ILLINOIS POLLUTION CONTROL BOARD
May 23, 1972

IN THE MATTER OF	)	
	)	
MINE RELATED POLLUTION	)	#R71-25
	)	
REGULATIONS	)	

OPINION OF THE BOARD (BY SAMUEL T. LAWTON, JR.)

On December 16, 1971 the Illinois Pollution Control Board ("Board") proposed comprehensive regulations for the control of mine-related pollution. Two amendments were added on January 24, 1972 (Ex. 1). Public hearings in Carbondale, Harrisburg, Peoria and Galena, Illinois produced a substantial volume of valuable testimony in response to which we revised our initial proposal and published on April 4, 1972, a proposed final draft (Ex. 44). Considerable additional written public comment was received (Ex. 45(a) - (p).) Today we adopt the final regulations with some sections changed for clarification, some sections deleted and some new sections added to allow greater flexibility to mine operators in meeting the requirements of the Regulations.

These Regulations require a permit for opening, operating and abandoning a mining operation; compel the institution of environmental safeguards into mining operations; and apply effluent criteria controlling the harmful water pollutants present in mine drainage. This action completes a most significant phase of the program for environmental protection in Illinois.

Following is a detailed discussion of the environmental impact of the Illinois mining industry; the ability of these Regulations to abate that impact; and the economic and technical feasibility of the prescribed control measures:

I. Illinois Mining and Its Environmental Impact.

Illinois has a varied metallic and non-metallic mining industry. The Illinois coal industry ranks fourth in the nation, surpassed only by the prodigious outputs of West Virginia, Kentucky and Pennsylvania. Illinois also produces clay, sand, gravel, limestone, fluorspar and lead-zinc, each with environmental problems of their own.

The present regulations cover both surface and underground methods of mining. Sand dredging in water and drilling for oil and gas are not covered by these regulations. Surface mining essentially consists of the stripping of coal and open pit extraction of clay and sand, limestone and gravel referred to as "aggregate". In open pit surface mining the "overburden",being the earth covering the mineral strata to be extracted,is removed and the mineral withdrawn. Because the mined strata are generally quite thick, open pit mining may continue for years in a confined area. The ratio of overburden to mineral is quite small, resulting in small spoil banks of removed overburden, and much less disruption of the earth's surface than coal strip mining.

The generally flat terrain of Illinois allows most surface mining of coal to be accomplished by area stripping, where the operator cuts a box-cut trench through the overburden, exposing a portion of the coal seam for extraction, and deposits the spoil in a row paralleling the first cut. The process is repeated, extending the cut horizontally to the limits of the coal seam. As the mining moves laterally, the overburden from each succeeding cut is dumped into the previous cut. At the horizontal limit of the coal seam the final cut is made, producing an open trench the depth of the thickness of the overburden and the coal seam, bordered on one side by the final spoil bank and on the other side by a "highwall". Prior to acceptable regrading and reclamation the mined area is a battered washboard of spoil banks and intervening furrows.

Contour stripping designed for hilly and mountainous areas is also practiced, although infrequently, in Illinois. The overburden is stripped from the edge of a hill exposing the outcrop of the coal seam for extraction. Successive bites are made inward toward the center until the depth of overburden is too great to continue with mining from the surface. Large draglines make surface mining possible to depths of nearly 200 feet; technological improvements may make surface mining possible to depths of 2,000 feet. This process is then extended laterally along the face of the hillside, creating a "ribbon" effect along the tops of hillsides as if each were spun and carved on a lathe.

Available technology permits most overburden from this process to be retained on the "bench", being the flat area created by the first cut into the hillside,referred to as the "block-cut" method. Common practice allows the overburden to be pushed over the hillsides. Water pollution from erosion and slides is produced by these sloppy downslopes as well as by the washboard spoils of area mining.

Auger mining is associated with stripping and is used to recover additional coal when the depth of overburden becomes too great for economical surface removal, or to recover coal near the surface outcrop left by earlier underground mining. Auger mining is conducted by boring horizontally into a seam, extracting coal much like wood shavings are pulled back by a drill. Auger insertions are often seven feet in diameter, and two hundred feet deep, paralleling one another for the breadth of the reachable coal seam. The major pollution danger from augering is posed by ground and surface water percolation through the exposed seam in the hole and out the borehole front carrying acid and mineral salts into the waters of the state.

Underground mining in Illinois extracts coal, fluorspar and lead-zinc. Shafts are driven into the ground vertically ("shaft" mine), horizontally at the base of a hillside ("drift" mine), or at an angle to the surface plane ("slope" mine) to the depth of the mineral seam. Spoil banks are formed from the overburden hauled to the surface.

The sources of air and water pollution from these mining activities are myriad. Previously we enacted controls for two of these sources; effluent in water and air emissions from the mineral preparation or processing plant. (See PCB Regulations, Chapter II - Air Pollution; Chapter III - Water Pollution). Today we enact regulations for the control of land runoff (specifically exempt from Chapter III, Water Pollution) and dust entrainment from mined and mine refuse areas.

The sources of contaminating mine drainage are mine refuse areas, spoil banks, exposed mineral seams; and mine haulage and entrance roads and mine yards covered with acid-producing refuse.

Mining-related water pollution in Illinois predominately comes from surface drainage over and percolation through mine refuse heaps, the solid waste products of the cleaning and preparation of mined minerals (See Exhibit 16(b), slides #6, 23-25, for pictures of this "gob" pile drainage). Coal mine refuse piles, in particular, pose a tremendous and continuing threat of water pollution because they contain iron sulfide, "pyrites", a mineral substance which upon oxidation and contact with water can produce drainage containing sulfuric acid and iron. Oxidation of pyrite to form sulfuric acid in coal mine refuse piles has been shown to occur at the rate of 198 pounds of acidity per acre of refuse per day. (Exhibit 19(a), p. 37) Acid is particularly toxic to aquatic life, and iron,when it settles out of the drainage,forms a coating on stream beds ("yellow boy") which smothers bottom dwelling organisms, taxes the oxygen capacity of the stream and reduces the breeding spaces for aquatic life (Ex. 14, Appendix F, p. 1-21).

Besides the continuous production and washing away of sulfuric acid at the outer mantle of these refuse areas, "gob" piles tend to act as giant sponges absorbing rainfall during the wet seasons and, in a delayed response, during dry weather oozing visible and hidden streams of polluted drainage at a fluctuating pace. An estimation is that 54% of the rainfall immediately runs off a pile; the remainder is absorbed, in part evaporating, in part becoming polluted seepage. (Ex. 19(a), p. 1).

Refuse piles from coal, lead-zinc and clay mining are potential sources of acid mine drainage, the threat varying with the pyrite concentration in the refuse; the spatial distribution, size and degree of crystallization of the pyrite; the geological characteristics of the surrounding refuse material and terrain, and the extent to which oxygen and water gain access to the pyrite. In addition, all mine refuse piles are subject to erosion at a rate of approximately 17 cubic yards per acre per year; (Ex. 16(b) p. 2) and can thereby, continuously supply quantities of mineral salts such as aluminum and manganese and suspended and dissolved solids to nearby streams.

Similar but less severe water pollution is caused by drainage over the massive areas of spoil banks and the exposed mineral seams. Because surface mining, especially stripping, involves disturbance of greater volumes of earth than underground mining, sedimentation from these areas can be quite severe. A study of the hydrological influences of strip mining found that sheet erosion from spoil banks had clogged two nearby Kentucky streams with dark gray sediment in places more than two feet deep. In the area adjacent to one stream, strip mining had disturbed only .8% of the land but contributed 83% of the erosion. In the area of the second stream, coal stripping had disturbed only 6.4% of the land and contributed 96% of the sheet erosion. One stream influenced by strip mine spoil erosion discharged 1900 tons of sediment per year, compared to 42 tons discharged during the same period by a controlled stream unaffected by surface mining (Ex. 9, p. B3).

Illinois, with the flat to rolling hill terrain of its mining sectors and an annual precipitation average of 33 to 43 inches likely endures somewhat less sedimentation from mine spoil banks than does Appalachia with its scarred mountains and rainfall exceeding fifty inches per year. But the difference relates only to the quantity, not the presence or absence of such pollution.

Drainage over exposed mineral seams is most often a problem with coal, lead-zinc, fluorspar and clay mining. In coal, lead-zinc and clay mines this drainage can become acidic; in lead-zinc mines it picks up lead and zinc; in fluorspar mining, fluoride in the run-off is a threat. Water pollution from this source occurs primarily from surface mines because most of the deep mines in Illinois lie below the level of the natural drainage. Generally, water entering a deep mine does not flow through but is either pumped back to the surface or retained underground, unlike Appalachia where much mine pollution is caused by surface drainage flowing into deep mine entrances, gathering contaminants, and running out, to the nearest stream or body of ground water. In Illinois contaminated water is pumped to the surface from underground mines for safety reasons or to permit mining to continue, and this drainage is polluted. However, the possible impact on groundwater of water percolating through underground mines in Illinois has not been adequately studied.

Another source of contaminated mine drainage is leachate or overflow from and ruptures in "slurry ponds". Mined minerals must be crushed and cleaned prior to distribution. This washing at a preparation plant produces a slurry effluent heavy in mineral fines, metal tailings and other contaminants, which is generally pumped to settling ponds, diked retention basins, in order for the solids to precipitate out and allowing re-use of the water in the washery. Most pollution from this source is accidental due to a break in the dam or due to faulty design or location (See Ex. 38, re: Man, West Virginia mine disaster on Buffalo Creek).

A related pollution source is flooded pits on surface mines, containing highly acid or alkaline waters. (See Ex.16(b); slide #31, 32 for pictures of pollutional drainage from these mine pits).

The remaining significant source of polluted mine drainage is runoff from mine roads and mine yards constructed with acid producing mine refuse. This is almost exclusively a problem near coal mines, although clay mine roads may have this condition.

Air pollution from mining is caused by wind sweeping across dusty mine roads, spoil banks, refuse piles, open pits and dried slurry ponds.

These sources of mine-related air and water pollution, unlike the sources of such pollution from most other industries, contaminate the environment during commercial production and continue to pose a pollution threat years after operations have come to a halt. Any meaningful strategy for mine-related pollution control must cope not only with the present effects of past mining and the immediate impact of current operations, but also with the distant environmental consequences of today's mines.

A multitude of these widespread contaminating point and non-point sources has polluted and threatens to pollute the water and air of Illinois.

The Illinois Environmental Protection Agency ("Agency") testified to typical drainage from southern Illinois coal mine yards, gob roads, refuse piles and flooded acid and alkaline strip pits and to the typical impact of such drainage on the waters of Illinois. The Agency witnesses conclusively demonstrated that coal mining imposes a burden of severe water pollution on the Saline and Big Muddy River Basins as well as other streams in southern Illinois.

Drainage from abandoned and active coal mines in southern Illinois reflects the following:

(a) Mine yards sampled had a pH of 2.6 to 3.3 and an iron content of 96 to 480 ppm.

