WEST VIRGINIA SURFACE MINING AND RECLAMATION ASSOCIATION

West Virginia Surface Mining & Reclamation Association's

Green Lands

QUARTERLY

FALL 1973

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ABOUT THE COVER

Fishing in a silt pond was probably thought an impossibility at one time, but now it is just an every day happening at Kingston, West Virginia. This was the site of Lawson Hamilton's Capital Fishing Derby and Company Picnic recently. (Story on page 3)

Also, the new seal of the West Virginia Surface Mining and Reclamation Association is displayed on the back cover. The seal will soon be seen on the association's official stationery.

"The old fishin' hole" just happens to be a new man-made silt pond in a surface mine drainage system. This is one of the three ponds used for the Fishing Derby held at Kingston for the employees of Pratt Mining Company, King Powellton Coal Company, Ford Coal Company and X-Cello Corporation.

Kevin Warwick, son of Mr. and Mrs. Robert Warwick of Kilsyth, feels one nibbling. . . .

hauls him in. . . .

Fishing Derby Huge Success

then proudly displays his 12 in. prize.

"You get a line and I'll get a pole and we'll go down to the old fishin' hole."

This was the theme of a "Fishing Derby—company picnic" held recently for employees of four southern West Virginia coal companies, but the "old fishin' hole" proved to be three manmade silt ponds in a surface mine drainage system.

The fishing derby idea was fathered by West Virginia Surface Mining and Reclamation Association President Lawson Hamilton, Jr. for the families of employees of Ford Coal Company, King Powellton Mining Company, Pratt Mining Company and X-Cello Corporation.

He noted that they sponsored a boat ride-picnic on Captain P. A. Denny's "Robin D" last year and that it proved a huge success.

"Every year we like to put on something like this to show all of our employees a good time and how much we appreciate their effort and loyalty on behalf of the company," Hamilton said. "We thought the fishing derby would be great fun for the kids so we decided to try it this year."

Planning for the derby actually began over a year ago when the three ponds were stocked with fish from the Mountain Trout Hatchery at Ruddles, West Virginia. Of course, because the ponds are in the drainage system coming off the surface mine operation, there was concern over maintaining water quality for species survival. A minimum pH of 5.5 is necessary and in a year's time none of the fish died.

According to Hamilton, the biggest worry over species survival had nothing to do with acid mine drainage, but whether or not all the fish would be caught by local residents before Derby Day.

But apparently the poaching wasn't too extensive, because the derby was a big success. Prizes were awarded for the largest fish caught in each of three age categories (six to eight, eight to ten and ten to sixteen), with over 50 rainbow trout being hauled in during the two hour contest.

The winners in their respective categories were: Gary Anderson, II, son of Mr. & Mrs. Gary Anderson of Pratt, 14 inches; Leroy Kirk, son of Mr. & Mrs. Vernon Kirk of Charleston, 12 1/4 inches; and Nora Campbell, daughter of Mr. & Mrs. Zenas Campbell of Scarbro, 16 inches.

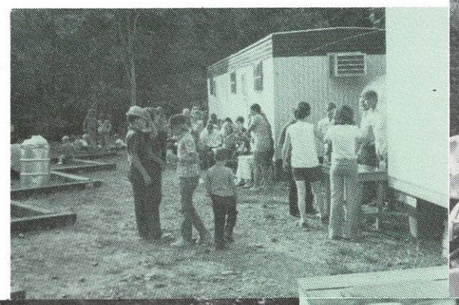
For those not particularly interested in fishing, live entertainment was provided along with a catered buffet, that included everything from chicken to cherry pie.

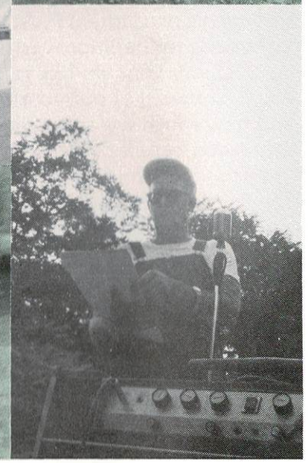
But Hamilton admitted that there was more behind the derby than just fun and games.

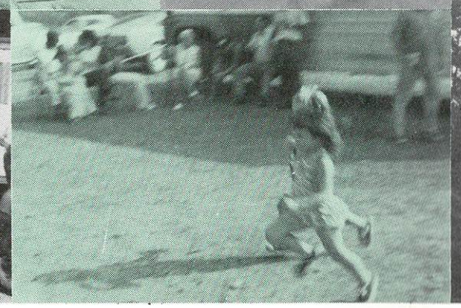
"People all over West Virginia and the nation are concerned about the environmental aspects of surface mining," he said, "including siltation and acid mine drainage, or 'offsite' damage. We are extremely proud of our work here and wanted to be able to prove dramatically that our drainage system eliminates these problems."

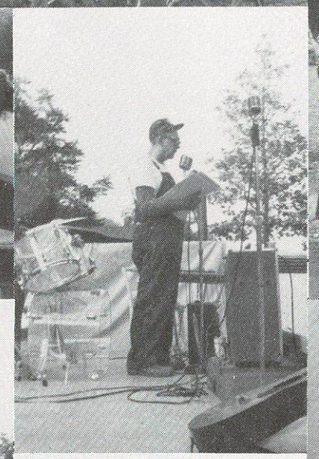
At the Annual Award Banquet of the West Virginia Surface Mining and Reclamation Association last January, Pratt Mining Company and X-Cello Corporation received an award for outstanding haulroad construction and the innovative use of gabion structures in the drainage system.

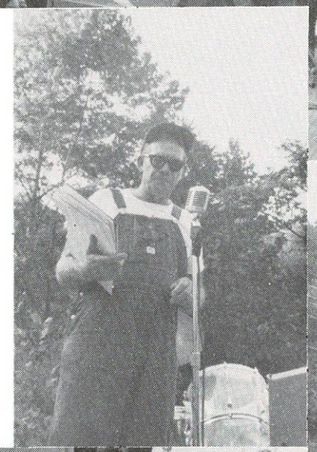
Hamilton concluded, "In view of the present energy situation, we want to be sure that we maintain production and do whatever is necessary to protect the environment in which we all must live."

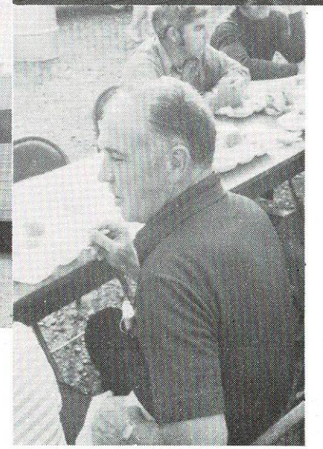












Toxic or Potentially Toxic Materials

by Richard Meriwether Smith, Walter E. Grube, Jr. and John Thomas Ammons

In cases where it is necessary to identify toxic or potentially toxic materials in overburden of coal prior to surface mining, we have agreed that a satisfactory definition can be provided by three measurements and their interpretation. These measurements, by methods described in detail elsewhere, are: (1) pH of the pulverized rock slurry in distilled water; (2) total or pyritic sulphur; (3) "neutralization potential" or calcium carbonate equivalent.

With the results of these tests at hand, toxic or potentially toxic material is defined as any rock or earth material having a pH of less than 4.0 or a net potential deficiency of 5.0 tons of calcium carbonate equivalent or more per 1000 tons of material, by the acid-base accounting method (1). The accounting includes maximum potential acidity possible from immediately titratable sources plus sulphur expressed as sulphuric acid equivalent, and balances acidity against total neutralization potential from alkaline carbonates, exchangeable bases, weatherable silicates or other rock sources capable of neutralizing strong acids as measured by the neutralization potential.

This definition will credit more acid potential to the sulphur than is justified when part of the sulphur occurs in sulphate or organic forms. However, with most rocks studied to date, except carbon-rich rocks (Carboliths) the error is insignificant. Moreover, as stated, determination of pyritic sulphur may be substituted for total sulphur if desired, but the determination is more complex and only in rare cases will the classification of the rock as potentially toxic or non-toxic be changed by determining pyritic sulphur only.

* Published with the approval of the Director of the West Virginia Agricultural Experiment Station as Scientific Paper No. 1297.

This work was partially supported by the Environmental Protection Agency. The ideas and conclusions are those of the authors and not necessarily those of EPA.

The choice of the deficiency of 5 tons of calcium carbonate equivalent per 1000 tons of material as the division between toxic and non-toxic material, obviously is arbitrary. However, when applied to the large number of samples studied during our past several years of minesoil research at West Virginia University, it corresponds rather satisfactorily to other supporting laboratory information about these samples as well as to extensive field experiences with minesoils developing in the different rock types. If rock or soil samples were defined to be toxic at much lower calcium carbonate equivalent **deficiencies** than 5 tons per 1000 tons, we would be declaring many of our natural soils to be toxic. On the other hand, with deficiencies much greater than 5 tons per 1000 tons, pH values below 4.0 and toxic concentrations of plant-available aluminum often develop rapidly and are difficult to prevent with near surface applications of reasonable amounts of pulverized limestone, as recently demonstrated by Ammons (M.S. Thesis, in process).

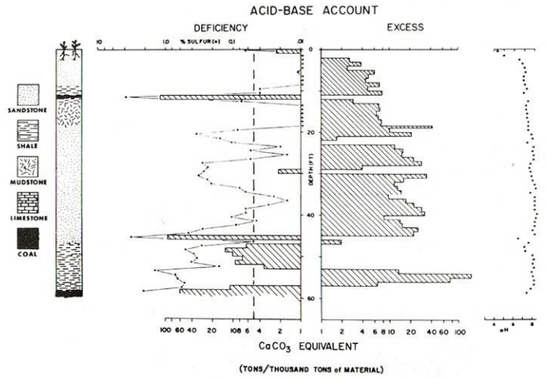
In considering these standards, as defined, it may be convenient to recall that, chemically, one ton of calcium carbonate equivalent corresponds with 2 milliequivalents per 100 grams of material, and that 1000 tons is the theoretical weight of an acre plow-layer, as the term is used by many agriculturalists.

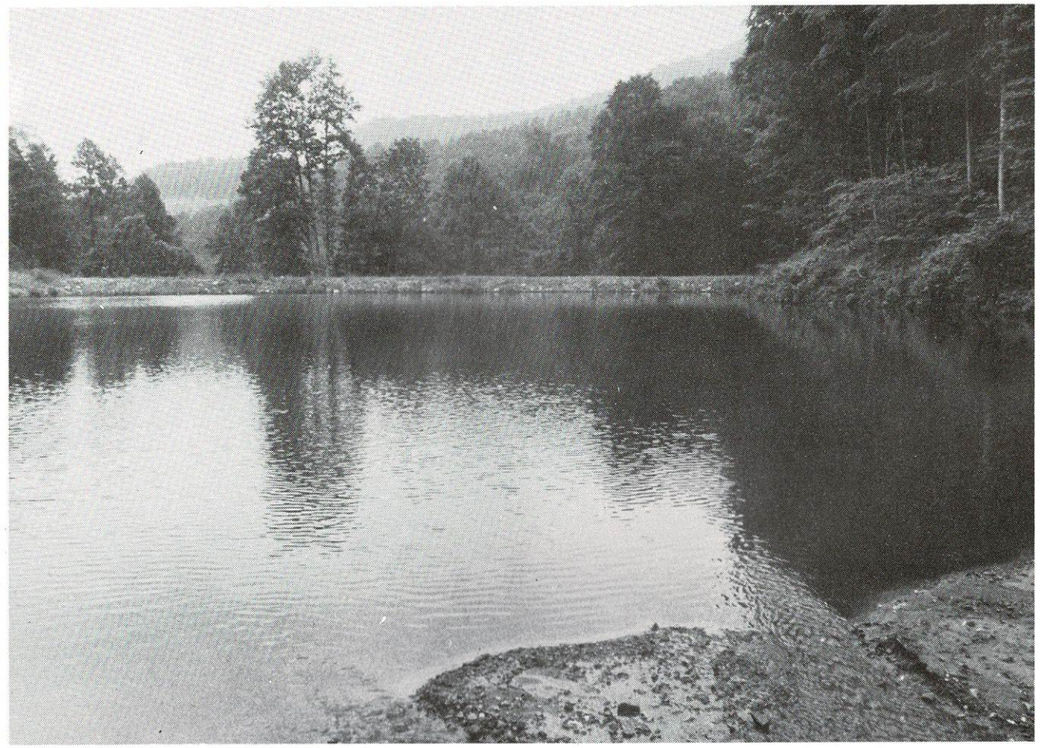
Figure 1 presents a graphic illustration of changes in net potential acidity or alkalinity for a section of coal overburden. Narrow zones at depths of about 12 feet, and from 45 to 53 feet would qualify as toxic or potentially toxic. However, ample calcareous material is present in other parts of this section to adequately cover the unfavorable material and prevent acid toxicities.

