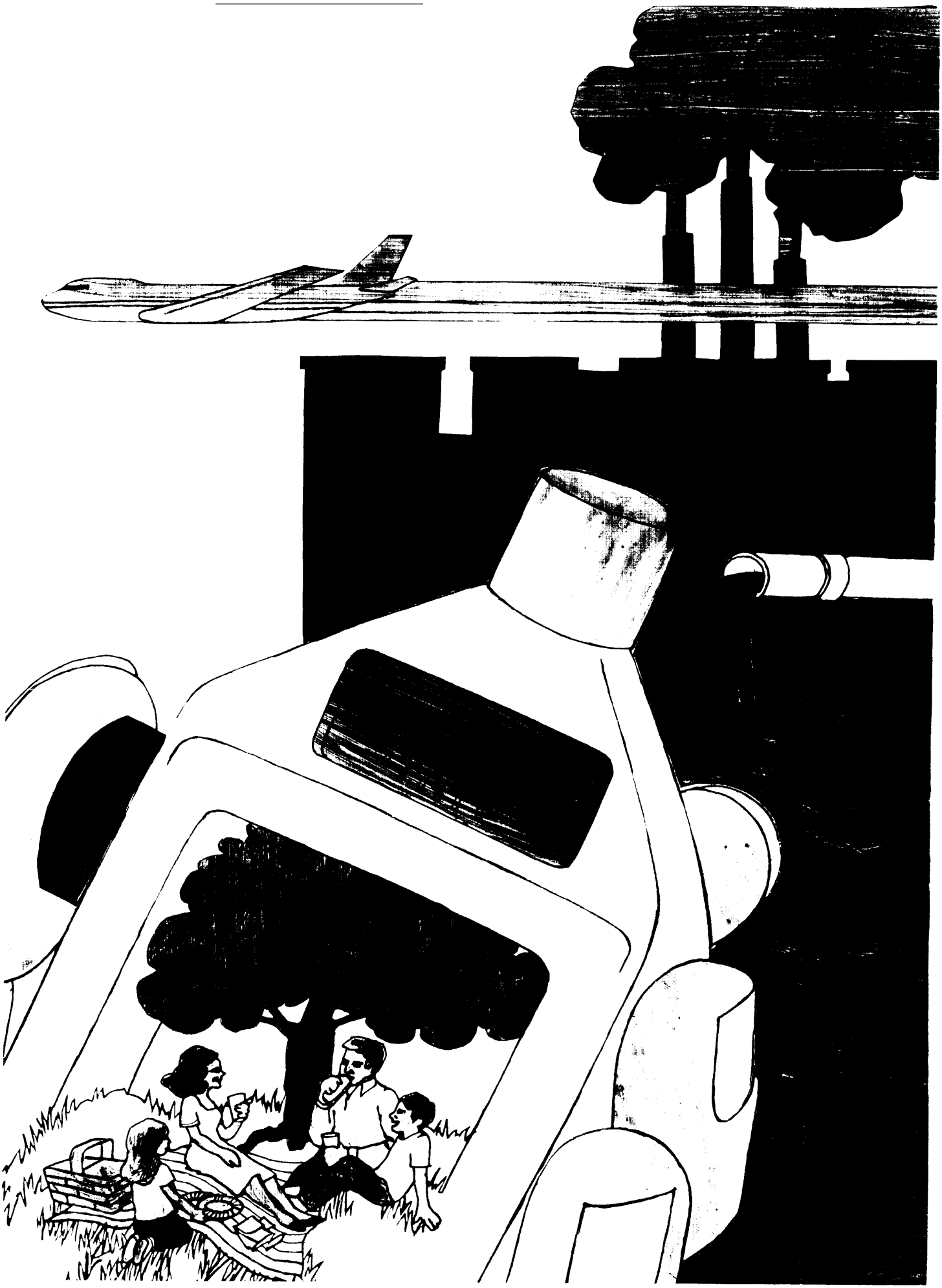
IV. Transport, Fate, and Monitoring Research



IV. Transport, Fate, and Monitoring Research

ISSUES LIST

IV. Transport, Fate, and Monitoring Research

INTRODUCTION

Rational regulatory action for control of a pollutant depends on an understanding of the ways in which pollutants are transported throughout an ecosystem and how they change or combine with other substances to become more or less troublesome.

Monitoring research is necessary to detect and document the movement and transformation of pollutants. This broad field of study combines two other large areas of EPA/ORD research: the control of sources, on the one hand, and the health of humans and ecosystems, on the other hand.

Before discussing specific issues, a general concern should be noted. A substantial portion of the research on the transport and fate of pollutants and on ecological effects is contained with in the energy -related subprograms. The importance of energy and energy-environmental research is clearly recognized and not at issue here. However, the Office of Research and Development (ORD) Plan does not adequately reflect the close ties that should exist between administratively separate, but scientifically similar research. The fragmentation of these efforts in the Plan hindered assessment of the overall content and thrust of research on the transport and fate of pollutants.

The review of the transport, fate, and monitoring elements of the ORD 5-Year Plan raises issues regarding monitoring and measurement technologies, research initiatives, specific ecosystems, and water research.

Monitoring and Measurement Technologies

The results of diverse studies within EPA must eventually be combined to set standards and to forge the control strategies to implement the standards. This requires a centrally coordinated and technically strong monitoring effort beyond the apparently fragmented responsibility existing within ORD. (Issue 1)

The ORD Research Plan suggests the absence of an adequate screening program to detect toxic materials singly or in combination in air and water. A broad monitoring-screening program will help avoid the "pollutant of the month" syndrome. (Issue 2)

In the ORD research monitoring program, physical and chemical techniques are emphasized to the neglect of biological needs. Neither biological monitoring research nor guidelines to discharges on effective biological monitoring are projected in the ORD Plan. *(Issue* 3)

EPA's methods to analyze air quality attempt to define air pollution levels and not pollutant concentrations. Further research is needed to develop analytical tools for the measurement of specific hazards not currently being researched. *(Issue* 4)

The variety and number of identified pollutant substances are steadily increasing. Accountability for analyzing these new substances is fragmented; new methodologies require extensive time for acceptance; and standards for technique acceptance are ill defined. *(Issue* 5)

Research Initiatives

Rational control strategies require knowledge extending beyond ambient levels of pollutants and emissions and their precursors. It also is necessary to understand the processes of dilution, transport, transformation, and removal that determine human and ecosystem exposure. Complex interrelationships are involved; thus, the research cannot be effectively performed in "bits and pieces." Since results strongly influence the develop-

ment and enforcement of regulations, such research deserves high priority within EPA/ORD. (Issue 6)

While pollution is often thought of in local or regional terms, it is also a global problem. To determine how global concentrations may affect us, it is necessary to have a fuller understanding of the global movement of pollutants. For example, EPA does not allow the sale of DDT in this country, yet significant quantities could enter this country through atmospheric circulation. (Issue 7)