(b) Drainage from mine roads constructed with acid-producing refuse had a pH of 2.5 to 3.3 and an iron level of 14 to 1140 ppm.

(c) Refuse piles typically discharged water of a pH range of 1.6 to 2.7; an iron concentration of 120 to 13,000 ppm; and a dissolved solids level of 6800 to 95,000 ppm, compared with our recently adopted limit on dissolved solids effluent from manufacturing and processing sources of 3,500 ppm. Two of the refuse piles sampled, abandoned in 1929 and 1949, continue to discharge water with a pH of 2.2 and an iron load of 1930 ppm to 8200 ppm, indicating the continuous nature of these pollution sources once they are underway.

(Ex. 16(a), "Mine Drainage Impact on the Saline River", Robert Gates.)

As a standard of reference it should be noted that the Board has imposed a limit of 2 mg/l (about 2 ppm) iron for manufacturing sources, and today adopts a pH standard of 5-10 for mine drainage. Biological studies show that a pH of less than 4.5 will destroy most aquatic life and that some game fish do not reproduce effectively in a pH of 5. Some of the effects of iron in mine drainage have been previously discussed. (See Exhibit 14, Appendix F).

Water quality data and biological testing in the Saline and Big Muddy River Basins (Exhibits 15 and 16(a), pp. 2-9) reflect the following:

(a) The South Fork of the Saline River upstream from major active and abandoned coal mining operations is not polluted and maintains a balanced aquatic life.

(b) Sections of many of the tributaries to the South Fork of the Saline River which are directly affected by coal mining drainage are polluted and do not support aquatic life.

(c) Much of the South Fork of the Saline and the Saline River itself downstream from major active and abandoned coal mining operations is polluted and does not support aquatic life.

(d) Mine polluted water in the mainstream of the Saline can "back up" into the North Fork where it enters the Saline, adversely affecting that portion of the North Fork. Acid slugs down the mainstream of the Saline have resulted in fish kills near the mouth at the Ohio River. (Ex. 16(a), pp. 8-9; 16(b) slides #56, 57 - Photos of these kills).

(e) At those points on the Saline and Big Muddy where known mine drainage does not exist, dilution can work to reduce the impact of mine drainage upstream.

(f) Those sampled points on the Saline and Big Muddy Rivers which are downstream from mining operations but which have a sufficiently high pH to support aquatic life, contain inordinately high levels of dissolved solids and sulfates, in most instances exceeding and in all cases approaching allowable water quality limits. (Ex. 15, p. 9; and 16(a).

(g) In certain sections of the Saline River Basin, not at present severely affected by coal mine drainage, as well as in sectors affected, large areas of unmined coal reserves are being acquired for future extraction. (Ex.16(a), pp. 5-6, 8). The water quality data and the survey of typical mine drainage would tend to indicate that dilution from large upstream watersheds is at present of prime importance in cushioning the over-all impact of coal mine drainage on the Saline River Basin (Ex. 16(a), pp. 3,5,6-7), which effect cannot be depended upon to prevent future adverse impact in currently unaffected sectors when the number of mine sites increases. There is little room to assimilate more mining, let alone additional industrial and municipal growth.

The evidence indicates a widespread local impact on small receiving streams which because of dilution is not always reflected in the larger rivers. (Although dilution on the Little Muddy River does not always prevent fish kills from mine acid slugs, Ex. 5). Sycamore Creek, a small creek flowing through one of the mined areas in the Big Muddy River Basin, upstream from a mined area carries acceptably low levels of iron, manganese, dissolved solids and sulfates; its pH is 6.3. Downstream from the mined area the pH plunges to 3.2; iron rises from .3 to 200 mg/l; manganese from .1 to 23.2 mg/l; and sulfates increase from 170 mg/l to 1600 mg/l. The expert testimony that this impact is by no means unique for small tributaries is borne out by data for Walker Creek near DuQuoin, Illinois, damaged by an abandoned mine refuse pile (Ex. 19, pp. 94-95).

The record likewise demonstrates the coal mine drainage impact on the water quality of central Illinois. Kahokia Creek near Gillespie; Macoupin Creek near Farmersville; Grape Creek in Vermillion County where a seven mile stretch is adversely affected by contaminated drainage from the refuse piles of one deep mine; Spoon River from eastern Knox County to its confluence with the Illinois River; and the south fork of the Sangamon River near Springfield have suffered from coal mine-related water pollution (R.573, 574).

The Illinois Institute for Environmental Quality conducted a study of the technical feasibility and the economics of applying effluent standards to mine drainage (Ex. 17). The Study's data and some of its conclusions affirm that the impact of coal mine drainage is a matter of serious concern in certain sections of Illinois.

Generally, Illinois surface and deep coal mines pose water pollution problems from suspended solids, heavy metals and acid mine drainage. Acid mine drainage is predominantly a problem of southern Illinois, where, based on preliminary effluent data, coal mines also discharge rather high levels of iron, lead, manganese, zinc and nickel. The Colchester No. 2, Davis and De Koven coal seams of southern Illinois seem to be the most consistent sources of acid drainage. (Ex. 17, p. 16). Surface coal mines in central Illinois appear to have suspended solids, manganese and iron problems. The northern sector of the coal mining area of the state does not appear to have acceptable discharges of suspended solids, fluoride, iron and lead. (Ex. 17, pp. 60-67).

Ground water, after seeping into underground mine workings becomes polluted, often containing high concentrations of acid, dissolved solids, iron and chlorides. (Ex. 17, pp. 50, 52). Refuse pile drainage from deep and surface coal mines is by far the major source of mine-related water pollution (Ex. 17, p. 56).

These effluent data are the more striking when the potential volume of mine drainage directly affecting the total mine contaminant load on the waters of Illinois is considered. From each deep coal mine approximately 56 million gallons per year (mg/yr.) of run-off occurs from refuse piles and from polluted water pumped to the surface from underground. Approximately 1500 mg/yr. of run-off is estimated to occur from the refuse piles alone of a strip coal mine containing high gob acreage. (Ex. 17, p. 59, Table 18). The volume of runoff from these two areas can be much greater. Some lead-zinc and fluorspar deep mines pump out 2 to 5 m.g./d (id. pp. 113, 124).

Further, the future of coal mining in Illinois portends an impressive threat of additional air and water pollution. This state has mined only 3% of its mineable reserves, with approximately 194 billion tons remaining. (Ex. 16 and 27, p. 93). Over three billion tons of these reserves are strippable resulting in the potential disruption of almost 1000 square miles of land. (Ex. 2, p. 2).

The testimony of Mr. R. E. Favreau, Regional Engineer for Region 5 of the Illinois Department of Public Health, on the need to control mine drainage in Illinois, raises the specter of disease related to mine runoff, of mining which if permitted in certain areas (Lusk Creek) would likely cause irreversible water pollution (R.128), and of municipalities and their water supplies seriously disrupted by contaminated mine drainage.

In the past, chloride washers have been used for coal cleaning operations, the discharge from which led to a "tremendous breeding problem" of encephalitis-carrying salt marsh mosquitoes ("aedesollicitan") in the West Frankfort and Saline County area, and in Carrier Mills and Stonefort, Illinois. This mosquito has now adapted to breeding in mine refuse and mine wastes that do not contain high chloride concentrations (R.122, 123). Studies in the area of Will Scarlet Mine, near Carrier Mills, indicate that in the flood plains receiving high sulfate or chloride discharges as many as 30,000 of these mosquito eggs per square foot may be deposited. (R.127). Mine drainage, high in chlorides and sulfates, must be so controlled as to prevent overflow into these breeding grounds likely to occur in flood plain areas. (Also see Ex. 22, pp.3-4).

Mr. Favreau affirmed previously discussed testimony of the destructive influence of coal mine drainage on the Saline River (See Ex. 16(b), slide #26); Bangston Creek; the Big Muddy River especially tributaries affecting Crab Orchard Creek, Lake Creek, Pond Creek and Beaucoup Creek; the Marys River and its tributaries (R.117). (See Ex. 16 (b)(f), slides #51 and p.5).

Favreau testified to mine drainage, including coal and slurry fines from slurry pond breaks, causing damage to private property, aquatic life and public water supplies in Murphysboro, Elkville, Herrin, Royalton, Harrisburg and Carrier Mills, Illinois.

The Murphysboro water supply intake on the Big Muddy River has a high mineral content, caused primarily by Beaucoup Creek drainage which is high in dissolved solids and sulfates, largely due to mine drainage; Ex. 15). The citizens of Murphysboro pay to soften their drinking water, which despite treatment is still high in dissolved solids (R.118).

Herrin, Illinois, after coal mining operations produced acid drainage in one of its watersheds, had to divert this sector of the watershed from its public water supply, producing additional costs for the people of Herrin and additional water pollution for the recipients of the diverted watershed (R.119).

Special treatment costs have been undertaken to correct mine-related acid, iron and total mineral content in that portion of the Big Muddy River supplying Royalton, Illinois (R. 119; see Ex. 16(b), slide #55 for a picture of a mine drainage fish kill at this water supply intake).

Harrisburg pumps its basic water supply from the Middle Fork of the Saline River and has had to resort to filling its side-channel reservoir only when heavy rainfalls are sufficient to dilute the acid and mineral content of the Middle Fork (R. 119, 337-38, 341-45). The problem of water shortage has thereby become critical, to the point that the City is paying an additional $350,000 for a plan to alleviate its sole dependence on the mine-drainage-controlled Middle Fork (R. 344). Otherwise 15,000 people in the area would be forced to find a new water supply. The City of Harrisburg testified,

> "This is particularly distressing, since the area has a very high unemployment rate and funds and tax base are not sufficient for improvements. Also due to the inability of the City to have an adequate water supply, industry has been reluctant to locate in the area which compounds the unemployment problem." (R.345).

Some southern Illinois communities have been forced to search for water supplies unaffected by mine drainage. (See R.120, DuQuoin's search for water free of contaminated mine drainage in the drought of 1954-55; Carbondale in its search for water to meet the demands of growth had similarly to skirt mine-drainage-contaminated sources). Gallatin County was denied a lake on Eagle Creek specifically because of water pollution from the area's active and abandoned surface and underground mines (R.121).

Mr. Donald Crane, Director of Environmental Resources and Planning for the Appalchian Regional Commission, and Study Director for the comprehensive report, Acid Mine Drainage in Appalachia, (Ex. 14) testified to the potential bleak future of southern Illinois if mining is not effectively controlled. Crane said of his experiences in the Carbondale and Herrin, Illinois areas:

> "The piles of waste from underground mines, abandoned coal processing plants, abandoned mine portals, equipment and other (mine) debris in and around towns and in the backyards of peoples' homes were a small example of the disturbances that I was later to see in the Appalachian Region.[1]

---

1 The Illinois Coal Operators Association and two coal mining companies objected to the testimony of the representatives of the Appalachian Regional Commission on the grounds that Illinois is, after all, not Appalachia. But these experts in their direct testimony express full awareness of the basic differences as well as the basic pollution similarities between coal mining in Appalachia and Illinois. Further, Mr. Crane was familiar with the mining techniques of southeastern (continued on page 11).

