The Florida Senate

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Committee on Environmental Preservation Senator Paula Dockery, Chair

ACTIVITIES RELATED TO THE CLOSURE OF PHOSPHATE MINING OPERATIONS AND THE USES OF PHOSPHATE MINING BYPRODUCTS AND CLOSED PHOSPHATE LANDS

SUMMARY

The United States is the largest producer and consumer of phosphate rock in the world and the leading producer and supplier of phosphate fertilizers in the world. Ninety percent of the phosphate rock mined in Florida, is used to make fertilizer. Of the remaining 10 percent, half is used in animal feed supplements.

Phosphate operations produce phosphogypsum, a sandy mineral by-product of phosphate fertilizer manufacturing. Phosphogypsum is stored in stacks, commonly referred to as "gypstacks," of 150 feet or taller. There are currently 25 stacks in Florida. The vast majority of these stacks are located just south of Lakeland and are in various stages of their life-cycle, 10 are active, 12 are inactive, and 3 are closed.

Phosphate mining operations are currently required to have in place reclamation plans for their operations when the life of the mine has expired. The Florida Institute of Phosphate Research was created to study alternative reclamation alternatives and technologies and to study the disposal and utilization of phosphate clay.

The Environmental Protection Agency (EPA) regulates the use of byproducts of phosphate mining, specifically phosphogypsum. Currently, phosphogypsum is classified as a waste product. As such, it cannot be used for any other commercial use. The EPA has, however, approved its use in limited quantities for research purposes and for limited agricultural uses.

On March 15, 2003, Congressman Adam Putnam, as chairman of the Subcommittee on Technology, Information Policy, Intergovernmental Relations and the Census, conducted an oversight hearing in Bartow, Florida on the topic "Phosphogypsum: Should We Just Let it Go To Waste?" Congressman Putnam has expressed concerns over the environmental dangers of stacking phosphogypsum and is seeking ways to use this phosphate mining byproduct in an environmentally safe manner.

BACKGROUND

The United States is the largest producer and consumer of phosphate rock in the world and the leading producer and supplier of phosphate fertilizers in the world. Florida provides approximately 75 percent of the nation's phosphate supply and approximately 25 percent of the world supply. Phosphate companies own or have mineral rights to almost 450,000 acres in the state.

Nitrogen, phosphate, and potassium are the three primary nutrients in fertilizer. Ninety percent of the phosphate rock mined in Florida, is used to make fertilizer. Of the remaining 10 percent, half is used in animal feed supplements. Phosphate is also used in a variety of products, including vitamins, soft drinks, toothpaste, light bulbs, film, bone china, flame resistant fabric, optical glass, and other consumer goods. There is no substitute or synthetic for phosphorus, which is essential for life in all growing things, plants and animals alike. (Phosphate Fact Sheet – Florida Phosphate Council)

There is an extensive history of regulation involving the industry.

1970's – Federal and State Clean Water Legislation and Rules imposed controls on stack system surface water discharges.

1983 – State groundwater rules established groundwater quality standards and required groundwater monitoring around stack systems.

1993 – Phosphogypsum management rules required liners for new and laterally expanded stack systems; established closure and long-term care requirements; and imposed financial responsibility demonstration requirements.

1996 – The Mining Dams Memorandum of Agreement updated construction standards for new clay settling area dams and spillways; updated operational, maintenance, and inspection requirements; and established best management practices for non-clay impoundments.

1999 – The Department of Environmental Protection (DEP) rules for earthen dams and dikes provided construction and inspection standards for new stack system perimeter dikes; created procedures for raising stacks and decanting water; and established detailed water management and other operational requirements.

2003 – The Legislature passed a bill to amend the severance tax on phosphate rock by providing for an increase in the tax and creating a new distribution formula for the tax proceeds. Also, owners and operators of phosphogypsum stacks are required to demonstrate financial responsibility for the costs of terminal closure in ways that protect the public health and safety.

