United States
Environmental Protection
Agency

Office of
Public Awareness (A-107)
Washington DC 20460

Volume 7
Number 3
March 1981

# EPA JOURNAL

## Protecting the Oceans

Oil Tanker Wallowing in Rough Seas

# New Approaches to the Environment

*Norman B. Livermore Jr.*

Less confrontation and more cooperation between users and protectors of the environment is foreseen by the leader of the Reagan Transition Team for EPA.

Norman B. Livermore Jr., the former California Secretary for Resources during the eight years when Reagan was governor of that State, said that he anticipates there will be a more balanced approach to environmental problems.

"We must recognize," he stated, "that the environment includes other social concerns such as jobs, safety from crime, education and overall energy and economic development as well as the essential protection of the natural environment."

Unfortunately, Livermore, a former member of the board of directors of the Sierra Club and the National Audubon Society, continued "there have been many examples of over-zealous environmentalism. I can cite a number of cases in California where excess zeal has hurt the environmental movement.

"By pushing too hard in their arguments for expansion of Redwood National Park, environmentalists antagonized the forest products industry, the U.S. Forest Service, and the whole business community.

"In the case of the Mineral King proposal for a ski resort project (which environmentalists succeeded in killing), they antagonized the skiers, who will play a key role in the settlement of important California wilderness projects. Skiers are now quite hostile to environmentalists because of the over-zealous opposition to any development of Mineral King."

Livermore, now a retired businessman who was recently awarded a Sierra Club Conservation Award, submitted a report to the White House last December for the transition team he headed which disbanded after reviewing and making recommendations on EPA operations.

Discussing the future of EPA, Livermore, who emphasized that he was speaking unofficially, said that he anticipates that the Agency will continue to play a strong and responsible role despite cutbacks in operating funds and probable stretching out of the construction grants program.

On extending the construction grants program, Livermore noted that "it took us many decades to get as polluted as we are. So whether it takes three years or 10 to correct these undesirable conditions is, in my opinion, not that crucial."

He said he expects EPA to be streamlined and reorganized, in part. Livermore added that while he expects some additional delegation of authority by EPA to the States, he recognizes that there are "many pollution problems which cross State boundaries and thus can't be shoved off on the States."

Speaking about the Clean Air Act, which will be reviewed soon by Congress, Livermore said that he is "a very strong believer in wilderness and parks" and recognizes the need to preserve visibility from the encroachment of pollution in these areas.

Yet, he continued, on a ranch he owns with some members of his family in Northern California, he has to phone 100 miles

*continued on page 40*

## Transition, Task Force Members

Members of Livermore's Transition Team for EPA and the function performed by each were:

Christopher DeMuth, policy analysis, lecturer at the Harvard University Kennedy School of Government and Harvard Law School; also Director of the Harvard Faculty Project on Regulation; James McAvoy, Federal-State relations, Director, Ohio Environmental Protection Agency; Lou Cordia, budget analysis, Environmental Policy Analyst for the Heritage Foundation; Fred Khedouri, U.S. House of Representatives liaison, legislative director for former U.S. Rep. David Stockman who is now OMB Director; Nancy Maloley, U.S. Senate liaison, legislative assistant for Senator Richard Lugar of Indiana; W. Ernst Minor, personnel, former EPA Public Affairs Director for EPA laboratories in Cincinnati and Reagan-Bush campaign official; Robert T. Herbolsheimer, administrative assistant, environmental lawyer and Congressional campaign manager; George Van Cleve, House relations, Legislative Director for Congressman Richard Cheney.

The Transition Team completed its review of EPA operations and submitted a report and recommendations to the White House in December.

In addition to the Transition Team, President Reagan also appointed an Environmental Task Force which dealt with broad environmental policy. Along with Livermore, this group, which submitted its report to the White House in mid-November, included among its members:

Dan Lufkin, former Commissioner of the Connecticut Department of Environmental Protection; John Busterud, former member of the Council on Environmental Quality; Henry Diamond, former Commissioner of the New York Environmental Conservation Department; Nathaniel Reed, Director of the National Audubon Society and former Assistant Secretary of the U.S. Department of the Interior; William Ruckelshaus, former Administrator of EPA; and Russell E. Train, former Administrator of EPA, Undersecretary of the Interior, and Chairman of the Council on Environmental Quality. □

United States
Environmental Protection
Agency

Office of
Public Awareness (A-107)
Washington DC 20460

Volume 7
Number 3
March 1981

# EPA JOURNAL

**Walter C. Barber,** Acting Administrator
**Charles D. Pierce,** Editor
**Truman Temple,** Associate Editor
**John Heritage,** Managing Editor

EPA is charged by Congress to protect the Nation's land, air and water systems. Under a mandate of national environmental laws focused on air and water quality, solid waste management and the control of toxic substances, pesticides, noise and radiation, the Agency strives to formulate and implement actions which lead to a compatible balance between human activities and the ability of natural systems to support and nurture life.

02663078

## Articles



## Departments



Front cover: Oil tanker crashes through heavy seas, an example of one of the perils in the mounting transportation of petroleum on ocean waters. (Article on p. 2)

Photo credits: Leo Touchet, The Photo Circle, Inc.; Cecil W. Stoughton, U.S. Department of the Interior; National Oceanographic and Atmospheric Administration; U.S. Coast Guard; M. Woodbridge Williams, Ralph Anderson, Richard Frear, National Park Service; Soil Conservation Service, U.S. Department of Agriculture; Steven Foss, James Patrick, EPA's Gulf Breeze Environmental Research Laboratory; U.S. Travel Service; The Cousteau Society; EPA's Environmental Monitoring Systems Laboratory, Las Vegas, Nev.; F. Mattioli, U.N. Food and Agriculture Organization; Bob Wands; Paul Sequeira, and John Messina.

Design Credits: Robert Flanagan, Donna Kazaniwsky and Ron Farrah.