"I understand that the geology, configuration, and topography of the Illinois basin is not the same as the Appalachian coal basin. However, I recognize that there are substantial similarities between the two basins, including the extent of social, economic and environmental impacts resulting from mining. If these impacts are allowed to accumulate, then conditions much like those in the Appalachian Region will occur."(R.244).

"Over the past hundred years coal mining has caused increased amounts of acid, sediments, sulfates, iron and manganese in the (Appalachian) Region streams, thus substantially altering the water quality."

"These conditions, for all practical purposes, are permanent and are not self-correcting, except in the geologic sense of time." (R.244,245)

"Postponement of pollution control from the mining operations...separates the cost from responsible and identifiable parties who draw a directly related flow of income from the mining."

"...this constitutes a direct subsidy to the ultimate users of the coal by those who will find it is necessary to abate pollution at a later date."

"One of the lessons from the Appalachian experience is that such a subsidy is wrong and it is now proving to be in many areas an insurmountable problem within the (Appalachian) Region." (R.260).

The record points up other subsidies:

(a) Mine drainage affects nearly every type of water use, increasing the costs to industrial and municipal users (Ex. 14, Appendix A, (R.249) and testimony of R. E. Favreau, supra).

Ohio, a part of the Appalachian Region, with topography and mining technology and surface mine drainage conditions similar to those of southern Illinois. (R.317-319). Further, the study, Acid Mine Drainage in Appalachia (Ex. 14, pp. 6, 15, 16, 21, 22) and the Coal-Mine Industry Advisory Committee to the Ohio River Valley Sanitation Commission in its report on mine drainage (Ex. 16, p. 3) affirm that there are basic pollution attributes of all coal mining. Also, the water quality impact of Illinois coal mining (discussed, supra) reflects that many of the environmental consequences of mining in Illinois are essentially similar to those in Appalachia.

(b) A setting of general environmental degradation including contaminated mine drainage and other mining disturbances may be a significant disincentive in the locational decision process of industry. (R.249 and testimony of the City of Harrisburg, supra).

(c) Small amounts of acid drainage can prevent the use of surface waters for recreation and for fish and wildlife management, preventing water resource development (R.250 and testimony of Favreau re lake on Eagle Creek, supra).

(d) Abandoned coal mines cause dreadful environmental damage and a costly economic burden from the past. Eighty percent of Appalachia's mine-related water pollution is estimated to arise from these "orphan" mines (R.247). An educated guess is that abandoned mines generate 30-35% of the mine drainage pollution in the Saline and Big Muddy watersheds of Illinois (Ex. 17, p. 68). (See Ex. 16(a) and 19 and Environmental Protection Agency v. Truax-Traer, PCB 70-10, and Environmental Protection Agency v. Ayrshire Coal Company, PCB 71-323, for representative examples of polluted drainage from coal mined areas long deserted). Pennsylvania may spend $1 billion dollars in an attempt to correct the aesthetic and water quality blight caused by its environmentally mismanaged coal mines (R.257). Maryland will spend about five million dollars in a similar effort (R.257). The Governor of Illinois proposes to spend one million dollars as an initial step in a ten-year program to cope with the burden imposed by 50,000 acres of abandoned, polluting mined land in this state. (See "Special Message on the Environment," Governor of Illinois, March 9, 1972; Ex. 43). The mining industry's orphans should be readied to face the future. Those abandoned mined areas presently causing water pollution should be corrected; the creation of more problems should be prevented.

This Board cannot hold that the citizens of Illinois must forever shoulder the considerable social and economic costs of additional public water supply treatment; of clean water feasibility studies; searches for uncontaminated public water supply; foregone industrial development; lost recreational opportunity; and increased public expenditures for mine-pollution abatement in order to subsidize the mining industry or in order to provide cheaper electric power to millions of people who live outside the mining region. An industry's neighbors should not be put to the Hobson's choice of dirty water or inequitable subsidies when pollution control is technically and economically feasible.

While we recognize that the impact of non-coal mines in Illinois does not approach the environmental damage of coal mining, available data do indicate that water and air pollution from these sources are sufficient to include them within a general regulatory scheme, flexible enough to avoid unfair hardship, but possessing a control framework designed to prevent possible pollution problems from occurring. Wind-blown fugitive dust from limestone quarries and haulage roads, and from refuse piles and dried slurry ponds at fluorspar and lead-zinc mines, as well as coal mines, (Ex. 19, p. 1) can cause air pollution, depending on their location and method of construction and maintenance (R.271).

Water quality data show that the mining in the Illinois side of the Upper Mississippi Valley Zinc-Lead District presents a potential drainage problem from water pumped to the surface from deep mines and from runoff and leachate from the mine refuse areas and mill tailings ponds (Ex. 17, pp. 119-20). The two million gallons per day pumped out of each lead-zinc mine may at times be high in zinc and suspended solids (Ex. 17, Table 62, p. 121) and the effluent data from a settling basin at a lead-zinc mine indicates a zinc problem (id.).

The Institute for Environmental Quality study shows that two to five million gallons of water are pumped daily to the surface from each of Illinois' fluorspar mines. This water is high in fluorides. (Ex. 17, p. 24). Runoff from tailing ponds and piles at these mines is a source of excessive dissolved solids. (R.208, 211, 387-88; See Ex. 16(b), slide #52 for fluorspar discharge).

Clay mines are likely to have silt and iron and acid-producing refuse piles and exposed mineral seams which must be controlled. (R.149, 154, 157).

The "aggregate" mines, (sand, gravel and limestone) have refuse piles, and limestone operations utilize a tailing pond system from which run-off can occur depending on location and method of construction. Limestone quarries are capable of causing air pollution from wind erosion of the pits, haulage roads and refuse areas. (Ex. 45(a)). The massive disturbances of the earth's surface from such mining constitute a sufficient threat of water and air pollution to warrant applying a permit system in order to assure that where a threat does exist, safeguards are taken. Pennsylvania has taken a similar approach in regulating all such mining, even though coal mining is by far the largest polluter (Ex. 18).

II. EFFICACY AND FEASIBILITY OF THE REGULATIONS

While serious damage has been done to the waters of Illinois and a severe pollution threat remains, Illinois has begun to protect its environment from the adverse consequences of mining. This state benefits from a recently reformed surface-mined land reclamation law which can achieve, if enforcement is up to the task, the satisfactory reclaiming of countryside hereafter subjected to surface mining.

(Ex. 34; Ill. Rev. Stat. Ch. 93, Sec. 201 et. seq., 1971). Illinois has effluent and emission standards restricting pollutional discharges from mine washeries and mineral preparation plants. (PCB Regulations; Chap. III, Water and Chap. II, Air Pollution.)

However, this record demonstrates that effluent and emission standards for mineral processing plants and land reclamation for all new surface mines are not adequate to cope with the severe burden of mine-related pollution.

Much mining is not conducted on the surface. Reclaiming surface mines hereafter will not reduce pollution from those surface mines begun prior to and not covered by the Surface-Mined Land Reclamation Act. Reclaiming stripped surface areas after mining is completed is primarily an aesthetic measure; in any event, it will not control polluted surface runoff and leachate and wind erosion while mining operations continue.

Effluent criteria alone cannot adequately control pollution from the multitude of widespread fluctuating, visible and hidden sources of surface and groundwater contamination which pose a constant pollution threat but the effects of which are weather-dependent. Numerical effluent and emission standards will not abate mine drainage and nuisance dust after the mining operation has closed, wastewater treatment ceased, and the pollution-generating property reverted to a farmer whose financial ability to correct his inherited problem does not match his legal obligation to do so. Neither effluent limitations nor surface land reclamation can wipe away the pollution damage and social costs caused by an environmentally ill-placed or mismanaged mine. Prevention, reducing the threat of pollution,is the more palpable alternative.

To these ends, we have combined the control philosophies of effluent treatment and reclamation, with the strategy of prevention through environmental planning. The Regulations, of necessity, specify in a certain few instances the required control procedure, but generally provide a flexible control framework, allowing a variety of approaches to meet a variety of pollution circumstances. These Regulations require:

(a) That a permit be obtained to open, operate or abandon a mine or mine refuse area;

(b) That specific, minimally acceptable environmental safeguards be embodied into mining operations; and

(c) That an operator meet defined environmental goals, the methods for attaining which are left to be determined according to local conditions.

LEGAL ARGUMENTS

The Illinois Coal Operators Association and some coal companies have raised legal objections to the adoption of these Regulations. Two of their objections have not been previously considered in Opinions of this Board:

(1) Whether this Board can constitutionally require a permit to open, operate or abandon a mining facility; and

(2) Whether the Surface Mined Land Conservation and Reclamation Act of Illinois ("Surface Act") considered in conjunction with the Environmental Protection Act of Illinois, bars any pollution control regulation, (except for water quality standards) of the mining industry.

Sections 9(b), 12(b) and 13(c) of the Environmental Protection Act empower the Board to require a permit and adopt standards for the issuance of such a permit for the construction, installation or operation of any equipment or facility "capable of causing" water or air pollution. Opponents of the Regulations contend that the Board, by requiring a permit for all mining operations, has presumed that all cause pollution, a presumption which, the contention goes has no basis in fact and thus constitutes a denial of Due Process of Law.

The argument fails at the first step. The Environmental Protection Act states that permits may be required of a facility "capable of causing" pollution. The Coal Operators Association has missed the plain wording of the statute in assuming that this Board has presumed that each mine in Illinois in fact causes pollution. Pursuant to our statutory authority, we do find that any mining and mine refuse disposal activity is "capable" of causing air and water pollution. The "factual basis" is overwhelming for this presumption underlying the permit requirement. The record, discussed in detail below, is conclusive that every kind of mining in this state maintains one or more of the following: refuse piles, slurry or tailing ponds, spoil banks and mine haulage and entrance roads; that any mining exposes mineral seams and massive quantities of excavated earth to wind and water; that any or all of these sources not only are "capable" of causing air or water pollution but, in fact, frequently do cause such pollution.

Implicit in the Coal Operators contention is that a permit may be required only of a facility which has been shown to be a polluter. (R.525). The Act, on its face, contradicts such an interpretation. Furthermore, to so hold would deprive the permit system of its intended value as a pollution prevention measure. (See Environmental Protection Agency v. Ayrshire Coal Co., PCB #71-323, where over $500,000 is being spent to control contaminated mine drainage from carelessly placed and constructed mine refuse piles. The pollution and the resulting expense could have been prevented by proper planning in the first instance.)