Phosphate operations produce phosphogypsum, a sandy mineral by-product of phosphate fertilizer manufacturing. Phosphogypsum is stored in stacks, commonly referred to as "gypstacks," of 150 feet or taller. The gypsum goes on to the stack and mixes with water. Rain also adds water to these stacks. Because the water is acidic, it must be contained on the site or recycled into the plant for cooling. These stacks must be continuously monitored to ensure that the water does not seep into the environment. There are currently 25 stacks in Florida. The vast majority of these stacks are located just south of Lakeland and are in various stages of their life-cycle; 10 are active, 12 are inactive, and 3 are closed.[1]

Phosphate mining operations are currently required to have in place reclamation plans for their operations when the life of the mine has expired. The Florida Institute of Phosphate Research was created to study alternative reclamation alternatives and technologies and to study the disposal and utilization of phosphate clay. Also, the Legislature in 2003 provided for the creation of a nonprofit corporation to assist in developing recreational opportunities on phosphate lands. That entity is incorporated as Florida Mining-Recreation, Inc.

The Environmental Protection Agency (EPA) regulates the use of byproducts of phosphate mining, specifically phosphogypsum. Currently, phosphogypsum is classified as a waste product. As such, it cannot be used for any other commercial use. The EPA has, however, approved its use in limited quantities for research purposes and for limited agricultural uses.

Mulberry Phosphates in Polk County and Piney Point in Manatee County are both former phosphate fertilizer chemical processing plants that closed in December 1999. The Mulberry Corporation owned both Mulberry and Piney Point chemical plants. In 2001, the company notified the DEP that it did not have funds to maintain the facilities and would abandon both sites. To prevent an environmental catastrophe, the EPA assumed responsibility for the environmental security at the facilities until transferring that role to the DEP in February 2001. In the same month, the Mulberry Corporation filed for bankruptcy protection.

Shortly after the DEP assumed responsibility for securing the sites, bankruptcy proceedings were invoked, and the federal bankruptcy court appointed a receiver funded by the DEP. The department is responsible, in conjunction with the receiver, for managing and securing the stack systems and providing for long-term closure.

In May 2002, the DEP and Cargill Fertilizer, Inc., entered into an agreement under which Cargill will manage and close the Mulberry facility. The DEP will reimburse Cargill up to $25 million for the closure work. Closure of the stack system is expected to be completed by 2008, after which Cargill will continue long-term care for approximately 50 years. Ownership of the stack system remains with the federal bankruptcy trustee.

Since February 2001, the DEP and the court appointed receiver have maintained the Piney Point gypsum stack system. The primary problem that is being addressed, in addition to ongoing maintenance of the system, is treatment, movement and disposal of hundreds of millions of gallons of water from the stack system. The existing inventory to be disposed of is approximately two billion gallons, which fluctuates due to the amount of rainfall.

[1] Senate Staff Analysis for CS/SB 18-E, October 22, 2003.

In July 2003, the DEP received an emergency federal ocean dumping permit from the EPA to discharge 537 million gallons of water from the Piney Point stack system into the Gulf of Mexico. The permit deadline was November 30, 2003, and the department requested a permit extension of six months.

From FY 2000-01 through 2003-04, the department estimated expenditures of $85.7 million from the Nonmandatory Land Reclamation Trust Fund (NLRTF) for Mulberry and Piney Point. The department estimates the additional cost to complete the cleanup and closure of both sites will be $78.7 million, $66.7 million for Piney Point and $12 million for Mulberry. These closure costs are spread over the next 8 years with a significant portion due over the next 3 years.

The NLRTF was established by the Legislature in 1978 to fund the reclamation of land that was mined before 1975. The Legislature declared that all lands disturbed by phosphate mining after 1975 must be reclaimed by the owners. The revenue source for the trust fund is a tax on the severance of materials, which was enacted into law in 1971 and was paid by all phosphate companies on the basis of tons of phosphate rock produced.

The proceeds from the tax on the severance of phosphate rock is distributed as follows:

- The first $10 million is deposited into the Conservation and Recreation Lands Trust Fund.
- 40.1 percent to the General Revenue Fund.
- 16.5 percent to counties in proportion to the number of tons of phosphate rock produced from phosphate rock matrix located within their political boundaries. These proceeds can only be used for phosphate related expenses.
- 13 percent to counties that have been designated a Rural Area of Critical Economic Concern in proportion to the number of tons of phosphate rock produced within their political boundaries.
- 9.3 percent to the Phosphate Research Trust Fund in the Division of Universities of the Department of Education.
- 10.7 percent to the Minerals Trust Fund
- 10.4 percent to the Nonmandatory Land Reclamation Trust Fund.

