

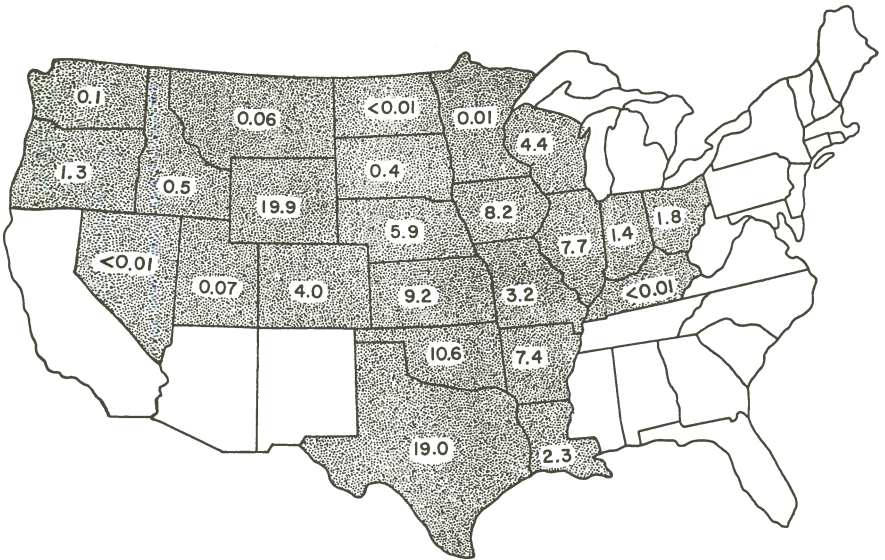
THE GEOLOGICAL SURVEY OF WYOMING

Gary B. Glass, State Geologist

Volume 1, number 4

December, 1983

MINERALS OUTLOOK FOR WYOMING



1982 Markets for Wyoming Coal

Laramie, Wyoming

1983

INFORMATION CIRCULAR

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Front cover illustration: Markets for Wyoming coal in 1982. Each state is annotated with the tonnage of Wyoming coal it received (all tonnages in millions of tons). The map was adapted from statistics in U.S. Department of Energy's Energy Information Administration Report DOE/EIA-0118 (82), 1983. Wyoming's 1982 coal production was 108 million tons.

MINERALS OUTLOOK FOR WYOMING

December, 1983

OVERVIEW

by Gary B. Glass, State Geologist

The year-end news is not so bad. Oil and gas drilling in Wyoming continues to increase after a sluggish start in early 1983, and as anticipated earlier, the first seven months' production of natural gas in 1983 is 8 percent above last year. The real surprise is trona. Due to significant production increases in August, September, and October, 1983 trona production is now forecast to actually exceed the 10.1 million tons mined in 1982. Earlier forecasts, which were based on the first half of the year, suggested trona production might decline to 8.7 million tons in 1983.

Coal production is still holding a course slightly above last year, but if it does exceed the 108 million tons mined in 1982, it won't be by much. Although reported monthly deliveries to power plants are 5.5 percent above last year, unreported tonnages which are mostly industrial and small power plant contracts are expected to fall short of the 4.8 million tons in that category in 1982. This prognosis is based on mine closures and production cutbacks announced by the mines that generally account for the smaller contracts.

Uranium and iron ore production, on the other hand, have deteriorated even further, and oil

production was running about one percent below 1982 at mid-year. Another uranium mine and mill closed in November, and the State's last iron ore mine appears all but closed, permanently.

Current price indicators suggest that the 1983 wellhead price for natural gas may increase 10-15 cents per MCF over last year, but oil prices may be \$2.00 or more below the average wellhead price of 1982. New coal prices and renegotiated contract prices are substantially below previous years, and soda ash prices are falling. Uranium prices, meanwhile, are increasing slightly or holding steady.

The forecast for 1984 mineral production is looking more optimistic than 1983. Oil, natural gas, coal, and trona production are all expected to exceed 1983 levels. No resumption of iron ore mining is expected, and uranium production will likely be little more than one million tons. See forecasts on pages 15, 25 and 26.

Recent Federal leasing actions will have an impact on mineral activities in 1984. In fact, leasing activities on Federal lands have ground to a near halt with the imposition of moratoriums on both Federal coal leasing and the Federal oil and gas lease lottery. The coal leasing moratorium was imposed several months ago while the Commission on Fair Market Value Policy for Federal Coal Leasing (Linowes Panel) investigated the Department of the Interior's coal leasing practices. Although public comments on the Panel's draft findings are due by the middle of December, a final report is not expected until sometime early next year. Meanwhile the moratorium will remain in effect.

Similarly, the six-week suspension of the Federal oil and gas lease lottery, which was to expire at the end of November, will continue into 1984. Federal officials are now indicating the moratorium may be extended several more months in Wyoming due to a large backlog in geologic and mineral evaluations of tracts. There is little, if any, enthusiasm among the independent and major oil companies for continuing the suspension.

METALS AND PRECIOUS STONES

by W. Dan Hausel, Deputy Director

Now that winter has set in, exploration for metals and diamonds in the State of Wyoming has "cooled" down. But Wyoming has numerous metal deposits that are enticing to the exploration geologist, and will again attract many mining companies in the upcoming 1984 field season. How much exploration and activity will largely depend on precious metal prices. If gold stabilizes at about \$400 an ounce, Wyoming should continue to receive a fair amount of exploration activity. If the price of gold should rise near \$450 an ounce, activity should show significant increases; but if the price remains below \$400 an ounce, exploration activity will decline in response to lower prices.

For Wyoming's iron ore mining industry, 1983 was a disastrous year. U.S. Steel Corporation suspended mining operations at its Atlantic City open pit iron mine, citing the costs of labor, utilities, transportation, taxes, and royalties as being too high to continue mining operations south of Lander. While in full operation, the

Atlantic City Mine employed more than 400 people and extracted five million tons of iron ore per year. The mine was developed on a structurally thickened, oxide facies taconite within the South Pass greenstone belt.

