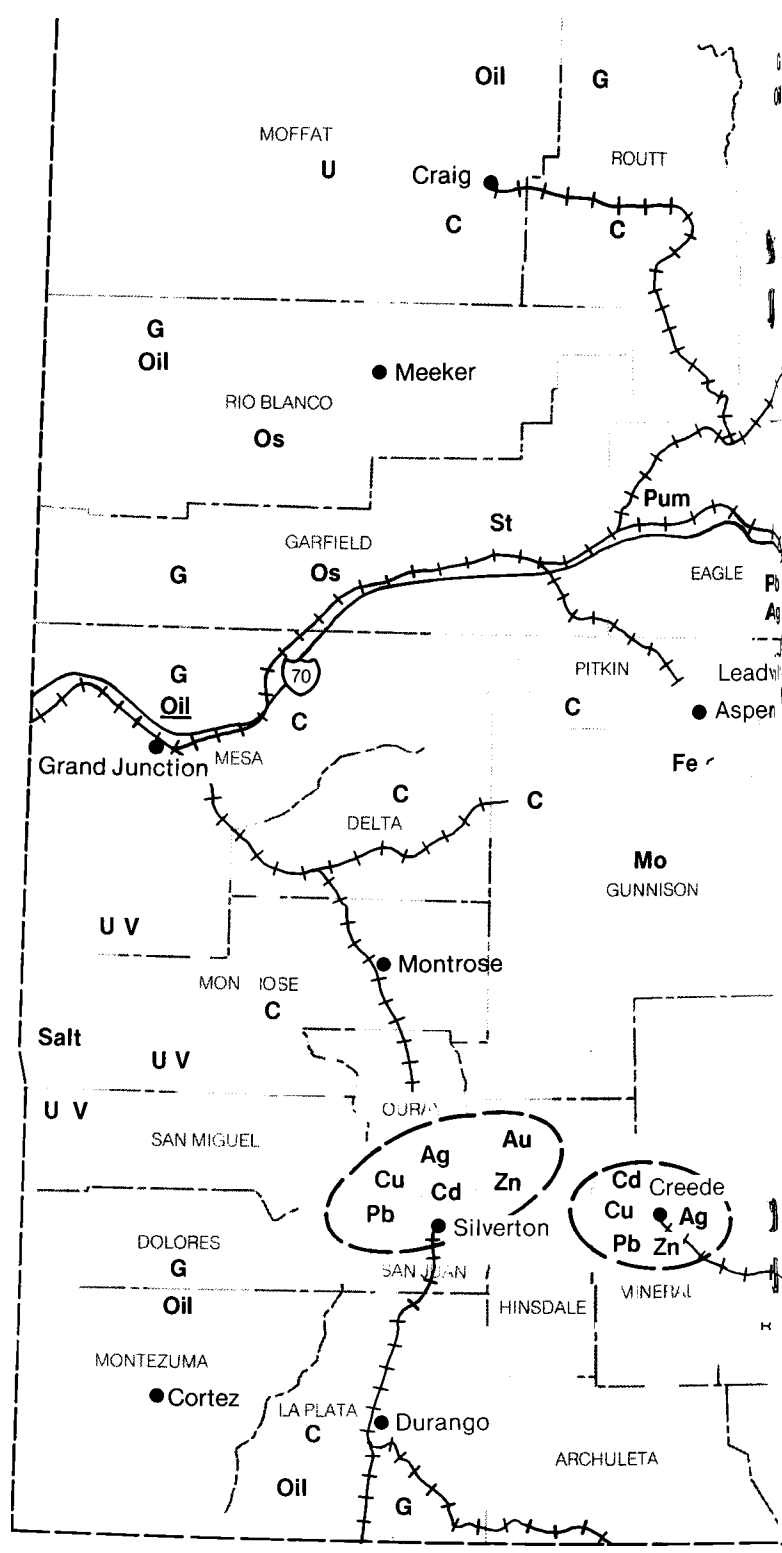


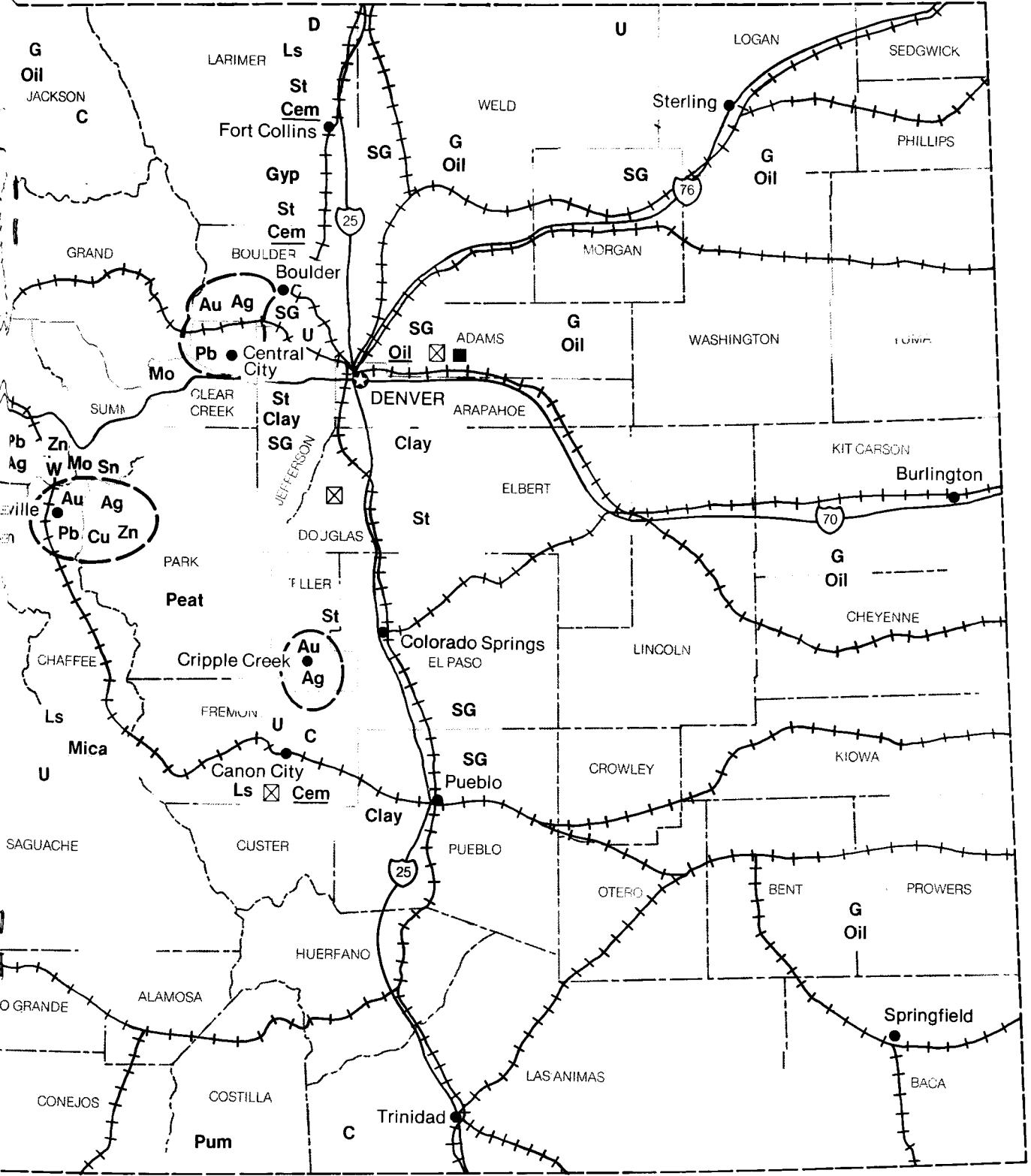
FIGURE 2. - Panoramic view of cement plant, Martin Marietta Cement, Lyons.