Summarizing, we are suggesting that toxic or potentially toxic rock or soil as represented in surface mining of coal in the Appalachian coal basins, may be defined by 3 relatively simple laboratory measurements: (1) pH; (2) total or pyritic sulphur; and (3) neutralization potential. Also, the methods of applying these measurements to coal overburden materials have been described in detailed step-by-step procedures (1).

References

1. Grube, W. E., Jr., Smith, R. M., Singh, R. N., and Sobek, A. A., "Characterization of coal overburden materials and minesoils in advance of surface mining", **Proceedings of the Research and Applied Technology Symposium on Mined-Land Reclamation,** Bituminous Coal Research, Inc., Monroeville, Pa.
2. Ammons, John Thomas, unpublished data to be included in M.S. thesis, West Virginia Univ. December, 1973.





West Virginia Breaks Reclamation Record Again

West Virginia has again led the nation in mined land reclamation, topping its own 1971 record by nearly 7,000 acres and doubling the production of its closest competitor, according to Ben Lusk, Executive Director of the West Virginia Surface Mining and Reclamation Association.

Figures from the West Virginia Department of Natural Resources (DNR) Reclamation Division reveal that 27,332 acres of mined land were reclaimed in the Mountain State last year, surpassing the old mark of 20,369.

This marks the fifth consecutive year that West Virginia has led all other states in reclamation acreage. Kentucky was the closest contender with 13,303 acres, followed by Ohio, 11,084; Pennsylvania, 8,870; and Virginia, 5,931. Completed reports were not yet available for Illinois or Indiana.

Lusk said it should be noted that the above acreage generally reflects land that has been backfilled, regraded and seeded according to the various individual state laws and some of the figures are subject to slight change.

According to the DNR, three different groups are responsible for West Virginia's outstanding reclamation success, but it is the surface mine operators themselves who are leading the way. Private companies completed work on 20,052 acres out of the 27,332 total. The remainder was reclaimed by the Soil Conservation Districts with 3,665 acres and West Virginia's Special Reclamation Fund accounted for 3,421 acres. This program is supported solely by the surface mine operators and funds reclamation work on orphaned banks (areas that were never reclaimed).

Since the Special Reclamation Fund was established in July 1963, $6.1 million has been paid by the operators and $5.1 million has been spent by the DNR in reclaiming over 18,000 acres of abandoned surface mines.

"Although West Virginia's reclamation supremacy has remained unchallenged, it is interesting to note that the Mountain State is far from being the surface mined coal production leader," said Lusk. "In 1972, West Virginia's 21.8 million tons ranked only 6th behind Kentucky's 63.7 million tons; Ohio's 34.3 million tons; Pennsylvania's 26.4 million tons; Illinois' 33.9 million tons; and Indiana's 24.4 million tons."

He also noted that a closer look at the figures shows that, in terms of surface production's percent of the total, West Virginia is far down the list. Of the 25 states involved in surface mining, only Utah has a lower surface-to-total percentage than West Virginia. And of those states mentioned above, 53% of Kentucky's coal is surfaced mined, 67.9% of Ohio, 34.7% of Pennsylvania, 51.7% of Illinois, 94.5% of Indiana, and 17.8% of West Virginia.

Seven states have 100% surface mined coal production and an additional seven have 90% or better.

During the past three years production has steadily decreased from 27.6 million tons in 1970, to 25.9 million tons in 1971 and 21.8 million tons in 1972. Statistics for the first quarter of 1973 show that production is off nearly 20% again this year. But during these same three years, reclamation acreage increased from 13,245 acres, to 20,369 acres to 27,332 acres. Since 1968, nearly 100,000 acres of surface mined land have been reclaimed in West Virginia.

"Of course, we are extremely proud of this outstanding record," Lusk said, "but we are by no means standing still. The research programs that have afforded us the methodology to achieve this successful reclamation are continuing and expanding."

He explained that the new EPA grant received by the Association would help improve reclamation even more by cutting down on initial environmental disturbance in the mining operation.

"We believe that the combination of a strong law, strong enforcement, the special reclamation fund and a concerted effort by government and industry is responsible for making West Virginia number one in reclamation during the past five years and will continue to do so in the future," he said.

ACRES RECLAIMED

	1972	1971	1970	1969	1968	Total	'72 Production
West Virginia	27,332	20,369	13,245	17,117	19,918	97,981	21,814
Kentucky	13,303	18,481	11,703	7,171	9,800	60,458	63,760
Ohio	11,084	9,230	12,972	12,459	11,105	56,850	34,360
Pennsylvania	8,870	10,259	9,089	9,914	10,811	48,943	26,400
Virginia	5,931	3,013	2,682	1,915	2,125	15,666	10,020
Tennessee	2,671	2,456	650	1,214	1,609	8,600	4,000
							Thousand Short Tons

Bagge Says House Bill Would Shut Down Surface Coal Mines

Carl E. Bagge, president of the National Coal Association, said today the strip mine bill now being considered in the House "would actually prohibit surface mining, in the name of regulation," while the nation is depending more and more on coal for future energy supply.

Bagge said the bill now being worked on by House Interior subcommittees is "arbitrary and punitive" and requires substantial amendment to make it workable. He submitted suggested amendments to the bill, known as Draft No. 3, in response to a request from Rep. Morris K. Udall (D-Ariz.), subcommittee chairman, for comment on the legislation. The amendments were concurred in by NCA and the American Mining Congress.

Bagge said, "The coal industry has developed the technology to achieve effective regulation, which should be the objective of any such legislation. A prohibitory, punitive and arbitrary bill will only drive many operators out of business regardless of whether they are doing good reclamation or not. Furthermore, at a time when events are causing the nation increasingly to turn to coal to meet our growing energy requirements, a prohibitory bill would foreclose our most readily available supply."

Bagge also attacked the argument that strip mining is unnecessary because the nation has abundant coal reserves which can be recovered by deep mining methods.

"Our strippable reserves can meet the present needs of the electric utilities for more than a hundred years and this bill would abandon that resource—needlessly so, for the land can be reclaimed," he said. He added that underground coal seams of extreme depth or thickness cannot be mined, and only about 60 per cent of even the mineable deep coal can be recovered—the rest is lost in the mining process.

Bagge added that electric generating plants now operating, and those planned for the near future, cannot await the development of better underground mining technology nor the lead time required to develop, man, and finance underground mines to replace surface mine production.

The amendments Bagge suggested would make extensive changes in the bill to achieve more effective reclamation, and to simplify its administrative requirements so that mining would not be halted by long procedural delays. For example, where Draft No. 3 would require that mined land be returned to the original contour, the coal industry amendments would permit other contours which could effectively control erosion, siltation and drainage. Where Draft No. 3 would, in effect, forbid placing dirt on natural slopes steeper than 20 degrees, the industry would permit it if the operator could demonstrate that the land would be stabilized.

Acid Mine Drainage

The Problem, The Treatment, The Cost

By William M. Aston

Iron pyrite glitters, it's yellow and it's metallic. It looks like gold — in fact, it's called fool's gold.

However, the disappointments that iron pyrite has caused in the past seem trivial when compared with the devastation it is causing now and undoubtedly will cause in the future.

Iron pyrite is the primary cause of acid mine drainage pollution.

When iron pyrite comes in contact with water and air, it forms sulfuric acid and a compound known as ferric hydroxide.

It is estimated that 6,000 tons of sulfuric acid each day enter the streams and rivers of Appalachia. This acid kills the fish and plants, eats away at tug boats and bridges, and makes the water unfit for drinking or swimming.

And for every ton of sulfuric acid produced from iron pyrite, about a half ton of ferric hydroxide also results. Ferric hydroxide, mixed with other things, is what gives streams that yellowish-red look. It's called yellowboy and is very similar to plain old rust. Because it doesn't dissolve in water, it settles out and coats the rocks and everything else in the stream bed.

Once the stream bed is coated with yellowboy, it's going to be there for some time even if the acid pollution stops. Since it doesn't dissolve in water, the only way to get rid of it is to let the current wear it away or siltation cover it up. There are so many factors involved in these processes that it is impossible to determine how long this would take.

Besides being ugly, yellowboy's effect on life in and around a stream isn't fully understood. It is known that alga can grow directly on it and that it doesn't seem to affect the growth of micro-organisms in the water. However, in some cases the coating can be so thick that it covers over the cracks and crevices in which immature stages of dragonflies, mayflies and midges live.

"The basic formulas for the formation of sulfuric acid and ferric hydroxide from iron pyrites have been known for sometime; however, it was only recently that researchers determined the rates of the reactions and the importance of the different components," according to William S. O'Brien of West Virginia University's Department of Chemical Engineering.

Iron pyrites are found in and around coal seams. The sulfur balls found by coal miners are one form of iron pyrite. Other forms include layers up to several inches thick in the shales above and below the coal seam and minute streaks in the coal and surrounding materials.

As long as a coal seam remains undisturbed, the iron pyrites are in balance with their surroundings and just lay there. There is moisture moving through the seam but apparently there is no free oxygen available for the first reaction. However, as soon as the seam is disturbed by mining, a landslide or erosion, a vicious cycle of acid formation begins.

In the first reaction, oxygen from the air combines with the pyrites and water to form a solution that contains sulfuric acid and a loosely associated compound known as ferrous sulfate. Such water is clear with a bluish tinge and it looks pure but under certain conditions it can be highly acidic.

In the second reaction, the ferrous sulfate combines with the sulfuric acid and more oxygen to form water and a loosely associated compound known as ferric sulfate. This solution is pale yellow.

A group of sulfur and iron-oxidizing bacteria known as Thiobacillus-Ferrobacillus, which occur naturally in acid mine water, greatly speed up this reaction which also takes place without these bacteria.

In the third reaction, ferric sulfate combines with water to produce sulfuric acid and yellowboy. This solution is yellowish-red and is what generally is thought of as acid mine drainage pollution.

As if to add insult to injury, the ferric part of the ferric sulfate can go back and combine directly with pyrite and water to form more ferrous ions and the components of sulfuric acid.

When these reactions are complete, one molecule of pyrite has produced two molecules of sulfuric acid. And the faster the acid is produced, the faster ferric ions are available to produce more acid.

"Once this cycle of reactions starts, it's difficult if not impossible under regular mining conditions to stop it," Dr. O'Brien explained, however, each component and each step of the reactions offer an opportunity to at least slow down the formation of acid.

"In the first reaction, for example, both water and air are needed. Thus by diverting water from active deep mines or quickly pumping it out, acid formation can be reduced. It is more difficult to prevent air from entering the mines.