Specific Ecosystems

Regional environmental concerns in studies of the transport, fate, and effects of pollutants deserve stronger support. It may be helpful to develop a taxonomy of ecosystems and, at least, undertake studies of the most critical ones that may not be covered by more generalized ORD studies. (Issue 8) "

The ORD research Plan, while enumerating the environmental studies being carried out by several agencies in Alaska, does not indicate that EPA is coordinating efforts so the State's environmental research needs are being thoroughly met. (Issue 9)

Water Research

Many basic questions relating to wastewater treatment and protection of water supplies remain unanswered. The EPA Plan presents research approaches and programs, but they are not assigned priorities in terms of the scale of effort or the perceived magnitude of potential health risks. (Issue 10)

The ORD Plan to examine tolerable pathogenic concentration in primary-contact recreational waters is too limited. The program does not currently include research on viruses and other parasites. Since Public Law 92–500 stresses such research, the program warrants expansion. (Issue 11)

IV Transport, Fate, and Monitoring Research

ISSUES

ABSENCE OF INTEGRATED MONITORING RESPONSIBILITY

Issue 1

Monitoring activities appear widely dispersed throughout ORD with no provision for centralized responsibility for accuracy of data, comparability of methods, or quality assurance.

Summary

ORD's Office of Monitoring and Technical Support has responsibility for establishing Federal reference methods used in pollutant sampling and analysis, and for the engineering development of new systems. Other offices are engaged in a wide variety of programs in which monitoring of pollutant levels play a central role, such as epidemiological studies of human health effects, emissions inventories, air- and water-quality model development, and trend analysis of ambient pollutant levels.

The results of such diverse studies must eventually be combined to set standards and to forge the control strategies to implement the standards.

The ORD Plan contains no provision to insure that the procedures and methods used in making these measurements will yield data that are accurate and comparable. To the extent these results are not comparable, control strategies cannot be designed with confidence that allowable emission levels are neither overly stringent nor too lax.

Questions

1. Under current priorities and organization, what level of effort and what mechanisms are directed toward coordination and quality assurance in ORD's monitoring activities?

2. Is this level of effort commensurate with the critical nature of the problem?

3. How does the present organizational structure provide a means, formal or informal, to insure that monitoring of activities and quality assurance are well coordinated ORD-wide? Agency wide?

4. How would the Agency respond to a recommendation that the currently fragmented monitoring and quality assurance activities throughout the EPA be brought under the direct control of a single, strong, properly funded central office within ORD?

5. How would the Agency respond to an alternate recommendation that a central authority within ORD oversee and coordinate these activities?

Background

The original organization of the Agency (1970) established the monitoring function as a major effort of the Agency's Science Office. Subsequent policy review of the monitoring function in 1972 resulted in a new concept of monitoring and assigned responsibility for various aspects of monitoring to the individual program offices. The Office of Enforcement and General Counsel was given responsibility for case preparation or compliance monitoring; i.e., monitoring which is undertaken to gather technical evidence for a specific case, hearing, or other form of litigation. The Offices of Air, Water, and Categorical Programs were given responsibility for ambient monitoring; i.e., monitoring which seeks to establish long-range environmental baselines against which changes can be measured.

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Air pollution: industrial gases belching from a steel plant in Houston, Texas

The Offices of Air, Water, and Categorical Programs were also given responsibility for monitoring specific sources in all media to measure point discharges. The Office of Research and Monitoring (ORM) was given responsibility for research monitoring; i.e., monitoring required in basic research experiments. Research monitoring, as defined, would be the smallest portion of the monitoring activity and of the least direct environmental importance.

An immediate result of this decision was the reemphasis of monitoring within ORM and renaming that office, ‘‘The Office of Research and Development (ORD). ” Portions of the monitoring function left within ORD, i.e., research monitoring, are further dispersed throughout ORD, and are not controlled or coordinated by the Office of Monitoring and Technical Support. There is no center of cross-media monitoring expertise within the Agency.

MONITORING SCREENING PROGRAM

Issue 2

The current monitoring program may not be capable of detecting certain toxic materials.

Water pollution: industrial wastes pollute a salt marsh in Middleton, Rhode Island Regulations require industry to obtain permits to discharge Into water supply outlets.

Summary

A monitoring screening program to detect undiscovered toxic materials in air and water is needed. There are few Federal agencies systematically testing a modest number of samples of polluted air and water to detect the myriad of toxic compounds which may be found in them, and assigning priorities to those needing most urgent attention. (An example is the National Cancer Institute program to screen 500 compounds for carcinogenicity.)

A broad screening program would greatly help EPA in identifying new pollutants of major concern. The program could be conducted by EPA and coordinated with other Federal agencies. At present, one of the major barriers to this program is the difficulty in obtaining information from industry on the nature and quantity of toxic materials which they release.

Questions

1. What monitoring research program attempts to detect all toxic pollutants of major concern present in the environment?

2. If such a program exists, how are its findings and predictions communicated to the ORD planners for appropriate action?

3. Is new legislation required to allow EPA to conduct a major monitoring screening program for toxic materials in the environment, and to obtain the necessary information on the materials in discharges?

4. How does ORD plan to collect adequate data in relatively clean areas to compare with data from more polluted areas? Will such data include information on whole ecosystems?

Background

A recent panel of the National Science Foundation, headed by Dr. Norton Nelson, attempted to develop an early-warning system for industrial organic toxic substances. The panel's program was based on the recognition that there were not sufficient mechanisms for anticipating the presence of potentially toxic materials in the environment. The panel compiled a list of materials, in order of importance, needing further study. Its work, however, fell short of the objective in part because of difficulties in obtaining appropriate information on the nature and amounts of major toxic materials used in industrial processes. EPA should take responsibility for an ongoing monitoring/screening program of toxic materials in the environment. The various transformations which chemicals experience in ecosystems after release make it important to anticipate what might form in the air or water from these emissions. For example, monitoring for the byproducts of emitted sulfur dioxide and nitrogen oxides could have been instituted long before they were if appropriate chemical analysis of potential transformations had been made. Such an anticipatory monitoring program needs to be carried out by the Federal Government, not just by industry and municipalities.

The emphasis on performance standards for technology leads inevitably to monitoring for the effectiveness of pollutant removal at the source. While some monitoring of ambient levels of pollutants in air and water is conducted by EPA, the effort is small in relation to need. There is little indication how EPA will determine which potential pollutants in the environment, other than those for which control levels have been set, should be monitored. The proposed study of viruses in aerosols from wastewater irrigation is useful, but many other more critical problems appear neglected. Particular emphasis needs to be put on detecting and measuring in the environment:

- synthetic organic compounds of potential toxic properties, for example, chlorinated hydrocarbons, pesticides, PCBs, chloroform, and carbon tetrachloride,
- other organics such as acrylamide,
- heavy metals, especially mercury, cadmium, arsenic, and lead in air, soil, and water, and
- viruses and other pathogens in water.

EPA will devote considerable attention in the future to remote sensing technology and development of sophisticated automated

devices for measuring individual chemicals. While these efforts are valuable, they may be insufficient unless coupled with a strong screening program to determine which pollutants are being formed or found in the environment other than already well-known pollutants.