LEGEND

- State boundary
- County boundary
- o Capital
- City
- Railroad
- Road
- D Interstate highway
  
- Mineral Symbols**
- Ag Silver ore
- Au Gold ore
- Cd Cadmium
- Cem Cement plant
- Clay Clay
- C Coal
- Cu Copper ore
- D Diamond
- Fe Iron ore
- G Natural gas
- Gyp Gypsum
- LS Limestone
- Mica Mica
- Mo Molybdenum
- Oil Petroleum, crude
- Oil Petroleum products
- Os Oil shale
- Pb Lead
- Peat Peat
- Pum Pumice
- SG Sand and gravel
- Salt Salt
- Sn Tin
- St Stone
- U Uranium ore
- V Vanadium
- W Tungsten ore
- Zn Zinc ore
- Fabricated metals plants
- H Chemical plants and allied products
  
- CZI :> Concentration of mineral operations

0 5 10 20 30 40 50 miles  
 0 5 15 25 35 45 55 65 75 kilometers





Coal deposits underlie 30,000 square miles or about 28 percent of Colorado. Colorado's estimated 230-billion-ton coal resource is 10 percent of the Nation's total. The Colorado Division of Mines estimates the State's 1978 production at 14.4 million tons, a record high production for the State. The previous high production record was 12.6 million tons produced in 1918. Sixteen of Colorado's 63 counties produce coal. Routt County is the largest producer in the State with an estimated 6.2 million tons mined in 1978. Of the 65 coal operations in the State (42 underground, 23 surface), 44 are on record as producing in 1978. About one-half of current production is from surface mines; one-third, from Federal coal leases. Ninety-four percent of the State's coal is judged suitable only for underground mining.

Pitkin County Commissioners have extended special use permits for another year for both the Anschutz and Mid-Continent mines based on reclamation work done by both companies.

Western Associated Coal Corp., a subsidiary of Eastern Gas and Fuel Associates, acquired a one-half interest in a mine now being developed near Carbondale, Garfield County, and expects to produce about 900,000 tons annually by 1984 in a joint venture with Anschutz Coal Corp.

A 123-acre coal strip mine to be operated by the Imperial Coal Co. 2 miles southwest of Dacono has been approved by Weld County Commissioners. It will develop an estimated 1.8 million tons of coal.

Atlantic Richfield Co. may speed up development of its 2.5-million-ton-per-year Mt. Gunnison mine in order to meet the "diligent development" requirements of the mineral leasing laws that require it to mine 2.5 million tons of coal from its Mt. Gunnison leases by 1986.

The Colorado State Board of Land Commissioners has granted a 10-year coal mining lease on 5,600 acres of State land in Las Animas and Huerfano Counties to Mobil Oil Corp.

Grand Mesa Coal Co. has purchased the Holly Sugar Co. property north of Delta intending to convert the 58-year-old sugar beet processing plant into a coal loading facility.

The Colorado State Highway Department estimates that highway, bridge, and underpass improvements necessary to handle increased coal-related traffic within and through the State would cost \$365 million, twice what the Department spent for all highway construction in 1978. It feels that Federal financial assistance is necessary.

The Colorado Department of Natural Resources estimates that 40 percent of the State's western slope energy needs (10 percent of the State total) could be met by geothermal energy. The Colorado Geological Survey has identified 56 areas with hot springs, mostly on the western slope, 30 of which have the potential to produce useful energy. State officials believe the technology to utilize this energy is available now and that the cost would be one-half to one-third that of the cheapest alternate form of energy.

The increase in the price of uranium oxide from \$7 per pound to \$43 per pound between 1974 and 1978 has increased interest in exploration and development of Colorado's uranium resource, much of which occurs in small, scattered deposits that had heretofore been considered unprofitable to mine. Exploration and development drilling for uranium was at an alltime high in 1977 (41 million feet nationwide) with larger amounts projected for 1978 (52.5 million feet). Of land held for uranium exploration and mining in the United States, January 1, 1978, nearly one-fourth was in Colorado. The Department of Energy said that uranium companies spent \$258.1 million looking for uranium nationwide during 1977 (a 51-percent increase over that of 1976) and expected to spend at least \$289 million in 1978.