"However, several methods are being used and others are being investigated. These include flooding abandoned deep mines that are below the water table, sealing the air from abandoned deep mines that are above the water table and possibly filling them with an inert gas. It even has been suggested that by providing miners with an independent source of oxygen, it could be possible to introduce an inert atmosphere in active mines. This would not only reduce acid formation but would prevent fires and explosions.

"Since the second reaction is highly dependent on the presence of certain bacteria, it might be possible to discover other bacteria or chemicals that could control them," Dr. O'Brien said.

Not all coal mines produce acid mine drainage. Some coal seams have little if any iron pyrite associated with them and other seams are associated with limestone so that if any acid is produced it is quickly neutralized. In some areas including southern West Virginia, the water from mining operations is alkaline.

Substances such as lye that cause water to be alkaline are known as bases. When the proper amount of a base and an acid are combined, a neutral salt is produced. The acidity, or the alkalinity, of a solution is measured by what is called a pH scale, which goes from 0 to 14. If the pH of a solution is below 7, it's acidic; if it's above 7, it's alkaline.

At a pH of less than about 3.0, all forms of life (except for a few organisms) disappear from acid mine streams. Most fish die if the pH drops below 5.0; however, catfish and some other species can hang on down to as low as 4.0.

Some people swim in water with a pH as low as 4.0. They report that they feel slimy when they come out, but it isn't known whether there are any harmful effects. But other factors, such as color and clarity of the water and appearance of the surroundings, seem to be just as important as pH in selecting a swimming site.

Water with a pH below 6.0 isn't considered suitable for public water supplies by U.S. Public Health Service standards.

The pH of a stream isn't constant but varies with the mining activities in the area, the rainfall and the season. Slugs of acid also pass down a stream from time to time. Thus on the same day, different parts of the same stream can have very different pH readings. Such slugs of acid are able to kill fish in normally productive streams.

Treating acid mine water after it forms and enters a stream is expensive and involves technical problems that haven't been solved.

The most widely used treatment process involves neutralizing the acid by adding lime or limestone to the water. Since both lime and limestone are alkaline in nature, they combine with the acid in the water to reduce its acidity.

"Treating all of the acid mine water that is formed would be economically impossible," according to Chester L. Dodson, director of the Water Research Institute at West Virginia University.

The Appalachian Regional Commission estimates that neutralizing 10 million gallons of moderately acidic water by lime would cost $2,900 a day. One small stream alone has a flow of about 10 million gallons a day.

Another problem with trying to treat all acid mine water is that it would be an unending task. Acid formation is related to annual coal production, which is increasing.

When acid mine water is neutralized with a base, you end up with water, alkali sulfates and iron compounds. Alkali sulfates, such as calcium sulfate, are what makes water hard. When you wash in hard water, you get a gray scum instead of suds.

This is how the neutralization process works: Lime is mixed with acid mine water in a tank by means of a mechanical stirrer. The amount of lime added is controlled automatically so that the desired pH is reached. The neutralized water, which contains iron compounds and calcium sulfate, is fed into an aeration tank or pond. The addition of oxygen causes some of the iron compounds to form ferric hydroxide. Then the mixture is fed into a settling tank or pond.

After the mixture has settled for awhile, the neutralization products settle out as a gooey sludge known as brown toothpaste and the treated water (that is now hard because of the calcium sulfate) is returned to the stream. But the settling ponds eventually will up with sludge and its disposal becomes a serious problem.

Another difficulty with lime or limestone neutralization of acid mine water is that the treated water isn't fit to drink and requires extensive treatment to make it so.

And in some areas it may be necessary in the future to use treated acid mine water as a water supply. Thus making water drinkable through reverse osmosis by adding lime to raise the pH may prove advantageous in some cases.

What is reverse osmosis?

The liquid world is divided into solvents and solutes. In seawater, the water is the solvent and the salt is the solute. Seawater is called a solution and can contain various concentrations of salt.

If pure water is separated from a solution of salt and water by a semi-permeable membrane, a rather remarkable thing happens. The pure water passes through the membrane and dilutes the solution. At the same time, the membrane prevents the molecules of salt from passing into the pure water. This process is known as osmosis.

Osmosis, like gravity, is one of nature's phenomena, and every living thing is dependent on it. The tiny roots of plants, which are full of a sugar solution, take up pure water from the ground by means of osmosis through plant cell membrances. The cells of our body are nourished and function by processes that involve osmosis.

Generally, the solvent passes to the more concentrated solution if the solutions are separated by the proper membrane.

Although osmotic pressure is forceful enough to cause pure water to pass through the outer covering of a plant's roots, it can't force the sap to the uppermost branches of a tall tree. At a certain point, osmosis stops.

However, by putting pressure on the solution to overcome the natural osmostic pressure — by means of a pump, for example — osmosis can be reversed. Then the solvent moves through the membrane and leaves a more concentrated solution behind. This process, known as reverse osmosis, is used to desalt seawater and to purify acid mine pollution.

The membrane most widely used in this process is cellulose acetate — the same type of material used to make photographic film. In one widely used form, the cellulose acetate is made in thin sheets and formed into a jelly roll-type configuration; in another form, it is fabricated into the shape of a soda straw.

The greatest disadvantage of using reverse osmosis to treat acid mine water is its high cost. Studies indicate that the capital investment for a 100,000 gallon-a-day plant would be about $250,000 and that operating costs would be about $2.50 per 1,000 gallons. A million gallon-a-day plant would cost about $1.4 million and operating costs would be about $1.10 per 1,000 gallons.

To determine if these costs can be reduced and to determine the quality of the treated water, West Virginia University has received grants totaling $341,385 from the U.S. Environmental Protection Agency.

G. Lansing Blackshaw, associate professor of nuclear and chemical engineering, is directing the project that involves construction of a 60,000 gallon-a-day pilot plant on Stewarts Crown in Monongalia County, which will treat water from an abandoned deep mine.

"This water is high in ferrous sulfate and is considered to be much worse than that previously treated by reverse osmosis on a large scale," Dr. Blackshaw said. "Besides determining the costs and the quality of the product water, we will be testing the special equipment that is being built for the plant."

The semi-permeable membrane for the new pilot plant will be spirally wound celluose acetate contained in a reverse osmosis unit designed and built by Gulf Environmental Systems Co. of San Diego, Calif.

In this form, the membrane is wrapped around a perforated pipe, jelly roll-style, and placed inside a cylinder. The acid mine is introduced at one end of the roll. Under pressure, clean water is forced through the membrane and collected in the pipe. The remaining acid mine water, which is now referred to as brine, flows out at the other end of the cylinder.

According to Chester L. Dodson, director of the Water Research Institute at W.V.U. — "Acid mine drainage is one of America's deferred debts but the question is — how are we going to pay it off? The magnitude of the debt is enormous."

In 1969, the U.S. Department of Interior estimated that the capital costs over a 20-year period of controlling and abating acid mine drainage would be $6.6 billion plus annual maintenance costs.

The Appalachian Regional Commission estimates that the annual savings (exclusive of recreational benefits) would be $4,230,000 by abating 90 percent of the acid mine drainage in the region. The savings would result from lower costs in treating water supplies and in longer life for culverts, bridges, towboats, barges and navigational facilities.

But Prof. Dodson warns that the ecological implications of continuing to pour such huge quantities of sulfuric acid into the nation's waterways are frightening because the long-term effects are completely unknown.

"Today we have slugs of acid going down the Ohio River," he said. "How long will it be before they are going down the Mississippi? And then out into the Gulf of Mexico?"

Prof. Dodson believes that new treatment methods have to be developed to abate acid mine drainage and that the biological seems to be the most promising of the three general methods.

The two others are the chemical treatment method, such as adding limestone or lime, and the physical method, such as reverse osmosis.

Surprisingly, some bacteria and some algae prefer to live in acid mine water and in fact are only found there. And some vascular aquatic plants don't seem to care if the water is acidic.

Even more surprisingly, one group of bacteria — which includes Thiobacillus thiooxidans and Thiobacillus ferrooxidans — are able to live off of the chemical energy produced when they oxidize inorganic compounds such as those containing sulfur and iron. And these two members of the group are found naturally in acid mine water and greatly speed up the reactions by which iron pyrite is converted into sulfuric acid and yellowboy.

Most animals and plants live off of organic materials — materials containing carbon that were once alive. Some organisms that carry on photosynthesis are independent of organic materials; however, they require radiant energy from the sun.

Thiobacilli, which are called autotrophic bacteria, are neither dependent or organic materials nor on sunshine. They use the chemical energy from oxidation (rusting is a common form of oxidation) to carry out all the activities of a living cell.

According to one theory, bacteria and acid mine pollution have been related for a long time — beginning when coal seams were being formed some 200 million years ago. Coal is essentially compressed plant debris from ferns, reeds and trees that grew in the swamps and marshes of the coastal plains of ancient seas. Bacterial attack on the plant proteins released hydrogen sulfide, which in turn combined with iron to form iron pyrites, according to the theory.

As early as 1919, researchers at the University of Illinois suggested that some organism might be involved in the production of acid in mine waters. And in the 1940s and 1950s A. R. Colmer, M. E. Hinkle, W. A. Koehler and K. L. Temple at West Virginia University found that the known sulfur-oxidizing bacteria T. thiooxidans were present in every sample of acid mine water examined and were most abundant at sites where acid was being formed.

They also found that when the pyrites were in certain forms T. thiooxidans increased the rate of acid formation in the laboratory. However, later experiments indicated that T. thiooxidans don't attack iron pyrites directly but apparently oxidize sulfur to sulfate.

Colmer isolated a new species of bacterium that oxidizes iron and is now known as T. ferrooxidans. It was shown that this bacterium changes ferrous iron to ferric iron and that it was present in every sample of mine water examined. Koehler and Temple also showed that T. ferrooxidans was able to enhance the formation of acid directly from pyritic material in the laboratory.

These findings could prove to be economically important in the chemical neutralization of acid mine water because mine water containing ferric iron can be treated with limestone, which is much cheaper than the hydrated lime used to treat water containing large amounts of ferrous iron.

The coal industry is now investigating the feasibility of converting ferrous iron to ferric iron by bacteria, then neutralizing the water with limestone.

The basic idea behind this line of research is the hope that bacteria will be found which will prevent the formation of acid from iron pyrites or which will speed up the reactions so they can be controlled.

The problem is complicated by the suspicion that T. thiooxidans, T. ferrooxidans and other iron-oxidizing bacteria are really the same thing. There is some evidence for this view and the apparent differences are explained by the different conditions under which the organisms live.

Acid mine waters aren't as devoid of life as they might seem.

Certain vasular aquatic plants also grow abundantly in acid mine water in many areas. Vascular aquatic plants, such as spike rush, provide cover for fish and other aquatic life and food for muskrats.

A study conducted by WVU's Water Research Institute on the Monongahela, West Fork and Tygart Valley rivers found that the nature of the river bottom is the determining physical factor in the distribution of the 13 species investigated. The study was directed by Dr. Roy B. Clarkson of WVU's Department of Biology.

River bottoms consisting of particles under two millimeters in diameter are the most favorable sites for these plants and this factor is far more important than the pH of the water. Other factors that affect the growth of these plants are the amount of phosphate in the water and the water-level fluctuations.

"Algae are the basic components of the aquatic food chain and have an extremely important role in the self-purification of polluted water," observed Dr. Herald D. Bennett of WVU's Department of Biology.

He made an extensive study of algae in relation to acid mine water, which revealed that the total number of genera and species of algae in acid mine water compared favorably with the numbers reported to be in comparatively unpolluted waters.

Samples were taken from 17 stations on creeks, rivers and ponds over a one-year period in Marion and Preston counties. A total of 406 species were identified compared to 618 species of algae in non-acid mine waters in West Virginia identified by other investigators.