The base tax rate is $1.62 per ton severed. Beginning January 1, 2005, and annually thereafter, the tax rate will be the base rate times the base rate adjustment for the tax year as calculated by the DEP. The base rate adjustment is a fraction, the numerator of which is the unadjusted annual producer price index for the prior calendar year and the denominator is the unadjusted annual producer price index for calendar year 1999.

If the producer price index for chemical and fertilizer mineral mining is substantially revised, the DEP shall make appropriate adjustment in the method used to compute the base rate adjustment which will produce results reasonably consistent with the result which would have been obtained if the producer price index for phosphate rock primary products had not been revised. However, the tax rate shall not be less than $1.56 per ton severed.

On March 15, 2003, Congressman Adam Putnam, as chairman of the Subcommittee on Technology, Information Policy, Intergovernmental Relations and the Census, conducted an oversight hearing in Bartow, Florida on the topic "Phosphogypsum: Should We Just Let it Go To Waste?" Congressman Putnam has expressed concerns over the environmental dangers of stacking phosphogypsum and is seeking ways to use this phosphate mining byproduct in an environmentally safe manner.

In 1989, the EPA promulgated a rule determining that the commercial product of phosphogypsum was a "waste" product and banned its use for any purpose whatsoever. As a result, it has just been accumulating in Florida. In 1992, the EPA modified the rule to allow the use of phosphogypsum from northern Florida for agricultural use and allowed small amounts of phosphogypsum to be used in research. In 1999, the EPA increased the limit on the quantity of phophogypsum that may be used for indoor research and development from 700 lbs. to 7,000 lbs. and clarified sampling procedures for phosphogypsum removed from stacks for other purposes.[2]

METHODOLOGY

Staff reviewed the federal rule which regulates phosphogypsum under Section 112 of the federal Clean Air Act. The federal rule is Subpart R of 40 CFR part 16. Also, staff reviewed information and data contained on the U.S. Environmental Protection Agency's website.

Staff obtained and reviewed the written testimonies of the witnesses testifying before U.S. House of

[2] Remarks of Congressman Adam Putnam, March 15, 2003.

Representative's Subcommittee on Technology, Information Policy, Intergovernmental Relations and the Census, of the Committee on Government Reform at a hearing in Barow, FL on phosphogypsum.

Further, staff spoke with representatives of the Department of Environmental Protection, the Florida Phosphate Council, and the Florida Institute of Phosphate Research.

FINDINGS

Environmental Protection Agency Phosphogypsum Regulation – National Emission Standards for Hazardous Air Poillutants

The U.S. Environmental Protection Agency (EPA) regulates phosphogysum under 40 CFR Part 61, Subpart R: National Emission Standards for Radon Emissions from Phosphogypsum Stacks. Phosphogypsum contains radioactive material (radionuclides), which could potentially result in harmful exposure to radon. Prior to processing, phosphate rock contains radium, uranium, thorium, polonium, and lead. Once the rock has been crushed and processed, the resulting waste has concentrated levels of these radioactive materials. Depending on the quality of the phosphate rock, the phosphogypsum could contain as much as 60 times the levels normally found prior to processing.[3]

The EPA is primarily concerned with radium, which tends to stay with the waste during processing. Radium-226 gives off radon-222, an odorless, colorless, and tasteless cancer causing radioactive gas. There is also a small amount of radiation being emitted from phophogypsum in the form of gamma rays. The EPA's regulations control the way in which the phophogypsum may be managed. Only two uses are permitted – limited agricultural use and research. Other uses may be proposed and considered on a case-by-case basis, but otherwise the phosphogypsum must be returned to mines or stored in stacks.[4]

The EPA first issued the national Emission Standards for Hazardous Air Pollutants (NESHAP) for phosphogypsum stacks in 1989. This regulation required that all phosphogypsum must be stored in stacks and did not permit any other uses, such as agricultural or indoor research and development.[5]