In the Hartville Uplift, on the eastern side of the State, Colorado Fuel and Iron Company (C.F.&I.) began removing mining equipment and reportedly initiated flooding of the lower workings of its underground iron ore mine. The Sunrise Mine produced about five hundred thousand tons of ore per year prior to suspension of operations in 1980. This new activity suggests that mining operations will not resume for quite some time, if ever again. The iron ore at Sunrise occurs in an Archean hematite schist (Silver Springs Schist) which was folded into an east plunging synform. The iron-rich schist was about 500 to 2,100 feet in horizontal dimensions and continued to a depth of nearly 1,000 feet. Mining ceased at a depth of about 700 feet with at least 10 years of reserves remaining in place.

Gold West Corporation recently received tentative approval from the U.S. Forest Service to open a placer gold mine, pending approval from the Wyoming Department of Environmental Quality (DEQ). If DEQ grants the necessary mining permit, Gold West reports that they will begin operations along Cottonwood Creek about 25 miles east of Jackson. The permit would allow the company to process about 500 cubic yards of gravel per day. Gold West would remove precious metals with gold washers and vibrator separators.

Other placer gold operations continued throughout the summer and fall in the South Pass greenstone belt at the southern tip of the Wind

River Range along with some underground exploration at the Carrisa, Mary Ellen, and Saint Louis mines. Freeport Exploration received a dozing exploration permit from DEQ for their exploration activities near the historic Miners Delight Mine. The majority of the mines in the South Pass District were developed in quartz veins and shear zones along a northeasterly trending metagabbro. Some production estimates suggest that as much as 325,000 ounces of gold were mined from this district in the past. Additional activity in the South Pass greenstone belt included sampling programs by a number of mining firms as well as sampling and underground mapping by the Geological Survey of Wyoming. Interested persons may contact Dan Hausel at the Geological Survey of Wyoming, Box 3008, University Station, Laramie, Wyoming 82071 for available information and maps of this district produced by the Survey.

Exxon Minerals continued limited exploration activities in their newly acquired Ferris-Haggarty property in the Sierra Madre range of Carbon County. The Ferris-Haggarty Mine was a world class deposit during the early 1900's because of its high-grade copper ore (sometimes running as high as 15 to 20 percent copper). It had a 15-mile long tramway, which hauled ore from the mine to a mill and smelter constructed at Riverside, Wyoming. Much of the ore mined from the Ferris-Haggarty was high-grade, epigenetic, fracture fill ore in a chlorite- to muscovite-quartzite. The ore was emplaced along the contact with an overlying impermeable schist in the hanging wall. Exxon was possibly attracted to the mine because much of the low-grade ore was left untouched by the early miners. This low-grade ore could run as high as 1 or 2 percent copper and possibly carry traces of silver

and gold. Also of interest, samples collected by the Geological Survey of Wyoming several years ago, as well as thin-sections made from those rocks, suggest that much of the ore was probably stratiform, or syngenetic, and was partially remobilized into fractures and veins. Historic mine reports indicate that the quartzite may have been mineralized over a thickness of at least 30 feet.

In the Bradley Peak area of the Seminoe greenstone belt to the north of Sinclair, Wyoming, Timberline Minerals continued exploration of their gold deposit. Work this fall included the opening of the historic Penn gold mines as well as core drilling. Visible gold, in this area, has been observed in quartz veins, metagabbros, iron formations, and talc-rich exhalite. Additional information on this deposit was published in the 1983 Colorado Mining Association Yearbook in a paper entitled, *Metallogeny of some Wyoming deposits*.

Exploration for diamondiferous kimberlite continues. The Cominco American-Chevron Minerals joint venture as well as Superior Minerals explored the Colorado-Wyoming kimberlite province. The Geological Survey of Wyoming continued stream sediment sampling and sample processing in the Laramie Range of Wyoming, and conducted research in cooperation with the University of Wyoming's Remote Sensing group of the Geology Department for applications of remote sensing imagery in kimberlite exploration.

The State of Wyoming is host to many mineral deposits that have and will still receive exploration interest in the upcoming years. Copper Mountain, north of Shoshoni, received a fair amount of interest by exploration companies this past summer. In addition to mining company in-

terest, the Geological Survey of Wyoming conducted regional reconnaissance mapping (1:24,000 scale) as well as detailed surface mapping (1:7,000 scale) and underground mine mapping (1:120 scale) of the three major mineralized areas (Gold Nugget, McGraw, and DePass mines). The Copper Mountain region has a number of potential ore deposits.










The southern Sierra Madre and the Mullen Creek-Nash Fork shear zone of the central Sierra Madre range, have a number of stratiform, exhalative, massive sulfide deposits. One such deposit was explored and drilled by Conoco Minerals in 1979. After the property was dropped by Conoco, Timberline Minerals staked the zinc-copper massive sulfide deposit in 1983.