The EPA Journal is published monthly, with combined issues July-August and November December, by the U S Environmental Protection Agency Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget

Views expressed by authors do not necessarily reflect EPA policy Contributions and inquiries should be addressed to the Editor (A-107), Waterside Mall, 401 M St , S W. Washington, D C 20460 No permission necessary to reproduce contents except copyrighted photos and other materials. Subscription $12 00 a year, $1.20 for single copy, domestic; $15 00 if mailed to a foreign address No charge to employees Send check or money order to Superintendent of Documents, U S Government Printing Office Washington D C 20402

Text printed on recycled paper.

nt Reyes National Seashore, Calif.

# Law of the Sea

By Elliot L. Richardson

Lake Erie must at one time have seemed far too vast to be affected by man's pollution. Yet everyone is now aware of the harm which has resulted from man's discharge of wastes into this body of water. Many believe that the oceans are too vast to be affected by man's pollution. However, unlike Lake Erie where abatement efforts are aiding natural restoration, the oceans may be too vast to be restored if we wait for precise determinations of the impact of man's pollution on them. All steps must be taken now to curb pollution of the marine environment.

Pollution of the oceans comes from several sources. The primary one is pollution from land-based sources directly into the oceans or into streams and rivers which flow into the ocean. Roughly 85 percent of marine pollution emanates from sources on land. Other sources include dumping of man's wastes into the oceans, the atmospheric transport of pollution from land into the sea, natural seepage of oil from the seabed, and pollution resulting from the recovery of oil from the continental shelf. The remaining source of pollution, and the one which attracts the most attention, is pollution from vessels at sea, particularly the large oil tankers which now and again cause disastrous pollution. The wreck of the 233,000 ton *Amoco Cadiz* off the French coast of Brittany in March of 1978 is a recent and spectacular example.

The Law of the Sea Treaty now in the final stage of development by the Third United Nations Conference on the Law of the Sea addresses each of these sources of pollution. It is to be an "umbrella treaty" which provides a general legal framework defining the rights and duties of countries with respect to the oceans rather than merely a technical convention designed to spell out specific rules and standards such as tanker construction requirements. Adoption of the treaty will contribute an important step in protecting the marine environment from man's pollution. One of its more important features, as I will point out more specifically later in this article, is that it would incorporate by reference a wide variety of other treaties.

## Land-Based Sources

Land-based pollutants include riverborne substances from domestic sewage, industrial waste and agricultural run-off, airborne pollutants such as vaporized hydrocarbons, and direct discharges of sewage and other wastes from coastal communities. With regard to petroleum, for example, land-based sources account for an estimated 50 to 90 percent of the estimated total of 2 to 5 million metric tons of oil which enter the oceans annually.

The U.N. Conference on Human Environment held in Stockholm in 1972 represented the first major effort by the international community to come to grips with the question of land-based sources of pollution. This conference, however, was not a treaty-drafting conference but rather attempted to identify the problem and to establish institutional arrangements for dealing with it.

One of the significant outcomes of the Stockholm Conference was the creation of the United Nations Environment Program (UNEP) headquarters in Kenya. UNEP's efforts include alerting countries to the harm to their own interests which results from land-based pollution of the marine environment and encouraging regional action to control such pollution. The recently-concluded Barcelona Convention for the Protection of the Mediterranean Ocean is a good example of UNEP's constructive efforts in this area. However, this is a regional agreement and is severely limited in substantive scope.

The Law of the Sea negotiating text also addresses in treaty language the question of land-based pollution. The text imposes a positive legal duty on all states to establish national laws and regulations to prevent, reduce, and control harmful discharges originating in their land territory. Specifically mentioned sources include rivers, estuaries, pipelines, and outfall structures. The text also calls on states to convene a separate conference for the purpose of establishing global and regional rules and standards to prevent pollution from land-based sources. Finally, the text requires states to enforce their laws in regard to land-based pollution and to adopt the necessary legislative, administrative, and other measures necessary to implement future international rules and standards. Although this is the first multilateral treaty to contain provisions of this type, more far-reaching provisions were blocked, partly by developing countries concerned that stringent controls on pollution might hamper their development and partly by other nations sensitive to possible infringement of "sovereignty."

## Pollution from Seabed Activities

Such activities account for only a small percentage of total marine pollution. For example, it is estimated that oil development, the predominant seabed resource activity, produces less than two percent of the oil pollution that enters the world's oceans. However, the localized effects of such activities can be dramatic and devastating. The Santa Barbara incident of several years ago and the recent Mexican blowout vividly bring home the potentially harmful consequences of uncontrolled or accidental discharges from oil exploitation on the continental shelf.

The text developed by the Law of the Sea Conference reflects the international attention which has been focused on pollution from seabed activities. It calls on all states to ensure that their domestic standards for exploitation on their continental margin are no less effective than the international standards. Unfortunately, there are no such international rules and standards at the present time. Recognizing this, the Law of the Sea treaty text calls upon states acting through a diplomatic conference to establish such international standards to ensure that seabed activities do not give rise to pollution of the marine environment.

The text also addresses pollution emanating from the other exploitation activities conducted on the deep ocean

floor like the mining of manganese nodules. It requires states to apply domestic standards that are no less effective than the environmental standards developed internationally through the international organization being created to govern the exploitation of these seabed resources. Further, the text makes clear that states may impose on ships flying their flag seabed mining regulations more stringent than those imposed by the Authority. This is particularly important for the United States, since our companies, along with those of a few other industrialized states, enjoy a significant lead in seabed mining technology. The major problem for international organizations and individual states has been the development of an adequate body of scientific knowledge regarding the effects of seabed mining upon which to base intelligent environmental rules and regulations.

## Dumping

The practice of dumping wastes in containers and sometimes without containers into the open ocean has been going on for many decades. However, the high toxicity of some of the wastes which have been dumped and the increased understanding of the harmful consequences of some past dumping practices have led to international efforts to regulate and control these activities. The first international conference on dumping, convened in London in 1972, resulted in a convention now in force which restricts and limits the dumping that can be conducted by signatories to that treaty. It contains detailed annexes which specify those substances which cannot be dumped and those substances which may be dumped only in accordance with special precautionary measures. The Law of the Sea text requires all states to establish dumping laws at least as effective as these global standards. This provision will make the London Dumping Convention standards applicable to all states which ratify the sea treaty whether or not they have ratified the London Dumping Convention itself.

