ECONOMICS OF FLORIDA PHOSPHATE MINING

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Florida is the world's leading producer of phosphate rock. From less than 2% of the state's land area, Florida's phosphate companies provide 80% of our nation's and one-third of the world's phosphate output each year. Florida alone out produces the Soviet Union, which is second to us in the world.

Last year we produced 43 million metric tons of phosphate rock. Of that, over 90% goes into fertilizers and 5% is used in the animal feed supplements. The remainder becomes part of a wide range of important products -- from soft drinks to toothpaste.

These statistics are impressive and reveal our state's vital role in our nation's and the world's supply of food.

But the subject of my remarks today is the how and why of our industry's pre-eminence.

What factors have led to our continuing leadership in world phosphate production and what do these factors foretell for the future?

Florida has been the leader in the production of phosphate rock for a number of interrelated reasons including

- the high quality of the ore
- the ore's amenability to extraction by relatively inexpensive methods

- its geographic position in close proximity to port areas
- Florida's climate and topography
- the ability of the Florida phosphate industry to provide continuing technological leadership in providing more efficient methods and equipment for mining and processing.

The key to our development is economics and economics, along with environmental and governmental restraints, will determine our course as we enter the second century of phosphate mining in Florida.

Florida phosphate mining began in the 1880s when miners could only recover the coarse pebble product. This early mining was done by pick, shovel, wheelbarrow and manpower.

Mining productivity improved dramatically with the introduction of the steampowered dragline in the early part of this century and again when the huge electrically powered draglines took their place on the Florida landscape.

These significant technological breakthroughs have improved the economics of recovering Florida's phosphate, enabling us to become the mainstay for this vital mineral.

The development of the flotation process in the 1930s was another technological milestone. This process made possible the recovery of the fine phosphate particles, called concentrate, that was previously unrecoverable. Flotation nearly doubled production and increased the average grade of our product because of the concentrate's high phosphorus content.

Innovation and expansion also highlight the history of the chemical fertilizer processing phase of our industry. The recovery of fluosilicic acid and yellow cake during the manufacture of phosphoric acid are clear examples of improvements in the economics of our chemical processing activities.

Florida's phosphate ore, which is called the matrix, is buried beneath five to 50 feet of soil overburden. This matrix is actually a stratum consisting of about 1/3 recoverable phosphate, 1/3 sand and 1/3 clay. Here's briefly how we mine and recover it.

The first step in the mining process is exploratory drilling. Normally, four holes per 40 acres are drilled for exploration. The core material is analyzed by the geologist then sent to the metallurgical laboratory where it is processed in a manner similar to actual plant processing. Samples from the met lab are sent to the analytical lab for analysis. Data recorded includes soil overburden depth, matrix depth, grade of pebble and concentrate, cubic yards of matrix to be mined per acre, tonnages of product per acre, impurities and other variables.

The value of the land is determined from these data, as well as the feasibility and economics of mining the deposit. Before mining, the drilling is increased to 16 holes per 40 acres to improve the accuracy of the preliminary information and to identify any unusual conditions which could cause mining problems.

With this information and knowledge of production, waste disposal, reclamation objectives and governmental requirements, the mine planner can do computer simulation runs to arrive at the best mine strategy. The large computers have had a significant effect on improving mine planning.

In the mining process, the dragline strips the overburden and deposits it in a previously mined cut. The dragline works in parallel cuts 150 to 300 feet wide and from a few hundred feet to several thousand feet long. Once the overburden is removed, the ore is then mined and placed in a nearby pit where high pressure water guns are used to convert the ore into a slurry for transfer to the beneficiation plant. The slurry contains 30-40% solids. Depending on its design, the pumping system can normally handle between 1,000-1,400 yards of ore per hour. Pipeline lengths vary from several thousand feet up to seven miles. The length of the pipeline is limited by economics.

After the slurry arrives at the beneficiation plant, the ore is washed and screened to remove the large phosphate pebbles. The remaining slurry now consists of clay, sand and fine phosphate. The clays are separated and pumped to vast man-made ponds, where the clay gradually settles from the water. The clear water is drawn off and returned to the plant for reuse.

The remaining mixture of water, sand and phosphate particles undergoes flotation that separates the fine mineral from the sand.

