MINING AND IDAHO

A slide presentation about Idaho's minerals industry

Produced by:

The Idaho Mining Association
408 Simplot Building
(P. O. Box 1738)
Boise, Idaho 83701
208/342-0031

INTRODUCTION

"Mining and Idaho," produced by the Idaho Mining Association in 1971, provides a general pictorial summary of Idaho's minerals industry.

The 139 slides included in this presentation cover mining and mineral processing activities from the famed silver-lead-zinc district of Shoshone County, to Southeastern Idaho where phosphate is king. Additionally, there is information about the many uses of Idaho's major mineral commodities, the color of Idaho's early mining boom, and the environmental improvement accomplishments of the mining industry.

The presentation may be shown by manually changing the slides and reading from this script for the narration; or by using the professionally-narrated cassette tape recording of this script. The tape, complete with background music, is synchronized and, if proper equipment is available, handles changing of the slides automatically. A Tiffen Show-Corder (Model 7100) cassette unit and a Kodak Carousel projector are recommended for maximum effectiveness.

Following the script portion of this booklet is a glossary which presents expanded information on many of the slides and subject areas.

Slide	Description	Accompanying Narration
1	Introduction "Mining and Idaho"	None
2	Infant	From the time we are born, our lives are dependent on minerals.
3	Downtown Boise (from Statehouse dome)	We Americans enjoy a quality of life unparalleled in the history of the world.
4	Overpass construction (Interstate 80 near Twin Falls)	This is directly related to the fact that we have been able to develop and use our vast mineral resources.
5	Air West DC-8 and F-27 at Boise Municipal Airport	Minerals are woven into the very fabric of our society and civilization.
6	Bicyclists	They are indispensable to the continued security of both.
7	Mores Creek Bridge spanning Lucky Peak Reservoir near Boise	Idaho is indeed fortunate ...
8	Typical South Central Idaho scene	Many of the 53 million acres within its boundaries are blessed with mineral deposits.
9	Mountain scene near Idaho City	And mining has contributed mightily to the wealth ...

Slide	Description	Accompanying Narration
10	Snow-covered mountains Shoshone County	... and development of the state.
11	Priest Lake, in extreme North Idaho	More than 20 different minerals are produced in Idaho.
12*	Chart of leading Idaho minerals	Silver, phosphate, lead and zinc are far and away the most important in terms of value.
13*	Silver Introduction	Idaho turns out more silver than any other state, and the demand for this valuable metal is climbing rapidly.
14	Silverware display in a jewelry store	Jewelry and silverware.
15	Seven commemorative coins from a private collection	Commemorative coins.
16	Girl displaying a silver cap on one of her front teeth	Dentistry.
17	Man with movie camera	Photographic film.
18	Kellogg, Idaho public swimming pool	And water purification systems are among the many silver uses.

*See glossary for additional information

Slide	Description	Accompanying Narration
19*	Phosphate Introduction	Phosphorus is an element essential to life itself and phosphate products are found everywhere.
20	Tractor in a Southeast Idaho field	Fertilizers and animal feed supplements.
21	Typical aisle of supermarket	Food products.
22	Aircraft making drop of fire retardant	Fire retardants.
23	Lighting candle with a match	Matches.
24	Girl brushing teeth	Toothpastes. The list is almost endless.
25*	Lead Introduction	Lead also plays a key role in our daily lives.
26	Battery being installed in auto	Especially in the automotive industry where lead batteries start our cars.
27	Petroleum products storage tanks	And lead additives for gasoline keep it running efficiently.

*See glossary for additional information

Slide	Description	Accompanying Narration
28	Stack of lead pipe	Lead is used extensively for plumbing fixtures.
29	Cartridges being loaded into a rifle	For ammunition of all kinds.
30	Lead glass windows at nuclear facility	And for radiation and acoustical shielding.
31*	Zinc Introduction	Zinc, too, is an extremely versatile metal.
32	Automobile grille	Automobile grilles and dozens of other accessories are made of zinc.
33	Automobile tire	Zinc oxides are an important ingredient in auto tires...
34	Sun tan lotion being applied at beach	... And suntan lotions
35	Kitchen appliances and housewife	Most appliances contain zinc.
36	Galvanized highway guardrail	And it is used widely to protect metallic surfaces from corrosion.

*See glossary for additional information

Slide	Description	Accompanying Narration
37*	Map - Coeur d'Alene Mining District	Virtually all of Idaho's silver, lead, and zinc are mined in the famed Coeur d'Alene District of the Northern Panhandle.
38	Kellogg, Idaho	Since the 1880's, this district has been the backbone of Idaho's hardrock mining industry.
39* 1	Cataldo Mission	It has produced nearly two-and-one-half billion dollars worth of minerals in its lifetime and ...
40	Wallace, Idaho	... from all indications, its life is far from over.
41	Aerial view of Coeur d'Alene Mining District	Some of the largest, deepest and richest underground mines in the world are located here.
42* 9	Sunshine Mine surface facilities	The picturesque Sunshine Mine, near Kellogg, has long been the nation's number one producer of silver.
43	Interior of Sunshine's Antimony Plant	The firm leads the nation in the production of primary antimony as well.