## Pollution through the Atmosphere

Evidence of DDT found in the ice sheet covering Antarctica has convinced even the most doubting skeptics that toxic substances are being distributed by the atmosphere throughout the world not only on the ice sheet of Antarctica but also into the world's oceans. Airborne pollution of fresh-water lakes in North America and in Europe is generating increasing controversy. Thus far, however, little international progress has been made on this complex question. It is difficult to write acceptable standards which limit activities within the borders of one country in such a manner as to ensure that those activities do not adversely affect the citizens of a neighboring country. The global concern about fluorocarbons' possible effects upon the ozone layer dramatically illustrates that the atmosphere upon which all depend is a global resource. Atmospheric loading of carbon dioxide from the combustion of fossil fuel, with potentially critical implications for global climate patterns, is another case in point. The interaction between the atmosphere and the ocean often results in transfer of these airborne pollutants to the ocean. The Law of the Sea treaty as an umbrella treaty does not contain detailed provisions on airborne pollution. However, countries are required to establish regulations to reduce and eliminate pollution of the marine environment from and through the atmosphere.

## Pollution from Vessels

Pollution from vessels is dealt with in considerable detail in the Law of the Sea treaty. The detail results from the fact that this source of pollution has long been a subject of international regulation and the fact that the use of the oceans for navigation remains one of the treaty's principal objects. The Law of the Sea text strives to balance the need for protection of the ocean from vessel pollution and the need to ensure that this important avenue of commerce is not foreclosed by the abusive exercise of rights by foreign states.

Pollution, particularly oil pollution from vessels, results from accidental discharges such as the *Amoco Cadiz* disaster or from operational discharges. Accidents are caused by navigational errors, improper equipment, poor training of the crew, and a myriad of other possibilities related to the construction, design, equipment, or manning of a vessel or its operation. Operational discharges often are for the convenience of the vessel operator to the detriment of the marine environment and the coastal state. These discharges result from pumping waste out of the ship's bilges, cleaning tanks which have been used to carry products such as crude oil, or deballasting. International efforts in the International Maritime Consultation Organization have created a complex matrix of standards to reduce the discharge of oil through operational discharges and to seek to prevent discharges of oil from maritime accidents or casualties. The Law of the Sea text does not seek to displace these standards but rather to build upon them by addressing jurisdictional questions whose resolution is necessary for their effective implementation and enforcement.

The treaty apportions jurisdiction to deal with vessel source pollution between those states—coastal states—likely to be most affected by it and best capable of dealing with it, the state in which the vessel is registered, and the states to whose ports the vessel is bound. Historically, it was felt that the state in which a ship is registered should be the one to assure its seaworthiness and the competence of its crew. However, many states—those which "provide flags of convenience"—have not fully lived up to their obligations in this regard. Thus the treaty imposes requirements on flag states more stringent than in any previous multilateral treaty. Flag states are obligated to ensure effective compliance with all applicable international rules and standards and their own national pollution laws irrespective of where the violation occurs. They must ensure that vessels flying their flag do not leave port unless the vessels are in compliance with all applicable international standards including those relating to the design, construction, equipment, and manning of vessels. The draft also sets forth requirements regarding the certificates vessels must carry to show compliance with international standards and obligates flag states to perform periodic inspections to assure that the condition of the vessels is in conformity with these certificates. Finally, flag states are required to investigate and prosecute properly documented violations occurring anywhere in the world.

Historically, some flag states have argued that certain international standards are not applicable to them because they have not ratified the convention under which the particular standard is promulgated. The Law of the Sea treaty attempts to solve this problem by elaborating coastal state standard-setting and enforcement competence for the most serious pollution problem—operational discharges. In its territorial sea (12 miles under the treaty), a coastal state may establish and enforce pollution laws and regulations more stringent than international standards so long as such laws do not hamper the traditional navigational right of "innocent passage"—the right to pass peacefully through a territorial sea. For example, a coastal state may prohibit the discharge of any oil in its territorial sea and may establish insurance and liability requirements at any level it deems necessary to assure adequate compensation in case of a major pollution incident. It may also establish laws necessary for the safety of navigation and the regulation of marine traffic. Beyond 12 miles, the international standards for discharges would continue to apply.

The Law of the Sea Conference limited the coastal state right to set standards

concerning the design, construction, manning and equipment of vessels traversing its territorial sea because it felt the potential multiplicity of regulations in these traditional shipping routes would place an undue burden on international commerce. Standards on these subjects would still be established by the Inter-Governmental Maritime Consultative Organization.

However, the treaty confirms the right of all states under existing law to set such standards for vessels entering their ports. For example, the United States has enacted port entry regulations regarding the design, construction, manning and equipment of vessels that far exceed existing international standards. It seems to me legitimate for coastal states, with due regard for the need to avoid undue burdens on international commerce, through exercise of their own jurisdiction over ships in their ports, to exercise pressure for the strengthening of international standards.

Beyond the territorial sea the treaty creates a new zone of jurisdiction called the "exclusive economic zone." In this area, which extends to a distance of 200 miles from shore, the coastal state will have rights over all living and non-living resources. Traditionally this area has been considered high seas, and coastal states had no jurisdiction over vessels with regard to the prevention of pollution. However, because of the potentially serious risk to the resources of the zone, the coastal state will be allowed to take legal proceedings in cases of serious violation of international discharge standards that cause or threaten major damage.

