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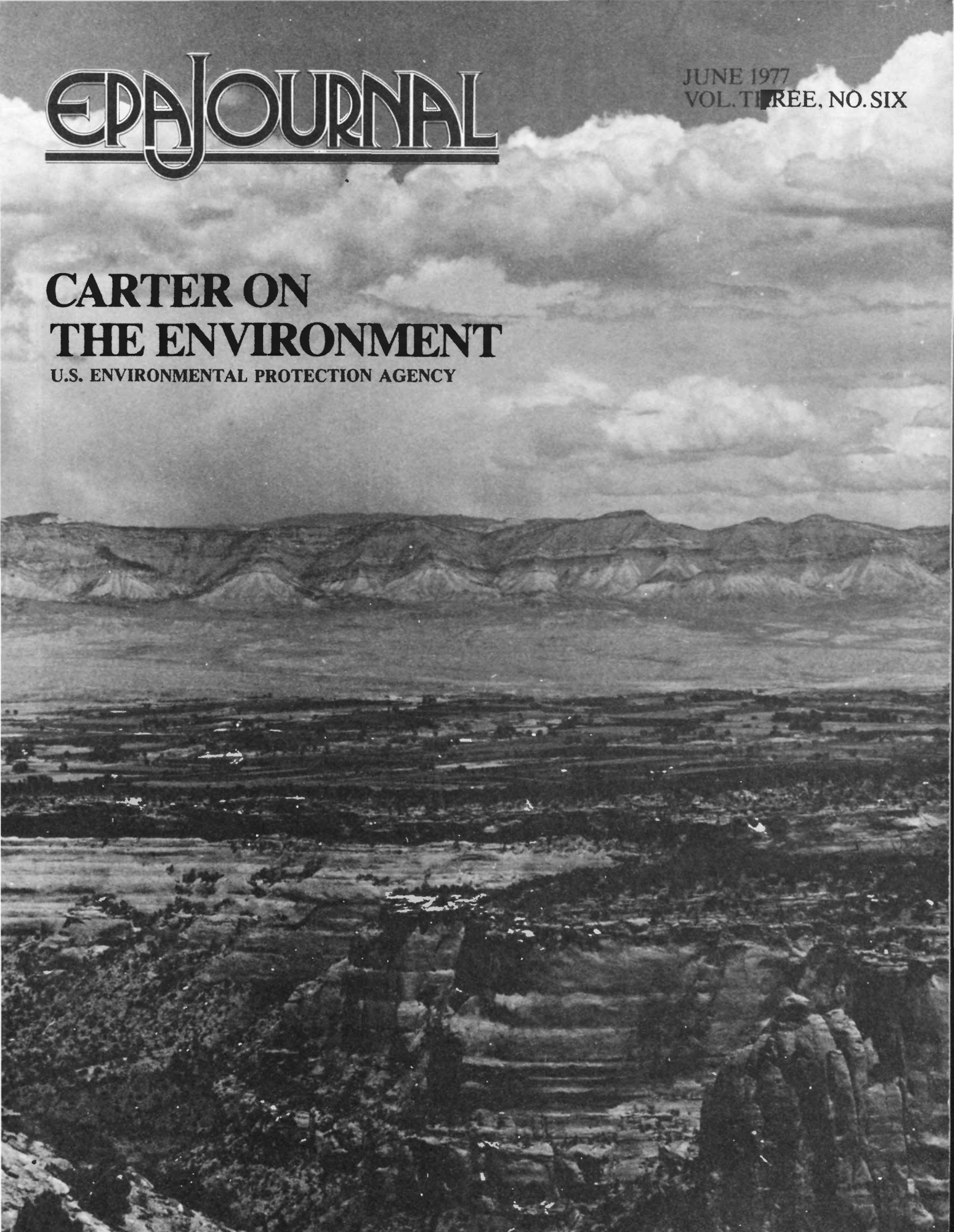
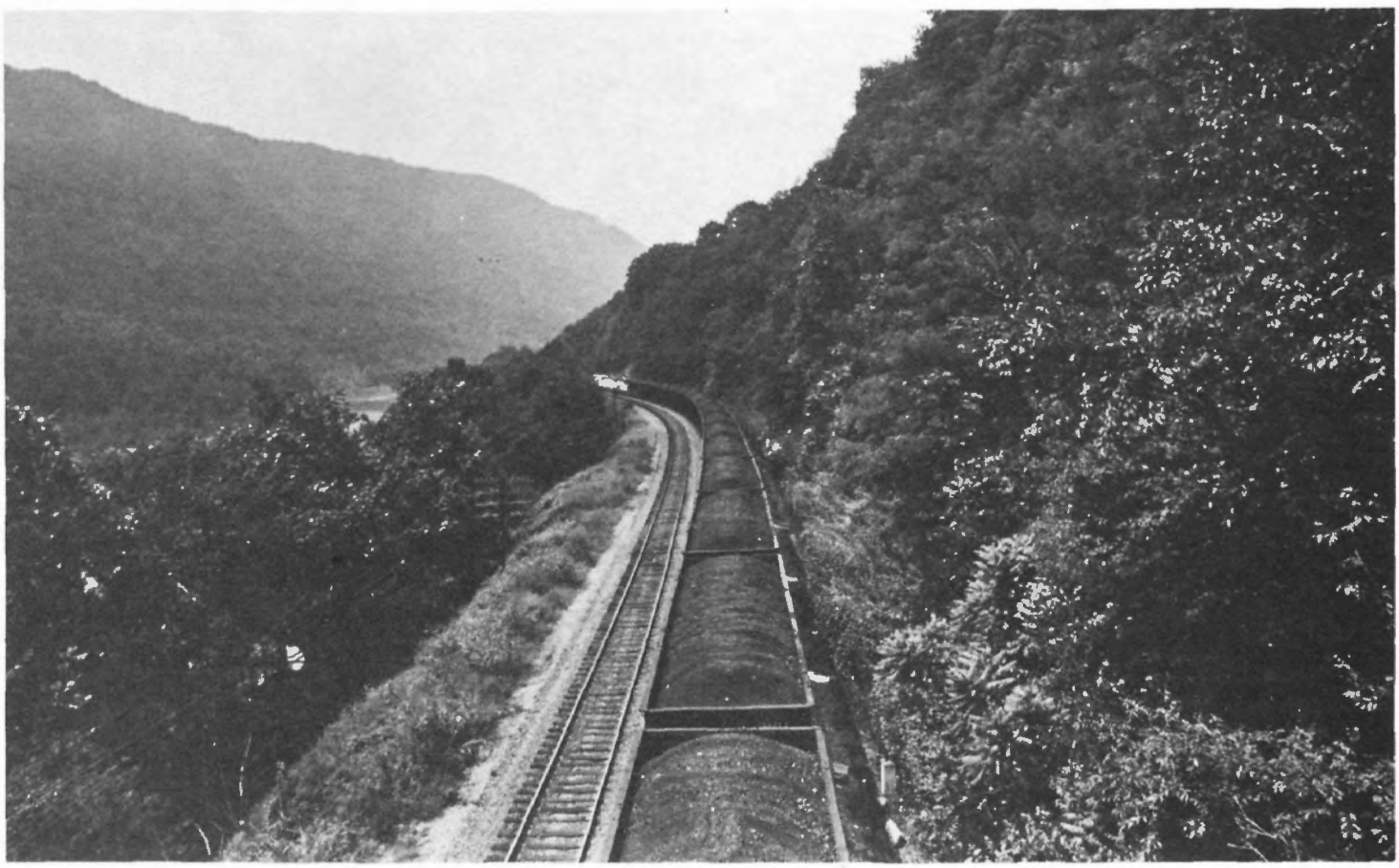
CARTER ON THE ENVIRONMENT

U.S. ENVIRONMENTAL PROTECTION AGENCY



PREPARING FOR A NEW COAL AGE



The mournful wails of coal train locomotives are echoing more frequently now as the Nation's railroads send a mounting number of cars brimful of coal snaking through mountain passes and rattling across the Great Plains.

We are witnessing the beginning of a new coal age in which EPA will play a significant role.

Some of the work being done by EPA's research program to make coal a more acceptable fuel is reviewed in this issue of the Journal.

One article is an interview with Stephen J. Gage, Deputy Assistant Administrator for Energy, Minerals and Industry, on the massive interagency program EPA is guiding to provide more energy without ravaging the environment.

Other articles on coal include:

A progress report on the status of air pollution control devices called "scrubbers," which spray stack gases from burning coal to help remove pollutants.

A report on strip-mined "orphan lands," which have been abandoned by their former owners.

A brief review of the history of coal.

An article on the "acid rain," which coal sulfur helps cause.

An analysis of how much pollution controls may boost home electric bills.

Also in this issue in the Environmental Almanac section is a quick look at our fundamental source of energy—the Sun.

The subject of another article is the discovery of gold and silver in sewage sludge in Palo Alto, Calif.

The action of Administrator Douglas M. Costle in proposing a ban on the manufacture and use of certain gases as propellants in spray cans is also explained.

The concluding article reports on a study which found minute amounts of pesticides in the milk of a majority of nursing mothers tested.

EPA JOURNAL

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U.S. ENVIRONMENTAL PROTECTION AGENCY

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ARTICLES

DEPARTMENTS

CARTER PLEDGES STRONG BACKING FOR ENVIRONMENT

Major new responsibilities for EPA have been recommended by President Carter in his environmental message to Congress.

The President calls for vigorous Federal efforts to extend the scope of protection for the Nation's land, air, and water and for the health of its citizens.

EPA Administrator Douglas M. Costle said that the message "demonstrates once again the President's commitment to the environment and his sense of its importance to the future of the Nation and the world. The message sets forth a comprehensive program for this Administration—a program which I fully support."

Costle said that in areas of EPA responsibility the message places priority where it belongs:

- the effective control of toxic chemicals;
- a strong Clean Air Act to protect public health;
- continued cleanup of our Nation's water;
- new approaches to solid waste and pest management;
- and improved implementation of environmental laws.

"It is most encouraging," Costle said, "to have such strong Presidential support, and we will do everything in our power to provide the sensitive administration and energetic enforcement which he has requested of us."

The President's comprehensive message included more than a dozen new legislative initiatives or commitments to submit future legislation, five executive orders, and a wide variety of policy statements and directives to Federal agencies.

The President emphasized his belief that environmental protection is "consistent with a sound economy" and has created—and will continue to create—many more jobs than it costs.

The message covered a number of major themes including: controlling pollution and protecting the public health; energy and the environment; the urban environment; protecting natural resources; preserving our national heritage; the global environment; and making environmental laws work more effectively.

Discussing toxic chemicals, the President noted that his Fiscal 1978 budget provides nearly $29 million—a threefold increase over Fiscal 1977—for EPA "to implement this important Act.

"I have instructed the Environmental Protection Agency to give its highest priority to developing 1983-best-available-technology industrial effluent standards which will control toxic pollutants under the Federal Water Pollution Control Act, and to incorporate these standards into discharge permits. My Administration will be seeking amendments to this Act, including revision of Section 307(a), to permit the Environmental Protection Agency to move more decisively against the discharge of chemicals potentially injurious to human health.

". . . I have instructed the Environmental Protection Agency to set standards under the Safe Drinking Water Act which will limit human exposure to toxic substances in drinking water, beginning with potential carcinogens."

Other areas in which the President assigned roles to EPA included:

Clean Air—the President reviewed his support for amendments previously submitted to Congress to strengthen the Clean Air Act. He added that "I have instructed the Administrator of the Environmental Protection Agency to review his Agency's regulations controlling new industrial growth in areas now violating air quality health standards and to recommend to me and to the Congress a fair and effective policy for meeting these standards in the future. Adoption of new legislative provisions in this area should await the results of this review."

Water Quality—the President recalled that he had already asked Congress to authorize the expenditure of $4.5 billion in each of the next 10 years for municipal wastewater treatment facilities and for an increase in funds for the Section 208 Planning Program.

". . . I will be submitting further water quality amendments for your consideration in the current session. They will include provisions to make pollution unprofitable as well as illegal by imposing penalties on firms that have failed to abate their pollution on schedule; provisions to make law enforcement more stringent; and provisions necessary to ensure that actions are taken in accord with water quality management plans."

Solid Wastes—the President said that the Resource Conservation and Recovery Act, passed in 1976, gave EPA the authority it needs to regulate hazardous wastes and to assure the safe disposal of other residues.

"Now," the President said, "it is important to move beyond the symptoms and address two principal causes of the solid waste problem: excessive packaging and inadequate use of recycled materials.

"The Act requires the EPA to undertake, through an Interagency Resource Conservation Committee, a two-year study of ways to encourage waste reduction, recycling, and resource recovery with financial incentives like solid waste disposal charges, refundable deposits on containers, Federal procurement of recycled materials, and excise taxes for litter clean-up. I am asking the Committee to accelerate its study and within six months present to me its first recommendations which are to address the use of solid waste disposal charges (levies on materials and products which reflect the costs associated with their ultimate disposal).

"In addition, I am taking several actions to encourage resource conservation within the Federal Government. In the White House itself, recycled paper will be used wherever practicable as soon as present stocks of paper have been exhausted. I am instructing the Administrator of the General Services Administration and the heads of other appropriate federal agencies to institute a waste paper recycling program wherever practicable by the end of this calendar year. I am also instructing the GSA to revise its paper-product specifications to encourage the purchase of more recycled paper."

Pest Management—"I am asking the Administrator of the Environmental Protection Agency to work with the Congress in enacting an amendment to the Federal Insecticide, Fungicide and Rodenticide Act which would

allow the EPA to regulate directly 1,400 active chemical ingredients, rather than 40,000 different commercial products which contain them in varying amounts. This change will help speed the registration of safe and desirable pest control compounds, and it will permit swifter revocation of registration for those which pose unwarranted risks.

Coal—The President said that "as our Nation increasingly turns to coal as a replacement for our dwindling supplies of oil and gas, —we must be sure" that environmental safeguards are preserved. He stressed the importance of swift passage of national strip mine legislation. He recalled that in his energy plan he had recognized that "pollution control technology for direct combustion of coal is not fully adequate and directed that Federal research be increased in certain key areas." The President said that he is directing the Administrators of EPA, the Energy Research and Development Administration and the Secretary of Health, Education and Welfare to establish a joint program to identify the health and environmental effects of "each advanced technology that is the subject of Federal research and development." He added that he is also directing the Administrators of ERDA and EPA "jointly to develop procedures for establishing environmental protection standards for all new energy technologies. These procedures should be agreed upon within one year."