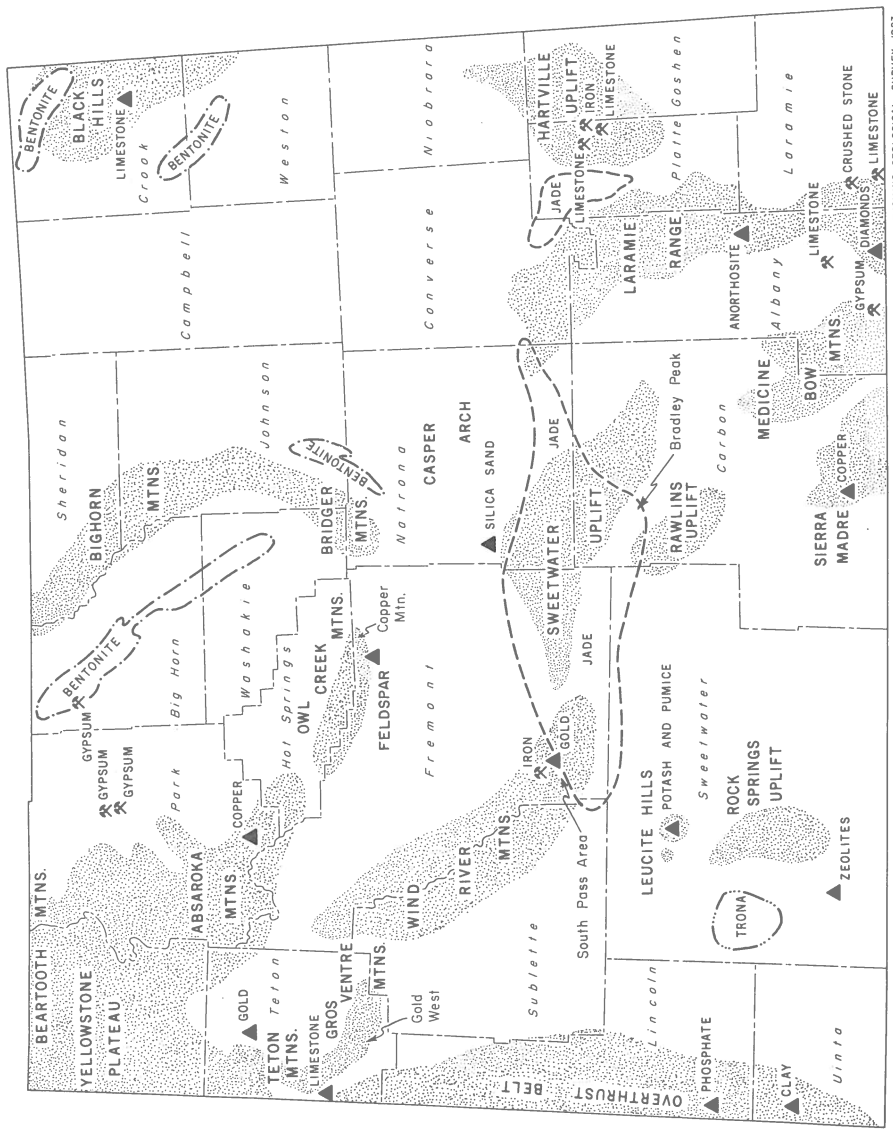
Similar exhalative base and precious metal deposits may also occur in the Hartville Uplift. The historic Michigan Mine in the central Hartville Uplift, has the appearance of an exhalative iron formation that is stained with copper silicates and stratigraphically overlain by a chemically precipitated chert.

Another region that is bound to attract attention is the Overthrust Belt of western Wyoming. Red bed copper-zinc-silver deposits are known in Pennsylvanian-Permian and Jurassic sandstones. The Phosphoria Formation must be considered seriously for its potential for hosting noseum¹ microscopic gold-silver deposits.

¹ *Noseum* refers to deposits which are not detectable with the naked eye.

EXPLANATION

-  Mines and quarries
-  BENTONITE
-  Bentonite mining district
-  (TRONA)
-  Trona mining district
-  Localities
-  (JADE)
-  Jade collecting areas
-  Uplifted areas



SELECTED MINERAL AND ROCK OCCURRENCES

WYOMING GEOLOGICAL SURVEY, 1983

In summary, the potential for the discovery of commercial metal deposits in Wyoming is high, but such discoveries will await the right exploration and economic climate. Incidentally, only a few of the more interesting mineral deposits were highlighted in this outlook article.

URANIUM AND INDUSTRIAL MINERALS

by Ray E. Harris, Uranium and Industrial Minerals Geologist

Uranium

Union Carbide, Wyoming's oldest major producer of refined uranium oxide, announced in November that it was closing its Gas Hills operations (mines and mill complex) indefinitely. Union Carbide has mined uranium in the Gas Hills since 1960. The layoff affects over 100 workers.

The closure of Union Carbide's Gas Hills operations is the fourteenth uranium mine closure in Wyoming since 1979. Wyoming still has five operating uranium mines and mills, down from 17 in 1978. See map on page 10.

Trona

Wyoming's trona industry is operating at 75 percent capacity, compared to 73 percent one year ago, and to a high of 90 percent three years ago. The price of soda ash (refined trona) has been cut by one major producer from \$84 to \$69 per ton. Industry officials cite layoffs and the increased use of plastic substituting for glass