*See glossary for additional information

Slide	Description	Accompanying Narration
44* 9	Lucky Friday Mine surface facilities	The Lucky Friday Mine, near Mullan, owned and operated by the Hecla Mining Company ...
45	Galena Mine (aerial)	And the Galena Mine, a joint venture of American Smelting & Refining Company, Callahan Mining Company and Day Mines, Inc. ...
46	Galena Mine surface facilities	... are major reasons why Idaho alone produces nearly half of all silver mined in the United States.
47* 10	Silhouette of mining equipment underground	All mining in the Coeur d'Alenes occurs underground.
48* 11	Underground hoist at Star Mine	In fact, mining is now taking place more than 6000 feet below the earth's surface.
49	Miner using bar to free ore	Geologists say that mineable ores persist in this unique District at even greater depths.
50	Underground "loader" and operator	Major deep exploration projects are now underway...
51	"Trackless" underground equipment	... and there is promise of developing new mines in the years ahead.

*See glossary for additional information

Slide	Description	Accompanying Narration
52	Coeur exploration project surface facilities	Indeed, minerals exploration work is vital to the future of mining.
53	Drill unit and operator	And is being carried out by modern, sophisticated means throughout much of Idaho.
54* 12	Underground scene in Bunker Hill Mine	One of the most productive mines in the Coeur d'Alenes is the historic Bunker Hill Mine at Kellogg.
55	Ore train emerging from Bunker Hill Mine portal	It has over 120 miles of underground workings, and has relinquished 30 million tons of lead, zinc and silver ore.
56* 13	Exterior view of Bunker Hill lead smelter	The Bunker Hill Company's Kellogg industrial complex is one of the largest in the state. Operations include a lead smelter.
57	Exterior view of Bunker Hill zinc plant	An electrolytic zinc plant.
58	Flotation section of Bunker Hill mill	A large flotation mill.

*See glossary for additional information

Slide	Description	Accompanying Narration
59	Casting silver at Bunker Hill Silver refinery	A silver refinery.
60	Exterior of Bunker Hill Chemical Fertilizer Plant	And a fertilizer manufacturing plant.
61	Map of Southeastern Idaho	Mining in Idaho, however, is by no means confined to the Northern Panhandle.
62	Pocatello, Idaho	At the opposite end of the state, near Pocatello ...
63	Highway historical marker near Soda Springs, Idaho	... and Soda Springs -- the mining industry is equally important
64*	Typical of terrain northeast of Pocatello	Underlying this region are some of the nation's largest known beds of phosphate ore ...
65	Sunset in Southeast Idaho	... deposited over 100 million years ago when the area was part of the Pacific Ocean.
66	Monsanto's Henry open-pit phosphate mine	About 4 million tons of phosphate rock are mined each year in Idaho.

* See glossary for additional information

Slide	Description	Accompanying Narration
67	Earthmover loaded with phosphate ore	Large earthmoving equipment is used in the mining process.
68	Earthmover unloading ore	Scrapers, shovels, loaders and trucks work in harmony to remove the valuable mineral.
69	Mining phosphate at Simplot's Gay Mine	Ore from the J. R. Simplot Company's Gay Mine is shipped to Pocatello processing plants by rail.
70	Ore train enroute to Pocatello	More than 25,000 carloads leave the mine each year.
71	Ore loading facilities at Henry Mine	Meanwhile the Monsanto Company uses trucks to transport ore 16 miles from the Henry Mine to its processing plant near Soda Springs.
72	Conveyor at ore stockpiling area near Monsanto plant	The company built its own highway for this purpose ...
73* 15	Ore truck on Monsanto's private highway	... and those trucks are the largest of their kind in the world.

*See glossary for additional information

Slide	Description	Accompanying Narration
74* 16	FMC Corporation's Pocatello processing plant	Southeastern Idaho has three large phosphate processing plants in operation. FMC at Pocatello ...
75	Monsanto's Soda Springs processing plant	... and Monsanto at Soda Springs ...
76	Loading elemental phosphorus into rail tank car	... convert the phosphate ore to phosphorus, in its elemental form, for use in the manufacture of a vast array of products.
77* 17	J. R. Simplot Company's Pocatello plant	The J. R. Simplot plant at Pocatello produces ...
78	Bin of chemical fertilizer at Simplot plant	... a variety of chemical fertilizers through direct processing of phosphate rock.
79	Process control panel	In its brief history, Idaho's phosphate industry has produced well over one billion dollars worth of phosphate products.
80	Truck being loaded with chemical fertilizer	An average of one-half million dollars per acre of mined land.