The EPA revised the standard in 1992 to permit alternate uses. Those revisions fell into three categories:

- Outdoor agricultural uses, e.g., as a conditioner for soils containing high quantities of salt or low quantities of calcium and other nutrients.
- Indoor research and development activities, e.g., to study the production of road-base and building materials using phosphogypsum.
- Other alternate uses that are approved by EPA on a case-by-case basis.[6]

In 1999, the EPA revised the NESHAP for phosphogypsum in response to issues raised by the Fertilizer Institute relating to the risk assessment supporting the 1992 revisions. The 1999 revisions increased the amount of phosphogypsum which may be used in indoor laboratory research from 700 pounds to 7,000 pounds per experiment, with no limit on the number of experiments; streamlined the sampling requirements for phophogypsum used in indoor research and development; and clarified that indoor agricultural research uses must comply with the indoor research and development provisions, while outdoor agricultural research and development uses must comply with the agricultural requirements.[7]

Florida Institute for Phosphate Research

The Florida Legislature created the Florida Institute of Phosphate Research (FIPR) in 1978 to conduct or fund studies that address the environmental and health impacts of Florida's phosphate mining and fertilizer industry, as well as the industry's efficiency. The institute also serves as a phosphate-related information resource. The FIPR's research concentrates on the following areas: chemical processing of phosphate rock into fertilizer (including studies on the byproduct phosphogysum); beneficiation or mineral processing to separate clay and sand from the phosphate rock; reclamation of mined lands; mining processes; and public health (including radiation issues.)[8]

The FIPR is directed by a five-member board of directors appointed by the Governor. The board must include one state university system faculty member, one major Florida conservation group member, one regulatory member (customarily from the Department of Environmental Protection), and two phosphate

[3] www.epa.gov, frequently asked questions regarding NESHAPs for phosphogypsum stacks.
[4] Id.
[5] www.epa.gov, Rad HESHAPs, How Has EPA Changed Subpart R?
[6] Id.
[7] Id.
[8] www.fipr.state.fl.us

industry members. Board members serve three-year terms, but may be reappointed.

The FIPR is funded through the Phosphate Research Trust Fund.

The board members of the FIPR and other community members have stated that the number one priority for chemical processing research funds is phosphogypsum which is the controversial byproduct that is produced when sulfuric acid reacts with phosphate rock.[9]

Since opening in 1978, the FIPR has invested more than $9 million in 63 completed projects that have looked at phosphogypsum issues and topics such as the byproduct's engineering properties, environmental impacts, its potential use as a commercial sulfur source, its use as an agricultural soil amendment, and as construction material. The FIPR currently has 14 projects working in this area.[10]

Congressional Hearing Conducted by Congressman Adam Putnam

On March 15, 2003, Congressman Adam Putnam, chairman of the U.S. House of Representatives Government Reform Committee's Subcommittee on Technology, Information Policy, Intergovernmental Relations and the Census, held a hearing in Bartow, Florida on phosphogypsum. Congressman Putnam is concerned over the one billion tons of phosphogypsum that is stored in 25 stacks in Florida. Because the EPA has classified phosphogypsum as a waste and has banned its use for any purpose whatsoever, the phosphogypsum has just been accumulating all over Florida.[11] The possibility of a catastrophic spill in Manatee County last year raised local and federal concern.[12]

Congressman Putnam stated that the scientific research that has been conducted by various entities support a position that phosphogypsum is not a "waste" but rather a potentially valuable product. Conclusive evidence by independent researchers and research councils challenge the claims that use of the byproduct is harmful and suggest that specific applications be reviewed. It can be environmentally safe and economically attractive to use phosphogypsum in a variety of ways to serve industries and potentially benefit public taxpayers.[13]

The subcommittee received testimony from the following persons:

- G. Michael Lloyd, Jr., Research Director for Chemical Processing of the Florida Institute of Phosphate Research
- Dr. Malcolm E. Sumner, Agricultural and Environmental Consultant
- Dr. Douglas Chambers, Director of Radioactivity and Risk Studies at SENES Consultants Limited
- Dr. Chih-Shin Shieh, CS Environmental Solutions
- Elizabeth Cotsworth, Director of Radiation and Indoor Air, Office of Air and Radiation, U.S. Environmental Protection Agency
- Harlan Keaton, Environmental Administrator, Florida Department of Health, Bureau of Radiation Control
- Richard Eckenrod, Executive Director, Tampa Bay Estuary Program