Global Environment—Recognizing "the urgency of international efforts to protect our common environment," the President said that he is directing CEQ and the Department of State, working in cooperation with EPA, the National Science Foundation, the National Oceanic and Atmospheric Administration and other appropriate agencies, to make a one-year study of the probable changes in the world's population, natural resources and environment through the end of the century. This study will serve as the foundation of our longer-term planning."

Improving Government—"Various programs within the Environmental Protection Agency provide funds to State and local government for planning, training, monitoring, enforcement and research in pollution control. They are presently authorized under different pieces of legislation, funded by different offices within the Agency, and entail different procedures for allocation of their funds. In the near future, I will submit legislation to the Congress designed to bring these programs into one comprehensive environmental grant program." The President also said that his Administration will promote better cooperation between government and industry to solve some of the serious remaining pollution problems. "I have directed the Administrator of the Environmental Protection Agency to meet with representatives of major industrial groups and develop a joint government-industry research program for unsolved pollution problems."

Other general subjects covered in the sweeping environmental message included: increased protection of wetlands, more stringent regulation of the use of snowmobiles, motorcycles and other off-road vehicles on public lands, the acquisition of more scenic river and wilderness areas, including huge tracts in Alaska, and the use of the Agency for International Development to help provide assistance for population and health care programs.

"Americans long thought that Nature could take care of itself—or that if it did not, the consequences were someone else's problem," the President said. "As we know now, that assumption was wrong; none of us is a stranger to environmental problems.

"Industrial workers, for example, are exposed to disproportionate risks from toxic substances in their surroundings. The urban poor, many of whom have never had the chance to canoe a river or hike a mountain trail, must nevertheless endure each day the hazardous effects of lead and other pollutants in the air."

The President declared that "intelligent stewardship of the environment on behalf of all Americans is a prime responsibility of government. Congress has in the past carried out its share of this duty well—so well, in fact, that the primary need today is not for new comprehensive statutes but for sensitive administration and energetic enforcement of the ones we have. Environmental protection is no longer just a legislative job, but one that requires—and will now receive—firm and unsparing support from the Executive Branch."

Commenting on the impact of environmental protection on the economy, the President said "previous pollution control laws have generated many more jobs than they cost. And other environmental measures whose time has come—measures like energy conservation, reclamation of strip-mined lands, and rehabilitation of our cities—will produce still more new jobs, often where they are needed most. In any event, if we ignore the care of our environment, the day will eventually come when our economy suffers for that neglect."

In outlining goals, the President said "we are particularly committed to strong measures to protect our most important resource—human health—from the increasingly apparent problem of hazardous substances in the environment.

- "We plan to improve enforcement of our pollution control laws.
- "We intend to make increased use of economic incentives to achieve our environmental goals.
- "We will seize opportunities to reduce pollution by conserving resources.
- "We will work with State and local governments to make sure that the job of controlling pollution is properly planned and does not stop with the promulgation of regulations in Washington.
- "We will make every effort to see that regulation of a problem in one medium such as water—does not create new environmental problems in another medium—such as air.
- "And we will squarely face emerging environmental problems so that they can be dealt with effectively without an atmosphere of crisis."

Copies of the President's 36-page Environmental Message are available from the Public Information Center, Printing (PM-215), EPA, Washington, D.C. 20460.

LIVING WITH KING COAL

An interview with Stephen J. Gage, Deputy Assistant Administrator for Energy, Minerals and Industry in EPA's Research and Development Program. Dr. Gage has a major responsibility for a Federal interagency program of research and development on the production of energy and its environmental effects. Under this cooperative program 18 different departments and bureaus, under the guidance of EPA, pool their resources and expertise. Over the last three years, EPA has spent more than $100 million annually on energy research, most of it in projects designed to reduce the environmental impact of coal burning.

"Coal is a 'dirty' fuel, but we have realized that fact and have made important progress toward ensuring that it can be mined and burned with minimal environmental damage."

Q: *Will environmental protection become a casualty of our war against energy dependence?*

A: No! If we are careful, we can significantly decrease our dependence on foreign oil sources without endangering human health or ecosystems. I am very encouraged by President Carter's statement that protection of the environment will be one of the basic principles of his energy policy. With strong leadership by Administrator Costle, we can make sure that we don't relax our pursuit of the Nation's environmental goals even while we redouble our efforts to achieve new energy and economic goals.

Q: *What are we doing in response to President Carter's energy proposals?*

A: My Office has been working with Dr. Schlesinger's Energy Policy Office in developing an expanded development and demonstration program aimed at making available improved control technology for the control of sulfur oxides, nitrogen oxides and particulates associated with coal combustion. This effort is considered critical since the President's proposed energy policy strongly emphasizes the increased combustion of coal as a replacement for scarce natural gas and petroleum fuels between now and 1990.

Q: *If the President's energy measures are adopted, what type of increase in the use of coal can we expect to see in the future?*

A: In 1976, the Nation used 700 million tons of coal for the generating of electricity, raising process steam, and making coke for metallurgical purposes. By 1990, we expect such usage to increase by over 50 percent to nearly 1,100 million tons per year.

"If we are careful, we can significantly decrease our dependence on foreign oil sources without endangering human health or ecosystems."

Q: *Is it not ironic, from the point of view of this Agency, that the least desirable energy source with respect to emissions is being encouraged?*

A: The environment encompasses economic activities and mineral resources, for example, as well as air, water, and land resources. Thus we in EPA cannot take a narrow unrealistic view of what's good for the Nation. We must deal with reality as it confronts us. Coal is a "dirty" fuel, but we have recognized that fact and have made important progress toward ensuring that it can be mined and burned with minimal environmental damage. Other fuels like oil and natural gas are too scarce and/or expensive to be burned in power plants. Besides, comparisons of fuels using only uncontrolled emissions as a basis are misleading. When you look at the environmental impacts associated with the many links in each fuel supply chain—coal, oil, gas, nuclear, geothermal, solar, etc.—you are struck by the fact that there is no perfect fuel. Production and transportation of

even our cleanest fuel—natural gas—results in deaths by offshore platform fires, pipeline explosions, and hydrogen sulfide poisoning.

Q: *If the Nation is to depend heavily on coal for the next several decades, how can we assure the protection of the environment?*
A: First let's make it clear that our policy of stressing coal for our energy needs means that there *will be* an adverse impact on the environment; we must not ignore the fact that this policy is trading off national security, balance of trade, and other considerations with environmental protection. The job of this Office is to help insure that this tradeoff is an acceptable one, by developing the means to sharply reduce the inevitable impacts.

The number of facets that must "fit together" to assure environmental protection is staggering, and developing proper control technologies is only one of these facets. Besides assuring that every mine and conversion facility is equipped with the best control technologies, we have to carefully control the siting process; insure that appropriate enforcement takes place; continually monitor the status of our air, water, and land resources; involve citizens in the decisions that will so drastically affect their lives; and, well, the list is too long to complete here. The present "policy system" that deals with coal development is too fragmented and uncoordinated to assure complete environmental protection, thus, the key to protection is political and institutional adjustments as well as technological change in the ways we use coal.

Q: *What is the technological and economic status of "scrubbers"—used to control harmful pollutants from burning coal?*
A: There has been much progress since 1968 when the first generation of scrubbers were installed in the United States. Scrubber technology is now at the point where a utility can order a lime or limestone scrubber system and have a high degree of confidence that it will operate reliably after a shake-down period. Such a period can vary from almost no time at all to a few months, depending upon a variety of factors.

Q: *What has been the attitude of industry regarding the adaptation of scrubbers?*
A: We must recognize that industry—in this case, primarily the electrical utility industry—will never enthusiastically embrace a technology that substantially adds to the cost of doing business. However, the utilities' attitude has changed over the last five years from what could be characterized as complete opposition by the entire industry to the present situation where attitudes vary considerably. Some utilities have a quite positive attitude toward scrubber technology, since it allows them to burn local high-sulfur coal consistent with local regulations. However, other utilities still strongly oppose scrubbers.

"The President's proposed energy policy strongly emphasizes the increased combustion of coal as a replacement for scarce natural gas and petroleum fuels between now and 1990."

Q: *Some scrubber systems produce non-reusable materials such as sludge. How serious is the problem of disposing of this waste in a satisfactory manner?*
A: The scrubber systems most often selected by the utilities are lime and limestone processes which produce a throwaway sludge. The sludge quantities produced, on a dry basis, are generally comparable to the amount of fly ash that is normally collected in an electrostatic precipitator; such ashes must also be disposed of in an environmentally acceptable manner. The two most significant potential problems are groundwater contamination due to leaching of trace contaminants from the sludge and the land use deterioration associated with the disposing of a non-settling sludge in a disposal pond. However, technologies are available which can dramatically minimize these problems. For example, fixation processes are offered commercially which involve treating the sludge produced with a lime-based material to produce a structurally sound, environmentally acceptable landfill material. Another option which is utilized extensively in Japan on oil boilers and which our R&D program is developing for coal boilers is to incorporate oxidation in the scrubber process. This allows the production of gypsum which can either be sold or easily dewatered and used as landfill material.

"Let's make it clear that our policy of stressing coal for our energy needs means that there *will be* an adverse impact on the environment; we must not ignore the fact that this policy is trading off national security, balance of trade, and other considerations with environmental protection."

Q: *Are we encouraging the use of one type of scrubber system over another?*
A: Neither the Clean Air Act nor the Agency in the implementation of the Act directly mandates the type of sulfur oxide control technology that is needed. The new Source Performance Standards for coal-fired power plants, for example, require an emission limitation for sulfur oxides. However, the Clean Air Act does mandate a relatively stringent time schedule for achievement of air quality goals. This essentially forces the use of control technology that is currently commercially available; in this case, lime and limestone scrubbing technology. However my Office has been active in sponsoring research, development and demonstration efforts aimed at giving the utilities alternatives to current lime and limestone technologies, for example, regenerable scrubber systems which produce a salable product such as sulfuric acid or sulfur.

Q: *Are there alternatives to scrubbers? Low-sulfur coal, pre-combustion, tall stacks, cleaning of coal, etc.?*
A: Within the next ten years, a coal burning facility that has to meet an emission standard can use several sulfur oxide control options. First, the plant operator can buy naturally occurring low-sulfur coals. Second, he can in certain applications physically clean his coal. Finally, he can employ flue gas desulfurization or scrubber technology. Beyond 1985, it appears likely that there will be other technological options available. These will include fluidized bed combustion—a method which involves combustion of coal within a bed of granular, noncombustible material used to absorb and remove pollutants; and coal gasification and liquefaction processes, in which the sulfur is removed prior to burning. Of these post-1985 options, I believe fluidized bed combustion offers the greatest promise as an effective, low-sulfur oxide control approach. *Continued on page 6*

Continued from page 5

Q: *How much of a monthly electric bill is attributable to the installation and maintenance of a scrubber?*

A: There is no simple answer to this question, since the incremental costs associated with the scrubber installation and operation vary substantially from utility to utility. For example, a utility system based primarily on nuclear power generation would obviously have no incremental costs associated with the use of scrubbers. However, for a worst-case situation, where the utility was completely dependent upon the burning of coal and every one of its existing and proposed plants would require scrubbers to meet sulfur oxide emission regulations, the total incremental costs associated with the scrubber would be 3 to 5 mills/kw hr. The average cost to produce electricity from a coal-fired plant without a scrubber is approximately 30 mills/kw hr. The increased cost of producing the power with a scrubber would be about 10 to 15 percent higher. However, *power costs represent only about 40-50 percent of the consumer's* electric bill. So even in this worst case, the consumer would only see increases of 4 to 8 percent.

"The abandoned deep mine problem has not been solved. If the proposed surface mining bill becomes law, funds would then be available for the abandoned mine problem and the controls developed in our program would be utilized."

Q: *In addition to control of emissions from coal, what other areas are included in EPA's energy research program?*

A: In addition to control of air emissions such as sulfur oxides, nitrogen oxides, and particulates, the program includes control of water pollution from coal combustion wastes—ash ponds, scrubber sludges, boiler cleaning wastes, etc. In addition, we are concerned with mining pollution problems (such as acid mine drainage), with emissions from advanced coal processing systems (such as gasification and liquefaction plants), and with thermal pollution from power plant cooling systems. Some work is also under way in advanced energy systems such as solar and geothermal power. In the conservation area, our wastes-as-fuel program is a major effort.

Q: *Can environmental problems be corrected if widespread strip mining occurs in the Western Plains States?*

A: There is still a great deal of uncertainty associated with the potential for successful reclamation of surface-mined land in the West, largely because of lack of long-term information on revegetation success. This is in the process of being rectified by a research program led by the Department of Agriculture with substantial financial support from EPA.

Although I believe that many people have a picture of the coal lands in the West as being a pretty uniform place—basically a semi-arid plain—in fact coal lies under a considerable variety of ecosystem types, with sharp variations in soils, plant cover, rainfall, and topography. Portions of this land,—in the Northern Great Plains especially,—offer good potential for successful reclamation, whereas drier portions of the Southwest may never be reclaimed. We need to know a lot more about the land between the extremes, where reclamation is not clearly impossible but where conditions are still unfavorable. Even after we know which land we can reclaim and how to do it *physically*, we still have to devise an enforcement system to make sure the potential becomes reality.

Q: *What are we doing* now *to prepare for a great speed-up in coal mining?*

A: We have placed more emphasis on coal mining pollution control, especially in the West where we have the farthest to go. We have both short- and long-term projects ranging from assessing the probable impact of mining to determining the effectiveness of various reclamation practices. Information from our control technology program for mining in the East is well enough along to compile it into a pollution planning mining manual, which should be ready in just a few months. This document will stress pre-mining planning so that controls can be designed into the mining operation at the outset.

Although we consider these technical studies to be crucial to achieving an environmentally acceptable increase in mining, our research program recognizes that policy problems are equally critical. Such problems include deciding on methods for implementing new technologies, formulating regulations and economic incentives to encourage good mining practices, evaluating the distribution of costs and benefits of increased mining, and determining how to compensate those who bear the brunt of the costs, etc. Our Integrated Assessment Program conducts broad policy-oriented assessments of all major coal-producing areas (Appalachia, the Ohio River Basin, and the Four Corners/Northern Great Plains area).

Q: *What has been the cost of earlier strip mining in miles of streams polluted by acid mine drainage? In number of acres of land left as wasteland?*

A: A study performed in 1970 revealed that more than 12,000 miles of streams in the United States were degraded by mining related pollution, and about 10,500 of the miles were in Appalachia. It has been reported that over 1¼ million acres of strip mined land exist and about 30-40 percent of this total needs proper reclamation. These miles of unsightly streams and devastated areas cause economic hardships to an already depressed area in the form of fish kills, streams choked with silt, prevention of water usage, and increased treatment requirements by municipalities.