The Coal Operators further contend that this Board denies the mining industry Equal Protection of the Law by singling out mining for such a permit control system "while ignoring substantially all other installations of like capability" (R.524-525). Again, the Coal Operators ignore the plain and obvious fact. The Board requires environmental protection permits of the great majority of the manufacturing and processing operations and all of the sewage treatment plants in this state, all of which are "capable" of causing air or water pollution. (PCB Regulations Chap. II, Air Pollution; Chap. III, Water Pollution). As another Equal Protection objection, members of the coal industry have complained that this Board unfairly controls surface drainage from mines because we have not similarly regulated agricultural drainage. The Board has already regulated combined sewer overflows, another form of land runoff pollution (PCB Regulations, Chap. III, Water Pollution). It has held public hearings on the problem of water pollution from agricultural drainage of plant nutrients; this issue remains under our jurisdiction while additional data are gathered on the extent of the problem and feasible methods of control. (See Opinion in #R71-15). Proposed rules for animal feedlot runoff and agricultural sedimentation are being proposed on which the Board will hold public hearings and enact such regulations as are appropriate based on the evidence. All surface drainage pollution sources cannot be treated alike, which fact prohibits simultaneous regulation of all of such sources. The evidence of the pollution impact of mining justifies giving that industry a priority in our actions.

The Environmental Protection Act contains numerous provisions authorizing the setting of operational or procedural pollution control standards. The Legislature has clearly recognized that successful environmental protection often entails more than the settling of numerical emission or effluent limitations. Sections 10 and 13 of the Environmental Protection Act empower the Board to adopt such operational standards where necessary to provide immediate and long-range protection against air and water pollution. Thus, the Coal Operators beg the question when they contend that in certain instances (Sec. 301 for example, requiring drainage diversion,) these Regulations by controlling how mining is to be conducted go beyond the Board's statutory authority. The question, answered in the affirmative by the record in this proceeding, is "are such measures reasonably necessary for pollution control?"

Having failed to exempt the entire mining industry from meaningful pollution control, the coal operators next contend that this Board's control of the surface mining industry, except for water quality standards, is preempted by the Illinois Surface Mined Land Conservation and Reclamation Act of 1971, because that "Surface Act" controls the reclamation of surface mines and thereby preempts the regulation of water pollution control related to surface reclamation. The issue is one of Legislative intent.

Section 206(g) of the Surface Act, following a delineation of the mining and reclamation duties of a surface mine operator, including certain measures pertaining to the "reduction" of water pollution, states as a further duty of the operator that, "All requirements of the Environmental Protection Act, and of rules and regulations thereunder shall be complied with fully at all times during mining, reclamation and after reclamation." A clearer statement of Legislative intent is difficult to imagine. The General Assembly in the Surface Act reaffirmed its purpose, expressed earlier in adopting the Environmental Protection Act, of maintaining in Illinois a comprehensive, unified program of air and water pollution control. In effect, the Legislature incorporated as part of the Surface Mined Land Conservation and Reclamation Act all air and water pollution control measures adopted pursuant to the Environmental Protection Act.

In the face of this statutory language, (Sec. 206(g)), the Coal Operators and Peabody Coal Company contend that the General Assembly thereby intended that only the Board's water quality standards were to be applicable to surface mining. In light of the wealth of provisions in the Environmental Protection Act which empower the Board to adopt pollution control regulations which go beyond numerical effluent standards (discussed, supra), no such strained discriminatory interpretation can be lent the language of Sec. 206(g).

Had the legislature intended that all pollution control measures pursuant to the Environmental Protection Act, except water quality standards, were to be inapplicable to surface mining, it would have so stated. Not only did the General Assembly not make such a distinction as to the kinds of pollution control regulations, it removed any confusion by expressly requiring that all pollution control regulations adopted pursuant to the Environmental Protection Act be obeyed.

Our position is buttressed by the fact that the Legislature, in enacting the Environmental Protection Act, specifically prohibited the application of any regulations, except water quality standards, to defined aspects of oil and gas operations controlled by a previous Act. (Sec. 45). Also in the Environmental Protection Act, the Board was expressly limited in regulation of pesticides (Sec. 13(f)). In July, 1970, when the General Assembly enacted the Environmental Protection Act, Illinois already had in effect the old Illinois Surface Mining Reclamation law. (Ill.Rev.Stat.,Ch.93,Sec.162-180,Repeal,1949) Had the Legislature intended that the Environmental Protection Act and regulations pursuant thereto, (except for water quality standards), not apply to the mining activity subjected to that first surface mining reclamation law, it would have so stated in the Environmental Protection Act, as it did with regard to oil and gas strata and pesticides. In adopting a new surface mining reclamation law, in 1971, after the Environmental Protection Act had already been adopted, the General Assembly sought to remove possible confusion as to preemption by the inclusion of Sec. 206(g).

Peabody Coal contends that Sec. 215 of the Surface Mining Act prohibits this Board from adopting "detailed reclamation measures" and allows only the setting of effluent limitations on surface mining. Section 215 requires that the Environmental Protection Agency not issue a permit for surface mining until all permits required by the Surface Mining Act are in effect.

If the Company is contending that this Board does not have as a delegated Legislative objective the reclaiming of mined areas,we agree. The Environmental Protection Act restricts our regulatory actions to those measures necessary for the control of pollution. In the case of mining, we have found that attaining this statutory objective requires that mine operators conduct their activities according to certain standards. If the Company is contending that the sequence of obtaining permits somehow bars this Board from adopting these Regulations, the logic of its position escapes us. If anything, the fact that the General Assembly saw fit to make obtaining the Environmental Protection Agency permit the point of final environmental clearance, reflects the special importance which the Legislature placed upon the control of air and water pollution from surface mining by regulations under the Environmental Protection Act.

To imply preemption is to contravene the General Assembly's intent by ignoring the plain statutory language of both the Surface Mined Land Conservation and Reclamation Act and the Environmental Protection Act. To do so is to fragment the comprehensive, unified approach to pollution control in Illinois. Such a drastic step by the Legislature cannot be blithely implied. In Mt. Carmel Public Utility v. Environmental Protection Agency, #PCB 71-15), this Board rejected the utility's contention that the Illinois Commerce Commission had sole jurisdiction over the environmental aspects of power plants. We held there, "Had the General Assembly intended the ICC to have exclusive jurisdiction over utilities in Illinois, it would have said so. It didn't." Today we affirm that holding as applied to the Surface Mined Land Conservation and Reclamation Act and the Illinois Department of Mines and Minerals.

While Sec. 206(g) is Legislative affirmation of the fact that operational standards beyond the reclamation provisions of the Surface Mined Act may be necessary to control and prevent air and water pollution, the regulations are consistent with the Surface Mined Act. (see Sec. 701, Chap. IV, Mine-Related Pollution). Reclamation measures, as such, are not required by these Regulations. In some cases, the Regulations provide for covering, regrading and vegetation as necessary to prevent air and water pollution from refuse areas. The periodic and final covering of acid-producing refuse is an indispensible water pollution control and prevention measure which does not in any way impede the application of the Surface Mined Act reclamation requirements for "gob" piles. The amount of and the timing for application of any required final cover of refuse areas and the grading and vegetation standards to be applied when necessary to prevent air and water pollution correspond to the land reclamation standards of the Surface Mined Act. (Sec. 401(c)(1) and (d); Sec. 701, Chap. IV, op. cit.) No air and water pollution control or prevention requirement of these Regulations impedes the attainment of any surface land reclamation objective of the Surface Mined Act.

A. Permit System; Part II, Sections 201-207

A permit procedure is a fundamental method of environmental control, essential to any effort to prevent costly pollution-causing errors and valuable to effective enforcement of pollution laws. Besides helping to assure compliance with the various procedural safeguards, a permit system can prevent mining and mine refuse disposal from occurring where air and water pollution could not otherwise be avoided, despite compliance with these Regulations. (See R.128, 507 for examples of the kind of situation which may necessitate this.)

We agree with the U. S. Environmental Protection Agency that, "Preplanning of all phases of mining, including opening, operating and closing is the most important step in controlling mining pollution." (R.9), and we find that the permit system best achieves this.

The Board has applied such a control measure in all of its air and water pollution regulations. The States of Pennsylvania and Kentucky require permits as part of their programs to control mine-related pollution (Exhibits 3, 18 and 25). Pennsylvania requires only one permit to operate a mine, for which the operator must demonstrate that pollution from mining will not occur during or after operations. We have adopted this requirement and a new control strategy, requiring a permit to abandon. This is an extra safeguard, a final check, to assure that an operator does not walk away from the environmental problems he has created. It should prevent water pollution from mines abandoned in the future.

The definition of "abandon" covers any mine which becomes inoperative after the effective date of these Regulations and which is not intended to be reopened, or which becomes inoperative after its mineable reserves are depleted. A mine closed down hereafter and which remains closed for one year is rebuttably presumed to be abandoned. It is reasonable to assume that some operators would forever "intend" to reopen in order to avoid the requirements of abandonment. Those operations in the aggregate mining industry which often close for years before reopening to meet renewed demand can reasonably demonstrate such conditions to the Agency and avoid the requirement of a permit to abandon. Any dispute over permits can be resolved by this Board, pursuant to the Act. A mine site once abandoned, of course, may be reopened and mining operations renewed. To avoid any possible pollution from operations while they are closed down (though not "abandoned") interim pollution control measures are required. (Sec. 501).

The permit applicant must submit data necessary for the Agency to assess the water and air pollution potential of the mining activity. Most importantly, the operator must describe the waters of Illinois which will be encountered during mining and mine refuse disposal and a plan which will be incorporated into the operations to prevent air and water pollution during and after mining. (Sec. 204(b),(c), (f) and (b).)

Generally speaking, the data we require as part of a permit application are required by the Pennsylvania Department of Environmental Resources of mines in that state. (Ex. 18). Little dispute exists over the permit application provision, except for Sec. 204(b), by which underground water resources to be encountered during mining or mine refuse disposal must be designated. The evidence on whether this can be done is somewhat confusing. The industry maintains that it cannot so locate groundwater. But its own testimony reflects that by core drilling locating bodies of groundwater which might interfere with mining operations is not only feasible but routinely performed (R.231-32). Pennsylvania requires applicants for mining permits to designate the location of groundwater, and the representative of their Department of Environmental Resources testified that this is feasible and routinely performed by mines in that state, and that mines may often avoid core drilling by relying on data gathered from previous mining operations in adjacent areas (R.516-517). The Illinois General Assembly has a similar requirement of surface mines (Ex. 34).

Protection of our groundwater resources is most important. Leachate from refuse piles and percolation through underground mine workings may constitute a significant threat to these resources (See R. 329-30 to the effect that if groundwater from Illinois mined areas or areas affected by deep mine percolation were utilized such might be found to be polluted. See Ex. 14, p. 21 to the effect that, "Most underground mines intersect groundwater, which becomes altered to mine drainage quality." The evidence shows that deep mining can significantly alter the hydrological pattern of an area (Ex. 17, p.32-36), and that underground mine water is often polluted. The fact that most public water supplies in Illinois presently depend on surface waters is part of the reason so little appears to be known about the impact of deep mining on groundwater quality. Our action today accounts for the fact that most underground mining in Illinois occurs below the level of natural drainage, thus preventing water which enters the deep mine from leaving it to enter surface streams (See Sec. 103(a) and 301(b),(d) and (c).) But the possibilities that sinking a deep mine shaft and altering the hydrological pattern of an area, that lateral percolation from deep mine workings and that leachate from refuse piles may adversely alter the groundwater resources of this state are threats which must be guarded against. While groundwater may not be particularly vital as a source of water supply now, this resource must certainly be protected for future use. (See R.368-370 for testimony in opposition to Sec. 204(b), which testimony implies that because surface water is the major source of public supply, we need not be concerned with groundwater.)