IN-STREAM BIOLOGICAL MONITORING

Issue 3

Current research monitoring efforts emphasize physical and chemical monitoring technology and neglect in situ (in-stream) biological monitoring methods whose use was mandated by Congress wherever appropriate.

Summary

Little research to improve detection of potentially toxic pollutants on living organisms in receiving waters is indicated in the planning document. Section 308 of the Federal Water Pollution Control Act (FWPCA) (1972) requires that the effects of each point discharge on aquatic organisms be monitored in the receiving waters wherever appropriate (''in-stream'' or biological monitoring). However, neither EPA research nor the development of guidelines for dischargers on how to conduct biological monitoring are projected in the research Plan.

Questions

1. What emphasis has EPA given thus far to in-stream biological monitoring of the effects of pollutants on stream organisms?

2. Are guidelines available to dischargers on how to conduct the in-stream biological monitoring mandated by Congress? If not, when will they be available?

Background

Past emphasis on the effect of single pollutants on single species in the environment has encouraged sampling for ambient levels of single pollutants. In the case of toxic materials w hich accum ulatc i n food chains (e.g., mercury, cadmium, copper, DDT), measuring the levels of these materials in water or air gives no accurate indication of the extent they exist in tissues of organisms in the affected ecosystem. The FWPCA mandates EPA to require of dischargers, wherever appropriate, the monitoring of effects of their discharges on aquatic life in receiving waters, "including accumulation of pollutants in tissue * * * [in] organisms representative of appropriate levels of the food chain * * *" (Sees. 308 and 504).

EPA proposes to continue measurement of effects of single pollutants in water using single species in tanks. This technique does not adequately reflect the likely response of an organism in a multispecies setting to a mixture of compounds. Hence, this technique is of limited value. The EPA proposes to increase research on pollutants in multispecies settings in the laboratory (microcosms), which, though useful for testing of new chemicals prior to full-scale production, does not address the need for in-stream biological monitoring of effluents from existing factories.

Development of biological indicator organisms, in both air and water, and signs of ecosystem disturbance due to pollutant effects also need considerable emphasis; it is not clear from the Research Plan how much attention this area will receive. There is, for example, no indication that EPA is planning to characterize the structure and function of ecosystems in sufficient detail to develop indices or to develop general guidelines for implementation of the initial steps taken by segments of the Agency.

MEASUREMENT OF AMBIENT AIR QUALITY

Issue 4

EPA's assessment of the hazards associated with the criteria pollutants other than CO are

subject to question because the analytical methods currently prescribed by EPA for measuring ambient air quality yield, in many cases, only indices of air pollution levels rather thn concentrations of the actual pollutants whose control is being sought.

Summary

The methods prescribed by EPA for measuring criteria air pollutants are not, in all cases, specific to the air pollutants whose concentrations are to be controlled. Additional research is needed to develop analytical methods that measure specific pollutants whose health effects are thought to be detrimental and whose concentrations in ambient air may need control. ORD has the capability of doing this research and contributing to the development of improved techniques.

Questions

1. Do the currently prescribed analytical methods used to monitor concentrations of hydrocarbons, SO_2, NO_x, and suspended particles in ambient air really measure these materials? If not, what do they measure? Are better methods under development? If so, what hope for progress is there?

2. Is it possible to measure sulfates separately in current particle determinations? Are methods for measuring sulfates and nitrates in the respirable size range being developed?

3. All hydrocarbons are not equally reactive in photochemical smog formation. Can the "reactive" species be measured as a unique group?

Background

From the time that the first ambient air-quality criteria documents were issued in 1969, there has been a serious question as to the validity of the analytical techniques recommended by EPA for measuring the concentrations of the criteria pollutants in ambient air. The first such case recognized by EPA was the use of the Jacobs-Hochheiser procedure as a measure of $N0_2$, It was found to be inaccurate and imprecise. Since that time, all measurements of concentrations of criteria pollutants in ambient air have been challenged.

It is well recognized that the dose-response relationships for health effects caused by $N0_2$, hydrocarbons, oxidants, $S0_2$, and suspended particles have not been unequivocally established by the epidemiological data in the public domain, This is attributable, in part, to the fact that the determinations of the pollutant concentrations were not accurately made during the studies. As a consequence, the conclusions reached concerning the health effects of the pollutants are vulnerable to question. It is most important that additional research be conducted to develop better methods for measuring individual pollutants in ambient air for future health-effect studies.

STANDARDIZATION OF ANALYTICAL TECHNIQUES FOR MONITORING

Issue 5

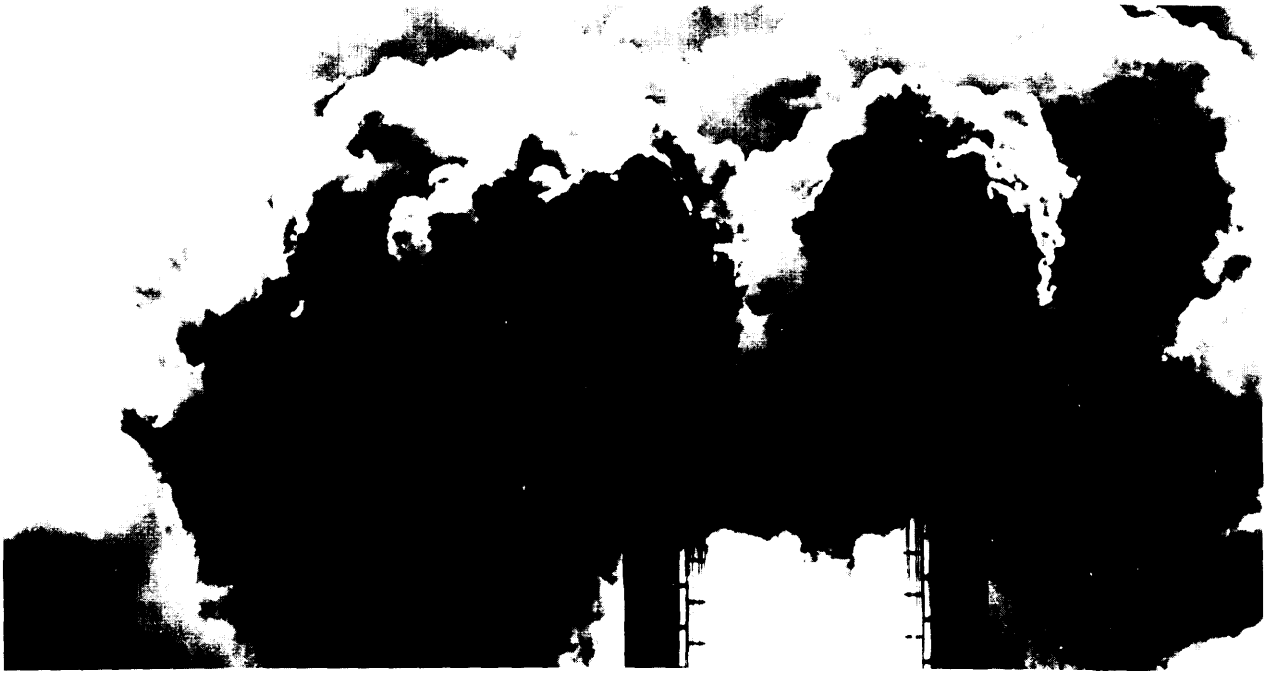
Improved measurement techniques and uniform analytical procedures are needed.