One of the more innovative features of the Law of the Sea text, and perhaps its greatest contribution to the effort to control vessel-source pollution, is a new jurisdictional concept in international law. The treaty gives a state the right to take action against a vessel voluntarily within its ports for any violation of international rules and standards. The port state can take legal action against the vessel for violations occurring not only within its own territorial sea and economic zone but anywhere in the ocean. This concept of universal port-state jurisdiction is important for several reasons. First, vessel-source pollution is a global problem not capable of solution solely by action of the jurisdiction where the pollution occurs. Even if a state could eliminate pollution within its own economic zone by effective standards and enforcement measures, it could not protect itself from discharges occurring just beyond its zone that are carried landward by winds and currents. Further, unilateral standards applicable only within a limited zone do nothing to protect the oceans as a whole from pollution. It is axiomatic that each state suffers to the extent that the

*Lighthouse at Cape Hatteras National Seashore, N.C.*

overall water quality of the marine environment is degraded. Thus, states not affected by individual pollution incidents within their own jurisdictions will nevertheless suffer over time the effects of discharges occurring in other parts of the ocean.

Recent international conventions established through the Inter-Governmental Maritime Consultative Organization prohibit any discharges of oil by tankers within 50 miles of land and beyond 50 miles set rigid standards regarding the amount of oil which can be discharged per mile (60 liters) and on the total amount of oil that can be discharged (1/30,000 of the total quantity of the cargo). They also establish higher standards for design, construction and equipment of new vessels and for the retrofit of many existing vessels.

The port-state system set forth in the treaty provides an efficient means of enforcing these standards. At one time or another most tankers call at the ports of the United States, Japan, and Western European countries. If these states acting in concert were strictly to enforce these standards, they would have a significant impact in reducing operational discharges of oil throughout the world.

A final contribution of the Law of the Sea Conference is the inclusion of compulsory third-party dispute settlement procedures to deal with environmental disputes. Such procedures will allow a body of "case law" to be gradually built up that will give more precise meaning to the previously mentioned environmental obligations. This body of law can become an effective means of bringing internal and external pressure on a foreign state to meet its environmental obligations. The threat of suit in and of itself can be a significant restraint. In addition, dispute settlement procedures can play a major role in reducing the serious international friction that may arise where significant economic interests are at stake. The treaty provides the first global agreement on compulsory third-party dispute settlement of broad environmental issues.

## Conclusion

While there are a host of other provisions dealing with the question of pollution of the marine environment, these are among the most important. The Inter-Governmental Maritime Consultative Organization is left with the role that it has been filling with increased responsibility in recent years—that of establishing international standards for the construction, design, equipment, and manning of vessels. The international organization continues to set standards for discharges beyond the territorial sea. The Law of the Sea treaty as an umbrella establishes basic jurisdictional rights and duties which the organization cannot address.

For a country such as the United States, whose ports are entered by 95 percent of the vessels appearing off its coast, the power to set construction, design, equipment, and manning standards as a condition for port entry remains an effective tool for preventing pollution of the marine environment. Similarly, the enforcement provisions of the Law of the Sea treaty, which give the broadest role to the port state, a strong role to the coastal state in the territorial sea and a more limited role to the coastal state in the economic zone, represent a creative accommodation. The oceans are protected from pollution, while at the same time navigational freedoms are also protected.

For all these reasons the Law of the Sea treaty, once in effect, will represent an important step in the worldwide effort to prevent and control pollution of the marine environment of the world's oceans. When combined with future international efforts addressing the complex issue of land-based pollution, the Law of the Sea treaty should materially contribute to protecting the world ocean from the fate that once befell Lake Erie. □

*Mr. Richardson was until recently the President's Special Representative for the Law of the Sea Conference. He is now the Senior Resident Partner in the Washington law office of Milbank, Tweed, Hadley, and McCloy. He has held several cabinet level positions.*

*A. The tanker Torrey Canyon, grounded on shoals off the southwestern coast of Great Britain on March 16, 1967, lost 36 million gallons of crude oil. Further environmental damage was caused by attempts to clean up the oil chemically with untested detergents.*

*B. On March 3, 1968, the Ocean Eagle ran aground while carrying 5.7 million gallons of crude from Venezuela to San Juan, Puerto Rico. The ship dumped two million gallons of oil into the San Juan Harbor.*

*C. A Shell oil rig in the Gulf of Mexico ten miles off the coast of Louisiana burst into nearly uncontrollable flames following an explosion on Dec. 4, 1970.*

*D. Dec. 15, 1976, the SS Argo Merchant, a Liberian tanker carrying over seven million gallons of heavy fuel oil, ran aground off the coast of Nantucket Island, Mass., and spilled huge amounts of oil. Coast Guard units staged an unsuccessful six-day fight to save the vessel, which was broken in half by powerful currents and high winds.*

C

# Major Oil Spills

A

A striking rise in the amount of oil spilled on the seas over the past decade reached an all-time high in 1979, with 328 million gallons pouring into the oceans from tanker spills. This increase can be attributed in part to growth in oil tanker capacities.

Although much publicized, ocean spills actually represent a relatively small percentage of the total 1.8 billion gallons of petroleum discharged yearly into the ocean. (Other sources include operational discharges from ships, river runoff, atmospheric rainout, and natural seepage.) But the public spotlight focused on the dramatic tanker spills emphasizes the vulnerability of the world's oceans and the delicate environmental balance in which the seas play a vital role.

B

D

*E. In March, 1978, the tanker Amoco Cadiz spilled more than 66 million gallons of oil when it ran aground in the Atlantic off the Brittany Coast of France.*

*F. Workmen pump oily water from French shores following the 1978 Amoco Cadiz spill.*

E

F

# Initiatives to Protect the Seas

By Alan Sielen

In the past decade the world community has come together at an unprecedented pace to seek solutions to the problems of protecting our planet's natural environment. This is particularly evident with respect to protecting that two-thirds of the earth's surface covered by oceans. United States leadership has contributed immensely to this phenomenon, and, in turn, EPA has played a large part in U.S. efforts.

The Environmental Protection Agency has been deeply involved in several international initiatives to advance our Nation's far-reaching interests in the seas. The Agency provides expertise to the Department of State and other Federal agencies for negotiations on a number of salt-water issues related to ocean dumping, vessel pollution, the law of the sea, and Antarctic resources.

The Agency's largest involvement is in the area of ocean dumping. As lead agency in the Federal Government for implementing the 1972 London Dumping Convention, EPA chairs United States delegations to negotiations held pursuant to the Convention, and provides most of the scientific and policy support for such deliberations.