EXPLANATION



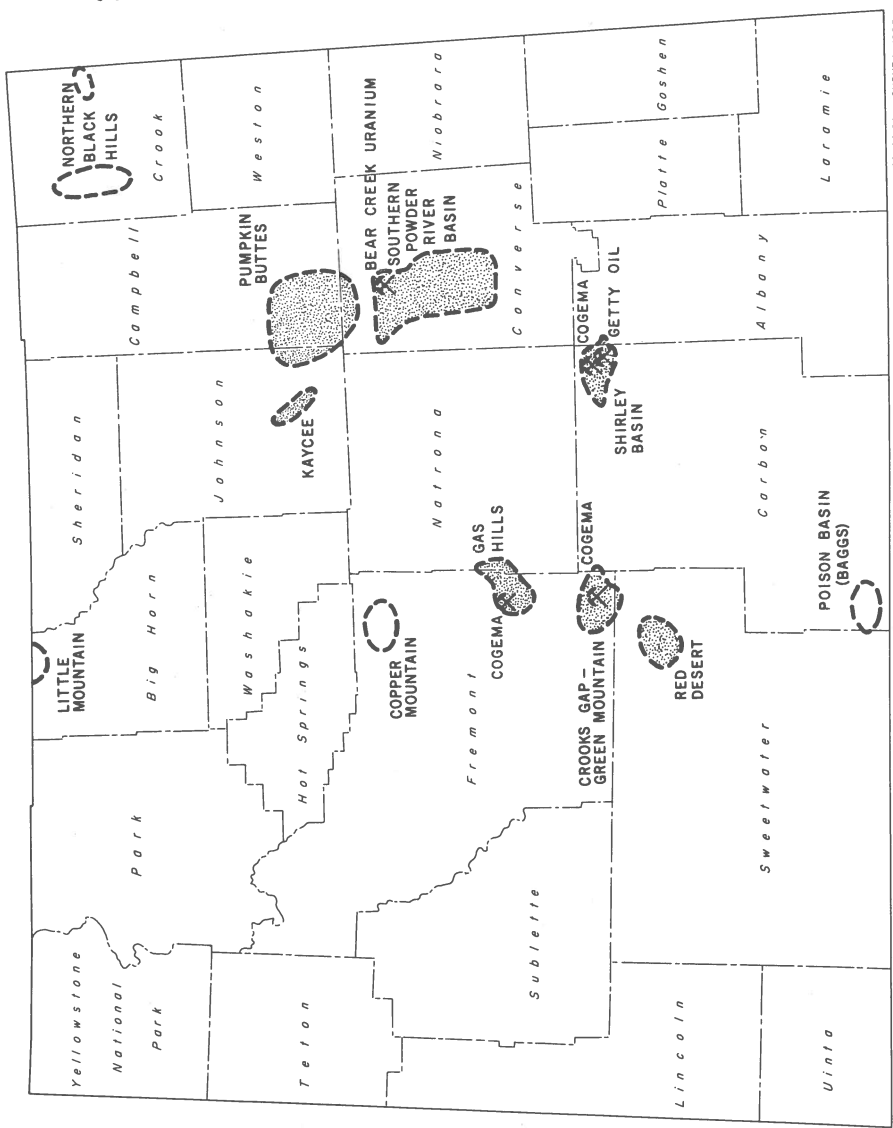
Uranium district with active or recent mining



Uranium district without recent mining



Active Uranium mine December, 1983



WYOMING GEOLOGICAL SURVEY, 1983

MAJOR ACTIVE AND INACTIVE URANIUM DISTRICTS

in containers as signs the industry is in trouble. Industry surveys by the U.S. Bureau of Mines, however, indicate that although the use of plastics is indeed hurting the industry, exports have increased 24 percent over last year (218,000 tons were exported in June 1983, 18.3 percent of the total production of soda ash). This increase apparently reflects a very slight positive trend for Wyoming's trona industry. Production in 1983 should show a slight increase over 1982, which was the worst year of the recession. See forecast on page 25.

Gypsum and Limestone

Gypsum and limestone production this past Fall quarter increased slightly over the same period last year, reflecting general economic trends.

Sand and Gravel

Sand and gravel production remains high, particularly in east-central Wyoming due to the construction and upgrading of the Chicago and North Western Railroad's new branch line right-of-way.

Bentonite

Bentonite production in 1983 should exceed 1982's low figure of 2,345,914 tons. Most of the increase in production is for foundry clay for making castings. Specialty uses and the demand for taconite pelletizing clay are also increasing. These uses reflect the general economic improvement. There is only slight improvement, however, in the demand for ben-

tonite for drilling mud, reflecting only slight increases in oil and gas well drilling, which in 1982 accounted for about 50 percent of the total bentonite sales. Drilling mud should account for less than half of 1983 bentonite sales. Bentonite should continue to show improvement during the last quarter of 1983 and the first quarter of 1984.

COAL

by Richard W. Jones, Coal Geologist

Coal production for Wyoming in 1983 is forecast at 108 million tons, which is the same as 1982. Production from the Powder River Basin, which has been increasing at the annual rate of 12 percent for the last two years, is not expected to increase more than 5 percent over last year's production. This modest increase in the Powder River Basin will probably offset projected production decreases in other parts of Wyoming. If Wyoming's coal production does remain at or even exceed 108 million tons, there is a good possibility that the State might become the second largest coal-producing state in the United States for 1983. West Virginia, traditionally ranked second behind Kentucky, has reported that their coal production for the first half of 1983 has dropped almost 16 million tons from last year and that there is little hope for improvement the rest of the year. Wyoming's coal production in 1982 was only about 20 million tons less than West Virginia's.

The Wyoming Geological Survey's forecasts for contracted production have been reduced from last year's forecasts to reflect deferred or cancelled deliveries on existing contracts, postponement or delays in construction of new power plants planning to use Wyoming coal, and by power plants switching to other fuel sources, such as Texas lignite. See forecast on page 15.

The sluggish coal market is even affecting coal mines in the Powder River Basin. In October, Thunder Basin Coal Company announced that in a cost-cutting reorganization of their mines, they were cutting back production at their newly opened Coal Creek mine and increasing production by an equal amount at the Black Thunder mine. The company also announced the layoff of fifty managers and technicians. This is the first time that layoffs in the coal industry affected Campbell County mines in over ten years. A more encouraging development occurred in Converse County early in November when Glenrock Coal Company announced that coal demand at the Dave Johnston plant had increased. Consequently, the mine's employees had returned to a 40-hour work week after being on a 32-hour work week since May.

The September Federal coal lease sale of tracts in the Fort Union region of Montana and North Dakota was recently declared invalid when a Federal district court issued a preliminary injunction forbidding the U.S. Department of Interior from issuing the leases. Some analysts say that the lease sale was not very successful, in that no bids were received on new production tracts and only single bids were received on the maintenance tracts.