Summary

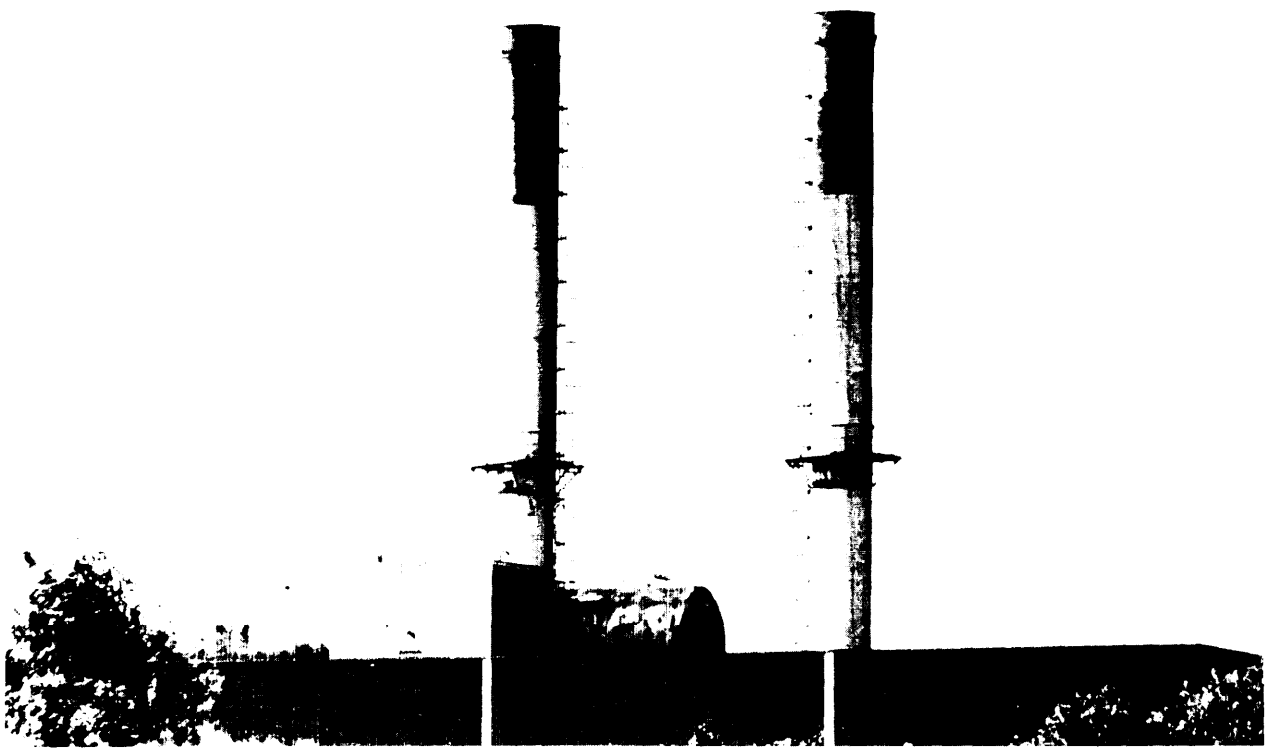
The variety and number of identified pollutant substances are steadily increasing. The authorities responsible for maintaining and developing analytical methods are spread throughout EPA and other Federal agencies. In some instances, analytical methods recommended by one agency are unacceptable to another agency. The introduction of improved methods is slow and cumbersome. The standards for techniques are ill defined. A review process is needed to establish mutually acceptable present and future techniques for air, water, and terrestrial measurements.

Questions

1. What is the role of the Office of Monitoring and Technical Support in promulgating uniform analytical procedures?



The pollution generated by this incinerator in south Houston Texas became so severe that citizen complaints and the cllosing of nearby schools forced the local government to discontinue its operation in January 1974



The same incinerator after closlng July 1975

2. What is EPA's method for staying abreast of the rapid proliferation of procedures?

3. What priority is assigned to the coordination of physical -chemical-biological measurements within the EPA and among Federal, State, and local agencies?

4. Does the variety of recommended analytical procedures between EPA, National Institute for Occupational Safety and Health (NIOSH), U.S. Geological Survey, and others represent an unnecessary redundancy in the measurement technology area ?

Background

A recent instance in which lack of reliable analytical techniques frustrated efforts for policy implementation is that of photochemical oxidant monitoring in southern California. The Los Angeles Air Pollution Control District was using a different technique for measuring oxidants than was the State Air Resources Board (ARB) or EPA, and was recording levels of oxidant 20 to 30 percent lower than ARB and EPA. Further testing established that the Los Angeles Air Pollution Control District technique, while less than perfect, was the most trustworthy. In the meantime, however, considerable confusion was generated among the public agencies, industrial emitters, and the public. A means of thoroughly checking the validity of monitoring methods before they are recommended in EPA regulations, either as principal or alternative means of monitoring, is needed.

Needed improved instrumentation is currently being introduced into the environmental market. However, the administrative procedures leading to acceptance of an improved instrument or procedure are inordinately time consuming, even after the technology has been proven. Improved analytical methods could be encouraged by establishing an effective, rapid review for a suggested improved technique. This review should not emphasize rapidity at the expense of quality.

SOURCE-EFFECT COUPLING MECHANISMS

Issue 6

ORD may assign too low a priority to research into the complex of processes that link source emissions and their effect on the biosphere.

Summary

The development of rational control strategies to reduce pollutants to medically safe and ecologically acceptable levels requires understanding a complex web of processes. Pollutants, or their precursors, are emitted by sources and eventually affect the biosphere. In between they undergo processes of dilution, transport, chemical transformation, and removal. Thus, any strategy aimed at maintaining safe levels must properly reflect these processes of change as well as ambient pollutant levels. Further complications follow because variable and uncontrollable natural conditions in the environment modify the entire chain of events. Regulations also frequently require protection for "worst case" conditions. Defining and achieving safe levels requires a research program which includes—

- complete, integrated, and well-funded research into the transport and fate of pollutants,
- assembly of results of such research for use in control strategy development.

Questions

1. Is knowledge of the transport and fate of pollutants adequate to define with reasonable certainty how a change in emission levels (for example, automotive reactive hydrocarbons) will influence subsequent achievement of pollutant standards (for example, photochemical oxidant) ?

2. Is the proposed research program into the transport and fate of pollutants strong enough and focused so that deficiencies in present knowledge will be systematically eliminated ?