"Most changes in water quality observed in this study could be interpreted as due to time, dilution and the addition of other pollutants," Dr. Bennett said. "Algae wouldn't necessarily be expected to make sudden, readily measurable changes; however, because of their ability to adapt to changing environments, they are likely to make significant changes in acid mine water."

WVSMRA Receives Federal Grant

New Surface Mining Technology to Minimize Environmental Disturbance

by John J. Mulhern, Mining Engineer, EPA
Ben E. Lusk, Executive Director, WVSMRA

On June 28, 1973 a grant was awarded to the West Virginia Surface Mining and Reclamation Association by the United States Environmental Protection Agency, to demonstrate a new surface mining method, often called "longwall stripping." This grant was awarded under the Federal Water Pollution Control Act Amendments of 1972, PL 92-500, Section 105 "Grants for Pollution Control Programs." This section PL 92-500 authorizes the Administrator to "(1) conduct in the Environmental Protection Agency, (2) make grants to persons, and (3) enter into contracts with persons for research and demonstration projects for prevention of pollution of any waters by industry including, but not limited to, the prevention, reduction and elimination of the discharge of pollutants.

The Environmental Protection Agency's Office of Research and Development, Mining and Land Modification Branch is seeking new and better mining methods that will bring a balance between mining and the environment. In our new mining methods research program we are striving for better methods to recover the Nation's needed mineral resources while minimizing the environmental disturbances.

The West Virginia Surface Mining and Reclamation Association is a nonprofit trade organization representing over 200 companies involved in surface mining and its related industries. Since its formation in 1966, the Association has initiated and promoted various state and Federal research programs that have provided the industry with more advanced surface mining and reclamation methods and techniques. This grant marks the latest and most significant step in that direction.

The use of longwall mining systems both in this country and abroad have been well documented and well accepted by the coal mining industry. The concept of utilizing this longwall system under relatively shallow cover was developed by the Environmental Protection Agency as a possible alternative to conventional strip mining. With the recent dramatic increases in surface mined coal more and more concern over the environmental problems associated with this mining method became apparent. With this increased concern in environmental effects, it became apparent that new mining methods should be considered in attempting to balance mining and the environment. While coal and other minerals are natural resources vitally needed, the Nation's land, air and water are also vital natural resources that must be protected. This new mining method is one that is hoped will provide the balance of mining and the environment.

If a conventional longwall mining system could be advanced at right angles to a narrow trench or along a strip mine highwall, a number of benefits could be achieved enhancing the environment while still providing the vitally needed coal for the Nation's energy requirements. This shallow covered coal could be mined without disturbing all of the overlying vegetation. Additionally, such a mining system would also achieve complete coal extraction, or total resource recovery. This should greatly reduce the chance of long-term environmental problems such as uncontrolled subsidence and acid mine drainage. The caved area resulting should be more completely sealed, reducing or eliminating the channels which act as tributaries for the eventual release of acid mine drainage. (See Figure 1, 2, 3 & 4)

A feasibility study performed for the Environmental Protection Agency by Potomac Engineering and Surveying of Petersburg, West Virginia, examined the literature available on the general subject of strata control relating to the stratagraphic action likely to develop in "longwall stripping." Some of this information examined related directly to shallow depth mining, while the remaining information involved situations such as extracting coal from distressed areas that have been previously undermined. However, the information available on longwall

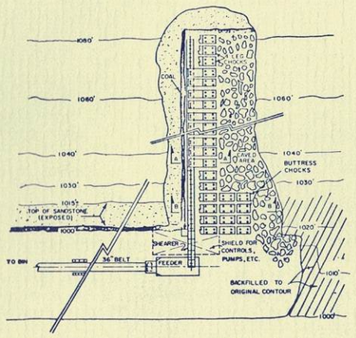


Figure 1—Plan View of Longwall Stripping System

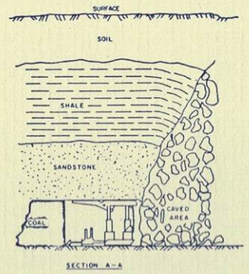


Figure 2—Typical Cross-section View of Longwall Stripping System

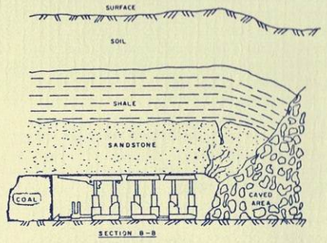


Figure 3—Cross-section View of Longwall Stripping System Along Highwall

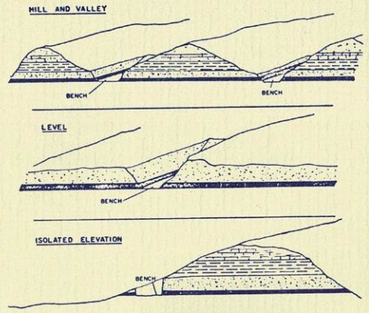


Figure 4—Various Types of Terrain Applicable to Longwall Stripping System

mining systems running under extremely shallow cover or "open end faces" was very minimal and no experiences of longwalling with "open end faces" were reported.

Because of the lack of published information on shallow covered coal recovery using longwall mining systems it became necessary for the feasibility study team and the Federal project officer to visit with mining company and manufacturing company personnel to learn of any previous experiences of mining under these conditions. As a result of discussions, both in the U.S. and other countries, it was learned that the open end longwall system had never been attempted before. Since the U.S. is one of the unique countries where coal measures are such that this system could be applicable it is easily understood why no other attempt has ever been made.

The theory of strata control for longwall stripping should be similar as that employed in conventional longwall mining underground. That is, the immediate roof strata above the coal must be supported and allowed to cave in such a manner to allow controlled support and caving of the upper strata. The desired sequence of events that will take place as the longwall face advances would be: 1) the immediate roof is relieved of the load of the upper overburden; 2) the immediate roof sags away from the stronger, higher strata, 3) the chocks would advance causing caving to occur with a breaker line formed at the rear of the chocks; 4) the caved material expands to fill the void in the mined area and the upper roof forming a span between the gob material and a line where the immediate roof has separated from the upper roof over and near the advancing wall face; and 5) most of the roof pressure taken by the solid coal ahead of the advancing face and the gob and the supports merely maintain the relatively light load of the immediate roof.

The major difference of longwall stripping as opposed to conventional underground longwall mining in strata control, is the extremely shallow cover ranging from 30 to 40 feet on the outby end to about 200 feet on the inby end of the face. In conventional longwall mining this is generally done under 400 or more feet of overburden. However, a combination of a massive or too competent roof strata that has not been subject to the normal conditioning stresses imposed by heavier or deeper overburden and the shallow cover will generally require heavier duty chocks than conventional longwall mining conditions. Therefore, it is anticipated that heavy duty roof supports will be utilized in this first demonstration mine of longwall stripping.

Mining for coal under shallow cover has occurred in many parts of the world. Longwall mining has worked out to the coal outcrop in many parts of the world. However, the "open end face," "fresh air" and "flying entry" of longwall stripping is unique and has never been attempted any place before. This fresh air end or flying entry offers many advantages to the longwall face particularly as contemplated for this first demonstration mine. The head end will be outside in fresh air where the longwall controls, pumps and face conveyor discharge end are also located. However, this outby end also can cause serious problems and it is recognized as being the most critical engineering problem to be solved.

The deflection of the roof strata at the outby end of the face can cause horizontal movement of the unconfined strata possibly resulting in a fall of overburden out into the faced up area. For this reason it is anticipated that special "buttress' chocks and possibly packwalling will be necessary at the outby end of the face. Because of the high cantilever loading at the outby end with resultant horizontal movement and collapsing of the overburden along the highwall, special consideration is anticipated at the open end.

Since the possible necessity of packwalling the outby end of the longwall face behind the chocks to prevent excess stresses that can cause this horizontal movement of the roof strata and the consequential highwall collapse is recognized, a system, method and means of doing this must be provided.

The use of stowing behind the entire longwall face offers several attractive possibilities to environmentalists. The first would be to rid the surface of coal refuse and fly ash reducing the associated environment problems such as air pollution from burning "gob piles;" secondly, the mined out area could be filled with material that would preclude air and water anticipating complete elimination of acid mine drainage; and lastly the replacement of the coal with refuse would reduce surface subsidence. However, the very nature of stowing changes the mining method wherein the strata behind the chocks would converge rather than cave and may present a significant mining problem. Additionally, the increased cost may radically alter the economics of the demonstration project so complete stowing with the prime objective is to dispose of refuse may require a separate study.

One criteria the EPA placed on the feasibility study was that it must use standard off-the-shelf longwall equipment with the possible exception of the outby end. With this restriction and the desire for the first demonstration mine to limit itself to the number of problems to be solved for a first attempt, general physical criteria were established for site selection. These general physical characteristics are as follows:

1) the coal seam should be at least 48 in. thick with the economics improving with increased thicknesses.
2) a strong 8 to 10 foot thick sandstone or consolidated shield member immediately above the coal.
3) the floor should be strong, preferably shale and reasonably impervious to water.
4) a flat or slightly upward pitch and coal seam with surface topography conducive to good drainage and drainage ditching.
5) the coal seam should be of uniform thickness and be free of serious undulations or heavy pyritic intrusions.
6) a readily marketable coal:

While the above characteristics seem to narrow the potential uses of longwall stripping these characteristics are considered desirable for the first attempt at mining in this manner. However, it is believed that as more experience is gained in the art of longwall stripping, methods and equipment revisions and innovations can be made to overcome most physical shortcomings of the seam and strata.

Proposed Demonstration Mining System

The concept of utilizing a longwall mining system for shallow cover coal removal is relatively simple. First a narrow bench would be open running parallel to the coal outcrop and in about 10 or 15 feet from the actual outcrop. Then perpendicular to this bench an open trench or an entry is driven into the coal seam. This perpendicular tranch or driven entry will be the longwall face that will continuously advance, along the coal outcrop recovering the coal. The bench would be advanced at a rate that would allow continuous progression of the longwall system and the continuously moving open air outby end. The material removed from the advancing bench would be returned behind the area previously mined. It is thought that this initial face would be from 200 to 250 feet long from inby to outby end.

The longwall system depends on the successful

operation of three interlocked systems involving hydraulic roof support, cutters and conveyors. The failure of any one system will cause production stoppages. However, it is believed that of the three systems the hydraulic roof support will be the most critical. While the final system to be selected will depend on the actual site conditions it is thought at this time the chocks will need to have sufficient area between the front and back legs to permit extending a ventilation tube to within 10 feet of the inby end of the face, constructed for the heaviest duty and be selected to minimize the length to which they extend back away from the face and into the gob. However, the extended length should not be restricted to interfere with the movement of men or with the placement of the ventilation tubing. Although complete automation of the operation of the chocks from the trench may be possible, a bank control method of automation for moving the chocks is being considered. Utilizing this method, only one man is used to advance 6 to 10 chocks from a single position. With this bank control all the chocks could be moved by a single miner from different positions resulting in a less expensive, automated chock system.

Coal cutting will be accomplished through the use of a shearer. The shearer would cut coal traveling inby the face and tram out to be repositioned on the outby end for the second and continuing cuts. Final selection between a single drum ranging arm shearer or a double drum shearer will depend on the conditions of the selected site and coal seam. It is thought that the three miners who will work the chocks will also work the shearer by passing the shearer from their respective chock station to the next station. This would be a modest form of longwall automation.

The Environmental Protection Agency's feasibility study of this new surface mining method was performed under contract no. 68-01-0763 to Potomac Engineering and Surveying. In this study an economic evaluation of the system was made. Assuming a 250 foot longwall face located in a 48 in. thick coal seam it was projected that this could produce about 100 tons of coal per pass of the shearering machine assuming a 30 in. web cut. It was estimated that the shearer could make 4 to 5 passes per shift for average shift production of 450 tons. Based on this production rate, and all mining costs involved from both the longwall face and the bench preparation area (including the coal recovery from the bench) they estimated that for a yearly production of 306,000 tons the coal cost delivered to the mine loading bin and prepared for delivery would be about $6.49 per ton. Obviously these costs can range substantially depending upon the mining conditions encountered.