Also in September, the U.S. House and Senate voted to place a moratorium on any further Fed-

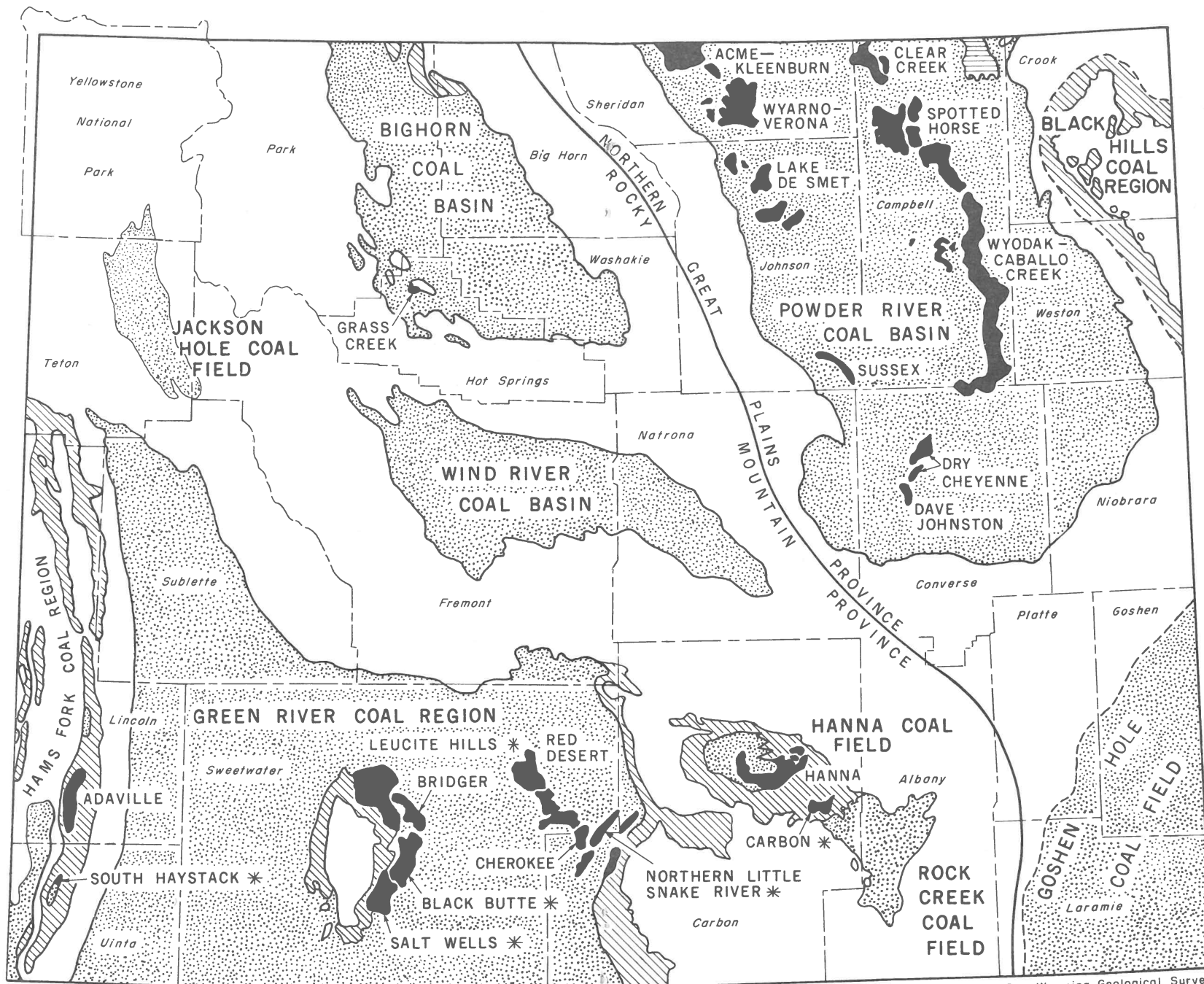
eral coal leasing until 90 days after issuance of a report to Congress on the leasing program. This report, which is due by the end of January 1984, is being prepared by the Commission on Fair Market Value Policy for Federal Coal Leasing (made famous by former Secretary of the Interior Jim Watt's controversial remark about the make-up of the commission's members). The commission has completed its four-month review of the Federal leasing program, and their report is expected to have significant impact on the current Federal leasing program and possibly an impact on the calculation and distribution of Federal royalties that Wyoming and other states receive from Federal leases.

In coal transportation news, Burlington Northern (BN) and the Chicago and North Western (C&NW) railroads' 10-year battle for joint ownership of a railroad out of the Powder River Basin is apparently over. In October, BN accepted a Federal order allowing C&NW to buy half-interest in the 93-mile rail line that was constructed by BN in 1977. The two railroads signed a 99-year agreement to share the rail line after BN dropped its U.S. Supreme Court appeal of the Interstate Commerce Commission's decision on the price (\$76 million) and terms of the sale. Although the two railroads will share the same rail line, competition between the two for new coal hauling contracts is keen: in mid-November, BN won a major contract with Cajun Electric Power Cooperative for coal deliveries from Shell Oil and Kerr-McGee Corporation mines in Wyoming to power plants in Louisiana. BN was forced to cut its current freight rates in order to compete with C&NW. Cajun hopes to save its consumers about \$500 million in freight rates over the next 15 years.