The recovered phosphate is graded for quality and stockpiled. Florida's phosphate is shipped in this raw state or further processed in one of the industry's chemical fertilizer plants.

Not all the ore is converted into product. The clay wastes still contain 15 to 40% of the phosphorus values in the ore, but it has not been economically feasible to recover this lost mineral at this time. However, when it becomes feasible, the technology will be implemented to recover this material.

The costs of handling the clays separated from the ore during processing figure prominently in the economics of our industry. The above ground clay storage ponds are very expensive commodities. Cost factors vary widely but the cost of a new 40 foot high dam over mined cuts has been placed at $1½ to $2 million a mile. In 1979, the Council's companies spent $25 million on dam construction with $12 million expended to maintain the dams. They are expensive liabilities. Further, they tie up large amounts of company property for extended periods of time.

Key to the cost of mining a ton of phosphate rock is the ratio of overburden to matrix and the pebble to concentrate ratio. A 1-to-1 soil to ore ratio is desirable. Phosphate mining in central Florida is moving south from the Bone Valley area -- the historic heart of our industry -- into Manatee, Hardee and DeSoto counties. The deposits in the southern extension have a considerably higher ratio of overburden to matrix and a lower pebble to concentrate ratio, two major reasons why the costs of recovering the ore will be considerably higher than existing mines. We will have to handle more material to produce a ton of product, product grades will be lower and additional processing will be required to remove impurities in the ore.

The issue of the cost of recovering these southern reserves is at the heart of recent controversy concerning how much phosphate remains in our state. The issue in a nutshell is "Are we running out of phosphate." The answer in a word is no and predictions that we are rapidly depleting our state's phosphate resources are based on an inaccurate assessment of the situation.

Historically, the Florida phosphate industry has carried reserves at an approximate 20 year supply level. This is exactly where we are today. Reserve holdings beyond 20 years are normally considered excessive due to the capital costs involved. Ore bodies are, indeed, a function of economics that relate to a time/demand factor. Demand creates the price of our product which then creates the pressure for technological development. These factors have functioned over and over again during the history of our industry as my brief overview of technology developments indicated earlier.

New technology is already being tested such as bore hole mining which would enable us to recover the state's deep phosphate deposits. Further, experiments are under way to recover a greater value of the phosphate from the ore during beneficiation.

Using this dynamic economics-based reserve logic, Richard Mayberry, a renown phosphate geologist, has recently estimated over 10 billion tons of Florida phosphate reserves, which roughly translates into 2 more centuries of phosphate mining in our state.

According to Mayberry's research, we are in the early stages of a whole new set of market conditions for phosphate rock. The Global 2000 report prepared for President Carter is forecasting critical food shortages for as many as 1.3 billion people by the year 2000. This report further projects the world will increase food production by 90% from 1970-2000. The increase for the U. S. is 28% during the same period. So the need, the demand, for phosphate is clear and Florida has the resources to meet this challenge.

But the price of recovering this needed mineral continues to escalate and the constraints on our growth to meet this potential worldwide food crisis continue to multiply.

Capital costs of new mines in central Florida have increased from about $12 per annual ton of capacity prior to 1975 to estimated levels of $30 in 1980 and $35 after 1980, according to the U. S. Bureau of Mines. The Bureau further predicts costs of $45 per annual ton of capacity for new mines in south central Florida. I have seen estimates on the cost of constructing and permitting a new operation in the range of $50 to $65 per ton of capacity with predictions of a capital cost of $100 per ton in the not too distant future.

One company has estimated its capital expenditures will exceed $300 million before the first ton of rock is mined. The permitting alone is expected to cost in excess of $5 million -- and can take five to six years to complete.

I submit that some government regulation of our industry is desirable and necessary, but the current permitting process is duplicative and burdensome, increasing the cost of our products to the consumer without compensating benefits.

Further, these added costs place our industry at a competitive disadvantage to the world's other phosphate producers; principally Morocco.

The permitting system is cumbersome, encompassing local, county, regional, state and federal permits.

Regulations covering existing facilities are likewise confusing and often conflicting. Here's an example.

For efficient mining, it sometimes becomes necessary to "walk" the dragline across the river. This is done by digging a channel to temporarily divert the river, the dragline walks across the bed, the channel is refilled and the river returns to its normal course.