*See glossary for additional information

Slide	Description	Accompanying Narration
81* 18	Engineers viewing Henry Mine	Speaking of land used by mining, U. S. Interior Department figures ...
82	Map showing mined land usage in Idaho	... show that just 7 thousand of Idaho's 53 million acres have been disturbed by hardrock and phosphate mining in the past 80 years. This is about 2 ten-thousandths of Idaho's total area.
83	Modified view of previous slide	The small dot on this map gives you an idea of the amount of mined land in proportion to the rest of the state.
84* 17	Mining engineer with transit	The minerals derived from this acreage mean jobs for many Idahoans.
85	J.R. Simplot Company secretary	About 6,000 persons are employed directly in mining and minerals processing activities.
86	Bunker Hill Mine crew	None
87	Monsanto Company engineer	None
88	Exploration geoligist	None

*See glossary for additional information

Slide	Description	Accompanying Narration
89	Freight train in rail yard	Requirements of the minerals industry for transportation, equipment ...
90	Hells Canyon Dam on Snake River	... and electric power provide substantial support for these and virtually every other segment of Idaho's economy.
91	1st grade class	And the millions of tax dollars paid by mining companies help finance a multitude of government services.
92	State Police Officer	None
93	Discovery State Park near Boise	None
94	State Capitol Building, Boise	None
95* 20	Historical photo -- mining camp	Minerals have always been vital to the economy of Idaho. Back in the 1860's, before Territorial days ...
96	Historical photo -- Kellogg, Idaho	... the lure of gold brought the first settlers to the region.

*See glossary for additional information

Slide	Description	Accompanying Narration
97	Historical photo -- mine crew	Among the historic figures associated with those free-wheeling early times were Noah Kellogg, James More and Wyatt Earp.
98	Historical photo -- mining operations	Places like Murray, Atlanta and Silver City are still synonymous with the great mining boom of that era.
99	Idaho World Newspaper office in Idaho City	Those first miners left behind an intriguing heritage.
100	Tombstone of early Idaho settler at Idaho City cemetery	And remnants from which residents and tourists alike ...
101	Downtown Silver City, Idaho	... still derive great recreational value.
102	Early day dredge operations near Idaho City	But, unwittingly, they also left behind some scars on the landscape which, by today's standards ...
103	Ravaged hillside near Kellogg	... represent unacceptable mining practices.
104	Former mill site near Burke, Idaho	Unfortunately the mining industry is today still being criticized for ...

Slide	Description	Accompanying Narration
105	Remains of mining operations near Murray, Idaho	... and judged by, these mistakes of the past.
106	Mining executives in planning session	Industry leaders, keenly aware of the need for environmental improvement, have made staggering investments of dollars ...
107	Research work in Bunker Hill Analytical Laboratory	... and manpower to lessen the impact of mining and mineral processing operations.
108*	South Fork, Coeur d' Alene River, 1966	For many years the South Fork of the Coeur d'Alene River ran brown with mine tailings.
109	South Fork, Coeur d' Alene River today	Today, all such wastes have beer removed.
110	Galena Mine tailings pond	Tailings are now piped to settling ponds where they remain permanently.
111	Star Mine tailings pond dike	Many of the pond dikes have been revegetated to better blend in with the surroundings.
112	Bunker Hill tailings pond	At Kellogg, the huge Bunker Hill tailings pond, constructed in 1929 ...

*See glossary for additional information

Slide	Description	Accompanying Narration
113	Bunker Hill tailings pond (close-up)	... serves as a disposal facility for domestic sewage and industrial wastes.
114	New Kellogg residential area	This attractive residential area, with over 50 new homes, has been developed on land previously covered with mine wastes.
115	Apartment complex in Kellogg	A new apartment complex is also located on reclaimed land in Kellogg.
116	Kellogg Junior High School	And so is this new junior high school.
117	Interior, Idaho Statehouse	A bill passed by the Idaho Legislature in 1971 assures reclamation of lands disturbed by minerals exploration and surface mining.
118* 2 V	Hand-planting shrubs at Ballard Mine, near Soda Springs	Long before that bill was adopted, however ...
119	Revegetated area at Ballard Mine	... responsible mining companies were voluntarily reclaiming mined land.
120	Mining engineer and forester inspecting new growth	In one case, four Idaho phosphate firms, cooperating with the U. S. Forest Service, conducted a 5-year land rehabilitation study near Soda Springs.

Slide	Description	Accompanying Narration
121	Revegetated acreage at Ballard Mine	The results of that study have now been put to practical use in company restoration programs.
122	Monsanto engineers discussing mine plans	Reclamation is an integral part of planning and engineering for new mines.
123	Revegetated overburden disposal areaat Henry Mine	Consequently, revegetation can be carried out immediately upon completion of the mining operation in most cases.
124* 23	Sulfuric acid manufacturing unit at Bunker Hill lead smelter (under construction)	Minerals processing also poses environmental problems, and these, too, are being solved. Bunker Hill, which has removed sulfur dioxide at its zinc plant since 1954 ...
125	Sulfuric acid manufacturing unit (close-up)	... has spent over 6 million dollars in recent years to bring sulfur dioxide emissions under control at its lead smelter.
126	Air pollution control equipment	At the same time, Idaho phosphate companies have developed and installed ...
127	Air pollution control equipment	... air and water pollution control equipment carrying a price tag of 8 million dollars.