WYOMING COAL PRODUCTION FORECAST TO 1990 (MILLIONS OF TONS)

	1981 ¹	1982 ¹	1983	1984	1985	1986	1987	1988	1989	1990
Campbell County	71.6	81.2	85.9	92.2	103.2	110.5	117.2	112.0	122.8	123.8
Converse County	3.6	3.4	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Sheridan County	2.8	3.0	2.7	2.2	2.2	2.2	2.5	3.0	3.0	3.0
Carbon County	8.5	5.0	4.0	4.6	4.6	3.7	3.8	5.1	5.6	5.6
Sweetwater County	11.2	11.0	8.1	7.6	8.1	9.1	9.1	11.0	11.0	11.0
Lincoln County	5.0	4.3	4.0	4.1	4.4	4.6	4.9	5.2	5.2	5.2
Hot Springs County	M ²	M	M	M	M	M	M	M	M	M
Total Wyoming	102.8	107.9	108.0	114.0	125.8	134.4	141.8	149.6	150.9	151.9
Increase per year	9%	5%	-0-	5%	9%	6%	5%	5%	1%	1%
Estimated contracted production	110.0	119.0	122.6	128.6	137.1	142.6	147.6	149.6	150.9	151.9
Below contracts	7%	9%	12%	11%	8%	6%	4%	-0-	-0-	-0-

¹These are actual values for comparison. ²M means minor tonnage (less than 0.1 million tons). Forecast by Wyoming Geological Survey, September, 1983.



The Wyoming Geological Survey
1983

 Subbituminous

 Bituminous

 Lignite

 Strippable Deposits

* Preliminary: based on company data

Coal slurry pipelines suffered another setback in September when the U.S. House of Representatives overwhelmingly defeated legislation that would have given coal slurry pipeline companies the power of Federal eminent domain, a power previously granted to railroads and now granted to natural gas pipelines. Coal slurry proponents argue that this power is necessary to construct an alternative coal transportation system, in that it would allow them access across property owned by railroads and other recalcitrant landowners along a pipeline right-of-way.

OIL AND GAS

by Alan J. VerPloeg, Petroleum Geologist

As of December 1st, the Wyoming rig count had climbed to 137, indicating continued upswing in industry activity within the State. The total was 113 in early September. A Uni-oil Company discovery, approximately 16 miles northeast of Cheyenne, along with an earlier Amoco discovery are apparently stimulating interest in the Wyoming portion of the Denver Basin. Unioil's wildcat flowed oil at the rate of 865 barrels per day from the Upper Cretaceous Niobrara Shale. However, the major thrust of the current upswing continues to be in the Powder River Basin.

Oil and gas production figures recently released by the Oil and Gas Conservation Commission, indicate a 2.9 percent decline in oil production in 1982 and a 2.2 percent increase in natural gas production. Oil production de-

EXPLANATION



Major Wyoming Basins



Oil shale occurrences



Oil and gas pipeline corridors



Refineries



1981 Oil and gas field discoveries



Oil field with cumulative production¹ greater than 100 million barrels



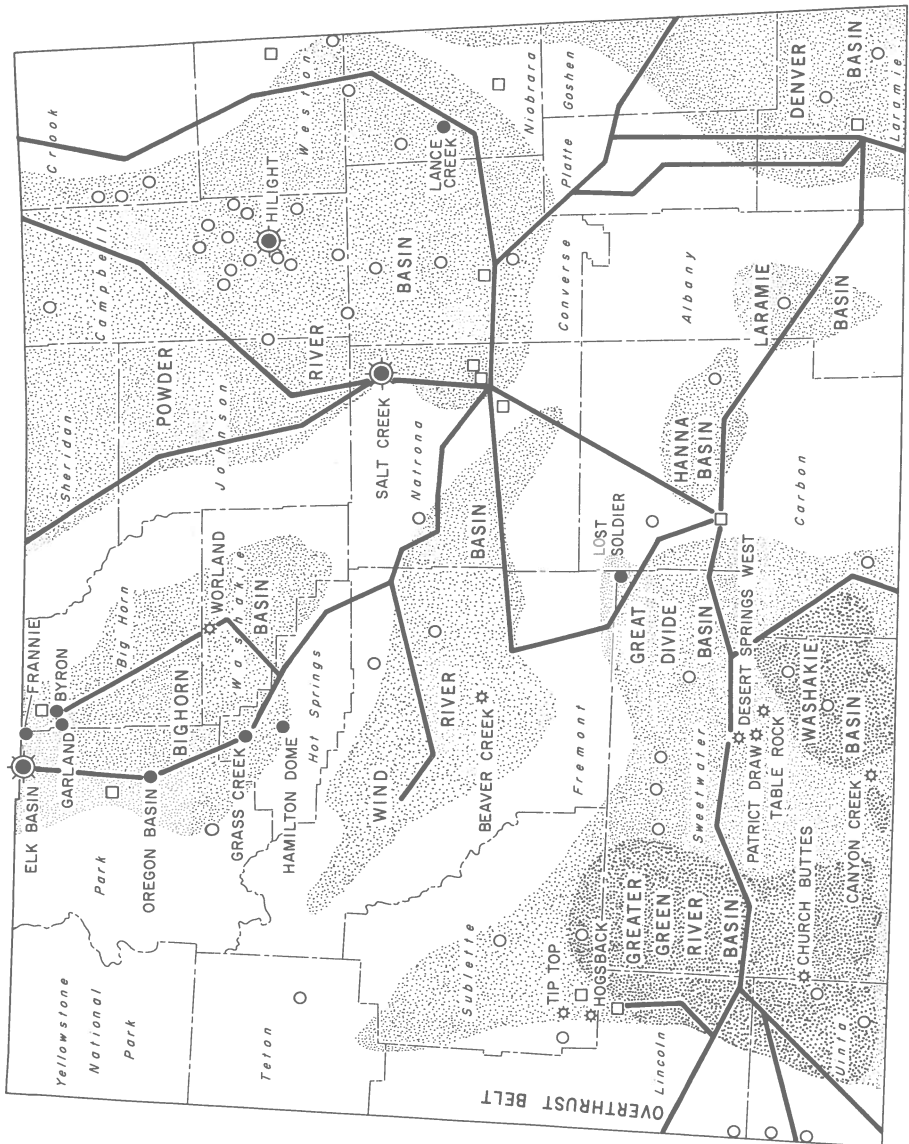
Gas field with cumulative production¹ greater than 200 billion cubic feet