3. Will research into the transport and fate of pollutants be related organizationally to regulatory needs so that the flow of new information permits periodic reevaluation and adjustment of control programs?

Background

Control strategies are now being developed and applied throughout the Nation in order to reduce or eliminate adverse effects of air and water pollutants. However, pollutants are exposed to an open lengthy, complex sequence of processes which may modify them before they reach sensitive elements of the biosphere.

Examples illustrating the importance of modifying processes are readily available. In air, formation of oxidant or photochemical smog is a classic case. The conversion of sulfur-containing combustion byproducts to sulfuric acid and sulfates is another important example. In both instances, control to avoid adverse effects is an important need, yet is difficult to achieve.

One approach to relating control requirements to emissions is based on the collection of comprehensive empirical data. Then, as emissions are reduced, the response of sensitive organisms can be observed. Controls can be eased when it is seen that impacts are reduced to acceptably low levels. Such a factual, direct basis for control may be an essential element of any strategy. But, unfortunate y, this approach demands vast amounts of data unique to each air basin or drainage. Also, some of the data obtained would be inexact. Therefore, an alternative, parallel approach is essential.

There is a common bond in the basic physics and chemistry of dilution, transport, transformation, and removal that intervene between the emission of a pollutant to the biosphere and its eventual deleterious effects on human health and ecological systems. A vigorous research program into this area could produce results with general applicability, and thus make best use of limited resources. Such a program is essential because current control decisions are evolving in an atmosphere of uncertainty. Better evidence is needed for making the difficult choices ahead.

GLOBAL BACKGROUND POLLUTANT CONCENTRATIONS

Issue 7

International sources of many pollutants will become increasingly important as controls within the United States become more effective and as industrialization increases in the rest of the world. Significant pollutants carried by wind or water must be evaluated and background levels must be monitored in anticipation of ultimate international efforts to coordinate controls.

Summary

Experiences with nuclear fallout and DDT have demonstrated that significant quantities of pollutants can be readily disseminated by global atmospheric circulation. Comparably broad distribution by means of ocean currents is possible. As the economies of the INorthern Hemisphere continue to expand, the significance of such international transport of pollutants will increase. International cooperation in pollution control becomes increasingly desirable, necessitating a careful appraisal by the U.S. Government. Moreover, it is plausible to expect that chemicals such as DDT, which the EPA allows to be sold only for use outside the United States, may reenter the country in significant quantities through the atmosphere.

Questions

1. What steps is the EPA taking to insure that it has an adequate understanding of global movement of pollutants, either through its own research or through that of other Federal or international agencies? What information exchange programs exist with other countries in this field?

2. What steps is the EPA taking to understand and monitor t natural sources of pollutants prior to setting standards?

3. What steps have been taken or are planned to determine the magnitude of the international movement of toxic materials other than radioactive fallout?

Background

The recent controversy over the role of fluorocarbons in the destruction of ozone in the upper atmosphere is an excellent example of a difficult-to-anticipate problem which could best be addressed by reliance on basic research. It is also a problem which requires analysis of global processes of chemical transport and transformation. To date, these areas have received little attention from EPA. There are several understandable reasons for this. Analyses of global processes have little apparent immediate relevance to the Agency's regulatory responsibilities, are expensive, and seemingly overlap with the jurisdiction of other agencies, NOAA in particular. Nonetheless, it appears necessary that EPA take action to insure that its specific data requirements for atmospheric, oceanic, and biospheric phenomena are met.

It appears probable that serious gaps will occur in the data base compiled by NOAA, NSF, and DOD in these areas of research unless the EPA undertakes its own reviews of the state of the art in global studies, and sees to it that the gaps are filled wherever feasible. This potential is illustrated by the record of DDT research, in which few measures were made of DDT in the atmosphere prior to 1970, despite the discovery through global modeling that the atmosphere must be a major reservoir of DDT. The lack of data was apparently not because of an inability to measure DDT in air prior to that time, but merely a failure to attempt to assess the potential magnitude of DDT transfers between environmental media.

In general, a similar failure to examine environmental problems in a sufficiently broad conceptual framework is present in the EPA Plan, raising the possibility of simple oversights in current appraisals of pollutant hazards. The remedy appears to be vigorous appraisal of the fate of pollutants at several levels, beginning with global overviews, and proceeding to appraisals within individual ecosystems which span the range of environments to be found within the United States and its territories, including its territorial waters.

SPECIFICITY OF RESEARCH AND REGULATION

Issue 8

Ecosystems should be characterized in sufficient detail to accommodate regional variation in the potential impacts of pollution.

Summary

Effective regulation of pollutants requires appraisals of the toxicity, transport, transfer - mation, and ultimate degradation of pollutants. All of these, particularly transport, transformation, and degradation, respond to variations in the properties of both the pollutants and the recipient ecosystems. Both of these sources of variation have received attention, but EPA has disproportionately emphasized pollutant-specific phenomena. The resulting regulations have not accommodated regional variations and have lowered the credibility of controls even where they are fully appropriate. Variation in the sensitivity of environments can be accommodated into regulations by increasing the specificity of the circumstances under which controls are required. A significant step in this direction could be achieved by increasing the specificity of the environmental distinctions already made in the EPA's regulations, such as discriminating between major lake types as opposed to merely discriminating between streams and lakes. Such distinctions are present in the EPA's research reports, but they do not carry into regulations nor does there appear to be a systematic attempt to explore the range of environmental sensitivities before regulations are formulated.

The selection of environments which are studied appears to be based wholly on con-

veniences of study, economic importance, and maximum sensitivity. These are necessary but not sufficient criteria.

Questions

1. What steps has the EPA taken toward the development of a comprehensive and detailed taxonomy of ecosystems?

2. How does ORD select ecosystems for study? How does ORD plan to extrapolate results from the limited number of ecosystems which it can study to the varied ecosystems which it cannot study?

3. What procedures are used to inventory regional problems and establish priorities for research? What are examples of regional research funded under these procedures?

4. To what extent does criteria setting depend on characterization of the environmental context in which the regulations will be applied? Would this activity benefit from an expanded effort in integration/characterization studies?

5. What efforts are made to use regional problems (for example, high ultraviolet radiation and high CO levels along the front range of the Rockies or air pollution in the Los Angeles basin) to anticipate effects of potential national problems or to determine long-term sensitivity of human populations to some pollutants?

6. Given that the need for rapid action and the paucity of appropriate data bases may often limit EPA's ability to set very specific standards initially, what procedures might ORD and the regulatory arm of EPA jointly institute to allow periodic refinement of regulations as research progresses?

Background

Primary standards are designed to protect human health from direct effects of pollutants. As such, they are designed for a single target orgna n ism (i .e., humans) and national standards for exposure to pollutants are appropriate. H owever, the persistence of pollutants in the natural environment and the rate of their dispersal vary regionally. Consequently, the hazards to humans associated with a given release of a pollutant vary with time and place. Regulations regarding the release of criteria pollutants should also reflect these variations if they are to adequately protect the public without excessive use of controls. In practice, this means that EPA's research and regulatory arms must use a taxonomy of ecosystems more detailed than is exemplified, for example, in the regulatory division of fresh waters into lakes and streams, so that both research and regulation can be tailored to the great diversity of landscapes present in the United States and its Trust Territories.