*See glossary for additional information

Slide	Description	Accompanying Narration
128	Research technician in Simplot laboratory	Additional millions in environmental research and equipment are budgeted for the years ahead.
129	Leaves	The minerals industry recognizes that environmental factors must be given serious consideration ...
130	Children at public playground	... if Idahoans -- and all Americans ...
131	Swans	are to continue to enjoy the best things in life.
132	Molten metal at Bunker Hill smelter	By the same token, this nation must have an adequate supply of minerals if its present ...
133	Hikers on a forest trail	... quality of life is to be sustained.
134	Coeur exploration project surface facility	Idaho's mining industry is demonstrating that a better environment, and ...
135	Chairlift, Jackass Ski Bowl	... increased mineral production are entirely compatible.

Slide	Description	Accompanying Narration
136	Terraced overburden dike at Henry Mine	Its successes in achieving both are growing each day.
137	Chipmunk receiving "hand-out" at Galena Mine	None
138	Youngsters	None
139	"The End"	None

GLOSSARY

Slide ~~12~~ 1 — Although silver, phosphate rock, lead and zinc account for more than three-quarters of Idaho's mineral production value each year, many other important minerals are also mined in the state. They include copper, antimony, mercury, gold, tungsten, vanadium, iron ore, perlite, garnet, pumice, clay, sand and gravel.

Slides 13-18 2 — Silver is Idaho's leading mineral commodity in terms of value and approximately 45 percent of all primary silver in the United States comes from Idaho mines. Silver -- like gold, a precious metal -- was used in U. S. coinage literally from the time this nation began minting coins. Although silver is no longer used in regular coins by our government, special commemorative medallions and coins, such as the recent Eisenhower Dollar, contain this traditional metal. In addition to its use in coinage, silverware, jewelry and dentistry, silver has a growing number of industrial uses. The photographic industry, for example, is heavily reliant on silver for use in all types of films, including cassette television systems. Also, silver has properties which make it an excellent water purifying agent. Silver played a vital role in the U. S. space program. American astronauts used silver batteries to power the portable life support systems in their back packs which kept them alive while walking or driving on the moon's surface; silver-zinc batteries also powered the first TV broadcast direct from the moon; and silver was prominently used in space vehicle electrical systems because it is an excellent conductor of electricity.

3

Slides 19-24 — Idaho's production of phosphate rock averages about four million tons a year. This is over 90 percent of all phosphate mined west of the Mississippi River. Phosphorus is one of the elements absolutely necessary to sustain life. That is why it is such a vital component of agricultural fertilizers and animal feed supplements. Phosphates are also an important ingredient in foods for human consumption such as soft drinks, baking powder, flour and yeast. Among many other uses, phosphates are found in plastics, gasoline, shaving soaps, water softeners, incadescent light filaments, photographic supplies, bone china, dyes, cleaning compounds and flares.

Slides 25-30 4 — Idaho ranks second to Missouri among the 50 states in the production of lead, and is accountable for about 11 percent of all lead mined in the nation. Lead is one of the oldest metals known to man, dating back to

Slides 25-30 (Cont) 3000 B.C. Today, it has a variety of uses. Lead is vital to all of our modern means of transportation -- automobile, airplane, railroad and ship; it is essential to modern methods of communication and electrical power transmission; it is important in the development of atomic energy; its suitability for plumbing is one of the greatest contributions to the comfort and sanitation of modern homes. The versatility of lead stems from a multitude of properties or characteristics including weight, resistance to corrosion, softness, and ability to alloy readily with other metals.

Slides 31-36 #5 Mines in Idaho collectively turn out 8 percent of the zinc mined in this nation and Idaho ranks fifth behind Tennessee, New York, Colorado and Missouri in total production. Zinc has been used to protect other metals against corrosion for more than 100 years. Its versatility enables application as a protective metallic coating, as a paint or as a sacrificial annode. Hundreds of millions tons of steel products each year are zinc coated to make them more attractive and rust resistant. The properties of zinc make it especially suitable for die casting (the process of producing dimensionally accurate parts by forcing molten metal under pressure into a polished steel die or mold). Zinc die castings are used extensively in the automotive industry; in the electrical appliance industry; in toy manufacturing and in the hardware industry. Zinc is rolled into sheets, strips, ribbon, foil, plates and rod for hundreds of uses. Zinc oxide serves as a major constituent of exterior paints because of its anti-corrosive properties.

Slide 37 6 The Coeur d'Alene Mining District, situated in Shoshone County of North Idaho is about 23 miles long (east-west) and 9 miles wide (north-south). Elevations range from 2600 to 6000 feet above sea level, with high ridges and deep canyons. Although it occupies only one-third of one percent of Idaho's total land area, the Coeur d'Alene District ranks as one of the richest mining districts in the world, having produced nearly $2.5 billion worth of minerals since 1884. Kellogg and Wallace are the District's two largest cities and both serve as headquarters for major mining companies. Other communities include Osburn, Mullan, Smelterville, Pinehurst, Burke, Silverton, Wardner and Kingston.