Summary of Remarks Submitted to the Subcommittee

G. Michael Lloyd, Jr, Research Director Chemical Processing, Florida Institute of Phosphate Research

In his written remarks, Mr. Lloyd stated that finding environmentally sound ways to utilize phosphogypsum has been a priority issue for the Florida Institute of Phosphate Research since the institute was organized. The FIPR research efforts looked at three basic approaches to phosphogypsum utilization: as a chemical raw material, construction applications (primarily for road beds), and agricultural applications.

In the early 1980s, there was a great interest in recovering and recycling the sulfur values in phosphogypsum. This interest was largely economic since sulfur was selling for $156 per long ton and sulfur could be recovered from phosphogypsum for less than $100 per ton. However, by the time the research was completed, the price of sulfur had fallen to well under $50 per ton and there was no interest in building full scale operating plants.

For construction activities, the FIPR primary research thrust was to use phosphogypsum for roadbed construction. Two secondary roads were constructed, one in Polk County and one in Columbia County. Both were subjected to environmental testing with testing continuing for the Polk County road. Testing by the

[9] www.fipr.state.fl.us/chemproc.htm
[10] Id.
[11] Opening statement by Congressman Putnam at a Congressional hearing in Bartow, FL, March 15, 2003.
[12] Id.
[13] Id.

Florida Department of Transportation showed that the physical strength of the Polk County road increased with time and use. These roads were completed shortly before the EPA ban on phosphogypsum use was issued and plans for the other roads were curtailed.

The FIPR has done varied agricultural research. Other phosphogypsum uses have been researched and include marine applications as oyster culch and artificial reefs, as a raw material for the production of glass type ceramics that can be used for tiles, and for daily cover in municipal solid waste landfills as a means of speeding up the decomposition of the solid waste.[14]

Dr. Malcolm Sumner, Agricultural and Environmental Consultant
Dr. Sumner's remarks pertained to the use of gypsum as a calcium and sulfur source for crops and soils in the Southeastern United States. His remarks were a summary of a report prepared for the FIPR to challenge the EPA's assumptions regarding the ban on using certain phosphogysum as a soil application. The report had the following objectives:

- To independently assess the published experimental evidence on gypsum use in agriculture in the Southeastern United States and in Florida in particular; and
- To compare the gypsum application rate assumed by the EPA in their calculations to actual field practice.

Dr. Sumner's research found that the experimental data strongly suggests that the phosphgypsum rate of application used by the EPA as the basis for formulating the final rule on phosphogypsum use is too high.[15]

Dr. Douglas Chambers, Director of Radioactivity and Risk Studies, SENES Consultants Limited
A portion of Dr. Chambers' remarks focused on using phosphogypsum as a daily cover for landfills. In April 2002, an application for an exemption was submitted to the EPA for approval to use phosphogypsum as a landfill cover material in a test cell at the Brevard County Landfill. The largest potential risks were estimated for the onsite resident who built a home on the test cell in the future. Dr. Chamber's stated that it is not reasonable to consider that a residence would be constructed on the landfill in the short or medium term time horizon. Other issues, such as methane production and chemical exposure are likely to be a greater immediate hazard.[16] The EPA is currently reviewing the petition for the use of phophogypsum as a landfill cover at the Brevard County landfill.

Dr. Chih-Sin Shieh, CS Environmental Solutions
Dr. Shieh indicated that the sulfate-enriched phosphogypsum can be used in the anaerobic environment, such as landfills, to enhance microbiological processes to decompose municipal solid waste, and thus extend the lifetime of landfills. Dr. Shieh developed a three-phase scientific study to determine if the use of phosphogypsum as a landfill cover is technologically and environmentally feasible. Phases I and II were conducted in the laboratory, which have been completed. Phase III is a proposed field study. The proposed Phase III study is still pending EPA approval.