Oil and gas field with cumulative production¹ greater than 100 million barrels and cumulative production of gas greater than 200 billion cubic feet

¹ CUMULATIVE PRODUCTION IS THROUGH 1981

² CUMULATIVE OIL PRODUCTION OF HIGHLIGHT THROUGH 1981



WYOMING GEOLOGICAL SURVEY, 1983

GENERALIZED OIL AND GAS INDEX MAP OF WYOMING

creased to 118,715,785 barrels in 1982, as compared to 122,173,818 barrels in 1981. Gas production rose from 455,352,540 MCF in 1981, to 465,142,140 MCF in 1982. While there are over 1,000 fields in Wyoming, more than 60 percent of the State's oil and gas production comes from 20 large fields. In terms of annual production, the three largest oil fields in the State are Oregon Basin (8,985,327 barrels), Salt Creek (5,495,362 barrels), and Painter Reservoir (5,083,000 barrels). The three largest gas producers were Painter Reservoir (29.6 billion cubic feet), Brady (21.8 billion cubic feet), and Madden 16.76 billion cubic feet).

U.S. Department of Energy's estimates of proven reserves for Wyoming were released in August. Oil reserves increased from 840 million barrels in 1981 to 856 million barrels in 1982. Gas reserves jumped from 9,659 billion cubic feet in 1981 to 10,155 billion cubic feet in 1982. Other resource and reserve estimates are tabulated on pages 28 through 31.

Drilling and completion statistics for 1982 were published for Wyoming in the October 1983 issue of the American Association of Petroleum Geologist's Bulletin, Volume 67, no. 10, p. 1618, and are reproduced as Tables 1-3 of this outlook article. Wyoming remained the most active state in the Rocky Mountain area with the drilling of 2,062 exploratory and development wells. The Powder River Basin remained the most active basin in the State with 363 exploratory wells drilled as compared to 79 wells completed in the second most active basin, the Green River Basin. However, the Green River Basin showed the best percentage of success at 53.2 percent. Also, overall activity has increased in the State in

terms of exploratory wells drilled (664), and a continuing trend toward deeper drilling is indicated (average depth 8,410 feet).

Another item with potential consequences for petroleum exploration is the Wyoming Oil and Gas Conservation Commission's proposed new seismic rules (Rule 339). Frustrated by persistent poor compliance with existing rules for seismic shot hole plugging and its concern for protecting shallow aquifers, the Commission has proposed a ban on drilling holes for the detonation of explosives unless an operator demonstrates (1) that the data cannot be obtained by an alternative seismic technique, (2) that the data is not available from another operator, (3) that the person paying for the seismic exploration has the right to drill on the explored lands, and (4) that the person paying for the seismic exploration agrees to make the basic data available to other bonafide parties on terms that are just and equitable, to accept full liability for all damages associated with the exploration, and to comply fully with the Commission's rules governing such operations.

The first public hearing on the proposed revision of Rule 339 is set for the regular January 1984 hearing in Casper, at which time numerous comments on the revised rule and proposals for alternative rules are expected. The Commission last revised Rule 339 in May of 1983 when it required the bonding of seismic hole plugging companies in addition to the seismic companies. Then in October, the Commission fined a seismic operator \$7,000 for the improper plugging of fourteen holes. This was the first fine levied by the Commission.

Table 1. Completion Summary, Northern Rockies, 1982

	Oil	Gas	Dry	Total	% Suc- cess
Exploratory wells					
Wyoming	107	60	497	664	25.2
Idaho	0	0	5	5	0.0
Montana	77	39	312	428	27.1
North Dakota	153	20	275	448	28.6
South Dakota	3	0	32	35	8.6
Total	<u>340</u>	<u>119</u>	<u>1,121</u>	<u>1,580</u>	29.1
Development wells					
Wyoming	1,089		309	1,398	77.9
Idaho	0		0	0	0
Montana	556		199	755	73.6
North Dakota	275		93	368	74.7
South Dakota	32		3	35	91.4
Total	<u>1,952</u>		<u>604</u>	<u>2,556</u>	76.4

From: American Association of Petroleum Geologists
 Bulletin, Volume 67, no. 10, 1983, p. 1618.

Table 2. Wyoming Completion Summary, 1982

	Oil	Gas	Dry	Total	% Suc- cess
Exploratory wells					
Powder River Basin	78	1	284	363	21.8
Green River Basin	4	38	37	79	53.2
Bighorn Basin	6	4	31	41	24.4
Overthrust Belt	5	9	60	74	18.9
Wind River Basin	3	4	30	37	18.9
Denver Basin	7	0	34	41	17.1
Laramie-Hanna Basin	4	4	21	29	27.6
Total	<u>107</u>	<u>60</u>	<u>497</u>	<u>664</u>	25.2
Development Wells	1,089		309	1,398	77.9

From: American Association of Petroleum Geologists
 Bulletin, Volume 67, no. 10, 1983, p. 1618

Table 3. Wyoming Activity Summary, 1976 to 1982.

	1976	1977	1978	1979	1980	1981	1982
Total exploratory wells	338	463	477	379	412	575	664
Footage (million feet)	2.3	3.5	3.9	3.2	3.5	4.6	5.6
Average depth (feet)	1,195	7,845	8,269	8,540	8,499	7,958	8,410
Total all wells	975	1,295	1,382	1,334	1,407	1,705	2,062
Footage (million feet)	7.0	9.5	9.7	9.1	10.8	12.1	15.2
Average depth (feet)	7,114	7,322	7,000	6,787	7,667	7,104	7,183

From: American Association of Petroleum Geologists Bulletin, Volume 67, no. 10, 1983, p. 1618.

