

Idaho's Phosphate Industry

Located near Pocatello and Soda Springs in southeastern Idaho are the mines and plants of the state's phosphate industry. Most people are surprised to find out how important the brown-to-black, nondescript appearing phosphate ore is to their lives and well-being.

About 90 percent of the U.S. production of phosphate goes into fertilizers. The use of these fertilizers is one reason why the United States is preeminent in agriculture worldwide. The remaining 10 percent of phosphate production goes into elemental phosphorous that is used in a variety of products such as detergents, water softeners, plasticizers, insecticides, and food additives including those in most soft drinks. (Go ahead! Check the ingredients on your next can of pop.)

About 10 to 15 percent of the country's phosphate is mined in Idaho. The rest comes from Florida, North Carolina, Tennessee, Montana, and Utah. About 25 percent of the U.S production is exported, so foreign markets are very important to the industry.

Over 2,600 people, more than half of the total employed in the mining industry in Idaho, work in the phosphate industry. All of the mines except the Gay mine are on federal leases; the Gay mine is on the Fort Hall Indian Reservation. Even though these companies pay royalties to the federal government or the Shoshone-Bannock tribes, half of the federal lease revenue is returned to the state and all of the tribal revenue enters the southeastern Idaho economy directly.

Unique geologic conditions led to the deposition of the phosphate ore. About 260 million years ago in what geologists call the Permian age, a great ocean lapped up against the west coast of what is now North America. Vast tonnages of phosphate ore were deposited in embayments along the shoreline of this ocean.

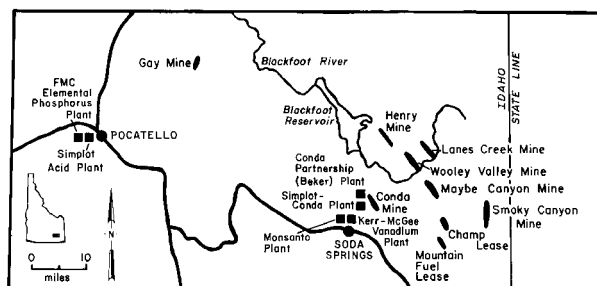
The phosphate in southeast Idaho is found in the Meade Peak Member of the Phosphoria Formation. The phosphate ore is mined from two separate zones in the Meade Peak with a combined thickness ranging from 30 to 60 feet.

The important ore mineral in the Phosphoria Formation is apatite ($\text{Ca}_5(\text{PO}_4)_3\text{F}$). The phosphate ore contains 20 to 35 percent P_2O_5 . The phosphorous content of the ore is very important because the process for making elemental phosphorous requires an ore grade of about 25 percent P_2O_5 and the process for acid needs 30 percent P_2O_5 . Weathering, or the influence of water and atmosphere on rocks, has in places altered the Phosphoria Formation to depths of several hundred feet producing naturally concentrated, higher grade ore zones. Mining is almost exclusively confined to these high-grade zones.

All of the mines are open-pit operations. The pits are typically 300 to 400 feet deep when finished. Large mechanical shovels or scrapers scoop out the ore, and trucks or trains transport it to the processing plants. A novel method of moving the ore is used at Simplot's Smoky Canyon mine where slurried phosphate is pumped through a 27-mile long, eight-inch diameter pipeline to the calcining plant at Conda.

The production of phosphoric acid involves several process steps. The ore from the mine is scrubbed, washed, ground up, screened, deslimed, and then heated to 1450 °F. in a process called calcining to remove water and organic matter. The calcined ore, which contains over 30 percent P_2O_5 , is then treated with sulfuric acid to produce phosphoric acid (H_3PO_4) of several different grades and concentrations. The acid is then reacted with ammonia or processed further to producer fertilizer products.

(over)



Location of major mines and processing plants of the phosphate industry in southeastern Idaho.

Acid is produced by the J.R. Simplot Company at its plant at Pocatello. Simplot mines ore from the Smoky Canyon mine (calcining plant at Conda) and from the Gay mine on the Fort Hall Indian Reservation. The company recently invested \$50 million in upgrading and enlarging its Pocatello plant.

The Conda Partnership (a joint venture between Beker Industries and Western Cooperative Fertilizer of Alberta, Canada) obtains its ore from leases in Dry Valley. Beker uses part of the ore for acid production at the Charles F. White acid plant at Conda. Western Co-ops ships calcined ore to its fertilizer plants at Calgary and Medicine Hat, Alberta, Canada. The Washington Construction Company handles the mining operations under contract to the Partnership.

Alumet, a joint venture between Earth Science Inc., National Steel Corporation, and the Southwire Company, mines phosphate from the Lanes Creek mine. The ore is sold to various sources for fertilizers.

Elemental phosphorous is manufactured by a totally different process than acid/fertilizer. The phosphate rock is mixed with silica (from quartzite deposits) and coke; then it is melted at 2700 °F. in electric furnaces, where phosphorous and other elements are volatilized. The phosphorous is collected in water spray towers. The other components are precipitated as dust and stored as waste product or sold as fertilizer.

In 1949, Westvaco constructed the first elemental phosphorous plant at Pocatello. FMC purchased the facility the same year, and now after several expansions, it is the largest elemental phosphorous plant in the world. FMC obtains its ore from the Gay mine. Monsanto built its elemental plant in 1952 at Soda Springs. The company mines ore from the Henry mine. The third producer of elemental phosphorous is the Stauffer Chemical Company, which mines phosphate from the Wooley Valley mine and ships it to an elemental phosphorous plant at Silver Bow, Montana.

The elemental phosphorous process also produces a light and heavy slag. The lighter slag is discarded or sold for road and railroad bed construction. The heavy material called ferrophosphorous slag contains vanadium, chromium and nickel. Kerr-McGee produces about 2 to 3 million pounds of vanadium pentoxide (V_2O_5) from

slag obtained from Monsanto's plant. The elemental phosphorous process is very energy intensive; for example, FMC uses about 15 percent of Idaho Power's electricity.

At practically all of the mines, an important part of the mining process is land reclamation. After graders reshape pit contours, the topsoil is replaced and hydroseeded. Soon the mined-out ground blends with the natural contours and appearance of the surrounding countryside.

The phosphate industry is an important part of Idaho's mining community. The Idaho Geological Survey thanks you for your interest in our state and its important mining industry.

A sample of phosphate rock is available upon request.

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