"As we all become aware that gross economic indicators are a pretty poor measure of our true quality of life, then I think we will be better prepared, intellectually and emotionally, to work toward real quality improvements."

Q: *What are we doing about correcting the problems left by the earlier strip mining?*

A: Abandoned mines represent one of many perplexing problems facing this Nation. Usually strip mines are connected with nearby deep mines to such an extent that controlling the problem for all situations is just not possible. Our program has developed techniques over the years to adequately control the abandoned surface mine problem; however the abandoned deep mine problem has not been solved. If the proposed surface mining bill becomes law, funds would then be available for the abandoned mine problem and the controls developed in our program would be utilized. At present, we feel that maximum benefit will be gained by an emphasis on active mines and

that only the most promising projects should be implemented in the abandoned mine area.

Q: *Do you have any projects under way to help reduce the impact of nuclear power on the environment?*
A: Our energy/environmental R&D program is primarily oriented toward fossil fuel combustion and processing with emphasis on coal. However, we do have a small program in conjunction with the Office of Radiation Programs to help solve some of the problems associated with the milling, mining, and waste disposal portions of the nuclear fuel cycle.

"I feel we can have a better life in a future with much lower per capita energy and material consumption."

Q: *Why are we moving from one non-renewable form of energy, oil, to another, coal? Wouldn't it be better to develop other sources, like sun or wind?*
A: The President has emphasized our efforts to develop renewable energy sources, especially solar. His proposals could significantly accelerate the installation of solar heating and cooling systems in new homes and offices. But such systems will contribute to our national energy needs only gradually and generally within only the residential and commercial sectors. Thus we need electricity and process heat for industries and for existing houses and offices. If we try to stretch out our oil and natural gas supplies, we are left primarily with two fuels—coal and uranium—to help through the 50-100 year transition to renewable energy sources.

Q: *Would use of solar power have any undesirable effects upon the environment? Are we engaged in any study of these potential problems?*
A: Solar energy is a potentially very large, but undependable, domestic resource for the United States which is now virtually untapped. Among the numerous possible technologies for applying solar energy for U.S. energy requirements, direct heating and cooling of buildings offer the best opportunity for early large-scale application and commercialization. Since most of these requirements are now dependent on the use of fossil fuels, either directly or through the generation of electricity, and since the actual consumption or use of solar energy releases no effluents or emissions to the environment, widespread use of solar heating and cooling systems would be expected to produce a net environmental benefit.

While solar heating and cooling is considered to be an environmentally beneficial technology, a systematic assessment has not yet been completed of direct and indirect environmental issues of the solar energy life cycle. The production of components for solar heating and cooling systems may be accompanied by the development of new materials and equipment with unknown environmental implications.

Q: *The President's energy program stresses energy conservation. Is the energy research program involved?*
A: Yes. Our program has two components—"wastes as fuel" and "environmental aspects of energy conservation"—that relate to conservation. We have a broad-based effort under way to develop technologies for recovering energy from solid waste. One exciting possibility under development—such as densified refuse-derived fuel—would make it possible for smaller coal-fired boilers across the country to burn, rather than bury, this unused resource to raise steam and generate electricity. Our work on energy conservation is limited, but will help establish the link between conservation and a cleaner environment.

Q: *Will your Office or any other EPA offices be reorganized into the new Department of Energy?*
A: No. The President specifically indicated, in submitting his energy reorganization legislation to Congress, that the Environmental Protection Agency and the Nuclear Regulatory Commission must remain separate from a Department of Energy. Such a separation provides the checks and balances on energy resource production and processing necessary to protect public health and safety.

Q: *How much money have we spent on energy research work? How many projects are involved? How long will this program continue?*
A: We will have spent approximately $330 million through this fiscal year. Literally hundreds of projects are involved. This includes research conducted by EPA's laboratories as well as the other agencies and departments that take part in the interagency program. We have program plans through 1982 although I expect a need beyond that. In later years, of course, our emphasis will be on new energy systems that are just being developed.

"I am hopeful that Americans will come to recognize that increased consumption of energy and other resources is not synonymous with an improved quality of life."

Q: *What is the interagency energy/environmental program? When did it start? Why did it start?*
A: In April 1973, the President directed the Chairperson of the Atomic Energy Commission to prepare a comprehensive and integrated national energy research and development plan. The result, entitled "The Nation's Energy Future," was completed in December, 1973. Drawing upon the efforts of 37 Federal departments and agencies as well as the private sector, it recommended a five-year, $10-billion energy research and development program. Proposed funding for, and brief descriptions of, the environmental control technology R&D required to exploit these resources were incorporated into the report, which also recommended a supporting environmental effects research program. Two interagency task forces were then commissioned by the Office of Management and Budget and CEQ to recommend how these funds should be allocated. Specific recommendations of the task forces formed the foundation for our division's role and the interagency program.

Q: *What is your prognosis for the quality of life in America over the next 30 years, assuming passage of the President's energy measures?*
A: I am hopeful that Americans will come to recognize that increased consumption of energy and other resources is not synonymous with an improved quality of life. The President's emphasis on energy resource conservation is probably the most important first step in what can only be an evolutionary process. I don't expect to see life-styles change radically overnight. But as we all become aware that gross economic indicators are a pretty poor measure of our true quality of life, then I think we will be better prepared, intellectually and emotionally, to work toward real quality improvements. The President's program is just the beginning; the rest is up to us. I feel we can have a better life in a future with much lower per capita energy and material consumption. ■

SCRUBBING COAL FUMES

We must be sure that oil and natural gas are not wasted by industries and utilities that could use coal instead. Our . . . strategy will be conversion from scarce fuels to coal wherever possible.

Although coal now provides only 18 percent of our energy needs, it makes up 90 percent of our energy reserves. Its production and use create environmental difficulties, but we can cope with them through strict strip-mining and clean air standards.

Excerpted from President Carter's April 20 energy message to Congress and the Nation.

By conservative estimates, there is enough coal encased beneath America's soil to meet all electrical power needs for more than 300 years. As liquid and gaseous domestic fuel supplies dwindle, coal has become the logical choice for meeting energy requirements.

However, the coal-burning segment of the electric power industry is the Nation's chief producer of sulfur oxides—an air pollutant which is among the most dangerous to human health. Released into the atmosphere during the combustion of coal, this chemical can irritate the upper respiratory tract and damage lung tissue, as well as harm vegetation, buildings and other materials.

Air pollution control devices called "scrubbers" offer what EPA Administrator Douglas M. Costle has described as "the best method we have for controlling this harmful pollutant." Scrubbers use a liquid spray to remove pollutants by absorption or chemical reaction from the gas streams which rise up the stacks of power plants. This process is called flue gas desulfurization.

"In the last five years, scrubber systems have been greatly developed and improved," Mr. Costle said. "Operational experience has shown that most scrubbers can remove 80 percent or more sulfur oxides from plant emissions, and perform this function in a highly reliable manner."

According to Dr. Stephen J. Gage, Deputy Assistant Administrator for Energy, Minerals and Industry, scrubbers are "playing a critical role as an immediately available option for attainment of sulfur oxide emission goals by the cleanup schedule mandated by the Clean Air Act Amendments."

Flue gas desulfurization systems can be classified under two general categories: throwaway product systems, in which the captured sulfur emissions must be disposed of as a waste; and salable product systems, which produce wastes such as sulfuric acid that can be commercially marketed.

Throwaway product systems include the use of a limestone or lime slurry which absorbs the sulfur oxides and produces insoluble sludge. Another throwaway product method is called dual alkali, so named because it utilizes two alkali chemicals. This system uses soluble sodium sulfite for cleaning the flue gas, and through further chemical actions produces calcium sulfite and calcium sulfate as waste products.

Salable product scrubber systems include the Wellman-Lord process, named after the company which first produced it some years ago. It uses sodium sulfite as the scrubbing reagent. The spent reagent is thermally regenerated, producing concentrated sulfur dioxide suitable for sulfuric acid or sulfur production. Another salable product scrubber system is the magnesium oxide method. This system uses a magnesium oxide slurry and yields magnesium sulfite, which upon heating produces magnesium oxide and concentrated sulfur oxide. Such wastes can also be used for sulfuric acid production. However, these scrubber systems are less proven and generally more expensive than simple throwaway product systems.

Citing the latest summary reports on scrubber systems, Mr. Costle said, "53 electric power companies have now installed or are building or planning 124 scrubber systems. This is a 280 percent increase over the 44 systems planned, in construction or installed by 24 companies in the fall of 1973, when EPA held special hearings on actions necessary to bring power plants into compliance with sulfur oxide air pollution standards.

"These 124 scrubbers . . . will control sulfur oxide emissions from the generation of a total 49,184 megawatts of power. This is over half-way towards meeting a goal of 90,000 megawatts of scrubber control, which EPA estimates will be needed to meet sulfur oxide emission standards by late 1980."

Mr. Costle added, "EPA is aware of the problems some power plants face in converting to flue gas desulfurization systems. Scrubbers can initially be expensive to install and operate, and some equipment problems have arisen in use. We feel, however, that much progress has been made in eliminating the mechanical problems; we also believe that the costs of scrubber installation and operations are reasonable in the long run.

"In light of these and other short-term difficulties, those 53 power firms deserve special commendation for remaining steadfast in their commitment to scrubbers and to the protection of this Nation's health."

For the last eight years, EPA and its predecessor agencies have sponsored a comprehensive flue gas desulfurization research, development and demonstration program which has been instrumental in accelerating the commercial viability of that technology, according to Frank Princiotta, Director of the Energy Process Division of the Office of Energy, Minerals and Industry. "A major component of this program has been the EPA funded (or co-funded) demonstration projects," Princiotta said.

"The major program in the throwaway-product-systems area is the lime/limestone prototype test program operating in cooperation with the Tennessee Valley Authority at TVA's Shawnee Steam Plant, Paducah, Ky. This program has been instrumental in identifying reliable, cost-effective process variations for both lime and limestone scrubbing

systems. Much of this technology has been utilized at recent commercial installations. Work continues on developing improved process variations offering cost and operational advantages over present commercial scrubber processes."

EPA also recently completed the first phase of another demonstration of a new full-scale sulfur oxide pollution control system in Louisville, Ky. The new system will use a dual alkali process to scrub clean the sulfur dioxide emissions and will soon be installed on an existing coal-fired 280-megawatt electric generating system of the Louisville Gas and Electric Company's Cane Run Plant.

The dual alkali process is expected to consume less than 1.2 percent of the energy generated by the power plant, or less than half of the energy required by other flue gas desulfurization processes now being installed. The new system is scheduled to start operation during the last quarter of 1978. Prototype testing of this scrubber system has shown removal of sulfur dioxide has been as high as 99 percent.

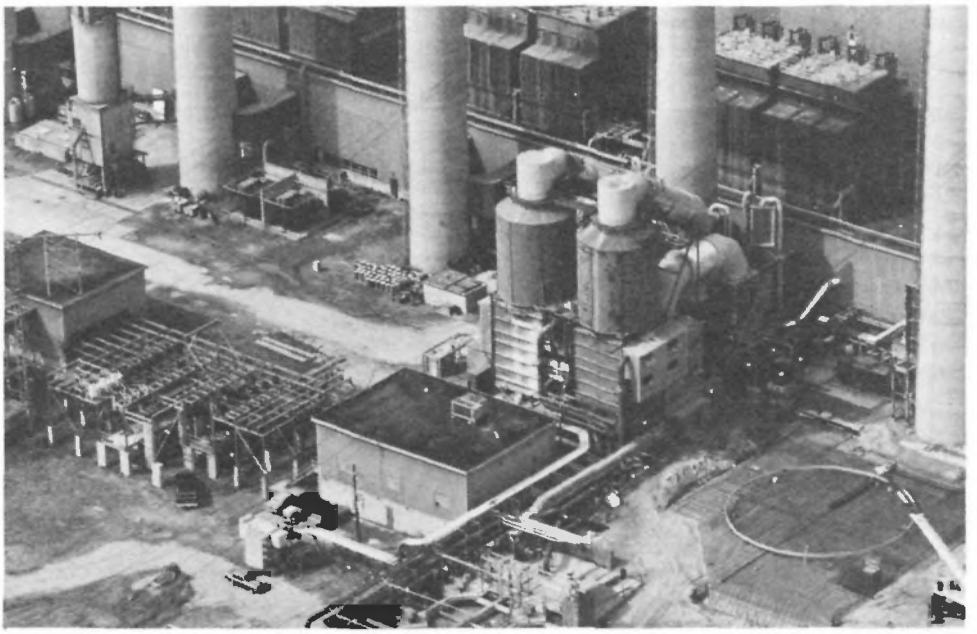
"Despite the recent advances in scrubber technology, more work remains to be done, including the development of cost-effective environmentally acceptable disposal techniques for the large quantities of sludge produced from lime and limestone processes, evaluation of process variations which will minimize cost and energy usage, and the development and demonstration of economically viable salable product systems for producing sulfuric acid or sulfur instead of sludge," Princiotta said. "EPA is working on a number of different programs to meet these challenges."

The following options and emerging technologies may also play a significant role in sulfur oxide control of power plants over the next five to 15 years:

Physical coal cleaning. This method is considered a possible alternative to flue gas desulfurization systems. Unlike scrubbers, which remove sulfur oxide emissions from gas streams after coal combustion, physical coal cleaning is a pre-combustion process in which the coal is crushed and then put in a liquid where the pollutants sink to the bottom and the clean coal remains on top.

The physical coal cleaning process is most effective with coal containing large percentages of pyritic (inorganic) sulfur and relatively low percentages of organic sulfur. It is anticipated that the process will have wide application in cleaning eastern U.S. coals, particularly those mined in central Pennsylvania, Maryland, and West Virginia. About 100 million tons of coal mined each year in these areas will probably be suitable for physical cleaning.

Physical coal cleaning may offer cost advantages over the scrubber method, and it also eliminates the sludge disposal problem associated with the latter. If successful, this method could replace flue gas desulfurization sometime around the mid-1980's.



Scrubber system is in foreground in this photograph of Louisville Gas and Electric Co. power plant at Louisville, Ky.

EPA is involved in a demonstration project of this method of coal cleaning. The project is being built near Indiana, Pennsylvania, at the Homer City Generating Complex, which is owned by the Pennsylvania Electric Co. and the New York State Electric and Gas Corp.