The London Convention is the chief global mechanism for regulating the deliberate disposal of wastes at sea. The Convention entered into force in 1975, and 46 countries have now ratified or acceeded to it including most of the major industrialized nations. Conceptually, the Convention is similar to our domestic ocean dumping law—extending many of that law's features to the international level. Prospective dumpers are required to obtain a permit from the relevant national authority in their country. There is a list of particularly harmful substances which may not be dumped such as organohalogens, high level radioactive wastes, certain heavy metals, and chemical or biological warfare agents. There is another list of substances requiring "special care" before dumping, and a set of environmental criteria to be considered by the national authority when issuing a permit.

Since 1975, the Convention Contracting Parties have reached agreement on a number of regulations and other measures needed to effectively carry out the objectives of the Convention. Mandatory regulations are now in force to control the innovative technology of incinerating hazardous chemicals at sea. Similarly, several measures have been adopted to tighten controls on the sea disposal of low-level radioactive wastes. Also, bioassay tests pioneered in the U.S. for determining the effect of pollutants on marine life are now required under the Convention.

Recently, there has been special attention focused on the problem of ocean dumping of nuclear wastes. Although the U.S. does not now dump nuclear wastes, we have been in the forefront of much international work to strictly control their disposal at sea. Through the International Atomic Energy Agency and the Organization for Economic Cooperation and Development's Nuclear Energy Agency, the U.S. has helped develop environmental assessment and monitoring requirements which will steadily inject a greater degree of accountability into this practice.

A second area of international environmental cooperation is vessel safety and pollution prevention. With a world fleet of nearly 7,000 tankers transporting almost two billion tons of oil each year, potential costs in terms of human life, environmental damage, and economic loss are a fact of life at sea.

*Shorebirds wheeling over an ocean beach.*

The well publicized wrecks of the *Torrey Canyon, Amoco Cadiz* and *Argo Merchant* are just a few examples of the risks attending the transport of oil and other hazardous chemicals by sea. Accidents often occur near shore where valuable estuarine and coastal areas are particularly vulnerable to damage. More important in terms of volume are the discharges of oil from routine vessel operations such as tank cleaning and deballasting.

Fortunately, the international maritime community is taking steps to prevent ship pollution and to further protect human life. During the past 25 years, a number of international treaties have been negotiated under the auspices of the Intergovernmental Maritime Consultative Organization (IMCO)—a specialized agency of the United Nations—to remedy problems of tanker safety and pollution prevention. The most significant of these agreements were concluded in 1978 largely as a result of the President's call for a total revamping of United States and global rules governing the design, construction, operation, equipment and manning of tankers.

These agreements, the Safety of Life at Sea and Marine Pollution Protocols of 1978, upgrade previous international regulations and establish a comprehensive set of safety and pollution prevention requirements for new and existing ships. The Marine Pollution Protocol strictly limits the amount of oil which may be discharged at sea, and contains effective operation and design requirements for washing of crude oil from cargo tanks, and segregated ballast —the placement of cargo and ballast in separate tanks. Moreover, to prevent loss of oil from accidents, new tankers will be required to place ballast tanks in protective locations on the side or bottom of the ship to cushion cargo tanks in the event of a grounding or collision.

These and many other features found in the 1978 Protocols can significantly reduce vessel pollution if conscientiously applied. In the past, maritime nations have been exceedingly slow in ratifying the various IMCO agreements, thus often delaying their entry into force for several years. There is hope, however, that this unfortunate pattern is now being broken. Several nations, including the United States, have already ratified the 1978 Protocols and it appears that these agreements stand a good chance of entering into force soon.

The many jurisdictional questions dealing with the rights and duties of nations to set and enforce environmental rules are not fully addressed in the treaties on dumping and tankers. Rather, it was felt that such legal issues would be best dealt with in the broader context of the Third United Nations Conference on the Law of the Sea whose mandate is to produce a comprehensive agreement on all aspects of ocean use and management—a virtual constitution for the seas. The Conference has produced a Draft Convention on the Law of the Sea, and is expected to adopt a final agreement later this year.

As Elliot Richardson discusses in detail elsewhere in this publication, the Law of the Sea Conference has taken enormous strides in creating a new environmental order for the oceans. The present Draft Convention deals in a comprehensive fashion with matters dealt with fleetingly, or not at all, in previous conventional international law. It answers basic questions on the distribution and exercise of authority in various areas of ocean space such as ports, territorial seas, 200-mile economic zones, and the high seas. It tells us how far seaward, and under what conditions, States can apply national and international regulations for the control of specific sources of ocean pollution. New environmental obligations are also created. States must develop contingency plans for responding to spills, monitor the effects of pollution, and assess activities for potential impact on the marine environment. Other measures also point to a greater degree of environmental accountability for marine activities: requirements to comply wtih international environmental rules; compulsory procedures for settling disputes; and obligations regarding liability and compensation for harm to the oceans.

Another focus of international attention is Antarctica. Recently, this interest has centered on the resource potential—both living and mineral—of Antarctica and the Southern Ocean. The United States is one of thirteen countries party to the Antarctic Treaty. (The others are Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, Poland, South Africa, Soviet Union, United Kingdom). Primarily, the treaty ensures that Antarctica will be used only for peaceful purposes; it encourages research in the area; and "freezes" the status-quo on territorial claims, while preserving the right to disagree on the recognition of such claims. So far, the Treaty has operated as something of a model of cooperation. With recent interest in the resource potential of Antarctica, however, new stresses will be placed on the treaty system including pressures from nations outside the exclusive orbit of the thirteen.

Antarctica is rich in marine life including fish, krill, squid, birds, seals, and whales. Krill—a small shrimp-like crustacean—is an essential element of the Antarctic foodchain, serving, for example, as the main source of food for whales of the Southern Ocean. Krill may also turn out to be a significant source of animal feed and food for humans.