The same arguments apply to secondary standards, which are designed to protect human welfare from indirect effects of pollut - ants upon ecosystems which suppor or affect humans in the broadest sense. Adequate appraisals of the potential for such impacts require a discrimination among ecosystem types at least as detailed as that implied by the distinctions between coniferous and deciduous forests in the health and environmental effects section of the research Plan, preferably more so,

Recommendation of use of a detailed taxonomy of ecosystems is not meant to imply each ecosystem type be examined. Rather, usage of a richly detailed conceptual framework is recommended as a means for tuning the regulatory system and extrapolating research results. Nor is it meant to imply that adjustment of standards should be only in the direction of relaxation. Indeed, care must be taken to avoid errors arising from overrelaxa - tion of standards when there is a possibility of direct or indirect impact on more sensitive ecosystems. To avoid this, effects should be appraised. at levels o f biological organization above and below the one of regulatory interest. For example, regulation designed for secondary standards requires ecosystem-level research, and should consider effects at the biosphere and population levels of biological organization to obtain an adequate perspective on the context in which regulations are to operate. A sufficiently broad approach is required to avoid value judgments based on a

limited view of the significance of natural ecosystems, such as their utility as sources of timber and food, while other values such as recreation are overlooked.

ALASKA ENVIRONMENTAL IMPACTS

Issue 9

Is the involvement of EPA/ORD in Alaska sufficient to safeguard the environmental quality of this large and diverse State?

Summary

Alaska is unique among the 50 States because much of its vast area lies within arctic and subarctic ecosystems which have experienced virtually no human impact in the past. The scene is now changing rapidly. Federal lands are being apportioned to natives, to the State, and to the multiple Federal designations as a result of the Alaska Native Claims Settlement Act, the Statehood Act, and subsequent legislation. Pressures for accelerated development of Alaska's energy and other resources are strong. EPA's responsibility in Alaska is exceptionally large because of the immense national interest in Alaska as a source of energy and other resources to meet national needs, because of the large share that all Americans hold in the extensive Federal lands in Alaska, and because of the high value many Americans place on Alaska's relatively undisturbed natural environment. The ORD research Plan, while enumerating the environmental studies being carried out by several agencies in Alaska, does not indicate that EPA is coordinating these efforts so the State's environmental research needs are met. (The same holds for similar environments in the northern part of the Great Lakes States and the northern Rockies.) In addition, there is need for followup studies on the environmental impacts of large development projects such as the Trans-Alaska Oil Pipeline. Such studies could serve as a basis for assessing the effectiveness of environmental impact evaluations made prior to the projects. Such studies coulld also assess the effect iveness of environmental stipulations governingi construction which resulted from the environmental impact evaluations.

Questions

1. Is research which has been initiated to assess the effects of spilled oil in the arctic marine environment sufficiently comprehensive to provide information on how a major oilspill would influence sea ice albedo, marine fish, mammals, birds, and invertebrates? The reference to such work in the Plan is quite vague.

2. Is EPA or the Department of Transportation monitoring the environmental effects of commercial polar flights which are now known to enter the stratosphere in the polar region ?

3. Does EPA's monitoring program include icefield sampling in Alaska to record long-term changes in fallout levels of industrial source pollutants as is being done in Greenland and Antarctica?

4. Are lichen plant communities, which are essential as winter range for caribou and reindeer, included in EPA's program to study pollution-sensitive vegetation types? (Early interests by NSF and the oil industry for support of this research have waned and no comprehensive studies have been initiated.)

5. What program exists to assess thoroughly the capacity of Alaska's rivers and streams to sustain the increased demands being placed on them as domestic water sources and effluent recipients due to the accelerated program to develop public water and sewage systems in rural Alaskan villages? What coordination exists with the Fish and Wildlife Service, the Corps of Engineers, and other agencies in this regard?

6. Is EPA accumulating data to anticipate the water and air pollution problems which will be associated with an expanded petrochemical industry in Alaska, assuming a trans-Alaska gas pipeline and liquefaction facility and additional oil and gas discoveries in Alaska?

7. What support could the EPA provide the State Department in the event of negotiations regarding trans-Canadian pipelines?

Background

Alaska's Outer Continental Shelf is considered to have an oil potential greater than that of any other State, yet the waters involved also support the largest commercial fishery harvest of all of our Continental Shelf areas. Oil and gas exploration and development on Alaska's Outer Continental Shelf should be conducted in concert with the collection and assessment of comprehensive marine, coastal, and estuarine ecological data. Such data are essential for setting guidelines to minimize the impacts on fisheries, marine mammal, sea bird, and other natural resource values.

The major anticipated environmental impacts associated with large-scale petroleum development in arctic Alaska apparently has been overlooked by EPA and other Federal agencies responsible for environmental protection. The Prudhoe Bay oil discovery, on State land, has attracted little Federal attention.

Since the initial environmental assessments necessary for the development of an environmental impact statement for the Trans-Alaska Oil Pipeline, the Federal Government has restricted its attention to pipeline surveillance during the construction period. The oil industry is preoccupied with the task of pipeline construction. The unique opportunity to carry out research on pipeline, road construction, and associated developments in northern environments has been largely overlooked. Several unexpected environmental problems have arisen as a result of pipeline construction and there is a need for research to assess their consequences, These include blowing road dust along the haul road which causes premature snowmelt—thereby exposing underlying vegetation and leading to concentrations of water fowl, caribou, and other wildlife—and $S0_2$ fallout from pumping stations on adjacent caribou lichen winter ranges.

Unanticipated widespread oil exploration and development on U.S. Naval Petroleum Reserve No. 4, and adjacent Federal lands and native selected lands, apparently falls outside the responsibilities of Federal research into environmental consequences of large-scale energy development, which is aimed at western oil-shale lands and the Outer Continental Shelf. Comprehensive environmental research in these arctic ecosystems is essential as a basis for prescribing guidelines for development activities. EPA should assume overview responsibility to insure that the needed information is being collected. These arctic and subarctic ecosystems are the basis for the subsistence economies of Eskimos, Indians, Aleuts, and many other Alaskans as well as supporting commercial harvests of renewable resources of great importance to Alaska and the Nation.

EPA's responsibility for coordinating environmental research also provides the incentive for development of a comprehensive system of information exchange with countries with similar northern ecosystems, associated problems, and experience in dealing with them. Full opportunity should be taken to use existing bilateral exchange agreements with the U.S.S.R. and to establish similar agreements where they do not exist with Canada, Denmark (Greenland), and Norway (Spitsbergen) to foster the exchange of information on problems of northern development. The international Man and the Biosphere Program (MAB) Project No. 6—Mountain and Tundra Systems—provides one such mechanism.