One company reports in the 1960s it took one telephone call to the Army Corps of Engineers to get permission. In 1972, it took four months to get approval from the Corps. In 1977, it took 14 months and involved contacting 16 different agencies.

Environmental controls are, of course, an increasing cost to our industry. From 1969 through 1979, the Council's member companies have spent $142 million for research, development and installation of water quality control systems and equipment, and $37 million on water conservation systems and equipment. During this period, over $180 million was spent to operate and maintain these systems.

Similarly, in the past decade, over $115 million of company funds went towards research, development and installation of systems and equipment to protect air quality with an additional $143 million spent to operate and maintain these systems.

Further, inflating the cost of our operations is increases in practically every item needed to mine and process Florida phosphate rock -- fuel, pipes, pumps -- the list goes on and on. Huge amounts of power are needed. The Council's member companies used 4 billion kilowatt hours last year at a cost of over $160 million. It's not unusual for a company's monthly electric bill to exceed $1 million. Bunker C fuel oil, used to operate our rock dryers, used to cost about $2 a barrel. Today, a barrel costs well over $20. Cost of pipe used to carry the slurried matrix from mine to plant has tripled in less than three years. And the average life of a length of pipe is only 10 to 11 months.

The companies continue to research and test new techniques and technologies to protect the environment and conserve resources. For example, the Council's member companies have spent about $20 million on research and experiments to speed up the dewatering of the clays separated from the mined ore. Several techniques have developed from these efforts that hold promise for helping resolve the problems associated with handling and storing this material.

Experimentation also is very evident in our reclamation practices. Companies have experiments under way to restore certain particularly desirable or desired natural systems, such as wetlands. As you're aware, county and state law require that we reclaim every acre mined, in accordance with strict governmental standards and regulations.

The cost of reclaiming the land is part, then, of our operating costs in the state. The price tag for reclamation varies widely, depending on the state of the mine site and the intended future use, ranging from as little as $500 to over $10,000 per acre. Average costs are from $3,000 to $4,000 per acre.

New state reclamation rules adopted last year may significantly increase reclamation costs, which must then be passed on to our customers. One company undertook a study of land and lake restoration of a mine site according to the old and new Florida Department of Natural Resources standards. The new requirements for shallow lakes with wide littoral zones could increase costs per acre to over $20,000 compared with less than $3,000 per acre based on old DNR rules. Unfortunately, increased costs do not mean a higher quality of reclamation. The new lake designs will create less environmentally

productive lakes than the previous rule, prevent many recreational uses of the water body, reduce land area available for other uses and eliminate the opportunity for diverse lake designs that could accommodate multiple uses. Also, local and state regulators may be at odds over the form the reclaimed land or lake should take.

Finally, no discussion of government, industry and economics would be complete without a reference to taxes. We pay the highest severance tax on phosphate in the nation -- 10%, and there is always the threat of higher taxation. The Council's member companies paid $51.7 million in state severance taxes in 1979 and have paid over $168 million since the adoption of the tax in 1971. And none of the tax is now returned to the mining company to help offset the cost of reclamation, as the law originally proposed.

Further affecting the economics of phosphate mining in Florida, particularly company reserve landholdings, is the practice of taxing authorities to make drastic increases in ad valorem taxes when ownership changes from an agricultural landholder to a mining company. For example, in one recent case, land taxes went up by a factor of 35 when a mining company took possession. Needless to say, this practice helps discourage companies from maintaining extensive long-term reserve lands and helps account for underestimates of Florida phosphate reserves.

Despite soaring costs, burdensome regulations, and a bewildering permitting process, the Florida phosphate industry is committed to maintaining its dominance in the nation and the world. Between now and 1985, 12 of our member companies anticipate the completion of major new projects which will increase our capacity while

resulting in $2 billion in new Florida investments. Council companies are planning six new mines, the expansion of two existing mines and the expansion of eight existing chemical fertilizer plants.

Whether or not the companies realize this commitment will depend in large part on securing the necessary government permits. Meanwhile, inflation swells the cost of the facilities. Increased competition for Florida land, fueled by our burgeoning population growth, increased governmental regulation and taxation, along with higher energy costs and environmental pressures, pose problems that must be resolved.

Nevertheless, thanks in large part to our sizable reserves, our advancing technology, and our transportation network, the economic future of the Florida phosphate industry is as bright as the state's famous sunshine.