The prospect of seriously depleting fish and krill stocks in Antarctica by overexploitation prompted Antarctic Treaty members to seek an agreement on conserving and managing the continent's marine living resources. Last year, treaty members concluded the Convention on Antarctic Marine Living Resources, which is open to all nations for signature. It is the first world fishery agreement to be based on ecosystem management principles. The scientific community must now get on with the research necessary to effectively carry out the objectives of the Convention.

The possibility of significant oil and gas deposits on the Antarctic continental shelf has also generated new interest in the southern continent. Antarctic Treaty members are now considering the negotiation of an Antarctic mineral resources regime. Important elements of a regime are a means for determining whether mineral exploration and exploitation—presently governed by a policy of "voluntary restraint"—should take place, and if so, where, and under what conditions. The fragile nature of the Antarctic ecosystem, the importance of Antarctica to the world environment, severe weather meaning extremely difficult working conditions, . . . and the lure of oil . . . all combine to make the Antarctic minerals risk-benefit equation a formidable challenge.

There has been real progress in protecting the earth's salt-water environment. But much remains to be done. Securing widespread acceptance, and effective implementation, of existing agreements must be the first priority. The difficult task of developing realistic strategies for the control of land-based sources of marine pollution—rivers, outfalls, atmospheric fallout—must be met head on. Work on rules to control new or as yet internationally unregulated sources of ocean pollution, such as offshore oil drilling, deep seabed mining and ocean thermal energy conversion must move forward.

Such prescriptive activities cannot exist in a scientific vacuum. Concerted national, regional and global efforts to study the impacts, fates and effects of pollutants on the marine environment are needed. This is particularly true with respect to some of the most harmful substances such as transuranic radionuclides, synthetic organic chemicals, heavy metals, and petroleum hydrocarbons. The duties of states to conduct environmental assessments and to monitor the effects of pollution are just now being recognized at the international level. This element of accountability has too long been missing from our collective psyches. General acceptance of these principles is revolutionizing our thinking on ocean use, and paving the way for a better future. □

*Alan Sielen is Special Representative for Marine Negotiations, Office of International Activities, EPA.*

# Managing the Coastal Environment

*Common tern rises from nest on Cape Cod, Mass.*

A handbook to help local officials and planners develop programs to protect and manage the Nation's coastal resources has been published by the Federal Government.

The guidebook, *Coastal Environmental Management: Guidelines For Conservation of Resources and Protection Against Storm Hazards*, was prepared by the Conservation Foundation for the Federal Insurance Administration, the Environmental Protection Agency, the President's Council on Environmental Quality, and several other Federal agencies.

The guidebook deals with such problems as beach erosion, wetlands conservation, saltwater intrusion into drinking water supplies, estuarine pollution, and the possibility of hurricane damage.

The guidelines proposed by the document are aimed at helping communities plan for sound development while conserving resources and protecting lives and property from natural hazards.

Traditionally, the guidebook notes, many coastal protecters and coastal developers have thought that conservation and development were at odds. But, the guidebook says, well-planned development generally adds to the prosperity of a coastal community, while bad development will, sooner or later, have a negative effect, including costs to the public in higher taxes to handle crowding and unplanned services.

Management techniques can serve multiple purposes, the guidebook notes. For example, setback requirements for beachfront building can save the nesting sites of turtles in sand dunes, and also protect beachfront homes from erosion and storm waves.

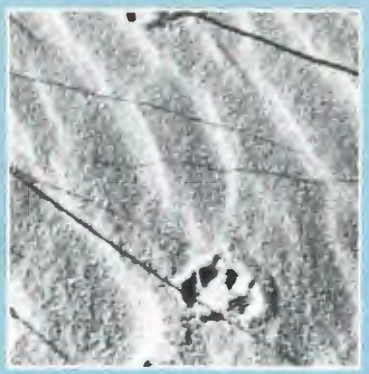
The guidebook offers a series of physical management policies which can help local managers tailor their coastal protection programs to match local needs and local environmental goals. The book also contains a description of relevant Federal and State programs.

Highlights of the coastal problems and proposed solutions as discussed by the guidebook follow:

## Beaches

While beaches serve as the main protective bulwark for property along the shores of oceans and large sounds, the guide emphasizes, they are fragile. If a community allows removal of sand, improper building, or blocking of sources of sand replenishment the beach may be severely damaged or destroyed, the handbook points out. For instance, Miami's once wide and beautiful beach has been reduced to fragments. The probable cost for repair is about $60 million tax dollars, the guidebook says.

The guidebook calls for community beach management programs to limit building, prevent excavation, and control inlet and beach protection structures. This would include locating all structures inland of the beach and encouraging effective restoration of seriously eroded beaches.



## Coastal Floodlands

Coastal floodlands are sporadically struck by storm waves and flooded by storm tides, with the most devastating effects produced by hurricanes. These floodlands attract many users, the guidebook notes—industry, commerce, recreational development, homes. They are often cleared, graded, filled, and built on without regard to their ecologic and hazard-resistant functions. The result includes increased danger to life and property from sea storms and hurricanes, and land subsidence.

To protect the floodlands, communities may need construction setbacks, provisions for elevation of homes and other structures, and restraints on excavation and groundwater pumping, the guidebook says. They may also need restraints on soil erosion, wetland alteration, and the modification of water courses.

## Dunelands

The guidebook explains that dunelands—the area of dunes, sand ridges, and flats between the beach and higher ground—are a unique natural habitat; they are also highly susceptible to storm damage.

The guidebook cautions that while the risk of building directly on the beach is obvious, the risk of building in the dunelands behind may not be so apparent. Active dunelands, like beaches, are uncertainly balanced between the erosive forces of storms and the restorative powers of tides, winds, and currents, making them a risky place in which to have a home.

The guidebook says dunelands need to be protected so they can continue to buffer the force of storm seas, store and provide sand to protect beaches and shorelands, and furnish valuable wildlife habitat.

Management needs for dunelands, the guidebook says, include setbacks, construction standards, excavation restraints, and traffic control. This includes prohibiting excavation and removal of active dunes and beach ridges and building all structures landward of active dunes.