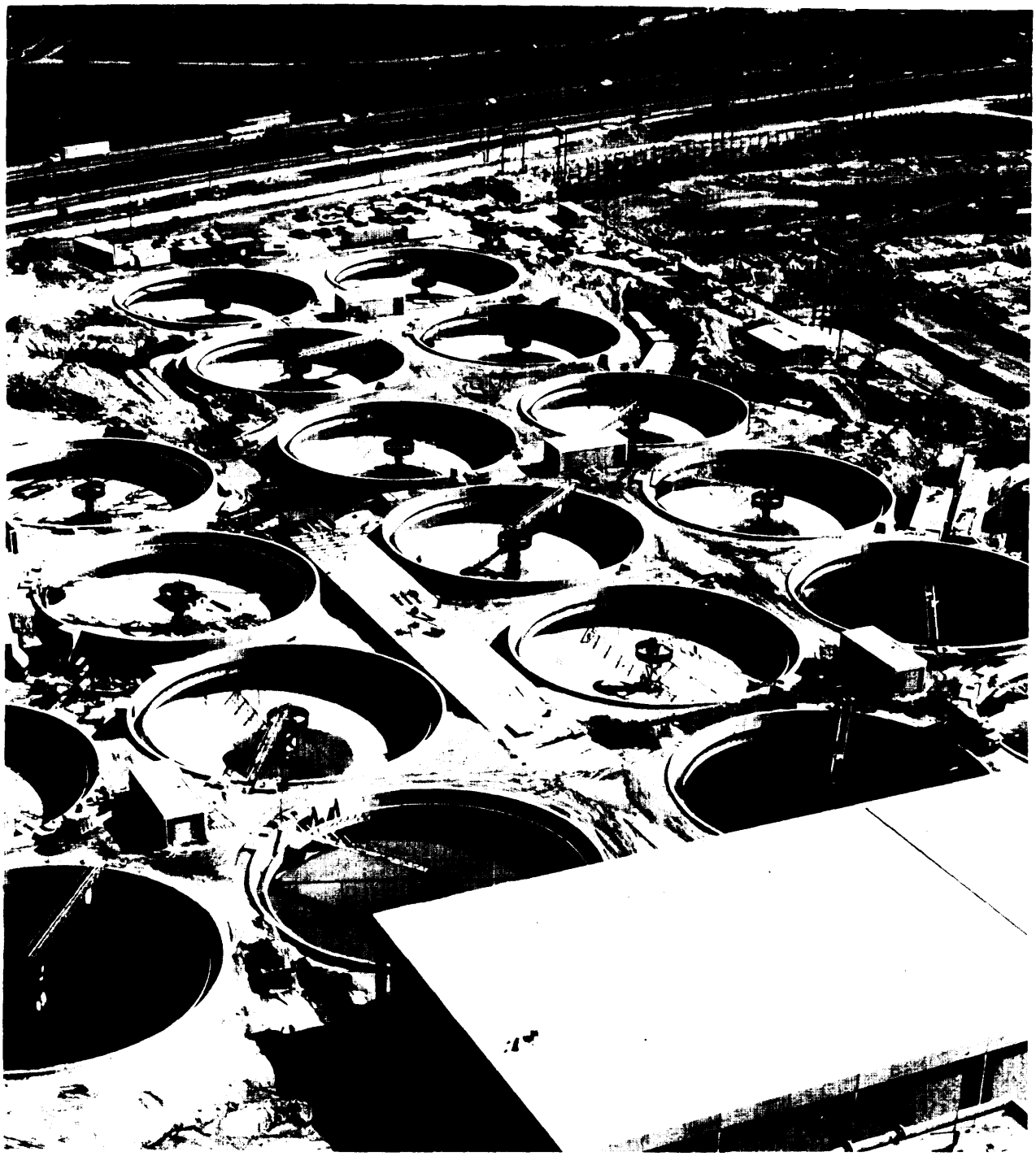
WATER TREATMENT AND FATE OF EFFLUENTS

Issue **10**

Expanded and redirected research into control of wastewater effluents and treatment of drinking water supplies is needed.

Summary

The EPA Plan expresses concern for the potential hazards to human health presented by



Sewage treatment plant, **Blue** Plains, Maryland

the growing amounts of wastewater and of water treatment byproducts entering the water system. There is reason for concern because today's wastewater effluent becomes tomorrow's water supply. And with growing demand, there is a movement toward shortcutting portions of the hydrologic cycle and so bypassing natural purification process. The ORD Plan lists research approaches and programs in this subject area primarily in general and nonspecific terms, without indicating priorities in terms of scale of effort or perceived magnitude of potential health risks. In constrast, emphasis is given to the potential

hazard of dispersion of viruses in aerosol form from irrigation with wastewater sludges. But this specific proposal is not matched, for example, by corresponding concern for the health effects of chemical toxicants from the same sources.

Many basic questions related to wastewater treatment and protection of water supplies remain unanswered, for example: the effectiveness of chlorine and ozone for virus inactivation, the effectiveness of removal of organic compounds, and the mechnisms for the transport and removal of viruses or carcinogens within aquifers. Proliferation of treatment plants and increased use of wastewater in irrigation, use of sludges in land treatment, and potential contamination of water for recreational use and drinking water supplies demand a direct and yet broad-based research effort. Balanced concern is needed across the full range of classes of agents: pathogenic micro-organisms (bacteria and viruses), and chemical toxicants (metals, pesticides, carcinogens, and other toxic substances) .

Questions

1. How effective are conventional wastewater treatment methods in removing toxic chemicals? Do removal processes add undesirable constituents?

2. How may constituents of particular concern, such as viruses and toxic chemicals, be carried from a wastewater source to a relatively nearby water source location?

3. How effective is inactivation of viruses using chlorine and conventional wastewater treatment methods? How do results compare with use of ozone and ultraviolet radiation? What is the extent of the research effort proposed in these areas?

4. What research is being done into the technology of removing organic compounds from drinking water?

5. How much is known about the types and extent of pollution of air, ground water and surface water supplies arising from sites used for sludge disposal ?

6. What research is being done to assess the effects of land disposal of sewage in place of secondary, not just tertiary, treatment of wastewater ?

Background

Under Public Law 93-523 (Safe Drinking Water Act) an increased effort is to be made to insure the safety of the Nation's drinking water supplies. To accomplish this, many new areas of research need development and a substantial commitment of resources must be made. One important reason for this growth in research need is that the quality of water supply is closely linked to wastewater treatment effectiveness. And since the time when standard methods of wastewater treatment were established, a great variety of new chemical contaminants (largely of industrial origin) have been introduced. The list includes toxic heavy metals such as mercury, carcinogenic materials such as asbestos fibers, highly persistent organic chemicals of high toxicity (including carcinogenic potential) such as polychlorinated biphenyls (PCB's), and the ever-increasing variety of pesticides.