Section 204(b) requires only that underground water resources be designated - aquifiers, underground streams or other substantial, concentrated flows. Core drilling every few feet is unnecessary to locate such resources. If for reasons of profit or safety, to avoid flooding a site, the industry can feasibly locate such groundwater, it can reasonably be designated for purposes of environmental protection.

Section 204(c) requires the general characterization of the mined soil and mine refuse. By requiring a general mined soil analysis, the provision should supply information valuable to preventing water pollution by the proper handling of refuse and spoil material. (See Ex. 42 for a discussion of the pollution control value of this mined soil pre-analysis).

In the event of an emergency pollution situation at the mine, most likely of the kind designated in Section 205(b), which threatens the sudden discharge of contaminants into the waters of Illinois, the permittee must immediately notify the Agency and take corrective measures. While the gentle hills of southern Illinois are, indeed, not the mountains of West Virginia, Illinois has had at least two large slurry pond breaks similar in kind if not in consequence to that which occurred in West Virginia on Buffalo Creek on February 26, 1972 (See Ex. 38.) Such environmental disasters must be prevented. Besides the permit system for supervising the proper construction and maintenance of mine-water retaining facilities, immediate notification of those expert in mine drainage control is necessary when emergencies arise.

B. Operational Procedures; Parts III, IV and V, Sections 301-502.

The operational safeguards of Parts III, IV and V of these Regulations constitute the embodiment into mining activities of the results of the environmental planning required by the Permit procedure of Part II. (R.253). Such safeguards are necessary not only to control current pollution, but to prevent mine sites from becoming long-term pollution sources. (R.277-78). The evidence, both from representatives of public agencies with expertise in and responsibility for coping with the environmental effects of mining, and from mine pollution abatement reports in which the mining industry was represented, is overwhelming that these procedural standards are necessary and feasible.

Section 301(a) requires that mining and haulage roads avoid contact with the waters of Illinois where such can reasonably be expected to cause water pollution. Not only will this control the location of spoil banks and haulage roads from mining, but will regulate the practice of strip-mining through small streams. Pennsylvania requires that no strip mining occur within 100 feet of a stream and that a permit be obtained to relocate a stream. (R.499 and Ex. 18). Kentucky has a similar provision. Rather than a rigid approach we have left the control method to be determined according to the specific mining conditions. Although the re-routing of very small streams may be permissible under certain conditions, the redirecting of streams is to be avoided, and allowed only under a showing that water pollution will not occur.

Section 301(b) requires in certain circumstances, diversion of water around and impoundment of run-off water from mine refuse areas. It prohibits the entrance to a coal, fluorspar or lead-zinc mine which lies above the level of natural drainage from intercepting a drainage course unless the water therefrom is re-routed around the entrance. The phrase "drainage course" applies, not to all natural drainage slopes but to streams, creeks and ditches, man-made or natural, which carry a concentrated flow of surface drainage. This section may require a "highwall diversion" ditch to divert all surface run-off from the mining pit. Rather than a rigid requirement, the determination of the need for such control is left to be made as part of the permit procedure. The requirement does not apply to a mine lying below natural drainage. The evidence shows that in such cases water entering the deep mine cannot escape directly to surface waters. Pits which are used to impound run-off water to comply with Sec. 301(b) will not be acceptable upon closing of the mine if they hold or collect polluted water.

Section 301(c) requires that all surface entrances to underground mines which lie above natural drainage be plugged and sealed upon permanent termination of their use. As with Section 301(b) and Part IV (infra) regarding refuse disposal, the operator has the burden of establishing, as part of the permit procedure, that his mine lies below the level of natural drainage. The phrase "level of natural drainage", as defined (Sec. 103(h) means that such water must not percolate to reach underground water resources. Sections 301(b) and (c) rest on the premise that as much water as possible should be kept out of these mined and mine refuse areas.

The requirements of Part III are similar to those imposed on the mining industry by Pennsylvania (Ex. 3 and 18, R. 498); and are recognized as feasible and necessary mine pollution controls by the following:

(a) The U. S. Environmental Protection Agency(R. 9, et. seq., and Exhibit #40);

(b) The Coal Industry Advisory Committee to the Ohio River Valley Sanitation Commission (Ex. 16);

(c) The Science Advisor to the Appalachian Regional Commission (R. 270 et. seq. and 290); and

(d) The comprehensive report, Acid Mine Drainage in Appalachia, (Ex. 14, Appendix B, pp. 130-141).

In addition, the testimony indicates that the cost of drainage diversion would likely be less in Illinois than in Appalachia where these costs are routinely carried by the coal industry of Pennsylvania and Kentucky. This is because the steeper, more unstable surface of Appalachian mining terrain makes maintenance of diversion ditches more difficult (R. 301, 302, 320, 323, and Ex. 14, id. p. 131). See Ex. 29, p. 27, for an example of a coal company routinely diverting all surface drainage around refuse areas to prevent water pollution).

Part IV controls pollution from mine refuse areas. All mine refuse must be deposited according to a plan submitted by the operator and approved by the Agency as part of a permit application. A refuse disposal site must be so located and the method of disposal must be such that run-off, leachate, flooding or wind erosion from the refuse area will not cause water or air pollution during or after active mining operations. No refuse site is to be located in an area of natural springs or a drainage course.

Acid-producing solid mine refuse disposed above the level of natural drainage is to be spread and compacted as it is admitted to the site unless conditions of wetness prevent such measures. Covering is required at intervals dependent upon whether the refuse is produced by surface or underground mining, which, in turn, relates to the amount of available cover material and the accessibility of pits or other surface depressions for burial of the acid-producing refuse. The distinction is based on economic reasonableness. All piles of acid-producing refuse generated after the effective date of these Regulations shall, upon completion, be covered with two to four feet of relatively impermeable material. Any operator who contends that in his particular operation the covering of acid-producing refuse is not necessary to prevent water pollution may resort to an alternative control strategy under defined conditions, discussed below.

All completed mine refuse piles shall be graded and revegetated and completed slurry or tailing ponds revegetated in accordance with specified standards when reasonably necessary to reduce siltation and prevent air and water pollution.

The value of environmental planning has been previously discussed and applies with special force to mine refuse operations. Keeping refuse areas out of water courses and springs is common sense. Avoiding the use of acid-producing refuse in construction (Sec. 404) is a necessity which works no hardship. Spreading and compacting acid-producing refuse is an inexpensive (about 10¢ per cubic yard or refuse, Ex. 17, Appendix B. p. 147) and necessary procedure to reduce soil erosion, spontaneous combustion from refuse pile fires and percolation. Our requirements for the covering of acid-producing refuse areas have been strongly opposed by the coal mining industry, generally with mere conclusions that the required system is not needed but with no compelling evidence of a better method for bringing this most pervasive and severe source of water pollution under control.

Overcoming the industry's uniform opposition are the following:

(a) the conclusions to be derived from the research presently available on the effectiveness and environmental benefit of covering;

(b) the testimony of experts based upon their field experience in regulating the mining industry to the effect that routine covering is necessary and feasible;

(c) the evidence that certain segments of the coal *mining industry presently utilize refuse covering* as a pollution control procedure.

The most complete studies available to date on toxic drainage from mine refuse areas and acid-producing spoil banks are "Control of Mine Drainage from Coal Mine Mineral Wastes" (Ex. 19a) and "Mine Spoil Potentials for Water Quality and Controlled Erosion", (Ex. 42), both conducted under the auspices of the U. S. Environmental Protection Agency. These studies warrant detailed discussion because of their reflection on the unique nature of refuse pile drainage and the elements which must be accounted for in any successful program to control this drainage. The first study, still in progress, involves a 40-acre refuse pile at what was formerly the New Kathleen Mine near Duquoin, Illinois. The refuse pile forms a part of a slope mine into the Herrin #6 coal seam, abandoned in 1955. The facts that the drainage from this pile into Walker Creek is highly acidic and that the Herrin #6 seam overburden is not normally as acid-producing as other seams, reflects the acid-producing potential of any coal mine refuse. The fact that the pile was abandoned in 1955 and continues exerting a most destructive influence on Walker Creek, demonstrates the potential continuous nature of the pollution problem which we seek to control. (Ex. 19, pp. 9, 81, 97). The pile is very susceptible to erosion and contains a mixture of clay, shale, and low grade coal, in which both sulfur and large crystal pyrite forms are found. The pile contains a large number of individual seepage points at its base, some flowing continuously, others sporadically, indicating that either a storage pool of water exists in the pile or that parts of the pile rest on ground water springs, or both. (See Sec. 401(a)(2); Ex. 19, pp. 9, 14).

The refuse pile is reactive (acid-forming) at its outer mantle, the surface exposed to the atmosphere. The zone of reaction extends approximately 4 to 24 inches into the pile, depending on the degree of compaction. Between rainfalls, pyrite oxidation (acid formation) proceeds at a relatively constant rate, with acid products accumulating in the reactive outer mantle at the average rate of 198 pounds of acidity per acre of refuse per day. During rains, approximately 54% of the precipitation appears at the base of the pile immediately as acid runoff, part of the remainder evaporates and part infiltrates to the interior of the pile, reappearing later as contaminated seepage.

Erosion at the outer surface of the pile during rainfall carries away acid products and constantly renews the reactive mantle, consequently, the refuse pile can be expected to produce acid at a relatively constant rate until it is completely eroded away or until effective abatement procedures are adopted. Such acid-drainage and siltation will occur during mining operations and can continue for decades afterwards. (id. pp. 1 and 5).

The testing to date is to determine the effectiveness of different techniques in abating the acid-drainage from the pile. Various procedures have been utilized on sections of the pile; spreading of limestone, revegation, installing a plastic cover, laying varying depths of earth cover, and leaving certain sections uncontrolled as a basis for comparing results. Preliminary results are inconclusive as to the effectiveness of the various covers in retarding or stopping pyrite oxidation and acid mine drainage. This is due to the fact that the 40-acre refuse heap has, since its creation, been building an internal store of leached oxidation products and percolation water. The pile will probably take several seasons to flush itself of this pre-existing reservoir of toxic water (id., p. 51).

However, much value can be derived at this point from the "New Kathleen Mine" research:

(a) It reflects what is for that particular pile a rate of sulfuric acid production and potential erosion of acid from the pile, (supra.) While this rate will vary somewhat among acid-producing refuse piles, results indicate a constant process of acid formation until the pile is eroded away or controlled.

(b) The study indicates that a refuse pile discharges acid and other contaminants from two sources: direct surface runoff after a rainfall and seepage from the base of the pile in a reservoir-building, delayed discharge response to rainfall.