Slide 39 1 Cataldo Mission, 10 miles west of Kellogg near Interstate 90, is the oldest building in Idaho. Built by Jesuit priests, lay brothers and Indians during a 5-year period beginning in 1848, it is of adobe construction with 12-inch walls of mud and grass, later covered with boards and paneling. The mission cornerstone was laid in 1848 and the church was first used in the winter of 1850. Establishment of the Cataldo Mission and construction of the Mullan Road from Fort Benton, Montana, to Fort Walla Walla, Washington, between 1858 and 1862 were the principal factors in opening the area which now is the Coeur d'Alene Mining District.

Slide 42 8 The history of the Sunshine Mine dates back to 1884 when the Yukon Lode, nucleus of present Sunshine holdings, was located by brothers True and Dennis Blake. The Blakes drove 10 tunnels, a shaft and dug many open cuts, recovering over $100,000 worth of ore. In 1914 the Blakes relinquished their holdings and Sunshine Mining Company acquired the lease and began development of the property. In 1931, a bonanza was struck 1,700 feet below the surface. Solid high-grade silver ore in a vein, often more than 20 feet wide, was common. By 1937 the Sunshine Mine was producing over 12 million ounces of silver -- more than any other mine in the world. Today, it continues to hold that No. 1 ranking.

Slide 44 9 The Lucky Friday Mine, owned and operated by the Hecla Mining Company of Wallace, is a prime example of mine development in the Coeur d'Alene District. It is a case where a small, insignificant-appearing silver-lead-zinc vein discovered on the surface developed, at depth, into a vein of major importance. The principal claims of the Lucky Friday were staked between 1899 and 1906. Development work began in earnest in the early 1940's and the first commercial ore was found 300 feet below the surface. Deeper exploration continued without interruption and the vein has now been developed to a depth of 3,500 feet. Since the first ore shipment of 500 tons in January 1942, the Lucky Friday has produced about $90 million in lead-silver-zinc ores.

Slide 47 10 No two underground mines are alike. They vary greatly in many respects and range all the way from the early prospect which may have a single level with limited lateral workings, to the deep and complex workings of mines

Slide 47 (Cont) that have been in production for many years. The opening and development of all mines, however, is very costly and requires a great deal of advance planning and detailed drilling. Mining, like most industries, has a language of its own. Words like ore, fault, shaft, raise, footwall, hanging wall, crosscut, stope, chute, skip are all a very real part of the mining parlance. Ore is defined as rock from which minerals can be profitably extracted. It is usually found in veins, which are fissures or cracks in a rock filled by minerals that have travelled upwards from some deep source, generally hundreds of thousands or millions of years ago. As ore is removed the ground must be supported and the most common method of support is by heavy timbers which, in most mines, are used temporarily until fill materials can be pumped in from the surface for permanent support. The ore itself after being loosened by drilling and blasting, is transported through a variety of underground openings (known as stopes, chutes and raises) before being hoisted through a shaft to the surface. In large mines, huge underground fans are used to maintain a supply of fresh air. To prevent the underground workings from flooding, water is constantly pumped to the surface.

Slide 48 The 2500-horsepower hoist in the Star Mine at Burke, Idaho, is the largest underground unit of its kind on the North American continent. (A hoist is the name given to machinery used to transport men, equipment and ore to and from the lower depths of a mine.) The Star hoist, which began operation in mid-1970, is located in a huge underground "room" 2,000 feet beneath the surface. The hoist room, carved out of solid rock, measures 104 feet by 40 feet and is 40 feet high. Each of the hoist's two drums holds 7,600 feet of 1 3/4-inch steel cable. The shaft, served by the hoist, presently extends from the 2,000 foot to the 7,300 foot level and it will ultimately be sunk to the 9,100 foot level. The Star, owned jointly by The Bunker Hill Company and Hecla Mining Company, is one of the deepest lead mines in the world.

Slides 54-55 The colorful beginnings of Bunker Hill Mine date back to 1885 and are shrouded in legend. Some insist that the original outcrop of ore was discovered by the jackass of a prospector named Noah Kellogg. Others contend the credit for the discovery should go to Kellogg himself. Two things are certain -- the present city of Kellogg, Idaho, was named after the prospector, and the discovery set off a lengthy legal battle between Kellogg and his

Slides 54-55 (Cont) grubstakers, who subsequently were awarded a half interest in the claim. The Bunker Hill Mine, named after the famous Revolutionary War battle, was to be one of the largest lead mines in the United States, and provided the basis for development of Bunker Hill's large industrial complex at Kellogg.

Slides 56-59 13 Once ore is brought to the surface of a mine it is taken through a process known as concentrating or milling. The purpose of this step is to separate and remove most of the waste material with which the valuable minerals are combined. Initially the ore is crushed, screened and milled to a fineness resembling powdered sugar. Chemical agents are added, and the solution is pumped to a flotation circuit, where mineral concentrates are separated. On the average, each ton of crude ore received at a concentrator produces between 300 and 400 pounds of lead and zinc concentrates.