In this feasibility study recently completed the concentration of effort was on the recovery of shallow coal utilizing existing underground longwall mining technology, however, during the course of the study several alternatives or modifications became readily apparent. The one factor pointed out by the study was that the most significant development in mining technology that can provide alternatives to mining this shallow cover coal is the recent advances in self-advancing remote control roof support systems. With the ability to control the strata above the coal several alternatives to the original concept of longwall stripping were suggested. Some of these alternatives were the use of the continuous mining machine coupled with longwall roof support system (shortwalling) mining, to shallow and parallel slopes spaced 300 to 600 feet apart, and "stowing" of mine refuse, fly ash and rock behind the roof support system instead of "caving."

Environmental Benefits

The environmental benefits of this mining method can be substantive. The elimination of the need to overturn the entire earth surface to recover the coal, the filling of the voids left by removing the coal seam and the minimizing of the time required to open the earth to recover the coal can obviously reduce the environmental disturbance. The ability to recover virtually the total coal seam without totally disturbing the total surface area above the coal seam can substantially reduce the sediment and erosion problems, prevent surface water from draining through the coal seam and prevent serious land slides from occurring in steeped slope areas.

The EPA Grant to WVSMRA

The project is to demonstrate the applicability of conventional underground longwall mining to shallow cover coal. As mentioned previously the uniqueness of this method is the open end outby side of the face. But, the main concern of the Environmental Protection Agency is to bring a balance between mining and the environment. This is the thrust of their research, development and demonstration project in seeking new mining methods that will continue to provide the Nation's needed mineral resources while minimizing the environmental disturbance. This grant is a project that will attempt to demonstrate that mining and the environment can be balanced.

The West Virginia Surface Mining and Reclamation Association, the grantee, has proposed to conduct in effect two simultaneous studies. One, will be the demonstration of this method of mining shallow cover coal and the other one will be the environmental effects of this method. In order to do this the grantee has selected two separate contractors to independently conduct their phase of the project. The mining part of the project or Phase I will be Potomac Engineering and Surveying and the environmental study will be Hittman Associates.

After the site has been finally selected the mining consultant will develop a mining plan. This mining plan would include all of the necessary considerations any mining company would encounter in developing a normal mining operation. Because of the uniqueness of this mining method, it will be necessary to consider both state and Federal underground and surface mining rules and regulations.

Simultaneously with the development of the mining plan the environmental consultants will move on site and develop the environmental baseline. This environmental baseline will attempt to determine the total environment that exists within the mining and adjacent area. This will include the enumeration of the numbers and varieties of the flora and fauna, the water quality and any other existing feature of environmental concern. After the environmental baseline has been established monitoring will continue over the entire mining phase. Additionally, the environmental monitoring phase will continue for one hydrologic cycle to determine if any adverse long-term environmental effects have occurred.

Because of the intense interest this project has generated in both the mining and environmental communities three advisory boards to assist the project have been suggested. One board would advise the project of environmental considerations. The second board will be the technical advisory board for surface mining. And lastly, the underground mining advisory board will provide the advice and assistance in developing the mining plan and carrying out the actual mining operation.

The existing coal reserves of this Country are vast and have been projected to last this Nation from 300 to 2500 years, depending on which forecaster you believe. While the big concern today is the use of coal for energy there is a real possibility in the near future that the nation will become more dependent on coal for supplying the basis for its chemical industry. While much concern is voiced about the country's energy shortage and how we will fill the gap when our petroleum becomes exhausted, little concern is expressed for our petro-chem industry. The most probable substitute will be coal and to this end there will always be a need for mining of coal in this Nation. It is therefore easy to assume that someday future generations will need to recover all of the available coal reserves. To do this, new methods and new adaptations, modifications, and other alternatives to mine much of the neglected coal reserves will be needed. It has been estimated that longwall stripping using only off-the-shelf equipment with no special adaptation, modification or special engineering could mine somewhere in the neighborhood of 15 billion tons of coal reserves known to exist in the U.S. This is approximately the size of the anthracite coal fields in northeastern Pennsylvania. How much additional coal could be mined with adaptions or modifications of this equipment is anyone's guess, but based on known shallow cover coal reserves this figure could substantially be increased.

NEW USES FOR FLY ASH AND MINE WASTE

Fly Ash Used In Special Reclamation Project

Fly ash from the Harrison Power Station is being applied as a soil amendment in the reclamation of an abandoned surface mining operation near Four States in Marion County.

The restoration program is a project of the Reclamation Division of the West Virginia Department of Natural Resources. The site is part of a 22-acre parcel mined by the Rex Coal Company on property owned by Simon Sturm and Vernon Williams.

Monongahela Power Company is participating in the project with the DNR, Soil Conservation Service, Energy Research Center of the U. S. Bureau of Mines in Morgantown, and Monongahela Soil Conservation District.

Charles A. Sheets, reclamation supervisor for the DNR with offices in Fairmont and project coordinator, termed the program a "team effort" with input coming from each agency.

He explained about one-half the area is being treated with fly ash at the rate of 200 tons per acre with the balance being utilized as a control plot. The 2,000 tons of ash was trucked to the job site from the Harrison Station at Haywood.

Bureau personnel, who have pioneered the use of fly ash in the revegetation of strip spoil banks and coal refuse piles, designed the application rate for the acidic spoil. L. M. Adams and Ed Eisentrout from the Morgantown station actually spread the material and prepared the spoil bank for seeding.

The recommended seed, fertilizer, mulch, and lime applications were prepared by an SCS team composed of Dave Stanley, Harry Summers, and Jim Crawford.

The entire site received equal applications of 10-10-10 fertilizer and the control portion of the spoil bank was treated with six tons of lime per acre. The seed mixture included Kentucky fescue, rye, red top, yellow sweet clover, and Birdsfoot treefoil.

The major portion of the work, which included back filling against the high wall and regrading the outslopes, was carried out with monies from the DNR's Special Reclamation Fund by the Water Company of Kingwood. This work began last November.

The Marion County project marks the first time DNR has utilized fly ash in its reclamation program. However, the Bureau of Mines' first application was on a one acre plot near Morgantown in 1965. Since that time the program has expanded into Pennsylvania, Ohio, and Illinois on tracts up to 65 acres.

Fly Ash, Coal Waste Made Into Aggregate

Conservation of energy and utilization of waste materials are the main features of a new patented aggregate called "LAPIDEX" made from fly ash and coal mine waste.

Developed in Hungary, the new process requires no fuel or additives to convert the raw material into lightweight aggregates. Concrete made from the LAPIDEX reportedly meets international standards and has good insulating and accoustical properties.

A spokesman for the developers, Dr. Robert Frank of Old Greenwich, Conn., said cost savings can be achieved by making the aggregates in locations where the fly ash and coal refuse is available. "This concept," Frank said, "would reduce disposal costs for both the utilities and coal companies as well as minimizing air and water pollution in these areas."

In describing the process, Frank explained the raw materials are mixed and granulated wet and have good green strengths. The granules are then fired in a counter-current shaft furnace utilizing only the fuel values already contained in the mix, he said. The product is collected at the bottom of the shaft as a porous material in any desired size and density.

Dr. Frank noted LAPIDEX is superior in many respects to such well-known products as "Kebamsit" (USSR), "Leca" (Germany), and other expanded clay products.

Further information may be obtained by contacting Dr. Frank at 17 Hendrie Drive, Old Greenwich, Conn. 06870, or by telephone at 203/637-1869.

EPA Utilizes Mine Refuse-Fly Ash Base Course In Road Construction Test at Crown Center

Two coal by-products — coal mine refuse and fly ash — are being utilized for the first time as a highway base material in an experimental project at the U. S. Environmental Protection Agency's Mine Drainage Control Field Site at Crown in Monongalia County, West Virginia.

The material was placed on the driveways and parking areas at the station to monitor subsurface drainage and to evaluate its potential in road construction.

Project Director Robert Scott said the base ranged in depth from 12 to 18 inches and incorporated three separate applications. Two utilized a blend of 75 percent refuse and 25 percent ash with the second having five percent hydrated lime added in the final lift. The third contained only refuse. The refuse-ash base was capped with a three-inch bituminous mix and a one-inch wearing course.

These matrials were first stockpiled on the job site, blended, and then placed on the compacted sub-grade in six-inch lifts. Compaction was obtained with a three-wheeled steel roller.

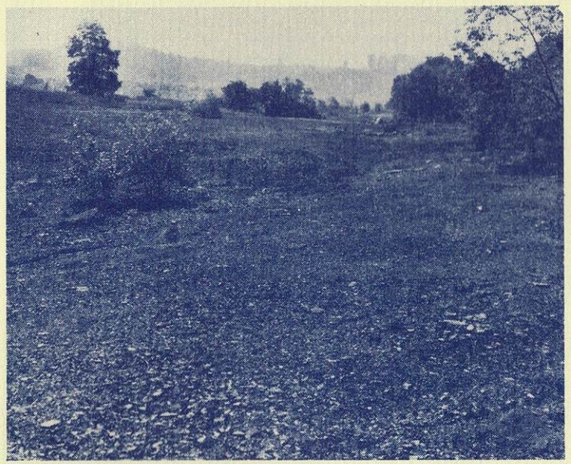
The EPA installed four monitoring stations under the base course to measure and analyze the leachate.

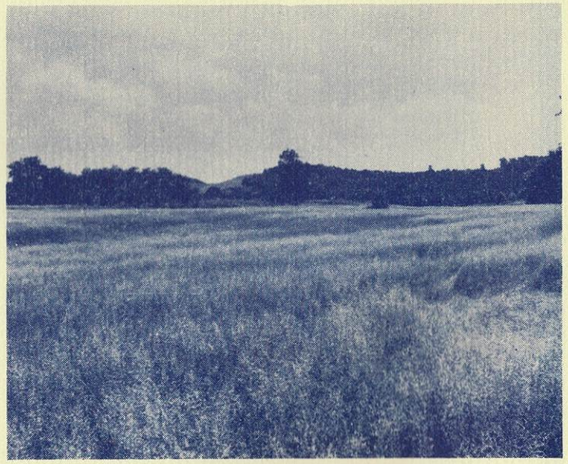
Three other groups are cooperating with the EPA in sponsoring the research project including Monongahela Power Co., the Civil Engineering Department at West Virginia University, and the Christopher Division of Consolidation Coal Co.

The Crown facility is operated as an adjunct of the EPA's National Environmental Research Center at Cincinnati to study a wide range of mine drainage problems.

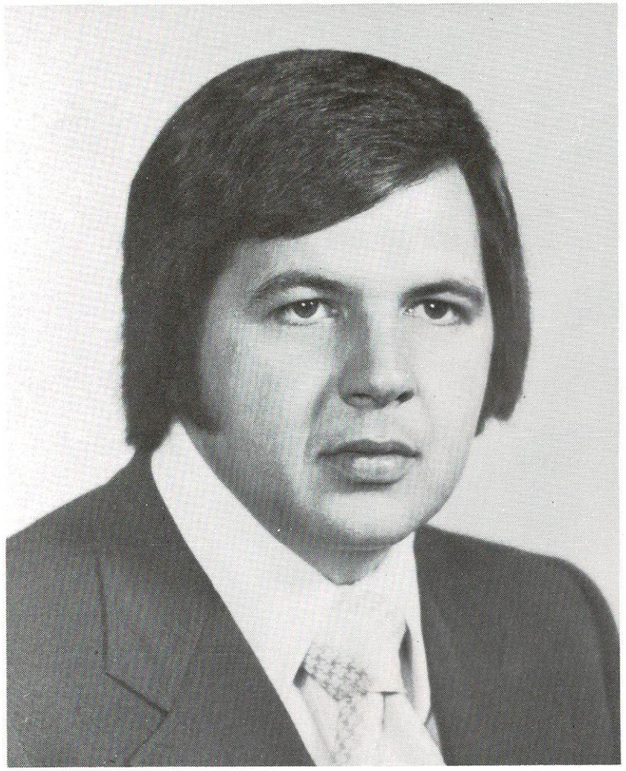
Director Scott said he believed the waste recycling process is the first application of its kind to be put down with controlled specifications. Other researching the subject have limited their work to laboratory studies.