Utilization of naturally occurring low-sulfur coal. According to Mr. Princiotta, "Naturally low-sulfur coal is the most straightforward control option. Unfortunately, projected production capacity is limited and most low-sulfur coal reserves are in the West, far away from Midwestern and Eastern users.

"It has been estimated that low-sulfur coal production will supply less than 44 percent of anticipated demand in 1980. Utilization of low-sulfur coal east of the Mississippi leads to substantial transportation costs, making over-all power production costs greater.

"Also, any tightening of the air quality standards on sulfur emissions would essentially eliminate the low-sulfur coal option, since the best low-sulfur coals can barely meet the present levels for new sources," Princiotta said.

Fluidized-bed combustion. This process, which may play a significant role in the post-1985 period, involves the combustion of coal within a bed of granular, noncombustible material, such as limestone. The bed is supported by a distributor plate, through which the passage of air causes the granular bed particles to become suspended, or fluidized. These particles then absorb and remove the sulfur oxides generated by combustion. Whereas physical coal cleaning takes place before coal combustion, and flue gas desulfurization takes place after combustion, fluidized-bed cleaning takes place *during* combustion.

While the main responsibility for the development of fluidized-bed combustion technology lies with the Energy Research and Development Administration, EPA is working closely with ERDA, the Tennessee Valley Authority, and the Federal Energy Administration on a total environmental assessment of this technology.

EPA is also helping to fund an experimental fluidized-bed combustion plant in Linden, N.J., built by the Exxon Research and Engineering Co.

Coal liquefaction and gasification. As an alternative to its direct combustion, coal may first be converted to either a synthetic oil or a gas. Although such oils and gases will not be available for years to come, the processes to produce them either exist or are under development. In 1980, the Energy Research and Development Administration plans to start up a commercially-sized coal liquefaction unit. Actual commercial facilities for this purpose are not expected to be available until 1993. ERDA also plans to start up a coal gasification demonstration in 1980, and have it commercially available by 1990. EPA is running an environmental assessment program of these technologies to carefully check for emissions, effluents and other environmental effects which might require the development of controls. ■

RECLAIMING 'ORPHAN' LANDS

About two million acres of land in the United States which have been scarred by strip mining are often referred to as "orphan" land, because no one is responsible for reclamation. Orphan lands exist in every State, but they are especially plentiful in mineral-rich regions.

EPA is improving the future of orphan lands through demonstration projects that show how they can be reclaimed faster, easier, and more cheaply through the use of sewage sludge.

Thousands of tons of sewage sludge are produced yearly by wastewater treatment plants that protect the quality of America's water. Sludge cannot be burned without affecting the quality of the air. But sludge has what orphan lands need.

The characteristics of these lands varies according to which mineral was mined from them. But all have some things in common that make them unable to support vegetation and minimize water pollution. The earth displaced during mining (the overburden) or discarded after the mineral has been removed (mine spoils) is often left in heaps or scattered along steep slopes subject to erosion. They are low in nutrients, organic matter, and necessary bacteria. Often they are stony materials that won't hold water and that contain substances toxic to plants.

Sewage sludge contains most of what is essential to make mine spoils livable for plants. It has organic matter that improves the coarseness of the spoil and increases water-holding capacity. The alkalinity of sludge counteracts the acid condition of the spoils. Nutrients in the sludge reduce the need for mineral fertilizers. And sludge supports bacteria that speed the recovery of soil microorganisms.

EPA has demonstration projects in Pennsylvania and Virginia that apply sludge on strip-mine spoils before the land is replanted. These projects are of special interest because of President Carter's energy plan and his statement that emphasis will be placed on coal as an energy source without sacrificing environmental goals.

A Senate report released in 1975 estimated that some 1,000 acres of land are disturbed each week by surface mining of coal.

Many of the orphan lands in the U.S. were abused and abandoned before 1960. More recently State mining laws have provided for acceptable reclamation. EPA officials feel the situation will improve further when pending Congressional surface mining legislation is approved. This law draws heavily from EPA research and development projects, especially those relating to abandoned mines.

In 1976, Dr. Stephen Gage of EPA told the House Committee on Science and Technology, "EPA and its predecessor agencies have been concerned about the environmental effects of the extractive industries, particularly the coal industry, since the early 1960's.

"The Agency's current research and development effort entails investigation into the environmental damages and control associated with all forms of extraction, including coal . . ." The Deputy Assistant Administrator for Energy, Minerals and Industry continued: "The early efforts to curb the environmental degradation caused by coal mining were large-scale demonstration projects—in cooperation with the Bureau of Mines, the Geological Survey, the Bureau of Sports Fisheries and Wildlife, and a number of States—to control acid drainage from abandoned mines. These efforts began in 1962 and have had Congressional encouragement."

Section 107 of the Federal Water Pollution Control Act authorizes EPA to grant funds or contract for demonstration projects that seek to eliminate or control acid mine drainage and other water pollution resulting from mining activities. The Act specifically mentions using sewage sludge and other municipal wastes to diminish pollution and restore affected land to usefulness.

Some successful reclamation projects use lime and commercial fertilizers to give vitality to the soil. When used by themselves these are expensive medicines. The application of digested sewage sludge to reclaimed lands, however, is proving to be an effective antidote to the acid sickness that afflicts mine spoil. Sludge is the only material available in quantity that can rapidly increase the humus content of the soil.

Orphan lands are often located far from the urban wastewater treatment plants that produce large quantities of sludge. A problem with using sewage sludge to reclaim land is the cost of hauling it to remote areas.

An EPA research and development report estimates that more than 12,000 miles of streams in the United States have been significantly degraded by mining-related pollution. While erosion and sedimentation can be severe during a mining operation, the most persistent and widespread pollution is acid mine drainage. When ground or surface water flows through or over a mined area it interacts with sulfur-bearing materials (pyrites) commonly associated with coal deposits. Acid mine drainage generally has lots of iron and sulfates and significant concentrations of aluminum, calcium, magnesium, and manganese.

Researchers have found that some plants and animals are killed outright by acid mine drainage. Others are weakened and their tolerance for other changes in their environment is lowered by the deterioration of water quality.

In some communities acid-tainted waters may also be used for municipal, industrial, and navigational purposes. This requires additional water treatment facilities and high costs for corrosion resistant materials or replacement of equipment and structures that touch the water.

To prevent acid mine drainage from forming, the mine spoils must be kept from making contact with air or water. Impermeable barriers of concrete, asphalt, latex, and clay have been tried with occasional success, but they are expensive and have limited application. Soil is one of the most effective sealants and easiest to use. It must cover the spoils to a certain depth and be held by vegetation to prevent erosion and a return to the acid drainage problem.

Topsoil is rarely available at surface mine sites. It gets buried under and mixed with mining spoils during operations and is expen-

Acid drainage from an abandoned Colorado mine pollutes a stream.

sive to replace. Without topsoil it is difficult to replant a strip-mined site.

The materials left by mining are often coarse and sterile, containing no nutrients to support plant life and incapable of holding sufficient water. The mine spoils are often dark in color, absorbing the sun's rays and raising surface temperatures to a level that scorches struggling plants. Toxic substances like copper, zinc, iron, and aluminum abound in the spoil. The biology of the soil has been disrupted on these sites, and few supportive bacteria remain to aid the establishment of growing things.

"Acid mine drainage pollution is a natural phenomenon accelerated by mining activities," Dr. Gage said. "Once begun and not properly controlled, the formation and release to the biosphere can continue for centuries after the mining has ceased. A similar phenomenon occurs for sediment (erosion), heavy metals, dust, and salinity. Control of these pollutants must be an integral part of the mining effort during the planning, mining, and reclaiming phases, if effective control is to be realized."

An EPA project in Tioga County, Pa., showed marked improvement in vegetation growth in plots that had been treated with sludge. This project includes inadequately reclaimed mined land in the watershed of the Tioga River. Deep mines as well as strip mines existed in the area. Large amounts of water ran over the strip-mined surface, collected in the deep mine workings, and severely degraded the quality of local streams.

In one 80-acre portion of the demonstration project, along Morris Run, vegetation was spotty: scattered patches of a few acid-tolerant species. EPA, working with the Pennsylvania Department of Environmental Resources, made plans to recontour the site, channel water away from the deep mines, and plant legumes and grasses to prevent further infiltration.

The land was cleared, regraded, and erosion control practices were implemented where necessary. Lime and fertilizer were spread over and mixed into most of the soil in preparation for seeding. A demonstration plot of 4.3 acres was treated with sludge from nearby Williamsport, but no lime or other fertilizers were used. An infiltration ditch was built around the sludge-treated area, then 400 tons of sludge were hauled to the site and worked into the regraded spoils. The entire 80 acres was seeded with fescue, birdsfoot trefoil, and rye grass, and mulched with hay in the fall of 1975.

Last August researchers tested the site to see if the sludge had in fact affected the plant growth. Grasses were cut from 12 equal plots; six from the sludge-treated area and six from the adjacent limed and fertilized area. The average weight of grasses from the sludge-treated plot was nearly three times that of grasses from adjacent plots.

Another project, set on 45 acres along Contrary Creek in Louisa County, Va., is using sewage sludge from the Blue Plains wastewater treatment plant in Washington, D.C. Some 8,000 tons of anaerobically digested wastes were spread on 16 acres of soil as a conditioner in addition to more traditional soil amendments like lime and fertilizer. A disking machine was used to mix the sludge, fertilizer, and lime into the spoil to a depth of 3 to 6 inches. It is important that soil conditioners be thoroughly integrated with mine spoil to that depth, or else developing surface vegetation will be retarded when roots reach down into the sterile materials.

The reclaimed areas were planted with grasses, but revegetation was hampered by a dry summer and severe cold last winter. The area was reseeded this spring.

Both projects were planned and paid for in a cooperative effort with State agencies, according to the project officer, Ronald Hill of EPA's Cincinnati laboratory. The cost of the Tioga County project was split with the State of Pennsylvania. The project at Contrary Creek is supported 60 percent with funds from EPA and 40 percent through in-kind services, project management, and monitoring work by the Virginia State Water Conservation Board. The Soil Conservation Service supplied engineering, inspection, and agronomic services.

Since 1965 EPA and its predecessor agencies have led research and development efforts concerned with abating pollution from abandoned mines. Through 1975, approximately $1 million has been funded for some 28 projects relating to abandoned and inactive mines. ■

THE BIOGRAPHY OF COAL

Coal, which fathered the Industrial Revolution, smelted the iron and steel, drove the trains and ships, is now a keystone of President Carter's energy policy for the United States.

The President wants America to return to this plentiful fuel for power generation, industrial processing, and commercial heating so that oil and natural gas can be saved for such special high-grade uses as gasoline for autos and home heating fuel.

To oldtimers who remember banking a furnace fire at night and carrying out ashes in the morning, the use of coal may seem a step backward.

However, coal-burning in industry today is a high-technology operation. Crushed to dust as fine as talcum powder, the coal is mixed with air and sprayed into the boiler. Combustion is fast, complete and closely monitored by instruments that control the process. Hot gases are cooled and most soot particles and other pollutants are removed before they go up the stack. Ash removal is also automated, and in many plants the fine ash is saved and sold as fill material or concrete aggregate.

As King Coal makes his comeback in America, let's look at where he came from.

A little girl takes a piece of coal to mark lines on the sidewalk for hopscotch. She doesn't know that the black marks are made of carbon particles from fern-like plants that flourished in a tropical swamp when the only animals on earth were amphibians, reptiles, and insects (including the cockroach, who is still here). There were no seed-bearing plants. Birds and mammals would not appear for 200 million years.

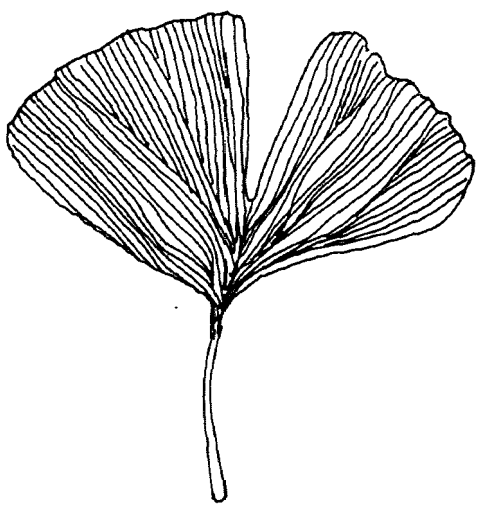
The swamp vegetation got thicker and thicker. Dead plants accumulated, only partly rotted, as other plants grew on top of them. After some thousands of years a thick wet mass of dead plant material was formed.

It is called peat, a spongy brown material that is used in America for garden dressing and in Ireland as household fuel, when dried. Peat smoke gives Irish whisky its flavor.

Peat is the precursor of coal. Even a layman can see it is made up of plant forms: leaves, stems, roots, etc.

The next step in coal formation depended on further compression of the peat as sedimentary rocks were laid down above it. Mud and silt deposited on top of peat eventually became shale and slate. Shells and skeletons of tiny water creatures piled up for ages to form limestone. Wind- or water-borne sand became sandstone.

When such rocks formed above a peat bog the peat was squeezed some more. Water and volatile hydrocarbon compounds were driven out, and the peat slowly changed to lignite, or brown coal. Then to bituminous, or soft coal. The final stage was anthracite, hard coal, which is nine-tenths pure carbon.



Typical plant forms from ancient coal beds.

Other forces beside compression are involved. Heat from the Earth's core can affect coal formation in deeply buried seams. Complex chemical interactions may take place between the growing coal and adjacent water and minerals. The Earth's crust can rise and fall. Volcanoes and earthquakes can pierce or shake the coal seam. Level strata can be folded or twisted into strange shapes.

All the coal in the Appalachian Mountains was formed flat and later bent and wrinkled so that some coal beds crop out high on the sides of mountains.

Geologists estimate that about 20 feet of dead plant material are needed to form one foot of coal. The plants use radiant energy from the sun to take carbon dioxide from the air and convert it to cellulose (woody fiber), lignin (a kind of glue), and other carbon compounds. The stored carbon holds a portion of the solar energy received by the plants millions of years ago, energy we use by burning the carbon and turning it back into carbon dioxide.

There are more kinds of coal than there are French irregular verbs. Peat counts only as a precursor. Lignite, bituminous, and anthracite are broad general divisions, of little use to the geologist or power plant engineer. Coals can be ranked or graded in many ways, according to their physical and chemical properties or by the uses they are best suited for.

One common ranking is by heating value: how many British Thermal Units per pound. Another ranking is by carbon content. Oddly, some bituminous coals with 56 percent carbon have more heat in them than anthracite with 88 percent carbon.