Lead concentrates are shipped to the Bunker Hill smelter where they are pelletized and "roasted" to remove the sulphur, an element with which virtually all metals mined in the west are physically combined. The roasting process produces a porous material known as "sinter" which, mixed with coke, forms feed for the blast furnace. In the furnace the metal values (bullion) are separated in molten form from the waste (slag). Refinement of crude bullion occurs in 100-ton "kettles." Once the lead is fully refined, it is cast in one-ton blocks and 85-pound "pigs" for shipment.

Although the predominate metal recovered on a volume basis is lead, other valuable by-products result from the refining process, including copper, gold and silver. At the Bunker Hill silver refinery, the silver (999 + purity) is cast into 1,200-ounce bars.

Zinc concentrates, meanwhile, are shipped from the mill to Bunker Hill's electrolytic zinc plant where, again, "roasting" occurs to remove the sulphur. The remaining zinc material, called calcine, is further purified and sent, in solution form, to the "cell room". The name is derived from the process involved, whereby the zinc is removed from the solution and deposited on aluminum plates in electrolytic cells. The plates are then removed from these cells and the zinc sheets stripped off. The zinc sheets,99.99-plus percent pure, are melted and cast into a variety of zinc products.

Slide 64 14

Many millions of years ago, according to geologists, an arm of the Pacific Ocean covered what is now southeastern Idaho, western Wyoming, northern Utah and southwestern Montana. The conditions were exactly right for the formation -- from sea water -- of phosphate deposits. The deposits formed horizontally and in fairly uniform thickness and grade on the ocean floor and, had they remained in their original form, finding and mining them today would have been easy. However, a variety of natural geologic occurrences-- erosion, faulting, folding, etc. -- complicated the situation considerably by distributing the phosphate randomly in the region. The most desirable phosphate beds for mining are those which lie closest to the surface. This reduces, to a minimum, the amount of waste material -- known as overburden -- which must be removed to reach the ore deposits. Following is a summary of the principal mines in Idaho's phosphate region:

- The Conda Mine, founded by the Anaconda Company in 1920, has been operated by the J. R. Simplot Company since 1959. Located seven miles north of Soda Springs, the Conda was an underground mining operation until 1956 when open pit procedures were employed.

- The Henry Mine, placed into operation by Monsanto on September 1, 1969, is expected to provide enough phosphate ore to meet the needs of Monsanto's Soda Springs elemental phosphorus plant for 20 years. Production averages about one million tons of ore annually.

- The Gay Mine, 30 miles northeast of Pocatello on the Fort Hall Indian Reservation, is operated by the J. R. Simplot Company which has industrial and mineral leases from the Shoshone-Bannock Indian tribes. Production has been underway since 1946 and phosphate ore from the Gay Mine is shipped by rail to Simplot's fertilizer plant and FMC's elemental phosphorus plant, both in Pocatello.

- The Ballard Mine, operated by Monsanto, furnished all phosphate ore for that company's elemental phosphorus plant from 1952 until September 1969, when it was phased out. The mine is located 14 miles northeast of Soda Springs at an elevation of 6,500 feet. Production totalled 10.5 million tons during the life of the mine.

Slide 73 15

The Monsanto Company transports phosphate ore from its Henry Mine to its elemental phosphorus plant near Soda Springs by truck. Each of the three-trailer trucks used in the mammoth hauling job is capable of carrying 210 tons of phosphate rock. The vehicles measure 175 feet in length -- over half the distance of a football field -- and each is supported by 50 large rubber tires. The trucks never travel on public roads or highways because Monsanto has built its own 16-mile "haul road" between the mine and plant. The roadway, because of the huge vehicles it must support, is built to specifications much more stringent and durable than those required for most public highways. About one million tons of phosphate ore are transported over the highway each year. Harsh winter weather in the region dictates that all hauling be conducted within the six-month period from May to October.

Slide 74 16

FMC Corporation's elemental phosphorus plant at Pocatello is the largest of its type west of the Mississippi. In processing over one million tons of basic raw material, the plant's furnaces consume more than one billion kilowatt hours of electricity each year -- more than Idaho's six largest cities combined. In the production of elemental phosphorus, the phosphate ore is crushed, washed and blended with coke and silica to form a furnace "charge". The mixture is subjected to tremendous electric energy pulsing through electrodes, each measuring 110 feet in length and 45 inches in diameter. Elemental phosphorus is liberated in a gaseous form and the remaining material becomes a molten slag. The phosphorus gas from all four furnaces is then purified, again using electricity, and condensed into a liquid. The liquified gas must be contained under water in storage tanks because phosphorus bursts into flame on contact with air. FMC's Pocatello plant produces over 1,000 rail tank cars of phosphorus each year.

Slide 77 17

The J. R. Simplot Company's Pocatello plant is easily the largest fertilizer manufacturing operation in Idaho and one of the largest in the western United States. In the manufacturing process, the phosphate ore is heated to about 1500 degrees to remove organic materials. It is then ground to a fine powder and combined with sulfuric acid to produce phosphoric acid and gypsum, the latter being a by-product. Phosphoric acid, ammonia and sulfuric acid are used in various combinations, to produce ammonium phosphate and ammonium sulfate fertilizers.