(c) Acid products leached to the center of an uncovered pile during rainfall can be stored there, and can discharge slowly from the base of the pile, even after the pile is covered at the top, assuming that the top cover alone were effective in preventing the formation of more acid.

(d) The study suggests the environmental goal of any effective refuse pile cover and the following criteria by which a successful cover is to be judged (id. p. 41).

The basic control approach is to minimize the movement of air and water into the pile by sealing it, thus reducing or eliminating the formation of acid, siltation, erosion and dust entrainment. To accomplish this a cover should possess the following characteristics:

"1. The cover may prevent erosion and thus prevent the continuing exposure of fresh pyrite surfaces. Since oxygen must be continuously supplied to support the pyrite oxidation reaction and since any layer of material separating pyrite from the atmosphere will function as a resistance to diffusion, then any physical stabilization of the pile surface will cause the zone of oxidation to move deeper into the pile and the overlying diffusion barrier will eventually control the rate of pyrite oxidation. The reaction will decrease with time due to this effect, although the decrease may be very slow."

"2, The cover may be sufficiently impermeable to oxygen transport to act as an efficient diffusion barrier. For example, a plastic sheet placed over the refuse may effectively stop all oxygen transport to the pyrite and oxidation will cease."

"3. The cover may be sufficiently impermeable to water movement to decrease or stop water movement into the refuse. If this occurs, then oxidation products will not be flushed away from the oxidation sites and the only movement of acid salts into the interior of the pile will be through seepage generated by the hydroscopic nature of the acid salts themselves. Depending on oxygen availability, pyrite oxidation may continue, but the products will be largely retained at or near the site of oxidation."

"4. The cover may function as an oxygen-consuming layer. A vegetative cover such as grass might build up a sufficiently high concentration of organic matter in the soil to support high rates of aerobic bacterial activity. Such a layer might be effective in removing oxygen from the soil atmosphere before it reaches the zone of pyrite oxidation."

The foregoing factors plus the presently inconclusive results of the "New Kathleen" project at the present time strongly suggest the need for periodic covering of acid-producing refuse. Before the "New Kathleen" project engineers can assess the abatement consequences of their various final covers, they must await the time, perhaps several years, when the pile has flushed itself of its pre-existing store of acid products. Consequently, any final cover applied to an acid-generating refuse pile cannot hope to abate the constant acid runoff and seepage from that pile during the months or years of its active life, before a cover is applied. After a cover is applied, the pile will likely continue as a source of water pollution for several years until its reservoir of acid products is flushed. Contaminated drainage at that point would be abated only if the final cover, in itself were sufficient to either prevent water from reaching the reactive outer mantle or prevent oxygen from reaching the pyrites in the mantle, or both.

To allow acid products to accumulate in the interior of thousands of acres of gob heaps, only to cap them over upon completion is tantamount to closing the hen house door after the fox is in, on the theory that the rest of the pack will be barred from the feast. Periodic covering with clean fill is the control most compatible with the environmental standards which an effective cover system should meet. Not only will regular covering with clean fill during the formative years of a gob pile likely control water pollution from the culminated heap, but the acid and mineral salts drainage of its active life will also be mitigated.

Laboratory studies conducted as part of the second study (op. cit., Ex. 42), which represent field conditions, tend to prove the point. Pulverized pyrite buried under three or more inches of normal soil in a lysimeter had a rate of oxidation only 10 to 25% as great as pyrite within 1/2 inch of the surface. When pyrite was buried at 6 depths from 1/2 to 36 inches in four feet of normal soil, no acid or iron drainage occurred during 24 weeks of water percolation. The downward movement through and reaction with the soil neutralized the acid and precipitated the iron (id., pp. 3, 154, 161).

This report on the acid-producing potential of spoil banks points up other results, both field observations and laboratory conclusions, that indicate periodic covering of acid-producing refuse to be the most feasible, effective method of long-range control presently available:

(a) The rate of oxidation of pyrite and extent of acid drainage are affected by the accessibility of pyrite to the near-surface weathering agents, by the type of pyrite and its grain size, and by the pattern in which the pyrite is disseminated through the refuse or spoil (id., p. 55). The more widespread the dissemination pattern and the finer the grain size, the greater the opportunity for oxidation and acid drainage upon contact with surface water. This is explainable in terms of surface for reactions to occur, which is inversely proportional to a linear dimension of the pyrite particles. Consequently, small percentages of pyrite can be a serious pollution matter unless neutralizing materials are present.

This suggests the need to retard the rate of oxidation by making pyrite materials inaccessible to surface weathering agents, by reducing the amount of pyritic surface on which reactions can occur, and by making available neutralizing materials. Compacting the acid-producing pyrite (Sec. 401(b)) will tend to reduce the surface for reaction of the particles with air. Burying the material renders it less accessible to surface weathering agents (id., p. 161). The layered clean fill provides an alkaline material through which the percolating drainage can be neutralized and, by attachment to cation exchange sites or precipitation, cleansed of its iron (id., p. 154).

(b) The role of microorganisms in the oxidation of pyrite is not definitely determined as yet but those which are thought to be most important in catalyzing the acid-forming process are strictly aerobes. Thus, the Report recommends that highly pyritic materials in the overburden from mining be set aside and then buried as deeply as possible where anaerobic conditions most probably exist. This should help abate acid drainage from mining operations. (id. pp. 154, 159).

(c) Some evidence indicates that alkaline earth carbonates may inhibit the bacterial oxidation activity, possibly by preventing the soil pH from becoming less than 5, thought to be necessary for growth of the sulfur and iron oxidizing organisms. (id. p. 161). This hypothesis suggests the potential value of limestone or earth cover. If the hypothesis is incorrect, earth cover retains much of its known acid-abating value. If it is correct, the clean earth fill requirement tends to deal with this one aspect of the acid problem as well as with many of the other factors which appear to be of major significance.

(d) Rapid establishment of vegetative cover tends to reduce the rate of acid formation because plant respiration and decomposition involves increased carbon dioxide and decreased oxygen in the reactive outer zone. (id. p. 164). Similarly, it tends to prevent erosion, which, by continuously renewing the reactive outer mantle, sustains the process of acid formation. A rapid vegetative cover can best be established in a final layer of soil. Although a final layer of four feet is unnecessary for revegetation, this thickness does tend to serve other control purposes discussed previously. Sec. 401(e) would require such vegetation in most cases. (See R.508, for evidence that revegetation is also necessary to reduce stream sedimentation).

The Pennsylvania Department of Environmental Resources similarly requires that coal mine refuse be buried between alternating layers of clean fill. In surface mining, coal refuse is returned to the open strip pits where it is layered and compacted, and the cut is backfilled and revegetated. Where strip pits are unavailable for refuse disposal, the operator must compact the refuse, and clean, non-acid cover must be placed between coal refuse layers, "in a manner similar to sanitary landfill operations." When the disposal area is completed it is covered and vegetated. (Ex. 18 and R.490-491). This method "has considerably reduced the potential for acid production in the pile, although it has not always resulted in complete abatement or elimination of pollution." (R. 491). The testimony from this expert is that daily covering may be unnecessary. If daily compaction is provided, then weekly covering would be adequate (R. 501). In an effort to be flexible, we adopt a standard by which the frequency and thickness of periodic covering depends upon the physical circumstances of the particular mine site. (See Section 401(b)(c) and (d).

The Coal Industry Advisory Committee to the Ohio River Valley Water Sanitation Commission similarly recognizes the value of crushing and placing the acid-producing material from surface mining where it will not be exposed. (Ex. 16(a), p. 5, Case Histories 2-6, 2-6.1, 2-7.1).

The evidence also indicates that certain members of the coal industry are presently burying acid refuse both from surface mining in strip pits and from underground mines. (See Ex. 29, pp. 27 and 37).

This covering requirement presents some difficulty. In many cases the costs should be insignificant. This is especially true where refuse can be buried in strip pits and covered with readily available overburden.But in most deep mining, pits or depressions of sufficient size are not readily available, and overburden from mining is inadequate. Pits or trenches can be dug and refuse covered with the earth excavated. (See Ex. 16(a), op. cit.; Case History 2-7.1). In other cases, earth excavated from borrow pits will have to be used for covering above-ground piles. Weather, as well as cost, is a problem in these cases (R.220, 221, 557, 558). Within the limits of environmental protection, we have sought to account for these physical-economic differences by requiring that all acid-producing refuse from underground mines be sealed at a refuse-to-cover ratio of no more than 6 to 1. This is the Federal Environmental Protection Agency recommendation (Ex. #40). Acid-producing refuse disposed by surface mining must comply with a 36" to 12-24" refuse-to-cover ratio (the Pennsylvania requirement is 30" to 24").

Cost data submitted by the mining industry for refuse covering for underground mines is based on the Board's initial proposal (Ex. 1) which proposed that all refuse, rather than just acid-producing refuse, be covered daily with six inches of clean fill. Thus, Inland Steel Company estimated that covering 15% to 25% of all the material which entered the preparation plant would cost $1,250 to $2,084 daily for a 3 million ton per year mine. This assumed a need for 500 cubic yards of cover which would have to be hauled one mile costing $2.00 per cubic yard, plus 50¢ per cubic yard to handle and spread. The requirement for final cover of the completed refuse pile of this size is estimated to cost from five million to eight million dollars. (R. 375, 382, 383). Testimony indicates that some mine refuse is non-acidic (R. 76) and thus the refuse quantity in this data is an overestimation. Likewise, the estimated costs are for a mine which produces three million tons annually and has 140 million tons of reserves. Thus, the industry cost estimate for covering which is overstated, assumes reasonable proportions when related to total output, and weighed against the social costs of failing to spend the money for such pollution. One study estimates total reclamation and water pollution control costs, including covering refuse, adds less than 20¢ per ton to the cost of coal. (Ex. 14, Appendix B, p. 146). Coal in 1969 had an average value of over $4.00 per ton (Ex. 29, p. 89).

In addition, other elements which go into the Company's estimate are extremely overstated (750 acres of land purchased to provide cover material, at a net cost of $550 per acre) when compared to other available data. A 23.2 acre gob pile in western Kentucky is shown to have been finally covered with 3 feet of earth and vegetated at a cost of $438.79 per acre and a total cost of $10,180.03 (Ex. 16(a), p. 21).

Old Ben Coal Company estimated borrowing and hauling a daily fill requirement of 2,000 cubic yards, four times the Inland Steel estimation; yet at a total cost of $11 to $14 million (R. 34, 35) for 14.5 million cubic yards of fill as compared to a total cost estimation of over $19 million for the Inland Steel example which required one-fourth the daily cover and estimated a total need for 8 million cubic yards of fill at $2.50 per cubic yard.

Other evidence indicates that the cost of earth for such cover is approximately $1.00 per cubic yard (Ex. 35(a)), and somewhat less if the operator conducts his own earth moving.