The percentage of ash is also important. It can range from 4 to 5 percent to more than 15 percent. High-ash coal is unsuited for many types of industrial boilers and firing systems.

A coal's sulfur content is of prime concern to environmentalists. Sulfur pollutes the air, and great pains must be taken to "scrub" sulfur oxides from stack gases to meet EPA emission standards.

For manufacturing steel, coal must first be converted to coke: porous, strong, baseball-sized pellets of almost pure carbon. Coke is formed by heating to drive off the volatile elements in the coal. Only bituminous coals that are low in sulfur, phosphorus, and ash are suitable for coking. Good coking coal commands a premium price, and many millions of tons are exported to Europe and Japan each year.

The volatile elements in bituminous coal, usually 30 to 40 percent, are sources for manufactured gas (coal gas) and various liquid hydrocarbons ranging from light oils to heavy oils, tar, and asphalt. The modern chemical industry began with "coal tar" products.

An important energy research project today is devoted to finding ways to convert coal's carbon content as well as its volatiles into gaseous and liquid fuels and chemical feedstocks.

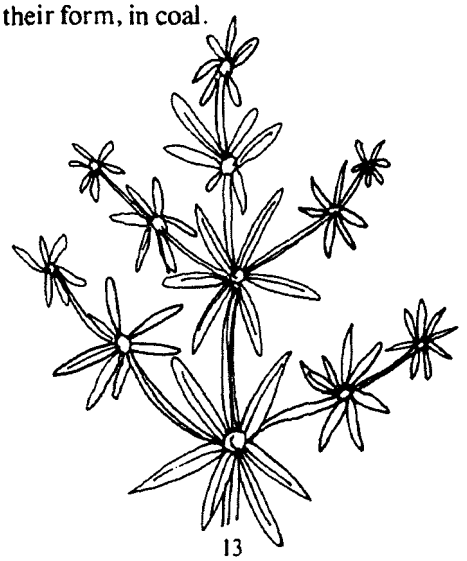
The story of coal is intertwined with geology, the story of the earth. The oldest coal beds were laid down in the Devonian period nearly 400 million years ago, the latest in the Pleistocene, the glacial era, around 30 million years ago.

The early coals were made from primitive plants—ferns, horsetails, and club mosses—the later ones from vegetation much like our own—flowering plants, grasses, and woody trees.

Starting in the Victorian era, more than a century ago, scientists identified plant remains and fossil plants in coal. Their estimates of when various beds began to form have held up remarkably well. They have been largely confirmed by modern dating methods, such as measuring the radioactive carbon isotope and lead-uranium ratios.

Much information about primitive plants has come from "coal balls," found in coal beds or in overlying shales. These are masses of plant material varying in size from an inch to several feet in diameter, which somehow became petrified instead of carbonized. The most delicate plant forms are preserved in them.

In the later coal beds, the impressions of tree roots have been found preserved in underlying rocks, though the tree itself has disappeared in the amorphous black seam. In the coal seam itself, the plant parts that resist change the longest are the tiny germ cells: spores, pollen, and seeds. A whole new science, palynology, has grown around the study of pollen and spores, both preserved intact in sediment and glaciers or mineralized, but keeping their form, in coal.



The use of coal by man is lost in antiquity. There is no record of the first man to build a fire on a coal outcrop and notice that the black stones burned too.

Aristotle mentioned flammable stones found in Thrace and northern Italy. Roman garrisons burned coal in Britain before 400 A.D., but ignored it in France despite the fact that their aqueduct building uncovered many coal seams.

When William the Conqueror's Domesday Book inventoried all the property in England in 1085, there was not one mention of coal. First reference to coal mining in Britain came around 1200, about the time the Chinese opened the Fu-shun mine in Manchuria to fuel a copper smelter, the earliest known commercial use.

Joliet and Pere Marquette found coal in Illinois in 1673, and U.S. coal mining is believed to have started in the Richmond Basin, Virginia, early in the 1700's. Before 1800, coal was found in many places in Pennsylvania, Virginia (including what is now West Virginia), Maryland, Ohio, and Kentucky. The Lewis and Clark Expedition reported finding the first western coal, in outcrops along the Missouri River, in 1804.

Starting about 1830, coal mining grew rapidly with the railroads, which used the coal themselves and transported it to other users throughout the country.

U.S. coal production reached a peak in 1918, during World War I, that was not exceeded until 1944, during World War II.

How much coal have we got? The experts differ both as to the total amount and the number of years it may last. But a reasonable figure is more than three trillion tons, which would be enough to last more than 4,000 years at the record consumption rate of 1944. ■

ACID RAIN: AN ENVIRONMENTAL THREAT

Much of the world's rain today contains acid, and the degree of acidity is rising, especially in areas downwind from regions of heavy industry.

Scientists believe the increased acidity comes largely from sulfur compounds spewed into the air from the burning of coal and oil and from nitrogen oxides produced by virtually all high-temperature fuel combustion, including automobile engines.

The two kinds of chemicals combine with water vapor in air to form strong mineral acids—sulfuric acid and nitric acid—that may travel hundreds of miles from the pollution source before they are washed to Earth by rain and snow.

The northeastern part of the country is the principal affected region, with acid rains being recorded over the last decade in upstate New York, the Adirondack Mountains, and the White Mountains of New Hampshire. There is mounting evidence that many other states east of the Mississippi are affected.

Rainfall in the Northeast now averages about pH 4 on the acid-alkaline scale, according to Gene E. Likens, professor of ecology at Cornell University. This is about one-tenth as acid as vinegar (see table). Most people would not be able to taste this degree of acidity, but its effects on the environment are likely to be far-reaching.

Already acid rain has been blamed for sharp declines in fish populations in many mountain lakes. One Cornell study found more than half of the Adirondack lakes above 2,000 feet elevation were highly acidic, and 90 percent of the acidic lakes were "devoid" of fish life. Acidity is believed to kill fish and amphibians (frogs, salamanders) in the egg stage or soon after the eggs hatch into fingerlings and larvae.

Acid rains have also increased greatly in Sweden and Norway and are believed to be the result of air pollutants that originate in Britain and central Europe, several hundred miles away, and are carried by prevailing winds to Scandinavia.

EPA scientists are concerned about other possible effects of acid rain on the environment. How does it affect the growth of trees and other plants? What does it do directly to leaves and stems? How does it influence the chemistry of the soil and the complex web of living organisms?

At the Corvallis (Ore.) Environmental Research Laboratory, EPA scientists are engaged in a two-year study of acid rain on sugar maple and red alder trees and on the complex ecosystem of the hardwood forest.

Dr. David Weber samples drainage from one of the test plots.

Each miniature forest is contained in one of these boxes. The poles are sprinklers.

Dr. Jeffrey Lee, system ecologist, and Dr. David Weber, plant pathologist are project officers.

Sixteen miniature forests, each about five feet square, were built on Oregon State University's experimental farm. A transparent roof over the row of plots permits sunlight to reach the maple and alder seedlings, but the plots are artificially watered with differing degrees of acid rain, while scientists observe the trees' growth and record the chemical and biological changes that take place in the litter under the trees and the soil beneath.

Each test plot is really a box set in the ground, built of strong plywood and lined with glass fiber. Before the trees were planted, the boxes were filled with carefully reconstructed layers of subsoil, topsoil, and leaf litter from a natural maple or alder forest. Probes were buried at various levels to monitor the flow and chemistry of water and nutrients in the soil. Water draining from the bottom of the boxes was likewise measured and analyzed.

The plots are watered regularly with water of four degrees of acidity: pH 5.7, the normal acidity stemming from carbon dioxide in the air; pH 4, the present average for the Northeast; pH 3.5, found in some northeastern areas; and pH 3, representing a possible extreme that may prevail if the present trend continues.

During each simulated "rain" a shade cloth is drawn over the plot to give the low light conditions plants normally experience on rainy days.

The acid rain experiments have been going on for 10 months. During this period, Weber and Lee report, the leaf canopy of the trees and the litter on the forest floor have had little "buffering" effect on the acidity of rain entering the soil. That is, passage of rain through the canopy and litter does not neutralize the acid, as some theories had indicated would happen.

Although all of the chemical sampling has not been analyzed, there is evidence, Weber and Lee said, that the acid rain treatments are leaching calcium—an important plant and animal nutrient—from the forest litter. However, clay particles in the soil tend to adsorb sulfates from the acid water, an action that may be an important factor in the leaching of nutrients from the soil.

Weber, Lee, and Donald Lewis are developing mathematical models for various nutrient cycling processes, for predicting changes as the experiment progresses, and for assessing the impact of acid rain on large scale forests over longer periods of time. They are still analyzing their data on tree growth, chemical transport of ions, and effects on microscopic plants and animals in the forest litter and soil. ■

What Is Acid Rain? What Is Acid?

The chemical symbol pH measures acidity and alkalinity on the same scale, running from 0 (totally acid) to 14 (totally akaline). Neither extreme is ever actually reached. The midpoint, pH 7, is neutral, neither acid nor alkaline. The scale is logarithmic; each shift of one unit downward means a tenfold increase in acidity. One unit higher means one-tenth the acidity (or a tenfold increase in alkalinity).

The H stands for the hydrogen ion, a hydrogen atom stripped of its one electron and carrying a positive electric charge, very active chemically and ready to join up with any available negatively charged compound or radical.

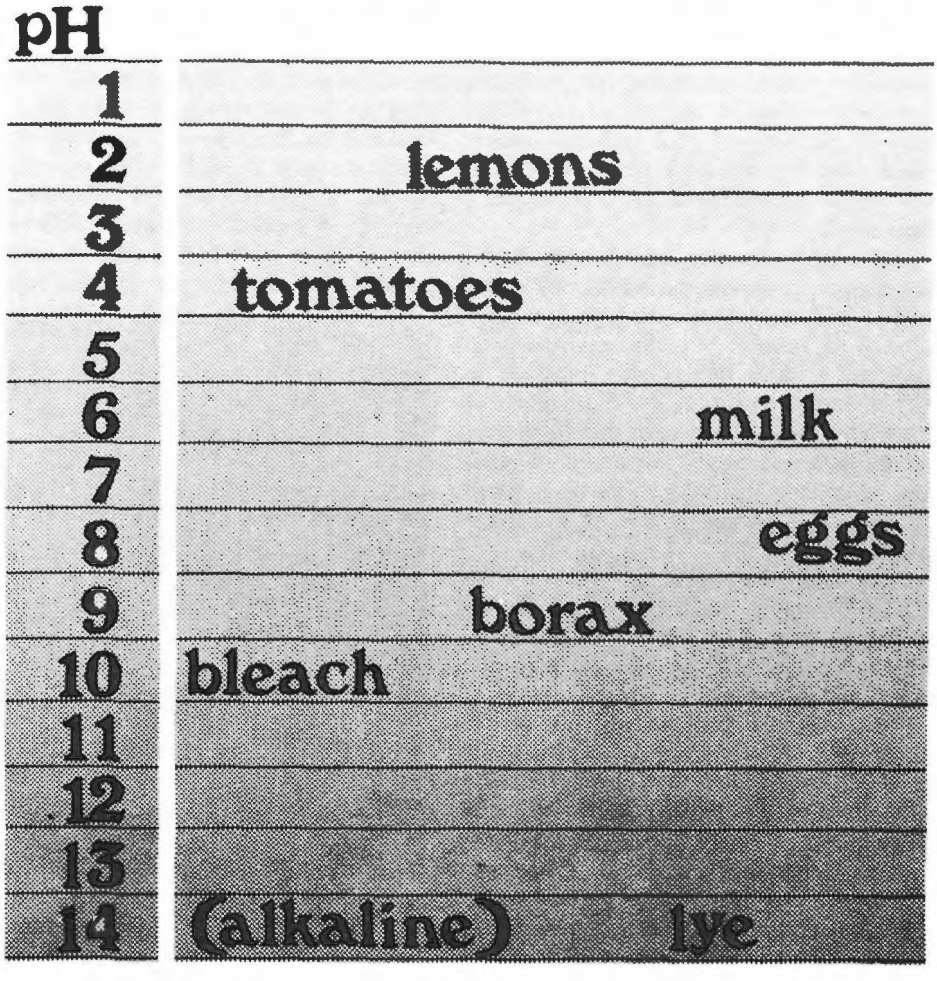
Rain is not called acidic until its pH is below 5.7. This is because natural rain dissolves enough carbon dioxide from the air to form carbonic acid, H_2CO_3. At normal pressures and temperatures this gives a pH of 5.7.

This weak acid has been sufficient, over geologic ages, to form all the earth's limestone caves and perform many other rock-weathering chores. (There are traces of some other weak acids in normal rain).

If rain of pH 4 is acidic, what does that mean in everyday terms? Most people cannot taste the sourness of pH 4. Household vinegar, is pH 3.1, almost ten times as sour. Lemon juice is about pH 2.3, the standard solution of hydrochloric acid about pH 1.

On the alkaline side, a 1 percent solution of baking soda is pH 8.2, a 1 percent solution of lye (sodium hydroxide) ph 10.7, and a "tenth-normal" lye solution pH 13.

In more technical terms, pH is the negative logarithm of hydrogen ion concentration, or activity, in gram equivalents per liter. Nobel Laureate Linus Pauling put it this way: "Instead of saying the hydrogen ions in gram equivalents per liter in pure, neutral water is one divided by 10 million (10 to the 7th power), we say the pH of pure water is 7." ■



WILL POLLUTION CONTROLS BOOST ELECTRIC BILLS?

The switch to coal as a primary energy source has already begun, dictated because domestic reserves of coal are enormous compared to those for oil and gas. But power companies that burn more coal will also be increasingly obligated to install expensive pollution control equipment. How will these added environmental costs affect the power industry? And even closer to home, how will they affect your monthly electric bill?

A study entitled *Economic and Financial Impacts of Federal Air and Water Pollution Controls on the Electric Utility Industry* attempts to project answers to these questions. The report was prepared for EPA's Office of Planning and Evaluation.

According to James Speyer, Acting Division Director of Policy Planning, the study indicates that "the cost of electricity in the future will still remain affordable, despite increased capital investment in pollution controls.

"It is projected that in 1985, the average consumer will be paying about $5.80 per month more than in 1975 for all goods and services because of such pollution abatement. This includes an increase of $2.80 in the average electric bill of $42.40 per month," Speyer said.

The study estimates capital expenditures for a plant in service during the 1975–1985 period will increase by 10.5 percent over normal as a result of added environmental controls. In hard figures, this translates to $25 billion more than regular expenditures of $237.1 billion. It is projected that 60 percent of this increased capital investment in pollution abatement technology will be required through 1980, and the remaining 40 percent through 1985.