Slide 77 (Cont) The ammonia used in the manufacturing process is produced at the Pocatello plant through a detailed chemical process. A fertilizer product known as triple super-phosphate, is also produced at the plant by directly combining phosphate rock and phosphoric acid. The resultant material is "cured" for about four weeks then ground, granulated, dried and screened.

Slides 81-83 18 The most recent study of land used for surface mining in the United States is a U. S. Department of the Interior publication entitled "Surface Mining and Our Environment," dated January 1, 1965. According to this report, 40,935 acres -- .08 of one percent of Idaho's total area -- has been disturbed by surface mining in the history of the state. Over half of this total -- 21,200 acres -- occurred as the result of early-day gold operations. Another 12,600 acres are attributed to sand, gravel, clay and stone quarries. The report shows that 3,100 acres have been mined for phosphate rock and lists 4,200 acres in an "all other" category. Presumably, most of those 4,200 acres are attributable to the surface used by underground mining operations. Therefore, 7,000 acres is appropriate for use in describing the amount of land area used for hardrock and phosphate mining in Idaho. This amounts to about .02 of one percent or .0002 (two-ten thousandths) of Idaho's 53,476,482 acres. Nationally, the report indicates, 3,187,825 acres have been affected by surface mining activity. This is less than two-tenths of one percent of the nation's total acreage.

Slides 84-94 19 A comprehensive economic survey of the Idaho mining industry, conducted by the Idaho Mining Association in 1970 showed that the value of the state's metals and phosphate products that year amounted to $242,289,000. The survey indicated that $212 million -- about 87 percent -- of these mineral products are sold to out-of-state customers, pumping that much "new money" into the state's economy. Idaho mining firms purchased more than $17 million worth of electric power, to easily rank as the largest single user of electricity, and spent another $20 million for transportation of raw materials and products. The mining industry provided direct employment for 5,875 persons and had a total payroll of $49,521,000 -- an average of $8,500 per employee. Following are the economic highlights of the Idaho mining industry survey:

Slides 84-94 (Cont)

1970 gross sales of products	$242,289,000
gross sales 1966-1970	$1,113,433.000
1970 purchases of goods and serv. .	$116,133,000
1970 average employment.	.5,875
1970 wages and salaries	$49,521,000
1970 employee benefits(company paid)	$5,931,000
Capital improvements (1966-1970). . .	$98,462,000

Slides 95-98

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It was the hypnotic lure of gold that brought the first rush of settlers to Idaho and their prospecting efforts brought the subsequent discoveries of silver and lead, which formed the basis of the state's initial economy. Gold was known in Idaho a number of years before careful prospecting of the Clearwater country led to the beginning of mining and to the creation of Idaho Territory. A Hudson's Bay Company fur trapper is reputed to have been aware of gold in Boise Basin as early as 1844, but that be the case he neglected to do anything in the way of mining. Another explorer noticed gold in Salmon River not long before 1860, and a prospecting party on the Coeur d'Alene panned some gold in the summer of 1860. More important, though, was a find by E. D. Pierce, February 20, 1860, on the North Fork of the Clearwater. The other discoveries were not followed up, but Pierce went out to the new town of Walla Walla, where he soon equipped a party of prospectors, and began to examine the Clearwater with some care in the fall of 1860. The Clearwater gold rush ensued.

Thousands of gold hunters joined the stampede to the Nez Perce mines on the Clearwater and on the Salmon River. While there were a few good claims around the original discovery of Pierce, most of the miners wanted to do better, so they extended their search throughout all the surrounding country. Scattering out to the south they came across some promising placer ground near Elk City, which was established in mid-1861. The big excitement that season, however, followed a find that all the prospectors had been dreaming of: in a high basin, soon to be known as Florence, a lucky miner could make a fortune. No longer would it be necessary to work for wages. As soon as the word got out, just about everyone in the Nez Perce mines took off for Florence. The rush to Florence, proved to be instrumental in bringing the mining expansion that justified, (1) the creation of Idaho Territory the following year, and (2) the division of the originally huge Idaho Territory in order to establish Montana in 1864.

Slides 95-98 (Cont)

Far more permanent and productive than Florence, the mines of Warren, and particularly of Boise Basin and the neighboring South Boise, Atlanta, and Owhyee districts, enjoyed a spectacular boom in 1863 and 1864. Many more miners could be accommodated in the Boise region, and most of Idaho's population concentrated there at that time. Just as the Clearwater and Salmon River mines had led to the starting of the important city of Lewiston in North Idaho, the Boise-Owyhee mines were responsible for the early development of Boise as a service community and as a base for operations. Soon irrigated farms began to spread over the nearby valleys to supply the mines, and Idaho's economy gained a broader foundation.