## Banks and Bluffs

The banks and bluffs that border many coastal waters are attacked by currents and waves, which may cause slumping and sliding. Water seepage from above may further weaken their stability. As a result, bank and bluff tops can be hazardous sites for development, the handbook notes.

Many wildlife species breed and sometimes live in natural bank and bluff habitats.

To protect banks and bluffs and minimize hazards, the community will need to enforce construction setbacks and controls on such factors as water seepage and physical alteration, the guidebook says. Engineering techniques can be used to prevent damage and restore already damaged banks and bluffs.

## Coastal Uplands

Coastal uplands might be farm fields, woodlands, or suburban neighborhoods. They might extend from a few feet back of the water's edge to a mile or more. Uplands terrain and water systems—streams, ponds, and wetlands—collect and hold large amounts of storm water, acting as a natural sponge, providing a balanced rate of runoff flow plus protecting against flooding. Their vegetation and soils cleanse the water as well.

The guidebook warns that upland benefits are diminished when the terrain is cleared of vegetation or paved, or changed to speed drainage; when surface water bodies and watercourses are filled, detoured, or channelized; or when the natural pattern of freshwater flow to the coast is changed.

Soil conservation and protection of natural water systems in the uplands are the management methods emphasized by the guidebook.

## Saltwater Wetlands

Saltwater wetlands—marshes and mangrove swamps—are a key part of the coastal environment, the guidebook points out. They support waterfowl, nourish marine life, cleanse the waters of the coast, diminish storm flooding, and beautify the shore. The more intensely developed an area, the more crucial is the need for wetland preservation through land-use controls and special regulations, according to the guidebook.

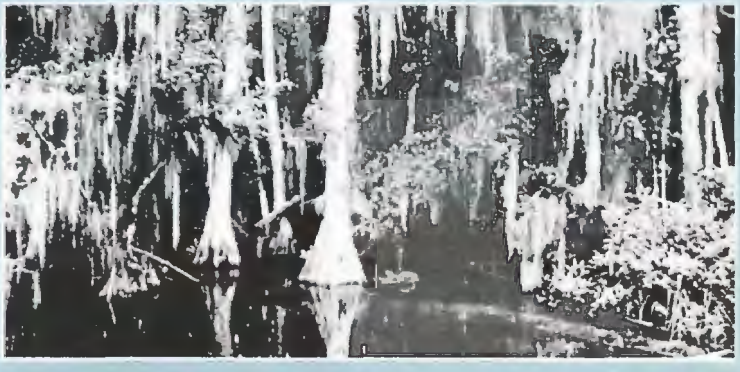
Management tools recommended by the guidebook include restraining excavation, filling, clearing, paving, and grading; discouraging activities that alter the natural water systems, such as draining and diking, and restraining the discharge of pollutants into wetlands.

Reviewing the overall picture, from dunes to bluffs, the guidebook says there are plenty of examples of poorly controlled development that has had a serious negative effect on the value of coastal resources. Demands for retirement and vacation housing and other investments in waterfront land have been intense. Developers have encouraged and satisfied these demands and, in so doing, have frequently imposed high capital and servicing costs on coastal communities, according to the handbook.

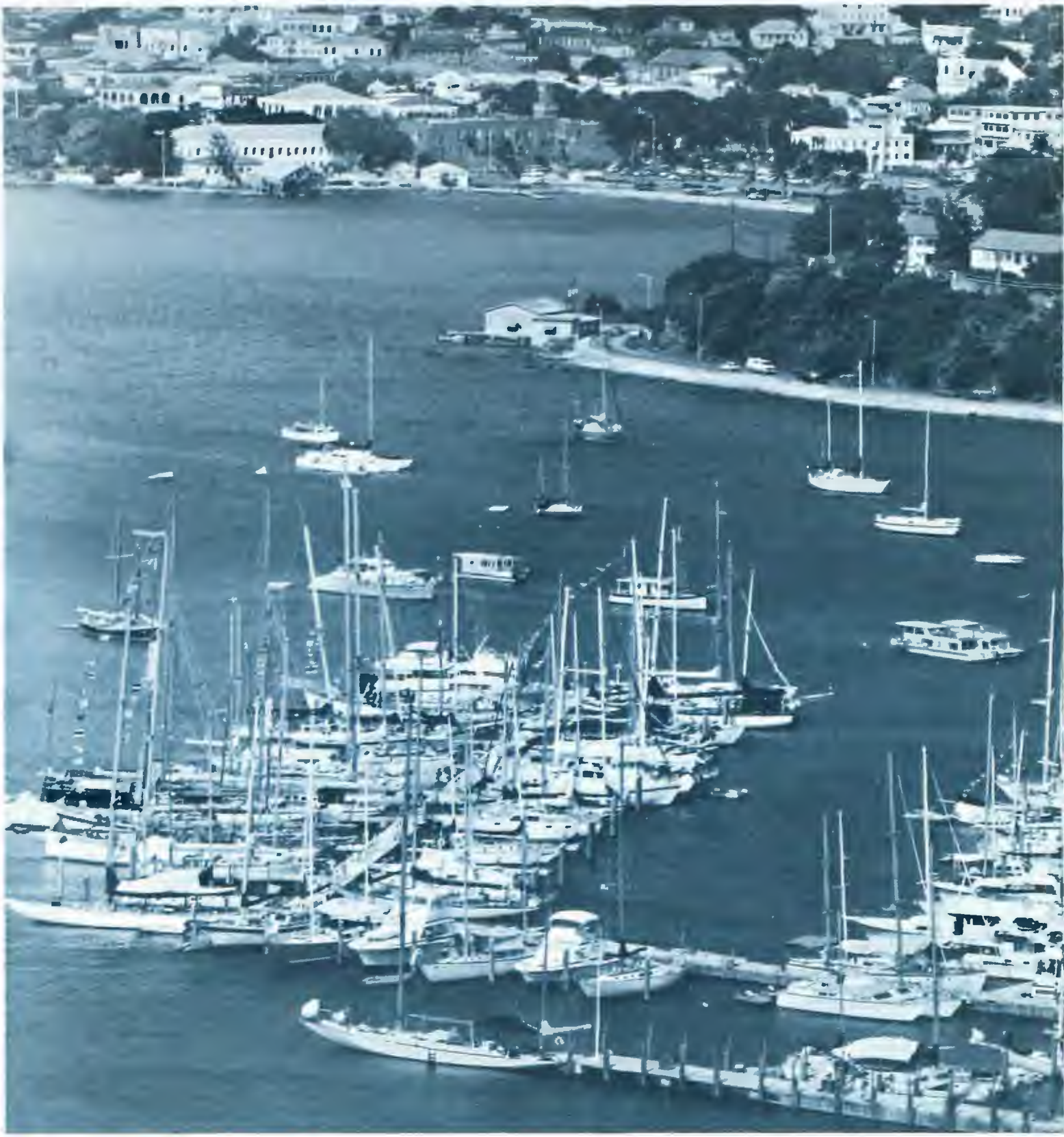
The costs of development impacts are felt by the public in higher taxes, the guidebook points out. In addition, poorly managed development can be destroyed quickly, at great cost to the community, in floods, severe storms, and hurricanes, the document says. "Thus, our primary goals, conservation of coastal resources and maintaining nature's systems, can also in the long run save the taxpayer money," says the guidebook.