The Ranchers Exploration and Development Corp. has been producing uranium oxide and vanadium concentrate from a tailings-leaching operation near Naturita in Montrose County since January 1978 and had planned to move its plant to a site near Durango in early 1979 to process some 1.4 million tons of uranium tailings there. The Colorado Department of Health has refused to issue a radioactive materials license because the firm has not resolved health and environmental questions about its proposed operation. Ranchers needed the license by December 31, 1978, to comply with contractual obligations. Consequently, the project is now in doubt. The government plant (under Public Law 95-604) to clean up these wastes, created by production of uranium for the old Atomic Energy Commission between 1942 and 1963, would cost the Federal Government about \$16.2 million and Colorado about \$1.8 million. Cyprus Mines Corp. and Wyoming Mineral Co. are planning to develop a large open pit uranium mine and a mill on Tallahassee Creek 30 miles northwest of Canon City in Fremont County where they have discovered a deposit reportedly containing an estimated 30 million pounds of U308, the largest such discovery to date in Colorado. A local Council of Governments mineral impact study is underway to determine the potential local government involvement that would result from the expected uranium boom in the county. Also near Canon City, the Cotter Corp., a subsidiary of Commonwealth Edison of Chicago, has nearly completed a \$57 million uranium mill. Completion is stalled pending the outcome of environmental questions about a proposed tailings pond. The question remains unresolved whether or not this mill must obtain Colorado Department of Health permits required by legislation that did not go into effect until the mill was partially completed. The Cotter Corp. also operates the Schwartzwalder mine near Golden, Jefferson County, and is developing several uranium mines in Colorado's Uravan belt in Montrose, San Miguel, and Mesa Counties.

Power Resources Corp. of Denver, Aquarius Resources Corp. of Casper, Wyo., and Wyoming Mineral Corp., a subsidiary of Westinghouse Electric Corp., reportedly have defined significant uranium resources in the Pawnee National Grasslands area of Weld County. An application has been filed by the joint venture with the Colorado Health Department to produce up to one-half million pounds per year of uranium yellowcake from a 30-acre site in a 1,400-acre plot near the town of Keota to begin in 1980. An in situ solution mining process is proposed that would eliminate part of the large capital cost, reduce surface disturbance, and eliminate the tailings that result from conventional mining and milling methods. Effect of the process on ground water is not clear. A test of the process is nearing completion near the Weld County



village of Grover. If successful, the process would permit mining of low-grade uranium ore deposits that are not economically minable by other methods.

Public opposition prompted a uranium mining company to withdraw an application for a mineral exploration lease on State-owned land in Boulder County. Boulder County Commissioners have themselves leased the 640-acre site from the State to forestall future mine development and have amended the county land-use regulations to allow underground uranium mines only by special permit.

Lessees are producing uranium from 25,000 acres in the Uravan belt leased to them by the U.S. Department of Energy. Total production from this land is 20,000 to 25,000 tons of ore per month; royalties paid to the government on this ore average \$500,000 to \$600,000 per month.

The draft Environmental Impact Statement on Homestake Mining Co.'s Pitch Project uranium mine in Saguache County has been completed. The Environmental Impact Statement (EIS) was prepared by the Forest Service with the technical assistance of the Nuclear Regulatory Commission after controversy over the necessity of an EIS on the proposed mine. The mine is on a 535-acre tract at 10,000 feet elevation in the Gunnison National Forest. Homestake has mining claims totaling more than 26,000 acres in the vicinity of the mine. On the site of the old Pinnacle mine property, which operated during the 1950's, the Pitch mine is to be an open pit mine about 1 mile long, 1,800 feet wide, and 700 feet deep with a projected mine life of 11 years. The company has received the required operating permits and since August 1978 has been strip-ping overburden at the rate of 300 tons per day with about 450,000 yards of material removed to date. Approximately 1,000 tons of exposed ore has been mined and sent to New Mexico for processing. About 100 wage and salary workers are currently employed. Output of the mine will be limited to 300 tons per day until a proposed mill is built in 1981 at which time production would be increased to the design capacity of 600 tons per day.

Colony Development Operation and Union Oil Co. are asking for Federal, State, and local permits to expand their oil shale developments. Colony is working on a 50,000-barrel-per-day, \$1.1 billion facility, and Union is working on a 9,000-barrel-per-day, \$100 million facility.