The transfer of exploration interest to base metal deposits which came with the Wood River rush of 1880 became still more pronounced after the Coeur d'Alene district gold rush of 1884 led to great North Idaho lead-silver discoveries in 1885 and 1886. Though not unlike gold-quartz mining in many ways, base metal mining for copper, lead, or zinc required an even more substantial industrial development. Smelters, which came to Wood River not long after 1880 were a necessity, and railroad transportation was imperative for successful operation. It was no coincidence that the Union Pacific took time out, while constructing its main line westward through the Snake River Valley in 1882, to build a Wood River Branch to Hailey and Ketchum; similarly before serious production of the Bunker Hill and Sullivan and other great lead-silver mines of the Coeur d'Alene District could get under way, a railroad had to arrive. The transformation that came over Idaho in the decade after 1880 -- new railways, new cities, new farmlands, and new people by the tens of thousands -- is associated to a considerable degree with the new opportunities of mining.

With the coming of the railway, introduction of capital in abundance (including major British investments in Rocky Bar, Atlanta, Silver City, and Bonanza) and improvements in methods of operating, gold-quartz mining came into prominence by 1886. And, since the Wood River mines also were flourishing at that time, the long-awaited general success of underground mining had arrived. Placer mining in 1862 and 1863 had been responsible for Idaho's creation as a territory; now gold-quartz and base-metal mining contributed substantially in enabling Idaho to secure admission as a state in 1890.

Slides 108-111

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In the process of milling -- or concentrating -- raw ores, a great deal of waste product is produced. In fact, about three-quarters of the crude ore is separated at the mill as a waste product, called tailings. Most of the mining companies in the Coeur d'Alene District return a high percentage of the mill wastes underground to fill the mined-out areas. For many years it was the common -- and publicly accepted -- practice of some companies to dispose of the waste tailings in the South Fork of the Coeur d' Alene River. As a result, fish and most other aquatic life, as well as most vegetation along the valley floor, were destroyed. Since 1968, however, the South Fork and its tributaries have been free of tailings. All mining firms, collectively investing more than one million dollars, have constructed settling ponds to capture and permanently store the waste material. This alone has served as a major step toward ending pollution of the South Fork.

Slides 118-123

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Idaho phosphate companies have reclaimed over 600 acres which have been disturbed by surface mining activities during the past 24 years. Furthermore, it is the policy of Idaho's major phosphate operators to reclaim at least as much land as is disturbed each year. These companies have been voluntarily conducting revegetation experiments and reclamation programs since 1959. The most successful and extensive experimental program was a study undertaken cooperatively by four Idaho phosphate companies and the U. S. Forest Service. The five-year study, which took place between 1966 and 1970 at three mining sites near Soda Springs, produced valuable information about the stabilization and revegetation of lands affected by surface mining in the area. During the program, 716 test plots were established, on which more than 11,000 trees and shrubs as well as 18 species of grasses and forbs were planted. The performance of each species has been carefully charted and will be observed for many years to come. This permits specific identification of the species best suited to the region, as well as the most successful planting techniques. The results of this study have been largely incorporated into the formal, budgeted reclamation programs initiated independently by the operating phosphate companies.

The Ballard Mine, for example, was taken out of production in 1969. During 18 years of mining operations, 604 acres were disturbed. Various experimental programs, including the cooperative study, resulted in the replanting of 108 affected acres. Budgeted revegetation projects have taken care of nearly 200 additional acres and plans call for

Slides 118-123 (Cont)

remaining acreage to be reclaimed during the next four years. The Ballard Mine program, being carried out voluntarily and without legal requirement, will cost the operator more than $100,000 or about $155 per acre. Significantly, the present market value of adjacent grazing lands undisturbed by mining is only about $75 per acre. Advanced engineering techniques and specific environmental planning now permit new surface mines to be designed so as to permit rapid and successful reclamation. For instance, the Henry Mine, located 16 miles north of Soda Springs, opened in 1969 and has already been partially revegetated. Rehabilitation has literally been "built into" the mining plan and can be conducted as mining progresses.

Slides 124-128

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The process of smelting crude ores, by its very nature, has an adverse impact on the environment in terms of the airborne and liquid waste emissions which are generated. In the western United States, for example, virtually all minerals are sulfides; that is, they are physically combined with sulfur, which is an impurity and must be removed in refining. As the sulfur is roasted, or burned off, it is converted to a gaseous form, sulfur oxide -- an undesirable emission. Since 1966 The Bunker Hill Company has invested well in excess of 9 million dollars at its zinc plant and lead smelter to control these sulfur dioxide (SO_2) emissions. In fact, initial investment of SO_2 control equipment dates back to 1954 at the zinc plant. Similarly, major anti-pollution facilities were installed in Idaho's three phosphate plants as early as 1953. Collectively, since that time, the four major minerals processing plants in Idaho -- Bunker Hill, J. R. Simplot, FMC and Monsanto -- have spent $30.8 million dollars in air and water pollution control equipment. In most cases, the facilities were not simply available for purchase and installation, but required intensive research and development. Each plant has its own characteristics and emission problems, and each requires specially-designed control equipment. During the past 20 years, a great deal of effort has gone into the development and installation of a multitude of systems to control dusts, gases, mists and to reprocess and neutralize water used in the industrial process. Researchers and engineers are still seeking answers to additional problems. Over 8 million dollars will be expended by the four firms in the next two years alone to find -- and implement -- many of these answers.