Elizaberth Cotsworth, Director of Radiation and Indoor Air, EPA
The EPA regulates phosphogypsum pursuant to the National Emission Standard for Hazardous Air Pollutants (NESHAP) authorized by Section 112 of the Clean Air Act. Radionuclides are listed as a hazardous air pollutant under this section. The processing of raw phosphate ore specifically concentrates radionuclides in the waste rock, phosphogypsum. Phosphogysum contains naturally occurring radiation such as radium-226 and radon-222. Radium, as it decays, emits radon gas. Due to its health risk, radon emissions in particular are controlled by EPA's NESHAP regulation.

EPA strives to provide maximum feasible protection against risks to health from hazardous air pollutants by trying to limit exposures such that an individual's lifetime excess cancer risk level is not more than one in 10,000 and may be as little as one in a million.

EPA has considered a number of uses and has modified its regulations to allow a small number that do not present unacceptable risk. Some activities do not meet the criteria for ensuring safety and health protection. For example, EPA found that a generic exemption for road building material could not meet the risk criteria. This is because of radium bearing dusts which are dispersed as the road surface degrades and radon emissions from the road itself result in undesirable

[14] Testimony by G. Michael Lloyd, Jr. in Bartow, FL, March 15, 2004.
[15] Written statement of Dr. Malcolm Sumner, submitted in Bartow, FL, March 15, 2004.
[16] Written statement of Dr. Douglas Chambers, submitted in Bartow, FL, March 15, 2004.

exposure. Also, when road material is eventually removed, disposed, or abandoned, additional exposures can occur.

The EPA works in partnership with the DEP regarding review and consideration of potential new phosphogypsum uses.[17]

Harlan Keaton, Florida Department of Health
The Florida Department of Health has a limited role regarding naturally occurring radioactive material in the environment. The department's Bureau of Radiation Control regulates the use of radiation and radioactive materials in medicine and industry. Although, the department does not regulate the disposal of or use of phosphogypsum and has not been directly involved in research regarding potential uses and possible health risks from the use of phosphogypsum, the department does conduct some testing in mining areas.

The department supports aggressive research to find appropriate and safe uses for phosphogypsum.

Richard Eckenrod, Executive Director, Tampa Bay Estuary Program
The Tampa Bay Estuary Bay Program supports the efforts to find beneficial uses of phophogypsum after full consideration of the appropriate health and environmental risk assessments.[18]

Proposed Uses of Phosphogypsum
The EPA has allowed phosphogypsum produced from North Florida mining operations to be used on certain agricultural crops. The radium and radon levels for phosphogysum from these mines are lower than phosphogysum produced elsewhere in the state. As a result, they are below the NESHAP for phosphogysum.

Another proposed use is as a daily landfill cover. In April 2002, an application for an exemption was submitted to the EPA for approval to use phosphogypsum as a landfill cover material in a test cell at the Brevard County Landfill. The EPA has not yet made a decision on the petition.

Several concerns have been raised about this potential use. The DEP has expressed concerns regarding odor, hazardous emissions, and methane production. Currently, gypsum wall board can be disposed of in landfills, particularly construction and demolition debris landfills. At some of these landfills, there have been significant odor issues. If vented properly, methane gas production could be managed.

Manasota 88, a Sarasota-based environmental group, is lobbying the EPA to deny the request. The group insists that allowing humans or animals to be exposed to his waste material is dangerous.[19]

CONCLUSIONS

Currently, the Environmental Protection Agency has determined that phosphogysum, a byproduct of the phosphate mining process, is a waste and is regulated under Section 112, of the Clean Air Act. because of the radiation phosphogysum emits. Only two uses are permitted – limited agricultural use and research. Other uses may be proposed on a case-by-case basis, but otherwise the phosphogypsum must be returned to mines or stored in stacks.

While research as to alternative uses continues, Florida cannot authorize a use or alternate application of phosphogypsum that is contrary to any federal law or rule.

[17] Written statement of Elizabeth Cotsworth, Director of Radiation and Indoor Air, EPA, submitted in Bartow, FL, March 15, 2004.
[18] Written statement of Richard Eckenrod, Tampa Bay Estuary Program, submitted in Bartow, FL, March 15, 2004.
[19] www.sun-herald.com/NewsArchive2/112104/op1.htm?date=112104&story=op1.htm