Ashland Colorado, Inc., a subsidiary of Ashland Oil, Inc., is withdrawing from its partnership with Occidental Oil Shale, Inc., in developing a 5,000-acre Federal oil shale tract (c-b) in Rio Blanco County. Ashland had a 25-percent participation in the project; the company said withdrawal, effective February 14, 1979, was prompted by the poor profitability outlook for oil shale and the technical, political, and regulatory uncertainties involved. Occidental reportedly indicated that it would continue development of the tract and is prepared to spend \$600 million or more on the project.

A Federal judge dismissed a lawsuit that would have halted work on two Colorado oil shale leases until separate Environmental Impact Statements were prepared. The Department of the Interior prepared a single Environmental Impact Statement in 1973 intended to cover all leases. The two leaseholders, Gulf Oil/Standard Oil of Indiana (C-a) and Ashland Oil/Occidental Petroleum

(C-b), are well along in work on support facilities and shaft-sinking operations on their lease tracts. Occidental Oil Co. has finished pouring a 313-foot concrete headframe over its main production shaft, which will eventually be 34 feet in diameter and 2,000 feet deep. On Logan Creek, about 25 miles southeast of the C-b tract, the collapse of the roof of a 160- by 270-foot underground chamber, or retort, in mid-August has slowed operations at Occidental's oil shale test facility.

Closure of the oil shale research facility at Anvil Points following completion of a Navy contract appears likely unless new Federal money is approved. It would be the third time the facility has closed since it was started after World War II. Paraho Development Corp. has just produced 100,000 barrels of crude shale oil at the facility under a \$10 million Navy contract. This crude oil was shipped to Toledo, Ohio, where it was refined by Standard Oil Co. of Ohio for extensive testing in various Naval uses. The Paraho facility, which is the only one currently capable of producing oil from shale, consists of one semiworks retort 10-1/2 feet in diameter and 60 feet high that can produce 200 barrels of crude oil from shale per day, and one 4-1/2-foot-diameter by 40-foot-high research retort. Paraho presently is presenting proposals to the Department of Energy for money to build one full-size retort 40 feet in diameter as the next step in scaling up its technology to full-scale commercial production which it believes would require 20 to 26 retorts 40 feet in diameter.

Equity Oil Co. of Salt Lake City is preparing to start a 2-year \$7 million test of a new in situ oil shale recovery technique utilizing superheated steam. The Department of Energy is paying 86 percent of the cost of the project in the Piceance Creek basin.

Garfield County Commissioners approved special use permits for Union Oil Co.'s shale oil conversion test plant. The project will utilize an underground room-and-pillar mine to produce and process 10,000 tons of shale and about 9,000 barrels of shale oil daily. Operation of the project would involve about 200 employees with an annual payroll of about \$4 million, and payment of approximately \$2 million annually in local taxes.

Employment in mining in Colorado reached 24,600 in July 1978, 2.4 percent of the total nonagricultural wage and salary employment in Colorado. Of this total, 9,900 were employed in mining metallic minerals, 3,300 in coal, quarrying, and nonmetallics, and 11,400 in petroleum and natural gas. Employment in mining increased 7 percent over July 1977 figures, compared with an increase in total nonagricultural wage and salary employment in Colorado of 4.2 percent. Employment over the year increased 5 percent in metallic minerals, 14 percent in coal, quarrying, and nonmetallics, and 6 percent in petroleum and natural gas. Employment in the mining industry will continue to increase as a result of labor demands from increased activity in production of uranium, coal, and oil shale. As of January 1, 1978, average weekly gross earnings for those employed in mining was \$272 and ranked third in the State after those for construction and communications-utilities. The mineral industry is a source of substantial revenue to State and local governments through payments of bonuses, royalties, and inspection fees, and severance, ad valorem, use, income, and

other taxes. State income derived from Colorado's share of Federal mineral lease revenues and leasing of State school lands for mineral production is shown in table 4.

TABLE 4. - Colorado's income from mineral bonuses, royalties, and grants, thousand dollars

Source	19751	19761	19762	1977	1978
Federal...	34,205	34,453	3,241	315,824	315,250
State . . . .	5,276	5,178	XX	16,H5	17,573
Total	39,481	39,631	3,241	21,939	22,823

XX Not applicable.

•'-Fiscal year July 1 through June 30.

2Transitional quarter July 1, 1976-Sept. 30, 1976.