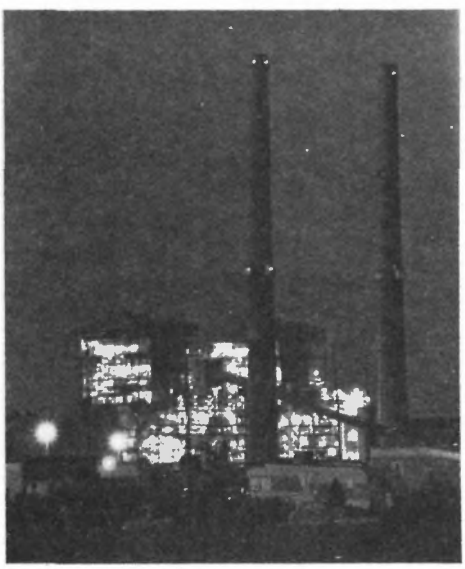
Water pollution control regulations will account for only a small percent of this increase, six percent by 1980 and 20 percent by 1985. The rest will go into air pollution prevention equipment.

Most expensive per kilowatt of the devices to protect air quality are scrubbers, which remove sulfur oxides from gases released during combustion. These will account for 39 percent of future capital outlays for environmental protection. Precipitators and wet scrubbers, used to capture particulate fly ash, will account for 36 percent, and cooling towers will make up 16 percent of the capital expenditures.

Meeting this increased level of capital investment will mean increased external financing (floating of bond issues, etc.). The report predicts that during the 1975–1985 period, external financing will increase for investor-owned power-producing utilities by 12.5 percent, or $19.3 billion over the $155 billion required before consideration of pollution control equipment.

The report states that "assuming the power industry is able to pass on the costs of pollution control equipment to its customers and to offer investors a competitive return on equity, the industry generally will be able to obtain the financing required both for regular needs and for pollution control equipment. . .The financing outlook for pollution control is guardedly optimistic due to favorable trends in earnings and in recent regulatory decisions."

Speyer explained that "what is meant by 'favorable trends in regulatory decisions' is that the States which regulate power companies have been willing to allow them larger returns of revenue. The plants usually accomplish this by increasing utility bills. The study indicates that larger power companies should encounter little difficulty with external financing of pollution control equipment. In the case of smaller companies, States may have to allow them higher returns on their service."



A Montana Power and Light Co. power plant at Colstrip, Mont., is lit up like a Christmas tree at night.

With regard to what kind of utility bills we can expect to be receiving in the future, the report states, "To view these costs in perspective, it is useful to relate them to the average monthly bill paid by residential customers. The average bill is projected to increase even in the absence of pollution control impacts at a real growth of approximately five percent per year, or from $25.60 per month in 1975 to $42.40 per month in 1985, reflecting a continuing growth in electricity usage per customer. In current dollars the bill is estimated to be $70.80 per month in 1985.

"The direct increase in an average residential electric bill as a result of Federal pollution control regulations will be approximately $1.80 per month in 1980 and $2.80 per month in 1985. In relative terms, those impacts represent 5.3 and 6.6 percent increases."

When price increases other than the $2.80 added to the electric bill are included—such as increased cost of products produced by electricity-intensive industries—the entire monthly increase attributable to costs for environmental controls is $5.80 per month, as Speyer previously noted.

"Generally the impacts of expenditures on pollution controls will be very small both on major users of electricity and on other areas such as the sulfur industry," the report indicates. "Product price increases in the most electricity-intensive industry, primary aluminum, would be only 1.1 percent by 1985 if all increased electricity costs due to pollution control were passed directly on in the form of increased product prices."

The report also notes that "the sulfur industry does not appear to be threatened by the volume of potential production of by-product sulfur from. . .scrubbers."

The report states that when broken down by geographical region, percentage increases in average customer charges are expected to be as follows: Mountain, 11.1 percent; East South Central, 10.2 percent; West North Central, 10.1 percent; West South Central, 9.0 percent; East North Central, 8.3 percent; South Atlantic, 5.2 percent; Middle Atlantic, 4.1 percent; New England, 1.8 percent; and Pacific, 1.3 percent.

The report was prepared for EPA by Temple, Barker & Sloane, Inc. of Wellesley Hills, Mass. Copies are available through the National Technical Information Service, Springfield Virginia, 22151. ■

ENVIRONMENTAL ALMANAC

A GLIMPSE OF THE NATURAL WORLD WE HELP PROTECT

JUNE

SUN AND SUMMER

The silent rotating of vast celestial machinery will bring us summer at 8:14 a.m. June 21 Eastern Daylight Time, the exact moment when the Sun will be at its northernmost point from the equator.

All over the world's northern hemisphere summer will arrive at the same instant, although individual clock readings will depend on the various time zones. This is the summer solstice when the tilted Earth's north pole is pointing more toward the Sun than at any other time of the year.

Of course, at the same instant in the southern hemisphere winter will be officially ushered in.

The sunward tilt of the northern sphere will give us our longest day of the calendar year.

The Sun will rise in the Washington area at 5:43 a.m. on that day and linger in the heavens until 8:37 p.m.

This gigantic atomic furnace blazing from more than 90 million miles away in space will shine this summer on a people concerned as never before with looming energy shortages.

Yet most of us who will use ever more costly gasoline to drive to the beaches and relax in the sun are rarely conscious of the fact that all energy used on Earth, with certain exceptions such as chemicals in batteries and nuclear reactors, can trace its origin to the Sun.

Not many of us basking on the beach and listening to the roar of the ocean think about the Sun's energy being equal to a million million megaton atomic bombs each second.

The sweltering crowds in our big cities noting 90-degree readings on bank clock-thermometers are largely indifferent to the fact that the Sun is a ball of glowing gases big as a million earths.

Fortunately for us most of the Sun's extraordinary scorching energy is lost in space. Yet we all know life would be impossible without the fraction of sunlight that reaches the Earth.

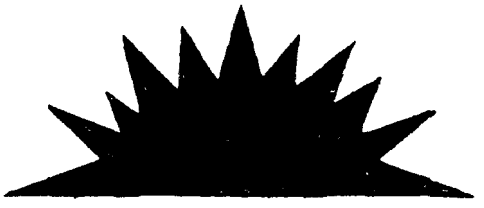
As we learned in school it is the heat from the Sun that stirs the atmosphere to make the weather. So it is the Sun that powers the wind, evaporates water and creates the clouds that bring the rain.

In our new-found interest with the possibilities of making direct use of solar power to heat houses, we should not overlook the basic fact that we are all solar-powered. The Sun's energy is stored in the vegetables we eat. Also dependent on sun-grown vegetation are the cattle and other animals we consume.

Oil and coal are captured sunshine—fossils of plants and trees which solar power helped fashion millions of years ago. Each of the billions and billions of leaves on plants and trees living today are sunshine traps. Energy from the Sun is used by these green plants in the vital processes of photosynthesis.

While sunlight offers enormous promise, it can, of course, be dangerous if treated without the care and respect it deserves.

Ultraviolet rays from the Sun are responsible for much of the increase in skin cancer cases in this country. The reduction of the ozone blanket in the stratosphere which protects us from the Sun's harmful rays has become a cause of international concern. This is why EPA has proposed a ban on the manufacture and use of certain spray-can propellants which reduce the ozone layer.



It is also the Sun which cooks the noxious brew of smog in Los Angeles and in other major cities, using as ingredients the auto fumes we allow to be discharged into the air.

Yet we cannot forget that the Sun's energy is the richest resource on Earth and solar power is among our few options for a future supply of energy. More than 90 percent of the energy now used to run the Nation comes from fossil fuels which once used will be gone forever.

The problem of course is to capture this energy and make it available in useful forms. The promise of this renewable energy resource is tantalizing. It can drive electric power plants that are smokeless and silent. It produces neither chemical nor radioactive pollutants.

Critics of our national energy policies have pointed out that fossil and nuclear fuels exact a much larger cost in the form of environmental degradation than their market price indicates and predict that the Sun's full impact on our lives is yet to be felt.

Indeed, if through some intellectual blindness we fail to harness this limitless power source for future use, our descendants may recall Milton's memorable phrase "O dark, dark, dark, amid the blaze of noon."—C.D.P.

AROUND THE NATION

phosphate ban

Vermont has a new law banning phosphates in detergents. (Phosphates pollute lakes and rivers by encouraging the growth of algae.) Wholesale distribution of phosphate-containing products is forbidden in Vermont after Jan. 1 next year, and retail sale and use by commercial establishments three months later. Violators may be fined as much as $100 per day to a limit of $2,500 for a single series of violations.

ecology awards

Winners of Region I's fifth annual Elementary Education Ecology Poem and Poster Program were honored recently at ceremonies held in the capitols of the six New England States. U.S. Senators Brooke (Massachusetts), Ribicoff (Connecticut), Chaffee (Rhode Island), McIntyre (New Hampshire), Muskie (Maine), and Leahy (Vermont) participated with Regional Administrator John McGlennon. More than 3,500 teachers sponsored the program in their classrooms, and about 100,000 pupils participated.

$100,000 penalty

A tuna packing firm in Puerto Rico has agreed to pay a civil penalty of $100,000 for violations of its wastewater discharge permit. Star-Kist Caribe, Inc., of Mayaguez, was charged with failing to submit timely reports and to abide by a compliance schedule, agreed to in its permit issued two and a half years ago, to abate the discharge of packing plant wastes into Mayaguez Bay. The penalty is believed to be the largest ever for compliance schedule violations. The firm and two other tuna plants in Mayaguez are now building an advanced wastewater treatment system.

spill emergency

Region II officials ordered EPA's trailer-mounted water treatment unit to Oswego, N.Y., recently to prevent leaking oil and chemicals from contaminating Lake Ontario. The wastes, many of them of unknown composition, were stored in metal drums on the property of Pollution Abatement Services, a waste collection firm. Many of the 7,500 drums were rusted and leaking and EPA officials were concerned that the hazardous contents might be washed by rainwater into Wine Creek, which drains into the Lake. State officials helped assess the situation and diverted the site's drainage into a lagoon. Both runoff and lagoon water were filtered and decontaminated by the trailer unit, which can treat 300,000 gallons per day and is based at EPA's Edison, N.J., laboratory.

water survey

An EPA survey recently identified 77 organic compounds in Philadelphia's Northeast sewage plant effluent and 78 in the Delaware River. The survey also found 44 organic compounds in the intake water of the city's Torresdale drinking water plant and 31 in its finished water.

Chloroform was found in concentrations of 160 parts per billion, above the recommended limit of 100 ppb, but the levels of other compounds are not believed to pose any long-term health risks.

EPA, City, and State officials discussed remedial actions, including improved treatment at Northeast, changes in processing at Torresdale, and reducing the industrial discharge of organics into the Delaware.

hexa is a hex

A jawbreaker chemical—hexachlorocyclopentadiene—said to resemble the phosgene poison gas of World War I, recently turned up in a sewage treatment plant at Louisville, Ky. About 30 plant workers were sickened by the stuff when it bubbled up in fumes in the plant's grit chamber.

Thousands of tons of sewage sludge were contaminated, as was plant equipment and a major sewer line. EPA representatives from Enforcement, Surveillance and Analysis, Water Supply, and Public Affairs rallied to help local officials solve the problems: Who was dumping "hexa" in the Louisville sewers? How can the plant be decontaminated? What should be done with the tainted sludge? One more item brought screams of anguish. The term "hexa," used by the public media to describe the chemical, turned out to be a trade name for an entirely different, and innocent, product.

noise exhibit

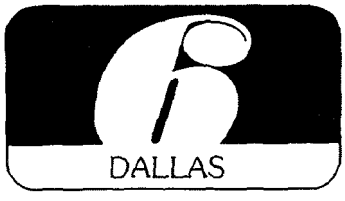
Acting Mayor Michael Bilandic of Chicago and Senator Adlai E. Stevenson III attended the opening of EPA's noise pollution exhibit at Chicago's Museum of Science and Industry in March. The permanent exhibit, EPA's first on noise, features visitor-activated films, slides, and recordings to teach people of all ages about environmental noise: sources, health effects, and methods of abatement.

hoosier energy

Regional officials have given preliminary approval for a new electric generating facility in Sullivan County, Ind. The Hoosier Energy plant, a subsidiary of Indiana Statewide Rural Electric Co., will have two 490-megawatt coal-fired units and will begin production in 1980.

plant is warned

The Commonwealth Edison Company, Chicago-based electric utility that is one of the largest in the country, was formally notified April 20 that EPA is not satisfied with the operation of its Quad Cities nuclear plant near Moline, Ill. Region V enforcement officials said the plant's intake structures that take cooling water from the Mississippi River destroy too many fish and fish eggs. They also objected to the plant's alternate cooling system, an array of canals and sprays that does not operate well, EPA officials said, in certain weathers.



open meeting

More than 200 persons attended an open meeting in Bartlesville, Okla., April 11 to discuss the proposed upgrading of the Chickasaw wastewater treatment plant. The meeting lasted four and a half hours, and Regional Administrator John C. White said, "EPA will not reach a final decision until the citizen comments have been carefully evaluated."

dedication

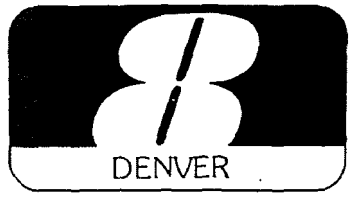
A new building for health and environmental sciences was dedicated April 15 at Oscar Rose Junior College, Midwest City, Okla. Region VI officials had been instrumental in the development of this project. Governor David Boren spoke. Certificates were presented to 40 persons who had completed wastewater treatment training at the college.

project scate

About 600 Iowa high school students are taking part in an unusual environmental education program that emphasizes political action. Called SCATE (for Students Concerned About Tomorrow's Environment), the program is funded under the Environmental Education Act by the Department of Health, Education, and Welfare. It is in its second year.

SCATE members select an environmental issue in the local community, study it and determine possible solutions. These are then discussed and voted on in Regional and State assemblies. Final recommendations are presented in person to State legislators and agency heads.

Recommended by the 1977 SCATE State assembly: a ban on leaf burning in any Iowa city, increased funding for solar energy research in Iowa universities, a mandatory deposit on all beverage containers, and a State income tax credit for persons who heat their homes with solar energy.



center opens

An Energy-Environment Information Center opened last month in Denver's Conservation Library. The interagency project's first year of operating expenses will be borne by EPA Region VIII and the Energy Research and Development Administration. The Center collects and disseminates published data on energy and the environment throughout the Region. Governmental bodies, industries, universities, and the public may get hard copy or microfilm copy from the Center, referral to experts, and computerized search and retrieval service.