In the past, it has generally been assumed that pollutants in wastewater will be diluted and dispersed when they reach large bodies of water. At this point all hazards to human health would be removed. This is not necessarily the case, however, particularly when growing demands for water dictate circumstances such as development of water recreation sites close upon wastewater disposal or sludge disposal locations. Both the transport and fate of potentially hazardous constituents, microbiological and chemical, must be thoroughly understood so that risk to the health of users in such instances can be controlled. This requires development of an augmented, balanced research program.

In addition, there still are basic research needs with respect to conventional water supply and treatment processes that have not yet been met. For example, the question of how standard disinfectants inactivate viruses, and whether or not the mechanism is similar to that of bacterial inactivation, needs to be

answered. Halogenated organics, found to be formed through use of chlorine during normal - disinfection practice, are suspected of being carcinogens. The present EPA research program to find alternate routes to disinfection appears inadequate.

A multiplicity of organic compounds has been found in the drinking water of several cities. The EPA is considering a standard for organics in drinking water. However, unless technology to achieve a standard is rapidly developed, States and local agencies may find themselves in the uncomfortable position of not being able to comply with the standard.

Pathogenic micro-organisms, bacteria and viruses, are present in raw sewage and constitute a threat to human health. These organisms can escape deactivation if the treatment processes are bypassed in times of flooding overloads. Both are likely to persist to some degree in sludges which are a result of treatment processes and may be used as a fertilizer or soil conditioner. Thus, a wide range of ways are open through which such microorganisms may persist (as in soil), may be taken up and even concentrated by living organisms, and may contaminate streams and rivers by runoff or percolation. Much more research remains to be done in this area.

RECREATIONAL WATER STANDARDS

Issue 11

Expanded research on the question of tolerable pathogenic concentrations in primary-contact recreational waters is desirable.

Summary

EPA's program to determine tolerable pathogenic concentrations that may occur without jeopardizing health of humans in primary recreational contact with marine waters is too limited, The program should be expanded and include consideration of viruses and other parasites. This need relates directly to the congressional mandate in Public Law 92–500 relative to recreation in and on the waters.

Questions

1. Is there a correlation between recreational water standards and hazards to human health? Is there a significant public health hazard associated with present standards for natural surface waters?

2. Has the question of deterioration of water quality resulting from bather loads in natural water bodies and impoundments been evaluated ?

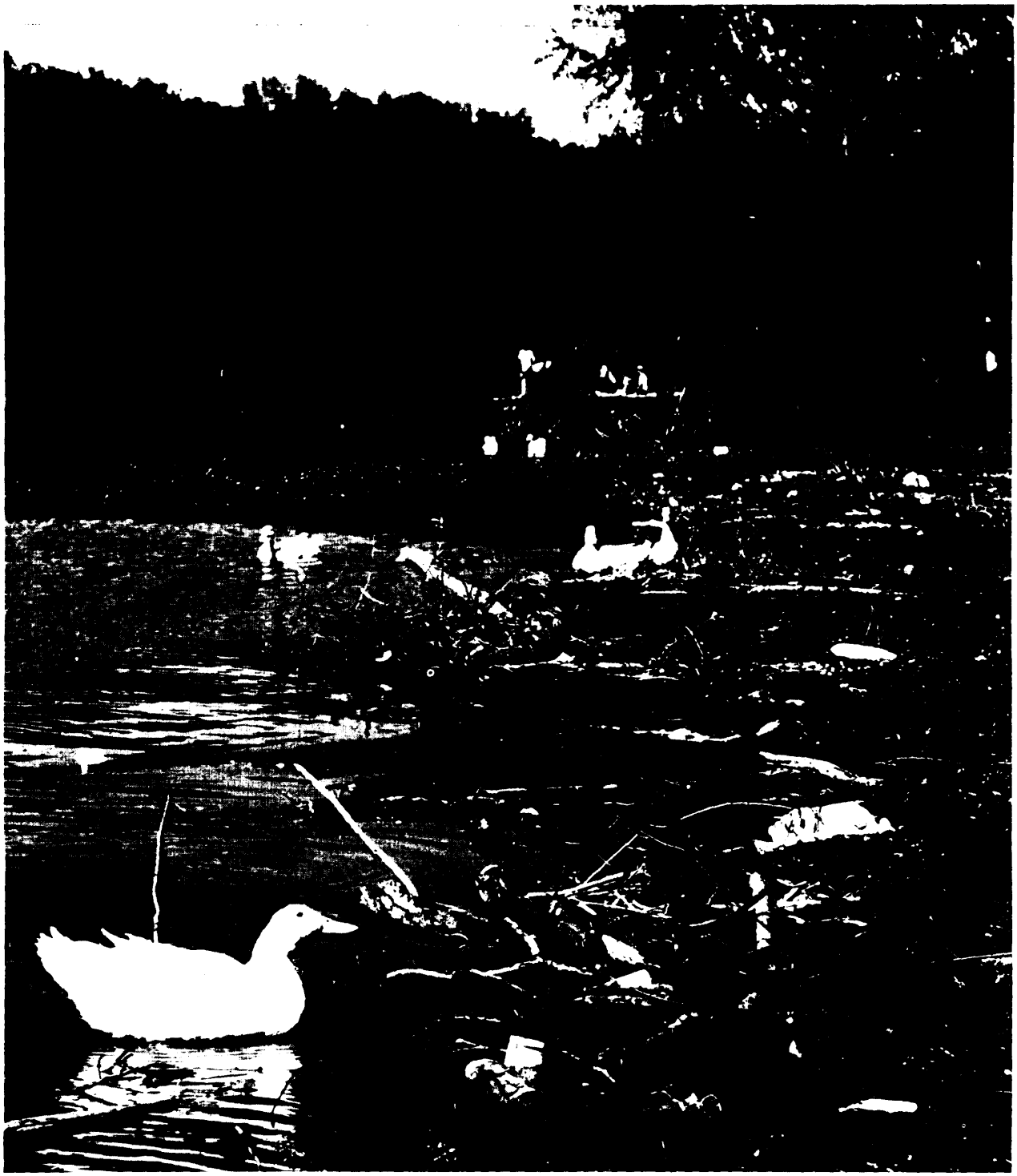
3. Are there pathogens of concern for which no standards have been set?

Background

Public Law 92-500 has had the effect of requiring the upgrading of many areas of surface waters to swimmable quality by 1983. The need to carefully study the human health hazards relating to this mandate is of utmost importance. The present standards for swimming in natural waters should be carefully examined and evaluated. The question of contamination of the waters by the bathers themselves should be examined, since there is evidence that a considerable pollution load comes from this source.

In many natural water, bodies, the water quality may appear satisfactory for swimming as long as there are no bathers, but may become unsatisfactory when there are bathers.

The common indices of water quality include counts of total and fecal coliform organisms. These have long been useful indicators of treated-water quality because chlorination adequate to protect health reduces coliform levels to very low values. However, many untreated waters may contain coliform organisms which have a soil or animal origin and may be in no way indicative of any important health risk. At the same time, tests for other bacteria and for viruses are not commonly included as a part of untreated-water quality determination. To show that this is not an academic distinction, recent research on the quality of natural waters used for recreation



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