The report, Engineering Economic Study of Mine Drainage Control Techniques, (Ex. 14, Appendix B) indicates that the cost of sealing coal refuse areas with alternating layers of clay, when the refuse areas are in excess of 200 yards in diameter, is less than one cent per cubic yard of refuse, plus a handling cost of 14¢ to 20¢ per ton of fill per half mile. This size refuse area has a refuse to clay ratio of twenty to one or greater. If the ratio is reduced to five to one (more cover than is required by Sec. 401(c)(2) for underground operators,) the cost for sealing is 3¢ to 10¢ per cubic yard of refuse, plus the hauling costs of 15¢ to 20¢ per half mile (id. 148-49, Fig. 33). This does not include costs of operation and depreciation of equipment (id. p. 148). But sealing and transportation account for the majority of the costs and are only a small addition to the original cost of piling the refuse from mining operations, which must be spent in any event (id. pp. 143, 144). The contrast with industry figures is striking.

On the whole, the cost appears reasonable when balanced against the public's environmental benefits from effectively sealed mine refuse piles. Hardship due to unusual circumstances in specific cases can be dealt with by the variance proceeding under the Environmental Protection Act.

This Board cannot gamble on the industry's speculations that untried, alternative control systems will prevent the continuation of Illinois' severe, long-range water pollution problems from mine refuse piles. Consequently, we adopt a covering requirement which has proven effective and which seeks to account both for the difference between surface and deep mining and for the social need for effective, long-range pollution control. The Regulation imposes a heavy burden on an operator seeking to avoid the periodic (not the final) covering requirement as unnecessary for pollution control under the particular conditions of his operation. To do so, the operator must demonstrate from actual field conditions that his disposal procedure for acid-producing refuse will not allow seepage from the refuse pile which exceeds the effluent limitations of Part VI. Comparable experimental data may be considered. If the system provides for collection and treatment of all surface runoff and seepage water during active mining operations, the operator must demonstrate by using performance data gathered from actual or representative field conditions that the refuse pile does not collect, through percolation and internal accumulation of acid-products, sufficient water, acid and iron to cause a seepage problem after treatment ceases. In any event, the refuse areas must be buried under two to four feet of earth upon completion. Upon termination of the use of the alternative system, it must be stabilized. Such permanent abatement measure shall be completed within one year from the completion of the refuse pile, and refuse pile drainage shall be treated to comply with effluent standards, pending permanent abatement. (See Section 402).

Monterey Coal Company is unique for offering testimony supporting what it contends is an equally effective, presently available system for controlling mine refuse drainage (R.556-7). Their proposed system would deposit acid-producing refuse in an artificially constructed pit with an impermeable clay bottom and earth-dike sides. The sides of the pit are raised as refuse is added to produce a berm which prevents runoff over the sides and erosion of the earth dikes. Refuse is compacted as admitted to the area to reduce percolation. Water which collects on the refuse surface is pumped out and treated. The earthen dikes are vegetated and upon completion of the refuse pit, it is covered over and vegetated. This control system or a variation (such as sloping the refuse surface to assure rapid runoff of all surface water, thus affording more protection against percolation) may well work, and any operator may implement it or another upon a showing that it will not only control present runoff, but will effectively prevent internal storage and delayed seepage from the base of the pile. To allow experimentation with alternative systems for refuse pile control, and to permit testing to gather the field data necessary to justify a proposed alternative control system, the Agency may allow an operator to establish "demonstration refuse areas"("Experimental Permits") which cannot be the principal place of acid-producing refuse disposal. While such refuse disposal operation need not comply with the periodic covering requirement, all other regulations are applicable. Before obtaining a permit to utilize such experimental refuse control program, the operator must clearly establish that the system has a substantial chance after completion, of preventing seepage and runoff from the pile which violate applicable effluent standards.

We agree with the Pennsylvania Department of Environmental Control that more research is needed in the area of mine refuse drainage control. However, pending the outcome of this search for more effective and economical control measures, presently available and feasible control technology, specifically the covering of acid-refuse, should be utilized because of its "considerable beneficial results". (R. 492) Thus, the Regulation requires compliance with the only presently proven control technology, according to the evidence of this hearing, but permits the use of alternative control methods should research demonstrate their effectiveness. Similarly, the Board will continue its observations of the problem of mine refuse pile abatement and will revise the regulation in response to convincing new evidence.

If covering is to be the general rule for treating acid-producing refuse, the question of what is "acid-producing" becomes important. As defined in Sec. 103(b), the phrase covers the variety of conditions which affect the quality of mine drainage. It is defined as "material which when exposed to air and water is capable of causing mine drainage containing free sulfuric acid." This definition takes into account the potential neutralizing and precipitating effect of non-acid-producing material which may surround and be mixed with potentially acid-producing material. This is accomplished by using the phrase "capable of causing" which relates the acid-producing potential of the material, ascertainable by use of numerous tests and standards, (infra) to its capability of producing drainage from the refuse pile containing free sulfuric acid. Of course, the term "capable" means that in cases of doubt, the refuse material must be covered. To err in the few borderline cases on the side of environmental safety is proper when the water pollution consequences of failing to cover acid-producing material are considered.

The acid-producing potential of the preparation plant refuse or of portions of the mine spoil depends directly on the presence or absence of pyritic sulfur. Refuse material which contains pyritic sulfur in concentrations of .1% upon complete oxidation will yield a quantity of sulfuric acid that will require 6,250 pounds of calcium carbonate to neutralize every one thousand tons of the refuse material. (Ex. 42, p. 55). Thus, a total sulfur observation through soil sampling is an initial step in determining acid-producing potential (id. Fig. 5). The sulfate forms of sulfur are soluble and, with Illinois rainfalls, should leach from and occur only negligibly in the upper few feet of land surface (id. p. 47). This weathered zone, relatively free of pyritic sulfur should be a great source of spoil material that will be relatively free of acid-producing potential (id. pp. 47, 48). Also, the organic content and basic cations of the different soil types as reflected in general soil classifications (see Sec. 204(e) and Exhibits 10 and 11, and Exhibit 41, pp. 27-28) are available information which should help assess the acid-producing potential of different mined soils. Mining experience in particular regions of the State is an overall indicator as to whether the overburden and the mineral seam are acid-producing. (See Ex. 17, pp. 16, 17 and supra, p.8). Generally, the greatest concentrations of pyritic sulfur can be tolerated most in clay shales and least in medium to coarse grained sandstones. (Ex. 41, p. 1).

Petrographic observations of the extracted earth can be used to determine the general grain size and dissemination pattern of the pyrite, which affects its acid-producing capability. (Ex. 41, pp. 33-35).

Direct chemical measurement can be utilized. Treating pulverized, mined earth with hydrogen peroxide will usually result in the oxidation of sulfur to titratable sulfuric acid (id. p. 55).

Many shales and sandstones show a close relationship between total sulfur and titratable potential acidity (id. p. 55). Soil color charts may also provide useful field clues to properties and reactions affecting water quality (id. pp. 2 and 3). And, as discussed supra, the acid neutralizing effect of carbonates and exchangeable bases such as calcium, manganese and potassium, on the known acid-producing material can be determined in order to estimate "net acidity" (id. p. 5).

Some industry witnesses suggested that we adopt soil pH or percentage of pyritic sulfur as the sole criterion for determining what refuse is "acid-producing" (R. 173-74 and Ex. 39). The record shows that there are other factors which need be considered. Tying the covering requirement solely to one numerical parameter would lead to inaccuracy and inequity.

Part V requires that the previously discussed procedural safeguards and all other reasonable steps necessary to prevent air and water pollution be taken prior to abandonment. Sealing of entrances to underground mines which the operator does not establish as lying below the level of natural drainage and stabilizing of refuse areas are most important "final house-cleaning" measures.

C. Environmental Goals; Part VI

These operational procedures of Parts III, IV and V are adopted in response to the fact that wherever possible prevention of mine-related pollution is preferable, both economically and environmentally, to treatment or abatement (Ex. 16(2), p. 3, and R. 252-257, 270, 280, 281, 298, 494, 495, 506, 507). But the primary control strategy of these Regulations is to establish goals and leave to the operator and the Agency the flexibility to determine how best to comply, given local conditions. The criteria established as part of the permit procedure have been discussed. No mining activity may cause or allow air or water pollution. In an effort to further define and more effectively control water pollution from mining, these Regulations also establish effluent criteria applicable to all surface drainage from a mined or mine refuse area controlled by an operator.

This Board recently enacted statewide effluent standards applicable to all manufacturing and processing sources in Illinois. Because of the lack of evidence at that time on the major sources of polluted land runoff and their treatment feasibility, those Regulations specifically exempt surface drainage. (Pollution Control Board Regulations, Chap. III, Water Pollution). The record in this proceeding demonstrated the feasibility of collecting and treating runoff from a mine surface so as to comply with effluent standards which will protect the waters of the State. (See Sec. 606(a)).

The effluent standards of Sec. 606(a) are limits on the most damaging contaminants of Illinois mine drainage - acid, iron, lead, zinc, fluoride and suspended solids (siltation). A standard has been set for nitrogen, not naturally associated with mine drainage, to prevent the casual use of anhydrous ammonia for neutralizing acid drainage, which might impose a heavy nitrogen load on receiving streams. To avoid restricting the use of fertilizers or sewage sludge in the reclamation of surface mined areas, we have applied this nitrogen limitation only to an operator using nitrogen in wastewater treatment. The regulation is applicable immediately to new sources. Sec. 606(a) becomes applicable in six months to operators, as defined, of abandoned mined and mine refuse areas and to those controlling active mined areas. The effluent limitations apply to the extent surface drainage across the mined or mine refuse area from any source picks up sufficient contamination to violate the standards, although background concentrations present problems comparable to those found where process waters are involved. To deal with this contingency, we have adopted an approach similar to that taken in the Pollution Control Board Regulations, Chap. III, Water Pollution. We do not simply permit credit for background concentrations. To do so would allow progressive deterioration of water quality. Nor do we require treatment solely to clean up what someone else has put into the water or to remove mere traces of material occasionally added. As in the effluent standards applicable to all manufacturing and processing sources, we leave the details to be worked out on a case-by-case basis pursuant to the general principle stated in the Regulations, (Sec. 601(e)) with one exception to account for a basic difference between the two situations. Because a mine site can be quite large with a diverse array of fluctuating influent sources, the presumption is that drainage from the mined or mine refuse area which violates the standards became so contaminated because of its journey across that area. The operator bears the burden of rebutting that presumption.

The decision to impose effluent criteria on inactive as well as active mined and mine refuse areas is a difficult response to the need to abate the extensive water pollution from abandoned mines, estimated to be the cause of one-third of Illinois' mine-related water pollution problem. (Ex. 17). The procedural safeguards of Parts III, IV and V for operating and abandoning all mines hereafter, hopefully mean that drainage from mined areas abandoned in the future will not be a substantial problem. (R.297-298, 506-507).