3Fiscal year Oct. 1-Sept. 30. Reduction from fiscal year 1976 reflects payoff of oil shale leases.

Source: U.S. Bureau of Land Management and Colorado State Board of Land Commissioners.

#### TRENDS AND ISSUES

##### Federal Programs

The Federal Mine Safety and Health Act of 1977 has made sweeping changes in mine inspection and employment training of miners. Under this law, fines are assessed for violations of the Federal regulations. The size of each fine will be based on the past record of companies as judged by a complicated formula. The act requires a detailed training program for all mining personnel. Initial training required is 40 hours for underground personnel and 24 hours for all surface people. Eight hours of retraining must be given to all mine personnel annually. Training for new tasks is also required. All training must have formal lesson plans submitted to and approved by Mine Safety and Health Administration (MSHA) and the State. These courses must be given by MSHA certified instructors.

In late 1978, Interior Secretary Cecil D. Andrus designated 22 schools and universities as State Mining and Mineral Resources and Research Institutes to share \$5.4 million under the Surface Mining Control and Reclamation Act of 1977, which is administered by Interior's newly created Office of Surface Mining (OSM).

The Act provides for annual allotments to one designated institute in each participating State through fiscal year 1984 and for research and scholarship grants to each institute. The institutes are to establish training programs in mining and minerals extraction, and to provide scholarships and fellowships. Each institute initially received a basic grant of \$110,000 and \$160,000 for scholarships and fellowships.

Colorado received \$15.3 million as the State's share of mineral lease royalties on Federal lands in Colorado (50 percent of mineral royalties paid

of Federal lands within its borders) in the fiscal year 1978. This is the third highest such payment to a State.

About 1.8 million acres of Colorado are now classified as wilderness and withdrawn from mineral exploration and development. Of the 14 million acres of National Forest in the State, about 6.5 million acres are classified as roadless areas. These areas, which constitute about 10 percent of the land area of Colorado, are now being reviewed for possible inclusion in the wilderness system under the Forest Service Roadless Area Review and Evaluation Program (RARE II), with as much as 1.9 million acres expected to qualify. The Executive Director of the Colorado Petroleum Association estimates that there is a potential for oil and gas in one-half of the 234 tracts inventoried as roadless areas in Colorado. This could amount to 2 billion barrels of oil and 4.2 trillion cubic feet of natural gas worth \$33 billion at current prices. The Bureau of Land Management is undertaking a similar evaluation of land it manages. The Bureau of Mines is assisting in making a mineral appraisal of these lands.

In January 1978, the U.S. Bureau of Reclamation issued a request for proposals for evaluation of three agency-furnished methods of treating water discharge from the Leadville drainage tunnel into the Upper Arkansas River. The discharge water contains higher than recommended concentrations of zinc, iron, cadmium, manganese, and copper. In October 1978, the Bureau of Reclamation contracted for \$3.5 million in rehabilitation work on the Leadville drainage tunnel including some excavation, concrete lining, bulkhead construction, and construction of a portal structure at the tunnel outlet.

By the end of 1978, the Colorado State Office, Bureau of Land Management, had received 60,000 filings of mining claims in compliance with Federal legislation that requires filing of unpatented claims in Colorado with the State Office. Claimholders were allowed 3 years from October 22, 1976, in which to file. Since a fee of \$5.00 is required with each claim filed, it is likely that large claimholders will wait until the October 22, 1979, deadline before filing. A total of more than 200,000 claims are expected to have been filed when the program is completed.

Public Law 95-604 requires cleanup of radioactive mill tailings in Colorado and eight other States. There are nine locations in Colorado in which there are radioactive wastes left from mining and milling operations of the 1940's and 1950's. The bill requires the Federal Government to pay 90 percent of the cleanup costs, the State 10 percent. Cost to Colorado could be about \$6.4 million. The bill also strengthens Federal and State controls over current uranium mining and milling operations.