Harman Bros. Construction Co. of Grafton was the contractor on the $20,000 demonstration project.





These two photos show the excellent "before and after" results of revegetation in soil that was treated with power plant fly ash several years ago. The area at the left is a seven acre plot near Cassville in Monongalia County, which was treated and seeded in the fall of 1971. The picture at the right was taken in the spring of 1972. (Photographs compliments of the U.S. Bureau of Mines.



Ben E. Lusk

Lusk Labels Federal Bills "Environmental Frauds"

Two bills to regulate surface mining in the United States now being considered by Congress have been labeled "environmental frauds," and will eliminate as much as 60% of the surface mining industry in Appalachia.

This charge was made by Ben E. Lusk, Executive Director of the West Virginia Surface Mining and Reclamation Association recently. The bills in question are Senate Bill 425 and House Committee Print No. 3.

Lusk noted that ironically, both bills have received full support from the ecologists, when in fact, they are unsound environmentally.

"Sections calling for 'return to contour with no depressions' may sound good, but the depressions are haulroads and drainage systems. Without these, water runoff will cascade down over the long, uninterrupted fill area and erosion and siltation will be uncontrollable," he said.

Lusk explained that West Virginia operators have successfully developed a method of controlling overburden and almost completely backfill the highwall, but maintain drainage above and below the fill areas. This way water is diverted into natural drainways and not over unprotected spoil, as the legislation presently allows.

He also explained that both bills are highly discriminatory towards surface mining of coal in Appalachia, because the regulations are very lax on open pit coal mining and almost non-existent for surface mining of other minerals.

"This represents class legislation and is obviously anti-Appalachia and pro-western coal," he said.

"According to the U.S. Department of Interior statistics in 1967, surface mining has disturbed 3.1 million acres, but only 20% of this lies in Appalachia. Since the bills will regulate only the Appalachian region, Congress is completely ignoring a segment of the industry that accounts for 80% of the land disturbance each year," Lusk said. "This incredible imbalance in law making cannot be justified."

He disclosed the third environmental problem with SB-425 and Committee Print No. 3 concerns mining methods.

"The legislation now dictates that contour operations all over the country must utilize the 'Pennsylvania box-cut,' eliminating all other controlled placement techniques recently developed, including valley-fill, mountain top removal, haulback, lateral movement and modified block cut."

"It is absurd to believe that this method, or any other method, no matter how successful in one area, will be applicable in every case," he said. "They want to apply this nationwide and it hasn't even been proven in Pennsylvania. There are 508 surface mining operations in the Keystone state and no more than six are utilizing the box cut."

He contended that the bills lack the necessary flexibility which must be applied to the many differences in terrain, geology and weather conditions in the various coal regions of the United States.

"It is obviously impossible to dictate one mining method that will be applicable for a 50 inch high sulphur seam with 60 ft. of overburden on 12° slopes in Pennsylvania and a 30 inch low sulphur seam with 100 ft. of overburden on 28° slopes in West Virginia and 70 ft. of high ash coal and 30 ft. of overburden on a gentle grade in Montana. And, of course, rainfall varies from 10 inches per year out West to as much as 60 inches per year in the East," he said.

Lusk noted that the mining industry has been accused of "crying wolf" many times in the past, but revealed, "Two years ago we warned that the 1971 Surface Mining Act in West Virginia would eliminate half of our industry and since then, that prediction has come true. We are not interested in scare tactics, only in legislation that we can live with."

Making one final point about the imbalance of the legislation, Lusk said, "If a farmer in California developed a new method for obtaining the highest possible yield from his orange trees, it does not necessarily mean that a farmer in West Virginia, using those same methods, will be successful at growing oranges."

"In fact," Lusk concluded, "the farmer in West Virginia would very likely go out of business."

Turning his attention to the critics of surface mining, Lusk then challenged those who believe that a 100% return to underground mining will solve the environmental problems of the coal industry.

"I think the biggest problem is that people try to separate surface mining from deep mining and play one against the other," he said, "but this is impossible because underground production and employment depend greatly on surface mine production and employment and vice versa."

Lusk explained that this interrelationship has blossomed only in the past few years, brought on by extreme problems in the underground industry.

"Costs underground have skyrocketed in the past few years and production has fallen off so drastically that many companies have turned to more economical surface mining to help keep their deep mines profitable," he said.

These two basic problems were outlined in the latest edition of the West Virginia Coal Association's **Coal Facts 1973.**

"One: operating costs have risen tremendously — by as much as 100% over the past four years. In addition to the overall inflation of equipment and supplies and rising employee wages and benefits, costs have been greatly increased as a result of new safety procedures, the decline in productivity (less production with greater employment), continuing 'wildcat' work stoppages and increased taxes. Let in the face of all this, the Price Commission has not allowed commensurate increases in coal prices. Hence, expansion and new development is discouraged."

"Two: the numerous new environmental standards — however desirable — have eliminated coal from many of its traditional markets. Many electric utilities and industrial users have converted to other fuels because of the inability to meet environmental standards with available coal or, in some cases, it was economically wise to cease burning coal because of the cost of necessary environmental control devices."

Coal Association President Stephen G. Young says, "In considering the development of the deep mining industry, we cannot ignore the role of surface mining. There are a number of deep mines operating in the state which probably could not survive were they not associated with surface mining on the same property. The lower cost involved with surface mines — both in operating and capital investment — makes it possible for a company to combine its surface coal with the more costly production from the deep mines and realize a reasonable profit."

The theory that for every one surface mining job abolished, three underground jobs will be created was also discussed by Young.

"This simply is not so. Abolition of surface mining will not strengthen the deep mining industry in West Virginia. To the contrary, it will be weakened. Lost surface mine production in West Virginia will not be replaced by new West Virginia underground production. It will be replaced by Kentucky, which mines over one half of its coal by surface mining, or by Ohio which has over 70% in surface mine production, or some other state," he said.

Explaining this further, the Stanford Research Institute's report on surface mining in West Virginia says, "The implications of surface mining relative to deep mining employment are apparently significant."

According to the report, deep mining could not be significantly increased to offset surface mining production and employment and, "in fact, surface mining has been the principal means for maintaining total production levels and by inference, therefore, helping to sustain at least a portion of the total deep mine employment."

Stanford concludes, "If surface mining operations are related to deep mine employment in the same proportion as is production, then approximately 6-8,000 deep miners are affected in some way by surface mining."

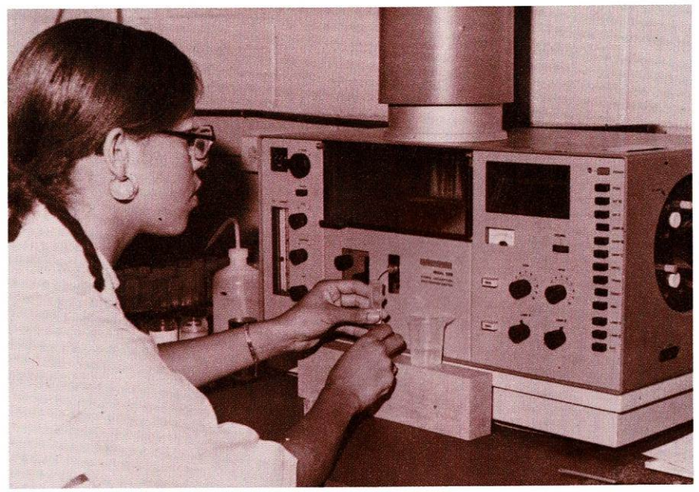
Lusk also explained that capital investment problems and excessive development time could prove to be serious problems in a new attempt at underground expansion.

"To replace production lost through a ban on surface mining would require 22 new deep mines, producing 1 million tons per year," Lusk said. "At $15 per annual ton (for development costs), the total capital investment would amount to more than $330 million. Plus the fact that it takes as much as three to five years to get some underground mines into full production."

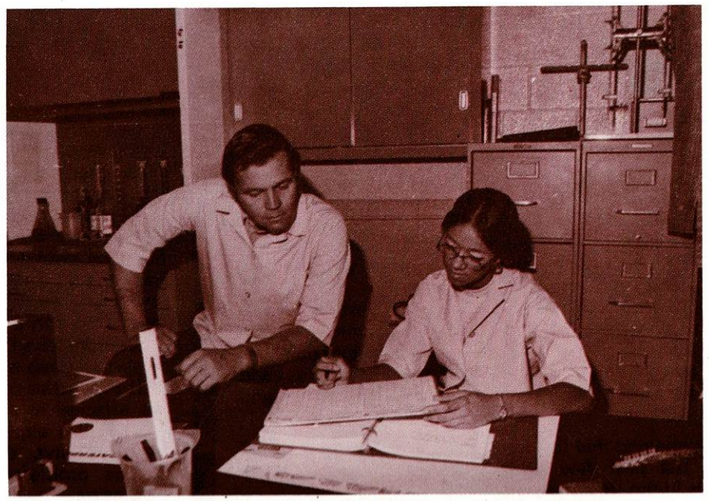
Lusk explained that the situation gets even more complex if you look at the national picture.

"In West Virginia, only about 18% of the total production last year was surface mined, but according to the U. S. Bureau of Mines, of all the coal produced nationally in 1972, nearly half (48.1%) was surface mined," Lusk said. "Obviously, it is impossible to even consider curtailment of any segment of the coal industry in view of the current energy crisis.

More importantly, to consider eliminating one half of the coal industry to help the other become stronger is like cutting off your left arm to strengthen your right."



Debbra Carter, a recent graduate of Beckley's Woodrow Wilson High School, is serving as a lab technician. She ranked near the top of her chemistry class and has done an excellent job since the lab opened July 1. Here she runs an oil sample through the atomic absorption spectrophotometer.



Heading up the S.O.S. operation is Denny Young (left), who is responsible for interpreting the results of each analysis, along with the lab technician Debbra Carter. Young has been with Walker Machinery for fifteen years and also serves as parts and service manager for the Beckley store. He and Debbra have both attended schools in oil analysis at Caterpillar's Peoria headquarters, as well as visited other oil labs.

New Oil Testing Lab Opens In Beckley

Cecil I. Walker Machinery Company is sending out an S.O.S. from their Beckley office, but the signal means anything but trouble for their many customers in West Virginia.

S.O.S. stands for Scheduled Oil Sampling and Walker recently opened the first oil analysis laboratory in the Mountain State. This testing method was developed by Caterpillar Tractor Company several years ago, for which Walker is a distributor.

What is oil analysis all about? S.O.S. is a program for determining machine condition by analyzing lubricating oil for wear particles. The purpose is to forecast and minimize failures in engines, transmissions and final drives, as well as hydraulic and cooling systems.

Basically, this is how S.O.S. works. Every moving part of a machine has a normal wear rate. As components wear, microscopic particles of metal become suspended in the lubricating oil. The concentration of these particles can be measured, and when compared with "wear histories" that have already been established for each Caterpillar machine, will indicate the wear rate of that particular piece of equipment.

According to Ken Hawley, Manager of Marketing for Walker Machinery, "By utilizing this testing method we can determine when problems are developing in various parts of the machine and then notify the owner on what steps to take to correct the problem."