WYOMING URANIUM PRODUCTION FORECAST TO 1990¹

Calendar Year	Gross Uranium Production (millions of tons)
*1981	4.6
*1982	2.1
1983	1.6
1984	1.0
1985	0.8
1986	0.8
1987	0.9
1988	0.9
1989	1.0
1990	1.3

*These are actual values for comparison.

¹Forecast by Wyoming Geological Survey,
December, 1983.

WYOMING TRONA PRODUCTION FORECAST TO 1990¹

Calendar Year	Gross Trona Production (millions of tons)
*1981	11.8
*1982	10.1
1983	10.4
1984	10.5
1985	10.6
1986	10.6
1987	10.7
1988	10.7
1989	10.9
1990	11.1

*These are actual values for comparison.

¹Forecast by Wyoming Geological Survey,
December, 1983.

WYOMING OIL AND GAS PRODUCTION FORECAST TO 1990¹

Calendar Year	Natural Gas production (billions of cubic feet)	Oil Production (millions of barrels)
*1980	450.6	126.4
*1981	455.4	122.1
*1982	465.1	118.7
1983	474.0	117.5
1984	500.0	118.0
1985	526.0	118.6
1986	553.0	119.1
1987	579.0	117.5
1988	619.0	116.0
1989	679.0	114.5
1990	739.0	113.0

*These are actual values for comparison.

¹Forecast by Wyoming Geological Survey, December, 1983.

PERCENTAGE OF WYOMING'S TOTAL MINERAL VALUATION BY
COMMODITY FOR 1983 AND 1973

	<u>1983</u>	<u>1973</u>
Oil	56.5%	75.5%
Gas	20.1%	9.0%
<hr/>		
Total		
Hydrocarbons	76.6%	84.5%
Coal	19.8%	4.0%
Trona	2.2%	3.3%
Uranium	0.8%	5.2%
Iron	0.2%	1.7%
Bentonite	0.2%	0.5%
Sand and Gravel	0.1%	0.1%
Phosphate	-0-	0.2%
All others	Less than 0.1%	0.4%
	(Limestone, Dolomite, Gyp- sum, Sugar Rock, Clay, Sodium Sul- fate, Feldspar, Decorative Stone, Cement Rock, Scoria, and Ballast.	(Dolomite, Gypsum, Clay, Sodium Sul- fate, Feldspar, Decorative Stone, Cement Rock, Scor- ia, and Ballast)
<hr/>		
TOTAL VALUA- TION	\$5,624,803,530	\$511,953,563
<hr/>		

Notable in the above figures are the relative declines in the proportions of uranium and iron to the total, and the relative increases in the proportions of coal and natural gas.

MINERAL RESOURCE AND RESERVE BASE ESTIMATES FOR WYOMING

PETROLEUM

Remaining Resources (January 1, 1983)

Discovered (Includes 10 billion barrels recoverable by enhanced recovery techniques).....	13.7 billion barrels ¹
Undiscovered	7.6 billion barrels ¹
Total	21.3 billion barrels

Remaining Reserve Base (January 1, 1983)

Measured reserves (Proved reserves)	0.9 billion barrels ²
Indicated and inferred reserves	2.8 billion barrels ³
Total	3.7 billion barrels

28

NATURAL GAS

Remaining Resources (January 1, 1983)

Discovered	21.0 trillion cubic feet ¹
Undiscovered (there is another 35 trillion cubic	

feet of noncombustible CO ₂ gas)	58.0 trillion cubic feet ¹
Total	79.0 trillion cubic feet
Remaining Reserve Base (January 1, 1983)	
Measured reserves (Proved reserves)	10.2 trillion cubic feet ²

COAL

Remaining Resources (January 1, 1983)	
Identified (Discovered)	136.6 billion tons ⁴
Undiscovered	800.0 billion tons ⁵
Total	936.6 billion tons
Remaining Reserve Base (January 1, 1983)	
Demonstrated strippable (Measured and indicated reserve base)	27.7 billion tons ⁴
Demonstrated underground-minable (Measured and indicated reserve base)	38.4 billion tons ⁴
Total	66.1 billion tons

TRONA

Original Resources	
Trona	81.7 billion tons ⁶
Mixed trona and halite	52.7 billion tons ⁶
Total.....	134.4 billion tons

URANIUM

Remaining Resource (January 1, 1983)	<u>U₃O₈</u>	995,000 tons ⁷
Remaining Reserve Base (January 1, 1983) <u>ORE</u>	<u>U₃O₈</u>	39,700 tons ⁷
Ore recoverable at \$30 or less/ton ...	29.4 million tons..	39,700 tons ⁷
Ore recoverable at \$30.01-\$50.00/ton..	225.1 million tons..	151,500 tons ⁷
Ore recoverable at \$50 or less/ ton...	254.5 million tons..	191,200 tons

¹ Barlow, J.A., Jr. and Doelger, M.J., 1983, Wyoming mineral resources: Barlow and Haun, Inc., Casper, 14 p.

- 2 American Petroleum Institute, 1983, Basic petroleum data book: Volume III, no. 2, May.
- 3 Modified from Barlow and Doelger (1983), footnote 1.
- 4 Wyoming Geological Survey, December, 1983. (Modified from Berryhill, H.L., Jr. and others, 1950, Coal resources of Wyoming: U.S. Geological Survey Circular 81, 78 p.)
- 5 Averitt, Paul, 1975, Coal resources of the United States: U.S. Geological Survey Bulletin 1412, p. 15.
- 6 Culbertson, W.C., 1983, Genesis and distribution of trona deposits in Wyoming (abstract) in Genesis and exploration of metallic and nonmetallic mineral and ore deposits of Wyoming and adjacent areas: Geological Survey of Wyoming Public Information Circular 19, p. 34.
- 7 U.S. Department of Energy, 1983, Statistical data of the uranium industry: Open-File Report GJO-100(83), 77 p.