Our original proposal required the land owner as well as the operator to meet effluent standards for abandoned mine refuse areas, even though these pollution-causing conditions might have been passed back to the owner upon termination of a sloppy mine operation at a time when concern for the environment was less than presently, and when sale of mineral rights did not always include the cost of pollution control. While such requirements could be legally sustained in consideration of the public's right to a clean environment (See Malibu Village Land Trust v. Environmental Protection Agency, #70-45), the hardship on the owner in some instances could be severe. Accordingly, we direct our efforts for achievement of these controls to the operator who has both the physical means and financial capability of eliminating those pollutional violations consequential to the mining operation. Perhaps the best long-term solution for treatment of all inoperative abandoned mine refuse piles is through a subsidy program comparable to that being considered by the Legislature. Our Regulations will insure prospective compliance with the limitations imposed.

The evidence establishes the feasibility of these effluent standards: a pH of 5 to 10, iron of 7 mg/l, lead of 1 mg/l, zinc of 5 mg/l, fluoride of 8 mg/l and suspended solids of 50 mg/l. These effluent criteria can be readily met by simple impoundment of the contaminated drainage, neutralization, coagulation and settling. (Ex. 17,pp.72,126-127; Ex. 32, p. 87). The treatment produces sludge which must be disposed according to the requirements of Part IV.

This elementary waste water treatment costs approximately 15¢ to 20¢ per 1,000 gallons of treated drainage. One estimate is that it costs generally less than 10¢ per thousand gallons (R. 275). Sludge disposal may add 7¢ to 9¢ per 1,000 gallons to this expense. Capital costs vary widely, depending on the kind of facility used, the volume and concentration of treated drainage and the length of time a facility is built to operate. At the upper end of the scale, the costs range from $172,000 to $259,000 for a 1-1/2 million gallons per day (mgpd) facility to $657,400 for a 4 mgpd plant. At the lower end (impoundment with hydrated lime treatment) a plant has been built for $9,850 to treat 4 mgpd of drainage with low total acidity. (Ex. 17, Tables 41-45,Ex. 14, Appendix B, Table 6, p. 32). The fact that such plants may be portable and moved from site to site is especially helpful to the very mobile strip coal mining business (R. 282-283).

The standards for acid and iron have applied to the coal mining industry of Pennsylvania since 1966(Ex. 3 and Ex. 18,and see Exs. 7 and 8 for the economic and technical data which justify that State's standards). Since 1966 over 200 mine drainage treatment plants have been built in Pennsylvania, from which "quite impressive" environmental benefits have been derived. "...with hundreds of miles of streams in Pennsylvania considerably improved in water quality". (R.489,490). That State's mining industry prospers while it complies (R. 276, 493, 494, 517, 518).

Kentucky recently adopted similar limits including a standard for suspended solids which is considerably more lenient than the Illinois standard. (Ex. 25). That state's mountainous terrain presents a more severe erosion problem than does the Illinois mining surface. Sedimentation is both greater and harder to control in Kentucky.

However, one of Great Britain's river boards applies a suspended solids limit to surface runoff, including mine drainage, which is stricter than the Illinois limit. (Ex. 17, Appendix A). In any event, suspended solids are likely to be a significant problem mainly in strip coal mining, and the benefits of reduced sedimentation warrant the simple, inexpensive treatment necessary to comply (R. 464-465). Retention and settling should work to meet the standard in most instances.

We will require compliance with the suspended solid limitations only when treatment is otherwise provided to meet the other effluent standards. Where compliance with Part IV of the Regulations will preclude the need for treatment to achieve the effluent standards other than for suspended solids, we do not require separate treatment for suspended solids alone.

Finally, the fact that one mining company supported the standards for iron and acidity supports the economic and technical feasibility of Sec. 606(a). (Ex. 37(a), p. 7).

In the present proceeding, this Board has chosen to refrain from adopting more stringent effluent limitations which would be compatible with those presently applicable to Illinois manufacturing and processing operations (including mine preparation plants) (PCB Regulations, Chap. III, Water Pollution). This decision rests on two bases, the first bearing more weight:

(a) The demands of environmental protection do not clearly warrant stiffer standards at this time. This is true not because the effluent limitations we adopt today would, in themselves achieve an adequate degree of pollution control, but rather, because the environmental planning and operational safeguards, which will hereafter become an integral part of any mining operation in Illinois, should effectively stop at the source most contaminated mine drainage that might otherwise occur. Effluent standards are an expensive after-the-fact curative; the essence of our strategy is to prevent the illness. The record offers convincing reason to believe our approach will succeed. (R. 282-83, 297-298, 489-90, 506-07).

(b) There is arguably a fundamental difference between manufacturing effluent and mine drainage, as sources of water pollution, namely, the great volumes of contaminated water involved. Thus the Institute study (Ex. 17, op. cit.) states that the Board should withhold adopting more stringent effluent criteria pending a thorough investigation of the economics of requiring tighter standards for such large volumes of water. An additional difference, the coal operators would have us believe (R. 59), is that, unlike the manufacturer, the mine operator does not utilize as part of the industrial process, most of the water which these Regulations would require him to treat. While mine drainage is not generally used in the mining process (although part of it is used as a source of supply for processing plant water) contamination of this drainage is a direct result of the mining operation. That an industry does not profit by using the water it pollutes is no excuse, for failing to clean that water polluted by its business activity.

The contention that the mine operator must, to comply with stronger effluent limits, undergo greater operation costs than the average manufacturer appears to be true. How much greater is a question of economics which we request the Institute to investigate. But there are certain basic facts presently available which this Board will keep in mind in re-assessing at some future date the need to adopt more stringent effluent criteria for mine drainage:

(1) The standards we adopt today can be readily attained by neutralization, coagulation and sedimentation. The tighter standards of Pollution Control Board Regulations, Chap. III, Water Pollution, can be attained in most cases, if total dissolved solids is not required to be removed, by the addition of a filtration step to this basic treatment process (Ex. 17 and 32,) at an additional operating cost of roughly 10¢ per 1000 gallons of treated drainage and a total cost of 25¢ to 60¢ per 1000 gallons (R. 465). Deleting dissolved solids (R. 103, 504, and Ex. 33) removes the necessity for the operator to use ion exchange treatment and saves 33¢ to 50¢ per 1000 gallons of treated water (R. 455, 465, 504). Also iron, next to acid the most persistent contaminant of coal mine drainage, can be reduced to 2 mg/l by neutralization and precipitation under carefully maintained conditions, without the extra cost of filtration (Ex. 7 and 32).

(2) The mine operator is not always handling volumes of contaminated water which exceed those to be treated by a manufacturer. (See Ex. 32, p. 171 for an example of a manufacturing process which treats several million gallons of waste water per day). Furthermore, the operator has certain options available which can reduce the amount of drainage requiring any treatment and which can reduce the volume of water requiring any but the most basic treatment.

The major source of run-off from deep coal mines requiring treatment to meet the acid and iron limitations, as well as some of the other heavy metals, is water pumped out of the mine and that drainage from the refuse piles (See Ex. 16(a). An estimation is that together these sources [on the average] will constitute approximately seventy million gallons per year (Ex. 17, p. 58). (But see Ex. 7 for a higher figure - several hundred thousand gallons per day from an underground coal mine).

From coal strip mines the major source of run-off requiring full treatment is from the refuse piles, constituting 12 to 600 million gallons per year of drainage, depending on whether the mine has low or high amounts of acreage devoted to refuse piles (R. 462 and Ex. 17, p. 59, Table 18.).

Of course, total surface run-off from a strip-mined area, or storm conditions, or an unusually wet deep mine will produce much greater volumes of water. But these are not average conditions of mine drainage, which would require full wastewater treatment in order to comply with the standards applicable to manufacturers. Thus, the estimate that on the average the operator must completely treat 3 mgpd is overstated (Ex. 17, p. 68, Tables 21 and 22). The operator who conscientiously incorporates into his operation the procedural safeguards of Parts III and IV of these Regulations will likely reduce capital costs by reducing the concentration of contaminants in the water which must be treated. (R. 282-83 and 450-451).

Frequent pit and deep mine pumping will reduce the residence time of drainage from those sources, diminishing the contaminant concentration. (id. Table 20). Drainage diversion and impoundment and plugging abandoned openings will prevent some water from flowing over, into or away from exposed contaminating surface areas, including deep mine shafts or tunnels. Proper location of refuse areas and handling of refuse, including compaction and periodic covering of acid-producing refuse, will diminish or totally prevent contaminated drainage from those areas. Proper surface reclamation as required by Illinois law (Surface Mine Land Reclamation Act (Ex. 34) will reduce the ability of water flowing across mined areas to become polluted. The proper placing of spoil banks, including the requirement that acid-producing parts of the spoil be treated separately and not carelessly spread through the other materials, and planning of mining, required by the permit procedures of Part II, will assist in keeping unnecessary water from the mined area.

Dr. David Maneval, Science Advisor to the Appalachian Regional Commission testified of the Pennsylvania experience:

> "With a passage of rather strict mine water control specifications in Pennsylvania in 1966, the mining companies have come to realize that every drop of water that they pump out must either be treated, or else it doesn't have to be pumped out at all. They have gone to extraordinary means to pump water out faster while it is still fresh and uncontaminated.
>
> They have gone to unusual lengths to avoid subsisidance problems under surface streams, which might allow a surface stream to enter a mine.
>
> They have cleaned up their housekeeping in a way by pumping out their sumps more regularly, and in this way if they make less water they have less to treat, and they realize this as a dollars and cents necessity to try to keep as dry a mine as possible; and where there is a reason to do it, they will find a way to do it."

Today we adopt eminently attainable, reasonable effluent standards. We leave to the Institute for Environmental Quality the investigation into the economics of, and environmental necessity for tighter standards or additional parameters. Aluminum, for example, may be a mine drainage contaminant requiring limitation. The conscientiousness with which the mining industry adheres to all of the Regulations we now enact as well as the results of the Institute's research will determine whether, and the extent to which, the Board must adopt further mine-waste pollution controls.

The cost of effluent standards and the other requirements of these Regulations may produce certain economic shifts within the mining industry, and may produce increased costs to the consumer of electricity. The Pennsylvania experience was that some small coal operators were bought up by the larger companies. An estimation is that the Pennsylvania controls have raised the cost of coal from as little as 5¢ to as much as 20¢ per ton, (R. 307), although the direct effect on coal prices from such environmental measures is difficult to assess. The Tennessee Valley Authority, the nation's largest consumer of coal, is currently attempting to assess the extent to which such pollution control costs will be reflected in higher business costs and in higher electric rates.

But these Regulations fall incontestably within the "practical range of abatement techniques" (Exhibits 14, 6, 16 and 33) and lie, as well, within the realm of economic reasonableness and environmental necessity (R. 494, 508, 517-18). That the public will eventually absorb some of the monetary costs of such measures is clear (R. 302-303); that this necessary cost of doing business should rightfully be borne by the entire mining industry and all of its consumers is equally clear.

I, Christan Moffett, Clerk of the Pollution Control Board, certify that the above Opinion was adopted on the 23RD day of May, 1972, by a vote of 5 to 0.

Christan L. Moffett