The Center was suggested by an ad hoc committee headed by Regional Administrator John A. Green. Other participating agencies include the Federal Energy Administration and the Departments of Interior, Commerce, and Health, Education and Welfare.

dredge warning

Region IX officials have issued civil complaints against the Bethlehem Steel Corporation and the Crowley Maritime Corporation for violation of ocean dumping regulations. The companies are charged with dumping polluted dredging spoils in the middle of the outbound shipping lane from San Francisco Bay, about seven miles from the authorized dump site. Penalties could run as high as $100,000.

tacoma smelter

The smelting plant at Tacoma, Wash., of ASARCO, Inc., is exceeding State-set limits for sulfur and particulate air pollution, according to Region X officials. The firm, formerly called the American Smelting and Refining Co., was notified of its emission violations April 7. Donald Dubois, Regional Administrator, said the action was the first step in a wider crackdown by Federal, State, and area officials.

"Emissions of arsenic from the smelter, the health of people in the community, and the workers inside the plant must also be considered," Dubois said. "The EPA enforcement process signals the start of a comprehensive review of air pollution and related public health matters at the smelter. In this process the Puget Sound Air Pollution Control Agency, the State, other Federal agencies, and interested citizen groups have roles to play . . ." The State has decided to cancel a five-year variance on air emissions granted to the company last year by the Puget Sound agency. □

STRIKING GOLD IN SLUDGE

By Larry O'Neill

Valuable gold and silver deposits have been found in the Palo Alto, Calif., sewage sludge ash, according to the U.S. Geological Survey.

If the ash left after the sludge is incinerated were an ore body, the Geological Survey said, "it could be called a 'bonanza' ore."

Samples of the sludge ash showed gold content as high as 28 and 32 parts per million (ppm) and silver content as high as 680 and 630 ppm, the geological agency said. Its estimated worth of more than $200 per metric ton of sludge "is greater than the value of much of the ore from the mines of the Comstock Lode in Virginia City, Nev., in it's heyday."

But before you trade in the family station wagon for a burro and shovel to stake your claim at the nearest treatment plant, consider this caution from Robert Bastian of EPA's Municipal Technology Branch:

"The Palo Alto case sounds unique. It's rare to find measurable gold residues in sludge. Silver is more common but normally doesn't occur in amounts as large as those found in Palo Alto."

The Geological Survey attributes the high concentrations at Palo Alto primarily to the discharge of wastes by the photographic and electronic industries into the area's sewage treatment plant.

Among firms of this type in the area are a major Eastman-Kodak film processing operation, Fairchild Industries, ITT, and Hewlett-Packard.

The Geological Survey said that many of these plants probably recover some gold and silver from their waste streams but that a portion of the metals—including some from the Survey's own photo development shop—must slip through.

The Palo Alto metals were discovered by Survey scientists during a study of the sludge as a possible source of phosphate fertilizer. Recapturing as much as possible of the gold and silver "could help defray—perhaps even eliminate—the cost of incinerating the sludge," the Survey said. But Palo Alto officials think recovery costs could exceed the metals' value. They are studying the issue.

Gold and silver are not the only heavy metals found in sludge, and incineration isn't the only disposal method.

Traces of metals like cadmium, copper, molybdenum, nickel, and zinc found in sludge prevent the application of much of this material to cropland.

An EPA report on the subject* says, "Application of sewage sludge to cropland usually benefits agriculture because of the value of sludge as a soil conditioner and as a source of many essential plant nutrients. However, there is also the possibility that the heavy metals in the sludge might be toxic to crops and might. . .have deleterious effects on animals and humans."

However, in some parts of the country, sludge has been used for many years to improve farm land and reclaim strip-mined property with no apparent harm to people, animals or plants. For example, in one such demonstration project, since 1971 Chicago has shipped some 300 tons per day of wet sludge to Fulton County in central Illinois. This has been sprayed on previously barren land to grow crops, such as corn, and create bluegrass pasture for grazing cattle and buffalo.

But "go slow" is still the watchword for land application in most of the rest of the country, while research continues on the effects of sludge application upon soil quality, plant and animal health, and the safety of ground and surface water.

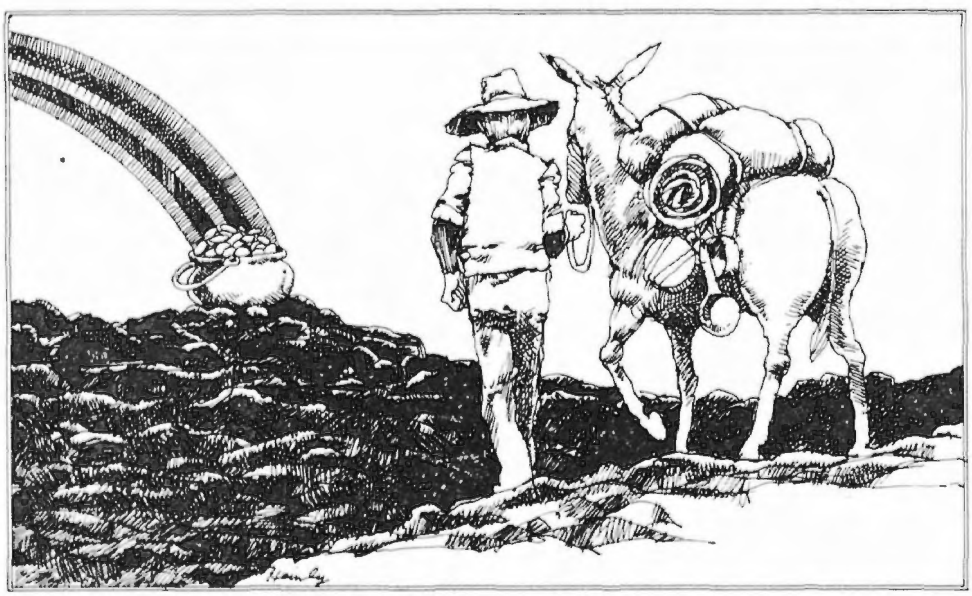
The EPA report suggests some ways of alleviating the heavy metals problem:

- Pretreatment: some local jurisdictions now require major industrial dischargers of heavy metals, such as electroplaters, metal finishers, and canneries to remove cadmium and other toxic metals prior to flushing their water into local sewers.
- Soil management: highly acidic soil can increase the solubility of heavy metals, leading to crop or animal injury. This can be prevented through applications of lime or other alkaline materials.
- Crop selection: in general, grain crops, such as corn, absorb less heavy metal than leafy vegetables or grasses. Little or no hazard is likely to result from spreading sludge on crops like cane sugar and sugar beets that are not eaten directly but processed into other finished foods.

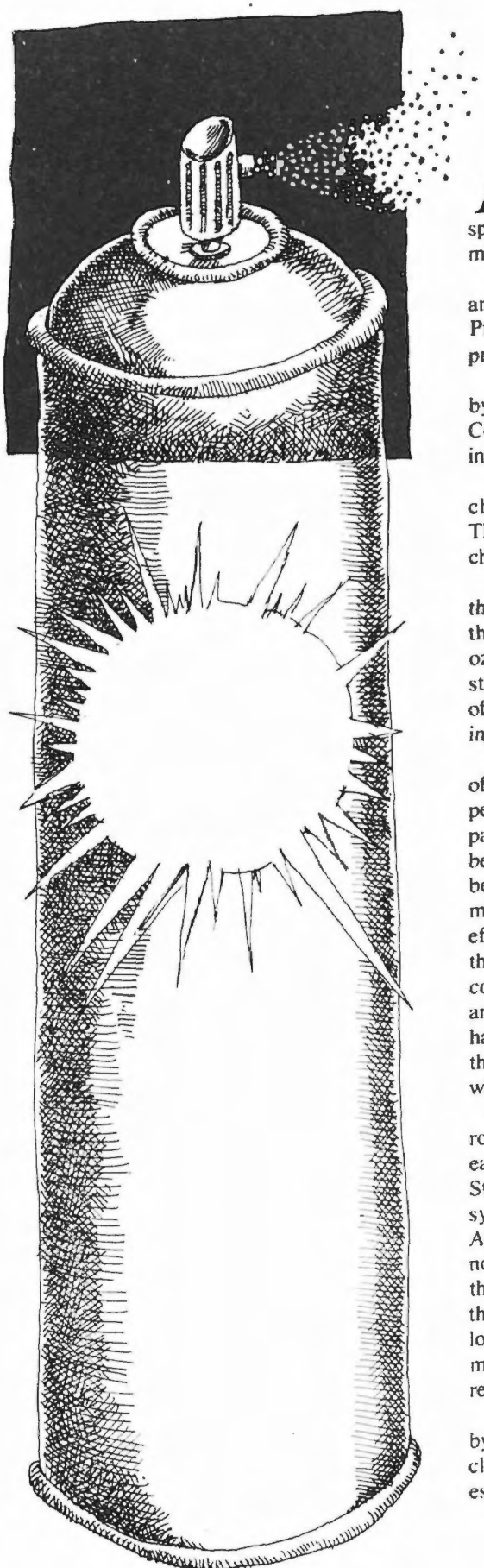
So sludge may indeed represent a gold mine—whether literally, as in the case of Palo Alto, or figuratively, in the event that today's human wastes someday become a cheap, readily available source of nutrients for productive farm lands.

*Application of Sewage Sludge to Cropland: Appraisal of Potential Hazards of the Heavy Metals to Plants and Animals. Copies available from GSA (8FFS) Centralized Mailing List Services, Building 41, Denver Federal Center, Denver Colo., 80225. ■

O'Neill is a Headquarters Press Officer.



BAN FOR HARMFUL SPRAY-CAN GASES



A proposed ban on the manufacture and use of certain gases as propellants in spray cans was announced May 11 by Administrator Douglas M. Costle.

Similar plans were announced by the Food and Drug Administration and the Consumer Product Safety Commission for spray-can products under their jurisdiction.

The action would be the first to be taken by EPA under the new Toxic Substances Control Act. It would become fully effective in April 1979.

The gases in question are usually called chlorofluorocarbons, trade name Freons. They are synthetic hydrocarbons containing chlorine and fluorine.

The compounds are not toxic or harmful in themselves, but when they escape into the air they migrate upward and react to deplete the ozone layer. A thin blanket of ozone in the stratosphere serves as a shield to keep most of the sun's ultraviolet radiation from reaching the Earth's surface.

Scientists believe that depletion of the layer of ozone—a form of oxygen—could result in permanent injury to human health (principally from increases in skin cancer, known to be caused by ultraviolet rays). They also believe that additional ultraviolet radiation might have upsetting, but still undefined, effects on the delicate ecological balances that have evolved among the plant life that converts the Sun's energy into food for itself and all other forms of life. These balances have developed over millions of years under the ozone's protective shield. No one knows what might happen if that shield is removed.

More than one million metric tons of chlorofluorocarbon compounds are manufactured each year, about half of them in the United States and Canada. They are completely synthetic, that is, they do not exist in nature. At sea level they are inert and stable and do not burn. Their most useful property is that they absorb a lot of heat when changing from the liquid to the gaseous state and release a lot of heat when the process is reversed. This makes them very efficient and convenient refrigerant fluids.

Refrigerant Freons would not be banned by the proposed EPA rule, since these are in closed piping systems, and the gases do not escape to the environment unless there is leakage or possibly when the refrigerating mechanism is eventually scrapped. Costle said EPA plans to propose regulations next year to control such releases. Refrigeration is regarded as an essential use, offering no present hazard, and there are no acceptable substitutes.

In spray cans, however, the chlorofluorocarbons serve as the vehicle to apply droplets of some other product: hair sprays, body deodorants, perfumes, household cleaners, paints, and insecticides. The Freon goes directly into the air and cannot be recovered. Costle noted that other propellant gases are available to do this work—compressed carbon dioxide, for instance—and many such products can be sprayed mechanically, by pressing a finger plunger, or applied by other means.

Costle said he chose to act under the new Toxic Substances law, rather than under the Clean Air Act, because the ban would be easier to administer. Less than half a dozen companies manufacture Freons, making the control of manufacture, shipment, and end-use regulation a relatively simple matter.

Under the Clean Air Act, all the States having aerosol manufacturing or packing plants would have to file for changes in their implementation plans and hold separate hearings.

The regulations are to be formally adopted next Oct. 15, Costle said. They would ban the manufacture of any "fully halogenated chlorofluoroalkanes (the technical name) for any aerosol propellant use." Exceptions will be made for:

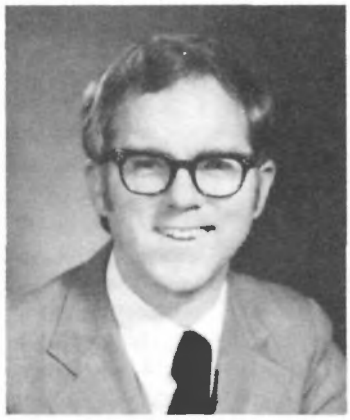
- Stench warning devices used in mines. No satisfactory alternative is available, and these devices are crucial for miners' safety.
- Release agents for plastic molds.
- Insecticides to kill flying insects in granaries, poultry coops, and non-residential food handling establishments, and for the fumigation of aircraft.

The manufacturing ban would take effect Oct. 15, 1978, and three months later, Dec. 15, 1978, the ban would apply to processing (putting the propellant gas in the aerosol can). After April 15, 1979, spray cans containing chlorofluorocarbon propellants would be barred from interstate commerce. ■

PEOPLE

Charles S. Warren has been named Director, Office of Legislation, succeeding Bryan F. LaPlante, who has retired.
Warren, 36, has been chief legislative assistant to Sen. Jacob Javits of New York since 1970. Before that he practiced law in Washington, D.C., and in New York City.
Warren is a native of Cleveland, Ohio, and was graduated from the University of Florida in 1962. He earned his law degree from Columbia University in 1965 and a master's degree in tax law from New York University two years later.
"Chuck Warren should be a definite asset for EPA and for continued environmental progress on Capitol Hill," Administrator Douglas M. Costle said.