Hawley noted that generally S.O.S. gives the owner better knowledge of his equipment, but more specifically, warns of inefficient maintenance, increases service life of components, lets you actually schedule down time and will reduce operating costs.

S.O.S. utilizes an extremely accurate analyzing instrument called an atomic absorption spectrophotometer, which measures in "parts per million." The five elements tested are copper, chromium, aluminum, iron and silicon.

These five elements serve as indicators for different parts of the machine. For example: excessive particles of iron suspended in the oil indicate oil pump wear, shaft wear and liner wear in engines; chromium shows wear of piston rings, bearings and valve stems; copper represents thrust bearing wear, water entry from coolers and transmission or steering disc wear; aluminum indicates piston or bearing wear and silicon levels are used as a measure of dirty entry.

Excessive amounts of these elements in your oil indicate an impending failure.

Hawley explained that taking these oil samples is a simple matter and that testing kits are available at any of Walker's locations. Once a sample is received by the lab, the written results will be back to the customer within 24 hours. Also, if an imminent failure is detected, the owner will be contacted immediately by phone.

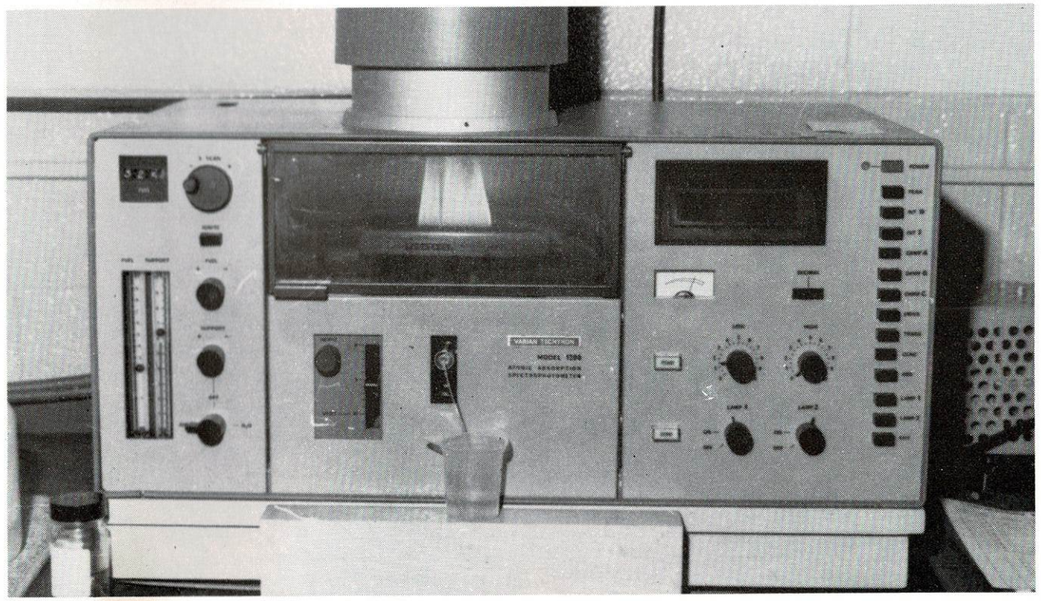
Heading up the S.O.S. operation is Denny L. Young, who is also parts and service manager for the Beckley store, which is located at 1149 North Valley Drive.

Young has been with Walker for over 15 years and says, "This new service is one of the greatest things that has happened, both for Walker Machinery and for our customers."

Working under Young as lab technician is Debra Carter, a recent graduate of Woodrow Wilson High School, who was near the top of her chemistry class. Both she and Young have attended schools in oil analysis at Peoria, Illinois headquarters, as well as visited several other oil labs.

Hawley concluded by emphasizing that S.O.S. is different from routine oil sampling, which analyzes only the oil and not the machine.

"Routine oil sampling cannot pinpoint machine problems," he said. "We invite everyone to come in and visit the lab and view our operation."



This atomic absorption spectrophotometer is used to measure the microscopic particles of metal that become suspended in the lubricating oil. The five elements tested are copper, chromium, aluminum, iron and silicon and are measured in "parts per million." Excessive particles of each of these elements indicate abnormal wear in various internal parts of the machine.

Nixon On The Nation's Energy Policy

SEPTEMBER 8, 1973

As you know, we have just completed a two hour meeting in the Cabinet Room of the major Administration officials having responsibilities in the field of energy. Governor Love presided over the meeting at my direction and gave a report with regard to the programs that he has initiated and that had been initiated prior to his taking over this assignment.

I would like to summarize for the members of the press, before having the Governor answer your specific questions in this field, the problem as I see it at this time.

We have heard a lot about a crisis. I do not use that term because we do not face a crisis in that sense of the word. I would simply say that in the short-term we face a problem, a problem with regard to energy, heating, for example, this winter, just as we thought we faced a problem of gasoline this summer, and the possibility of brown-outs.

We are not Pollyannish about solving that problem, but insofar as the short-term problem is concerned, Governor Love has a program which he is working on and one which is designed to meet the problem and to deal with it.

So I would summarize by saying that short-term we face a problem. But long-term, and this is the important thing for us to remember, the prospects for adequate energy for the United States are excellent. I would say the prospects for adequate energy for the United States are as good as they are for any industrial nation in the world and perhaps better, better because of our enormous research capabilities.

This morning we addressed both the short-term problem and the long-term problem and the legislative problem and the administrative problem.

In my press conference a couple of days ago, I mentioned seven pieces of legislation. Today we have moved down to four pieces of legislation that we consider to be of the highest urgency and that must be acted upon before the end of the year. These pieces of legislation deal with both the short-term problem and address themselves particularly, however, to the long-term problem.

One is the Alaska pipeline which is presently in conference and, of course, where the prospects are excellent. The second is the deep water ports. The longer we wait here, the longer we are going to have to wait to have the capacity to bring in the products from abroad that we need to meet our energy needs. The third is the deregulation of gas. This we must act upon now because only through deregulation can the new construction, which is essential, the new construction, the drilling, et cetera, and refineries be undertaken. And the fourth is the legislation with regard to strip mining.

The strip mining legislation, as we know, has elements of controvercy because of conflict with the environmentalists. But Mr. Train was here at the meeting this morning, at our request, and he has been participating in all of these meetings and he believes that the legislation that we have presented to the Congress, properly administered, is one that can be consistent with our environmental goals.

So much for what the Congress should do. These four pieces of legislation the Congress should consider on a high priority basis, because failing to act means that we could have very serious problems, not just this year, but particularly in the years ahead.

The other points that I would make are with regard to what we can do and have done and are doing from an administrative standpoint, that do not require legislation.

One is the relaxation of emission standards. Governor Love is calling together several Governors who have particular interest in this area and he will be meeting with them either next week or early in the following week. The relaxation of emission standards will have the effect of dealing with the immediate problem, the problem we face this winter and unless those standards are relaxed, we could have a very serious problem this winter. That is why the Governor is moving in this particular area. This can be done, incidentally, administratively, but it requires the cooperation of the Governors because the Governors have, in many instances, as a result of our asking them to do so, had their legislators adopt standards at the State level which presently are State law. It will be necessary for those to be modified.

A second area where administrative action is possible is with regard to the Elk Hills Naval Reserve. Here consultation with the Congress is required and we will institute that kind of consultation that is necessary, particularly with the Armed Services Committee. But developing the Elk Hills Reserves is essential in terms of providing, from our domestic sources, for the needs that we have.

And consequently, we are moving next week in the consultative process so that we can go forward with the Elk Hills development.

And then further, and this looks down the road, we gave the go-ahead this morning for a sharp step up in the development of peaceful uses of nuclear energy.

Now, there are many old wives' tales and horror stories that are told about nuclear plants and all the rest. Russell Train was there, I asked him about the effect on the environment, to separate out the fears from what actually the facts were. He came down on the side of going forward with the program, the development of nuclear power, not only having in mind our present technology, but also research which would allow us to develop nuclear energy in much more exciting ways, looking to the future, for peaceful purposes.

And in this field, I will be meeting myself next week with members of the Atomic Energy Commission, along with the Governor and with Russell Train so that we can give new impetus to that program of the development of nuclear power for peaceful purposes.

We were the first to make the breakthrough in nuclear power for military purposes. We have lagged behind in peaceful uses. Some nations abroad, while they certainly do not have our technology, at least have more thrust here, they have more drive here in this area than we have. But the development of nuclear power for peaceful purposes is to be a major Administration initiative from now on through the balance of our term here.

In the field of research also — this relates clear back to the strip mining a moment ago — is the area of research with regard to the use of coal. Secretary Morton pointed out in our meeting this morning that when we think of the energy sources for the United States, that four percent, only four percent presently in the ground come from oil, three percent potentially from natural gas and 91 percent from coal.

The United States, at the present time, has almost half of the coal reserves of the world. And the problem only is to get the coal out in a way that is not too destructive to the environment, but also to find the uses for coal, liquification programs, other programs which the Governor is quite familiar with and I am not, but which he will be glad to fill you in on.

I would simply summarize in this way. The other day in our press conference — the Governor and I did discuss this and I have asked him, once he does have the time, to perhaps travel abroad and have an opportunity to survey the situation in some of these countries himself — I was asked about the developments in the Mideast and what that meant to us.

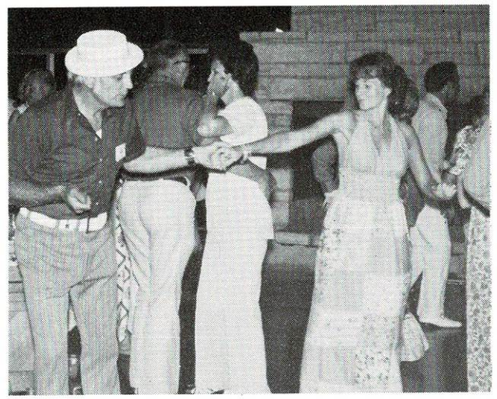
The United States would prefer to continue to import oil, petroleum products from the Mideast, from Venezuela, from Canada, from other countries, but also we are keenly aware of the fact that no nation, and particularly no industrial nation, must be in the position of being at the mercy of any other nation by having its energy supplies suddenly cut off.

We are going to do the very best we can to work out problems with the Mideastern countries or any other countries that may develop, so that we can continue to have a flow of imports into the United States of oil products particularly.

On the other hand, the programs that I have discussed here today, for the most part, and you know, deal with developing within the United States itself, the capability of providing for our energy resources. We can develop those resources. It can be done within a matter of a very few years. I am not going to put a timetable on it, but it can be done. Because the United States, as a great industrial nation, the most advanced industrial nation of the world, must be in a position and must develop the capacity so that no other nation in the world might, for some reason or another, take an unfriendly attitude toward the United States, has us frankly in a position where they can cut off our oil, or basically more important, cut off our energy.

NEARLY 200 ATTEND GREENBRIER MEETING

Nearly 200 members of the West Virginia Surface Mining and Reclamation Association converged on the Greenbrier in June to make it the largest annual meeting on record. Some special guests, beautiful weather and outstanding entertainment (from Pittsburgh and Charleston) added to the festive atmosphere and helped provide a most enjoyable and productive convention.