Federal coal leasing laws have been amended to permit the Secretary of the Interior to negotiate leases without competitive bids where applications involve rights-of-way through Federal coal land in which small amounts of Federal coal might otherwise be bypassed. Amendments also authorize the Secretary to exchange certain leases and preference rights for other Federal coal lands in areas that are less sensitive environmentally and to lift a ban on women miners working in underground mines on Federal land. Four applicants

in Colorado are affected. A proposed new Federal Coal Management Program designed to meet national coal production needs has been released for industry and public review. A moratorium on Federal coal leasing has been in effect since 1973 pending development of a new coal leasing program.

#### State Legislation and Hearings

Colorado's mineral severance tax which became law on January 1, 1978, is expected to raise \$16 million in 1978, its first fiscal year--\$6.5 million from oil and gas, \$6.1 million from coal, \$3.6 million from molybdenum production. A total of 41 firms pay severance tax in Colorado; five categories of minerals are taxed--oil and gas, coal, molybdenum, shale oil, and other metallic minerals, with only the first three yielding revenue in 1978. The tax on crude oil and gas is 2 percent of the first \$25,000 of gross income, 3 percent on income \$25,000 to \$100,000, 4 percent \$100,000 to \$300,000, 5 percent above \$500,000 gross income. Stripper wells are exempt, and companies get a credit of 87.5 percent on all property taxes paid to local governments. The tax on coal is \$0.60 per ton for coal mined by surface methods and \$0.30 per ton for coal mined by underground methods, with the first 8,000 tons produced in each quarter exempt. The tax changes 1 percent for every 3-point change in the wholesale price index. It is now 61.8 cents per ton for surface mined coal. Underground mines get a 50-percent tax credit. AMAX, the only molybdenum producer, pays 15 cents per ton of molybdenum ore produced. Severance tax receipts are distributed 40 percent to the State's general fund, 15 percent to the severance trust fund, and 45 percent to the local government tax fund.

In other State legislative activity related to mining, this year has been primarily one of updating wording, titles, and other clarification. Legislative action proposed included the following acts:

34-40-121 is a new statute to allow the Colorado Division of Mines to coordinate and maintain a uniform training program in the State. This training will be Mine Safety and Health Administration approved.

34-40-122 details State and Federal coordination in mine safety training.

37-47-103 updates the use and permitting of explosives in Colorado correcting an oversight in existing legislation limiting the Division of Mines authority in issuing permits to use explosives.

34-47-123 imposes fines for failing to submit an annual report to the State Division of Mines.

34-31-101, 102, and 103 are acts pertaining to the private use of eminent domain, local mining on rights-of-way, and accounting for coal removed and rights to survey the tunnel on these easements.

34-43-106 and 114 details transfer of title of patented mining claims and annual assessment procedures to bring them up to Federal standards.

## State Programs

The Colorado Division of Mines is currently assuming a positive role in trying to mitigate some of the costs of the Federal Mine Safety and Health Act of 1977 to operators within Colorado. Small mine operators in particular appear to be in need of help. The Division, under a Federal grant, will be coordinating and contributing tuition payments for the training of miners in local community colleges and vocational-technical schools. Much of the mandatory Federal training can be done in these institutions and a central bank of records will be maintained by the Division to minimize duplicate training and to allow individual miners maximum freedom in transferring between jobs. In addition, the Division is assisting individual mine operators in formulating lesson plans to meet the Federal requirements.

A program started in conjunction with the Federal Government in 1976 and carried on unilaterally by the Colorado Division of Mines is the Program in Accident Reduction (PAR). Various high accident rate operations have voluntarily allowed studies of their operations. The findings are reviewed with management and labor. Periodic followup visits are made to monitor progress. To date, these study operations have shown an overall 55-percent reduction in lost-time accidents. Another fringe benefit of the program is special understanding of operator and labor problems that enables the Division to be a better partner in preventing accidents and at the same time gives the operators and labor a better understanding of the functions of the Division of Mines.

Records of most former mine operations and a variety of other information are available to the public at the Colorado Division of Mines office and are widely used by the public.

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Box 25425 Federal Center  
Denver, Colo. 80225

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1526 Cole Blvd. at W. Colfax Ave.  
Golden, Colo. 80225

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Washington, D.C. 20402

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State Board of Land Commissioners  
1313 Sherman St.  
Denver, Colo. 80203

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Colorado Oil and Gas Conservation  
Commission  
1313 Sherman St.  
Denver, Colo. 80203



As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