George F. Armstrong Jr., M.D., a specialist in aerospace physiology and biomedical engineering, has been appointed Director of the Health Effects Division in EPA's Research and Development Office. This is a new post, reporting to the Deputy Assistant Administrator for Health and Ecological Effects, Dr. Delbert S. Barth.
Dr. Armstrong, scheduled to assume his new position June 5, has been associated for 13 years with the National Aeronautics and Space Administration's Manned Spacecraft Center in Houston Texas, where he headed the Space Physiology Branch, the Biomedical Technology Division, and the Health Services Division. For the last year he has been a medical officer with the Center's Operations Group.
Dr. Armstrong was born in Houston, Mississippi, 53 years ago and attended the University of Mississippi, Jackson, for two years before joining the Naval Reserve, where he had four years' active duty as an officer and qualified as a Naval Aviator. He returned to the University and earned bachelor's degrees in physics and medicine and a master's in physiology and then transferred to the University of Illinois, where he won his medical doctorate in 1956. He taught physiology and biophysics at the University of Mississippi and was on the graduate faculty of the University's School of Medicine before joining the Spacecraft Center in 1964. He received a Superior Achievement Award from the Center in 1969. He has written or co-authored 34 technical medical articles.



Dr. Alvin R. Morris, former Region III Deputy Administrator, is serving as Acting Region III Administrator. He succeeded Daniel J. Snyder III, who resigned to practice law with a Philadelphia firm.
Dr. Morris, who began his career as a biologist with the Federal Water Pollution Control Administration, served as Assistant Regional Administrator for Management in EPA's Region II office in New York City before becoming Deputy Regional Administrator in Philadelphia.
He received his Bachelor of Arts degree from Lafayette College in 1957. His graduate work was done at Lehigh University, where he received his M.S. in Microbiology in 1959 and his Ph.D in biology in 1963. He was awarded the EPA Bronze Medal in 1973 and the EPA Silver Medal for Superior Service in 1976.

Thomas P. Meloy, engineering administrator for the National Science Foundation, has been named Director, Industrial and Extractive Processes Division, in the Office of Research and Development, reporting to the Deputy Assistant Administrator for Energy, Minerals, and Industry.
With NSF for three years, Dr. Meloy was responsible for awarding some 700 grants worth $36 million annually.
Before that he did research and development work in private industry: four years with Meloy Laboratories Inc., Springfield, Va., a firm he helped to found, on electronic pollution monitoring devices; three years with Melpar, Inc., Falls Church, Va.; and five years with Allis-Chalmers, Inc., Milwaukee, Wisc. He has also worked for the General Electric Co. in Schenectady, N.Y., and Evandale, Ohio, and taught at Boston University and the Massachusetts Institute of Technology.
Dr. Meloy, 51, was graduated from Harvard University with a degree in physics and earned a B.S. and a Ph.D in mining engineering from MIT.

Richard E. Reavis was recently appointed Deputy Director of the Water Division, Region VII, Kansas City. In this post he will supervise the Region's water supply program, water quality standards, and the River Basin Commission staff.
Reavis is a Public Health Service officer and has worked with the Indian Health Service and as a city engineer and public works director. He holds a B.S. in sanitary engineering from the University of Missouri, Rolla, and an M.S. in public health administration from Northwestern University.

Elva Slagle, Safety Management Officer for EPA's Region VI, Dallas, is the first woman to serve on the National Safety Council's Executive Committee, Research and Development Section.
She heads the group's Associations Committee, a liaison and focal point for the exchange of information among 44 national safety associations. This fall in Chicago she will chair a research and development session at the Council's annual conference.
Ms. Slagle has had 27 years of Federal service, starting with the Veterans' Administration in 1948. She joined EPA in 1970. She has served as secretary and chairman of the Dallas-Fort Worth Federal Safety Council and is in charge of personnel security at the First International Building, where EPA and several other Federal agencies are located. She and her husband have four children and two grandchildren.

Patrick K. Monahan has been appointed Director of the Air and Hazardous Materials Division in EPA's Region VII Office in Kansas City, Mo. He succeeds Donald A. Townley, who has retired.
Monahan had served as chief of the legal branch, Enforcement Division in Region VII since 1971. From 1961 to 1971 he was in the Department of Justice as an Assistant U.S. Attorney and Special Agent of the F.B.I.
He has a B.S. degree from Rockhurst College, Kansas City, Mo., and an LLB from the University of Missouri at Kansas City.

Thomas C. Voltaggio is the new chief of the Air Compliance Branch in Region III, Philadelphia. With EPA since 1971, he has served as a chemical engineer in Region VI, Dallas, and more recently with Region V, Chicago, where he successively headed the Enforcement Division's Compliance Section and the Engineering Investigation Section. Voltaggio had worked as a plant engineer with the Stauffer Chemical Company in Houston and Fort Worth, Texas, for three years before joining EPA.
He was born in Queens, N.Y. and earned a B.S. in chemical engineering from City College of New York and a master's in management science from Texas Christian University.

Wilson K. Talley, Assistant Administrator for Research and Development since December 1974, is resigning at the end of June to return to the faculty of the University of California.
Dr. Talley will be Professor of Applied Science at the University of California at Davis. He will teach at the University's Livermore branch and conduct research.
Before joining EPA, Dr. Talley was Study Director of the Commission on Critical Choices for Americans. He had previously served for three years as the University of California's Assistant Vice-President for Academic Planning and Program Review, and for a year as a special assistant to the Secretary of Health, Education, and Welfare. His prior posts at the University of California, starting in 1963, included assistant, associate, and full professorships in the Department of Applied Science; vice chairman and acting chairman of the Department; and leader of the Livermore Laboratory's Theoretical Physics Division.

Elizabeth L. Anderson has been appointed the first Executive Director of the Agency's Carcinogen Assessment Group. The CAG is an advisory body which assesses the possible health risk of all suspect carcinogens entering the environment for which EPA has regulatory authority.
Dr. Anderson, a native of Nathalie, Va., came to EPA in 1971 as a staff chemist for the Office of Technical Analysis. In 1973 she became assistant to the Deputy Assistant Administrator for General Enforcement.
Dr. Anderson is a graduate of William and Mary College, where she received her B.S. in chemistry in 1962. In 1964 she earned an M.S. in chemistry under a National Science Foundation grant at the University of Virginia, and in 1970 she received her Ph.D. in organic chemistry under a Defense Department Fellowship at American University.
The Carcinogen Assessment Group is comprised of senior scientists from within EPA with a liaison member from the Department of Health, Education and Welfare.

UPDATE

A listing of recent Agency publications, and other items of use to people interested in the environment.

GENERAL PUBLICATIONS

Single copies available from the Public Information Center, Printing, (PM–215), US EPA, Washington, D.C. 20460.

Trends in the Quality of the Nation's Air (June 1977) A 16-page booklet that explains and illustrates with pictures and charts the improvements in air quality brought about by the 1970 Clean Air Amendments. It covers total suspended particulates, sulfur dioxide, photochemical oxidants, carbon monoxide, and nitrogen dioxide.

EPA—Protecting Our Environment (June 1977) This 28-page booklet looks at the mission of EPA. It discusses the changes that have taken place in the environment since the Agency was formed in 1970. New Legislation such as the Resource Conservation and Recovery Act and the Toxic Substances Control Act are included.

Soil and Pollution (June 1977) A 16-page reprint from the EPA Journal that reviews how our use of the land affects air and water quality.

Clean Water and the Rubber Processing Industry (May 1977) One of a series of booklets on industries that are subject to EPA's effluent guidelines. This 16-page booklet explains what effect compliance with the laws will have on the rubber processing industry.

Clean Water and the Beet Sugar Industry (May 1977) Another in the effluent guidelines series. This 16-page booklet examines how pollution control will affect the beet sugar industry technologically and economically.

Safe Storage and Disposal of Pesticides (June 1977) This 8-page illustrated booklet is designed to inform large-scale pesticide users of EPA guidelines for storing pesticides, and disposing of leftover materials and empty pesticide containers.

FEDERAL REGISTER NOTICES

Copies of Federal Register notices are available at a cost of $.20 per page. Write Office of the Federal Register, National Archives and Records Service, Washington, D.C. 20408.

Pesticide Programs. EPA issues notice on registration of products containing amitraz. Wednesday, April 6.

Pesticide Products. EPA cancels registration for certain products containing copper arsenate and copper acetoarsenite. Thursday, April 7.

Pesticide Program. EPA notice of intent to cancel registrations of pesticide products containing chlordecone (kepone) and response to USDA and Science Advisory Panel comments on cancellation. Monday, April 11.

Air Pollution. EPA amends rules on maintenance of national ambient air quality standards. Friday, April 15.

High Altitude Motor Vehicle Emission Requirements. EPA identifies counties designated as high altitude: effective 4/20/77. Wednesday, April 20.

Toxic Substances Control. EPA proposed procedures for rulemaking: comments by 7/1/77. Thursday, April 21.

COMING EVENTS

More information about these events and EPA participation in them is available from Sue Sladek (202) 426-4188.

American Environmental Forum, Portland, Oregon, June 15.

Air Pollution Control Association 40th Annual Meeting, Sheraton Centre Hotel, Toronto, Canada, June 20–24.

MOVIES

Movies are available on a free-loan basis from Modern Talking Picture Service, Inc., Central Distribution Office, 2323 New Hyde Park Road, New Hyde Park, N.Y. 11040. Please request movies well in advance of planned showing date.

Jet Roar. The problem of airport noise is examined by this 15-minute, color, 16-mm film. It looks at what people, airports, and airlines personnel are doing to cut engine noise.

An Investment To Protect. Millions of tax dollars have been spent to build wastewater treatment plants as an investment for clean lakes and rivers. This 13-minute 16-mm color film explains that dedicated operations personnel, an adequate operating budget, and support from local people are necessary to protect our investment. □

TOUGHER STANDARDS FOR COAL-FIRED POWER PLANTS?

EPA held public hearings May 25 and 26 in Washington on the possibility of tightening its sulfur dioxide standards for new and modified coal-fired power plants. EPA issued its original standards in 1971. The Sierra Club and some chapters of the Navajo Tribe petitioned EPA last year to tighten these standards. EPA has been making a study to determine whether the sulfur dioxide standards should be revised and is expected to reach a decision by early 1978.

EPA HOLDS CONFERENCE ON COAL CLEANING

Methods of cleaning coal so it can be burned without polluting the air were discussed at a conference in Arlington, Va., May 24-25, sponsored by EPA and Battelle Laboratories, of Columbus, Ohio. Executives and planners from the coal industry, power companies, banks, and government bodies exchanged ideas on the technology and costs of sulfur removal by pretreatment, special combustion methods, and flue gas scrubbing.

COSTLE TAKES PART IN WORLD ENVIRONMENT DAY OBSERVANCE

World Environment Day was commemorated June 1 at a two-hour public meeting in the State Department auditorium, Washington. Speakers scheduled included EPA Administrator Douglas M. Costle; Undersecretary of State Lucy Wilson Benson; Patsy T. Mink, Assistant Secretary for Oceans, International Environment, and Scientific Affairs; Charles Warren, Chairman, Council on Environmental Quality; and Curtis Farrar, of the Agency for International Development.

STUDIES LAUNCHED ON TWO COMMON PESTICIDES

New inquiries into the benefits and risks of two well-known pesticides have been started by EPA. They are Toxaphene and Pronamide. Toxaphene - used for 20 years on cotton, soybeans, and other crops - has been blamed for fish kills and may cause cancer in laboratory animals. Pronamide - a weed killer widely used on lettuce, alfalfa, and golf courses -- is also a suspected carcinogen.

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MOTHERS' MILK

Detectable levels of three pesticides have been found in the milk of a majority of nursing women tested.

This finding is based upon analyses of milk samples from nearly 1,500 subjects, the largest survey program of its kind ever undertaken. The results, recently released by the U.S. Environmental Protection Agency, showed extremely small amounts of the chemical dieldrin in about 80 percent of all milk samples, heptachlor epoxide in roughly 63 percent, and oxychlordane in 74 percent.

Health experts both at EPA and among the university researchers who conducted the study during 1975 believe that the levels detected pose no immediate health hazard to either the mothers or their newborns. However, the possible long-term consequences of these minute amounts are uncertain. The 1,436 women who served as subjects are being informed of the results, which have also been made available to the Department of Health, Education and Welfare for review and assessment.

Milk samples were tested for six pesticide compounds: dieldrin, heptachlor, a breakdown product of heptachlor called heptachlor epoxide, chlordane and its breakdown product called oxychlordane, and Mirex. No chlordane or Mirex was observed in any of the samples.

All of these pesticides have been curbed to one extent or another by EPA, primarily because they are suspected of causing cancer in humans. Dieldrin, heptachlor and chlordane have been prohibited for most uses, including all food crop uses. Mirex, a fire ant pesticide, may not be applied in the U.S. after June 30, 1978 as the result of an agreement between EPA and the producer.

Lower levels of the dieldrin, oxychlordane, and heptachlor epoxide in human milk may be expected to occur in the future because of such restrictions on their use. In 1975, for instance, the Agency reported that levels of DDT in human fatty tissue were declining due to decreased application of this pesticide in the early 70's.

Maternal Caress, a color print by Mary Cassatt. National Gallery of Art, Washington, D.C., Chester Dale Collection.

Assessing the significance of the new study, Dr. Jack Griffith, head of the Human Effects Monitoring Branch, Office of Pesticide Programs, said, "EPA now has the means to statistically estimate, nationally, the magnitude of certain pesticides residues in human milk, and to effectively monitor whatever changes may occur in the future."

The milk sampling program was performed under contract to EPA by Colorado State University in Fort Collins with assistance from the Medical University of South Carolina, Mississippi State University, and the State health departments of Michigan and Utah. One hundred and fifty hospitals were randomly selected from 7,000 general care units in 46 States. Both high and low pesticide usage areas were picked to ensure the representativeness of the sample.

The average detectable amounts of the minute traces of the three pesticides found in the women's milk varied: The mean level for dieldrin in the fatty part of the milk was 164 parts per billion (one part per billion is roughly comparable to one inch in 16,000 miles). The mean level for the heptachlor epoxide was 91 parts per billion, and the mean level for oxychlordane was 96 parts per billion.

Some of these same milk samples were also analyzed last year for PCB's, the oily substance used in heavy-duty electrical equipment and found to cause serious health problems in laboratory animals. An initial group of 379 of these samples contained PCB's that ranged from barely detectable to low parts per million. All of the remaining samples are now being examined for PCB's.

In addition, the samples have been tested for other pesticides, including DDT, BHC, HCB, Lindane and transnonachlor, a breakdown product of chlordane. The mathematical portion of this study is still in progress, but a report of findings is expected later this year.

Copies of the milk study may be obtained from the Environmental Protection Agency, Office of Pesticide Programs, Human Effects Monitoring Branch (WH-569), 401 M Street, SW., Washington, D.C. 20460. ■

*U.S. GOVERNMENT PRINTING OFFICE: 1977 720-136/6 1-3