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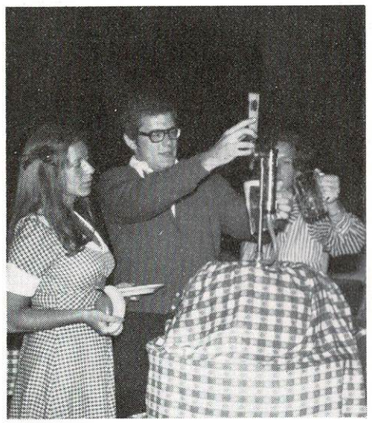

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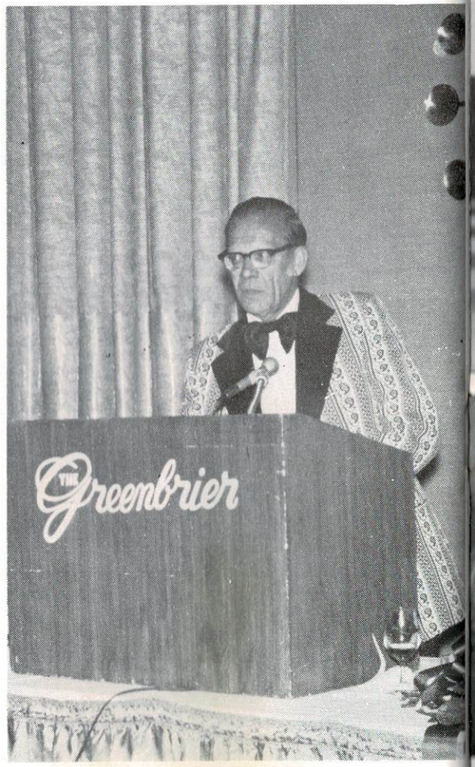

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1 *Don Johnson, President of the Kentucky Surface Mining and Reclamation Association, checks in at the registration desk with Mary Ann Steele.*

2 *With stories of the escapades of the Horn children, accented by occasional jabs at Lawson Hamilton, Tom Horn did a marvelous job as Master of Ceremonies at Saturday's banquet. His smooth style behind the microphone may win him that job again in the future.*

3 *Outgoing President Jim Wilkinson received a well deserved standing ovation following his State of the Association message. Jim's year as president proved to be one of the most hectic and crucial in the history of the industry and his contributions on our behalf were numerous.*

4 *On a serious note, new President Lawson Hamilton takes over the mike and the reigns of the Association, explaining the tough road that lies ahead. Hamilton is the seventh man to serve as president of the West Virginia Surface Mining & Reclamation Association which was formed in 1966.*

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5 *It looks like some of the Hamiltons are celebrating their father's inauguration a day early, at Friday's Mardi Gras. From the left, Barbara, Trip and Bev (Mrs. Paul Moran).*

6 *Contrary to popular belief, there was a technical session, held Saturday morning preceding the golf tournament. Here, Jim Wilkinson explains the details of the EPA grant for a study of "longwall surface mining." The Association received money for the first phase of that project three weeks later on July 10th.*

7 *No matter what the scene or location, there's always time for a little serious discussion. Association Board member Bernard Folio (right) makes a point to newly elected Board member Mike Kennedy (left) and Nick Roomy of Appalachian Power.*

8 *Matt Matson of Walker Machinery and his lovely wife Joyce seem to be in that Mardi Gras spirit on Friday night. The second year at Kate's Mountain proved to be even more fun than the first.*

9 &10 *Who'll ever forget the "battle of the bands," when the Association's own "Better Band" took on Pittsburgh's Benny Benack. On Friday, a near riot broke out and charges of "fix" could be heard in the crowd, when an unidentified judge ruled that Benack's group had won. But, at Saturday's rematch, the crowd did the voting and it was obvious that the "Better Band" was the better band. Later, proving themselves gracious winners, they consented to "help out" Benny's group with just one of their many selections, "When the Saints Come Marching In."*

11 *Outstanding entertainment for the weekend was provided by Benny Benack of Pittsburgh. He and his group proved to be good sports as well as good musicians and added greatly to the success of the meeting.*

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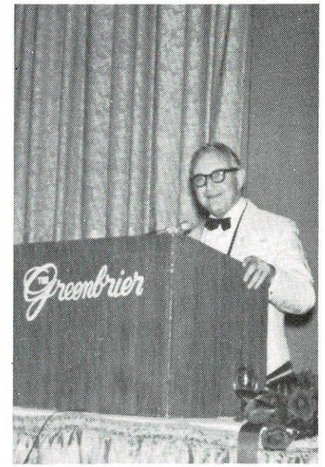

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Industry in the News

IMPROVEMENTS IN STRIP RECLAMATION ARE HAILED

A strip mining report compiled by engineers and ecological scientists indicates the stripping industry now pays more attention to reclamation.

The document, prepared for the State Department of Natural Resources following a tour of various strip mine sites conducted by the agency, makes observations on the total reclamation picture, considering active operations as well as special reclamation jobs.

The DNR sponsored the tour in early summer. Three sites in Preston County were among those visited — Laurel Run, the now-completed strip mine by H. L. Kennedy; a Daughterty Coal Co. mining site near Masontown, and a strip mine near Kingwood operated by Cadco Coal Co.

In a summary of the report, Frank W. Glover of the Soil Conservation Service in Morgantown said most of the 113 persons who participated in the evaluation were "impressed with the progress that has been made to reduce the damages during mining to a minimum and to control offsite damages."

The degree of sophistication in reclamation continues to increase, he said.

The tour is an annual event, and this year's report indicated that "planning has noticeably improved over previous years." The DNR Reclamation division now requires extensive preplanning before stripping begins. These plans cover drainage, soil disturbance, runoff and other areas of disturbance caused by the mine. They specify how each is to be controlled and repaired.

One of the most significant improvements in reclamation, according to the report, is in the layout, drainage and construction of haulageways at the strip mines.

SURVEY OF WEST VIRGINIA COAL ADVANCING

The West Virginia Geological and Economic Survey has reached the northern edge of the low-volatile, low-sulfur coal field of the state in its inventory of the chemical and physical nature of remaining minable coal reserves in West Virginia. They survey started in July.

"Eventually, all prospective minable seams in West Virginia will be included in the investigation," Dr. Robert B. Erwin, state geologist and survey director, said. Maps of surface and underground mines and existing information on coal seams are being compiled, he said.

He added that long-term benefits of the survey include land-use planning and reclamation. Coal companies and private citizens are being solicited for information, and the U.S. Bureau of Mines and U.S. Geological Survey are cooperating with state agencies in the survey.

SCOTTISH PLANT TESTS UPGRADING OF COAL GAS

A demonstration plant was started up in this Scottish locality this week which may help American housewives across the U. S. cook their evening dinners in years to come.

A test at the Westfield Plant in the Scottish Region of British Gas has been launched to demonstrate the commercial feasibility of upgrading the heat content (or BTU value) of gas produced from coal to roughly the equivalent of natural gas. If successful, the project will provide the only missing link in the commercial chain of processes necessary to convert America's huge coal reserves to gas.

Funded entirely by a group of American companies, the project is being managed by a Continental Oil Company subsidiary, in association with the Scottish Region of British Gas. Continental is the parent firm of Pittsburgh-based Consolidation Coal Company.

Consol has developed its own process for converting coal into low BTU coal gas and is presently testing its CO_2 Acceptor Process in a gasification pilot plant in Rapid City, South Dakota. The goal of the Scottish project is to take such gas and increase its BTU value to pipeline quality for use in such applications as residential furnaces, ranges and other gas-burning appliances.

Converting coal to gas is not new, but producing large quantities that will burn with the equivalent heat of natural gas will be something new. Previously, it has only been done on a small scale in laboratories.

The Scottish project takes on added importance because U.S. reserves of natural gas have fallen sharply in recent years in the face of rapidly increasing use of gas.

Total cost of the test program is expected to be approximately $6 million. Plant construction has been carried out by Woodall-Duckham Limited.

P&M DEMONSTRATES BIG DOZER BLADE FOR RECLAMATION

The Pittsburg & Midway Coal Mining Co. has designed and demonstrated a 40-foot-wide bulldozer blade that P&M officials believe will significantly reduce dirt handling costs for surface mine reclamation. P&M demonstrated its "Big Dude" blade, weighing an estimated 40,000 pounds, in leveling a surface mine spoil bank at its McKinley mine complex near Gallup, N.M.

The section had been mined before New Mexico passed its land reclamation law. Although the company is not legally required to regrade the property, Big Dude's economies are making the reclamation more feasible, P&M President James A. Borders said.

P&M has performed similar pre-law land reclamation in other locations where it has been economically possible, Mr. Borders said, "and Big Dude should help us do even more."

U.S. COURT SLASHES FEES FOR MINERS' LAWYERS

U.S. District Court Judges Charles R. Richey recently cut about $2 million from legal fees claimed by attorneys who helped retired coal miners win their pensions. The pensions were secured by a class action suit filed by three Washington law firms.

In his action this week, the judge invalidated contracts calling for the miners to pay one-third of their pensions to the law firms and set the fees for the legal work at $73,000.

AEC REJECTS NADER PLEA FOR PLANTS SHUTDOWN

The Atomic Energy Commission this week rejected a petition from consumer advocate Ralph Nader for shutdown of 20 nuclear power plants that Mr. Nader said were unsafe. The Commission said, "The record is uncontradicted in showing that an accident is a highly unlikely event."

Mr. Nader, who has filed a legal suit against the AEC, said the agency failed to demonstrate the safety of its emergency nuclear core cooling systems. Unless the core cooling system operates in less than a minute, the core could melt, leading to a leakage of radioactive material into the environment, Mr. Nader claimed.

AEC, however, said it has imposed "stringent" safety requirements on core cooling systems in reactors, and gave the problem "the very close attention it deserves."

McCARTNEY CITES INDUSTRY PROBLEMS

James R. McCartney, Director of Community Relations and Civic Affairs for Consolidation Coal Company said recently that lower productivity and rising costs have drastically reduced coal industry profits. In 1970, coal production in West Virginia totaled 143 million tons. In 1972, total tonnage in West Virginia had dropped to 122 million tons.

Regarding rising costs, he said, it is interesting to note that it now costs coal companies more in labor alone to produce a ton of coal than it cost eight years ago for labor, supplies, machinery, taxes, return on investment and all other costs in connection with underground mines.

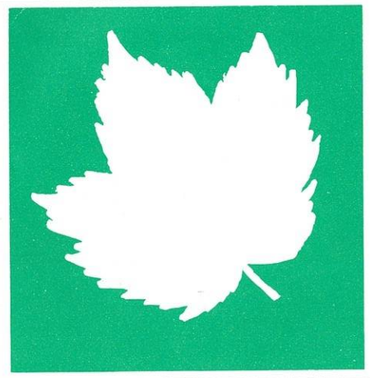
McCartney stated that back in the late 1960's, the deep mines in West Virginia averaged 16 to 18 tons of coal per man day. Presently, he said, it is only 10 to 11 tons per man day, and a significant part of this decrease is due to the new health and safety law.

He also pointed out that during the past 18 months, over 4,000 coal mining jobs have been lost in our state.

McCartney said that the forecast is that in ten to twelve years, we will need to import as much petroleum as we now consume—up to some 17 to 18 million barrels per day. He stated we should not waste precious petroleum in stationary boiler plants when coal, our most abundant energy source, can do the job.

McCartney said the ecology-energy controversy is still with us and must be resolved. He said, "A balance must be struck between the need for environmental protection and the need for economic development.

"We just can't continue to pass tougher laws and regulations and expect to have a cheap and endless supply of energy," he concluded.



EASTERN ASSOCIATED AWARDED DUST RESEARCH CONTRACTS

Eastern Associated Coal Corp. has been awarded two research contracts related to respirable dust in coal mines by the Bureau of Mines. Eastern said the contracts call for development of a non-clogging water spray system for use in mining operations and a more convenient and reliable way of measuring the exposure of working miners to respirable dust.

The company said its scientists and engineers, working on both projects concurrently over the next nine months, will attempt to determine the causes of nozzle clogging on spray systems and then develop a non-clogging system.

They will also develop an area sampling method for measuring respirable dust that will meet present health and safety standards, Eastern said.

"Good ventilation and effective water spray systems are presently the best means for controlling respirable dust concentration to the acceptable level, which is now 2 milligrams per cubic meter," H. E. Harris, Eastern's director of research, said.