Other agencies contributing to the guidebook were the National Oceanic and Atmospheric Administration's Office of Coastal Zone Management, the Corps of Engineers, and the U.S. Fish and Wildlife Service.

Copies are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The order number is 064-00-00009-8; the price is $5.50. □



# Plan for the Caribbean



*St. Thomas harbor in the U.S. Virgin Islands with the town of Charlotte Amalie in the background, a picturesque area in the Caribbean.*

Most of the 26 states of the wide-ranging Caribbean region, including the Gulf of Mexico, plan to join forces at a meeting April in Kingston, Jamaica, to do something about the deteriorating environment of their common sea and their coastal areas.

The principal objectives are to assess the state of the environment in the region and to assist Caribbean governments to solve or minimize environmental problems through careful management of development activities.

At the April meeting, top level representatives of the Caribbean governments are scheduled to sign an ambitious Caribbean Action Plan designed to meet these objectives. They are also slated to set up a small secretariat in the Caribbean region to carry out the plan.

The action plan was prepared by scientific and legal experts selected by these governments at a meeting last month in Managua, Nicaragua.

Activities under the plan are to deal with oil spill prevention and control, coastal water pollution, the impact of tourism, the protection of coral reefs and mangroves, the destruction of tropical rain forest, and the special problems of fragile island ecosystems. Included are strategies to improve early warnings for natural disasters such as hurricanes, and programs to train scientists and technicians and equip marine laboratories.

Three concerns facing Caribbean government officials at the April conference will be: (1) what priorities should be assigned to the 66 projects proposed as part of the action plan; (2) is a Caribbean environmental treaty needed, and if so, what kind; (3) how can a Caribbean Trust Fund be set up to help pay for environmental activities in the region and who will give how much.

The Caribbean meetings are being sponsored by the United Nations Environment Program, and the U.N. Economic Commission for Latin America.

The broad sweep of the arbitrarily-created area known as the wider Caribbean draws in those states bordering on or part of the coastal and open waters of the Caribbean Sea proper, the Gulf of Mexico, and adjacent waters of the Atlantic Ocean —every land mass from the tiny, undeveloped island of Montserrat to the large, rich lands of the industrialized States along the U.S. Gulf Coast.

The word Caribbean conjures up visions of clear blue waters lapping onto white, sandy beaches, soft sea breezes, and swaying palm trees. But in addition to the wealth of natural beauty to be found in many of the countries in the Caribbean, the region is also known to be rich in petroleum, gold, silver, copper, bauxite, manganese, nickel, iron, lead, and zinc.

The countries with extensive petroleum holdings plan to develop energy-intensive industries such as petrochemical processing; iron, steel, and aluminum smelting; and chlorine production. Those countries without such natural resources are trying to attract light industries and tourism.

For many reasons, including easy waste disposal and ease of trans-shipment, much of this development will occur in the fragile coastal zone. Development and urbanization, especially when the environmental consequences of these activities are not known or sought, carry the risk of pollution and financial ruin.

For example, an island with bountiful mangroves may, as a result, have a thriving shrimp industry. This island seeks increased tourism. Not knowing that the shrimp fishery depends on the existence of healthy mangroves, the government decides to destroy the mangroves to build harbors, marinas, and other tourist centers. The loss of the mangroves results in a ruined shrimp fishery. Had the government known that the two were intertwined, it might have changed its development course.

A regional association is the key to protecting the Caribbean from such disasters, many observers believe. Tiny countries which cannot tackle alone the environmental problems they may face could benefit enormously from a regional organization, said Arsenio Rodriguez, a scientist associated with the Caribbean-wide project. Even the wealthiest of states in the region cannot muster the resources to solve problems that transcend their borders, he added, in an article in Chemical & Engineering News.

With the pending action plan, "The region has come together to work on common problems, to incorporate the environmental dimension in the planning and development process," said A. Mel Gajraz, a senior research officer on the regional project.

Assessing the state of the environment and the region's resource base will be crucial in establishing the sound management practices envisioned by the plan, officials working with the Caribbean effort pointed out. Among pollutants to be monitored are petroleum hydrocarbons, heavy metals, toxic organic chemicals, and nutrient loads from agricultural runoff and domestic wastewaters. Officials believe additional research is needed to determine the environmental quality criteria suitable for tropical waters.

Adoption of an action plan for the wider Caribbean region could be a crucial first step in preventing the environmental disruption of this relatively unpolluted region now on the verge of rapid growth, many knowledgeable observers believe. □

# The Impact of Ocean Pollution

By Allan Hirsch

*Fishermen haul in net on purse seiner off Korean coast.*

Threats to the marine environment are increasing. The oceans are the ultimate repository for many of man's wastes, which arrive there through various routes. Continuing concentration of population and economic development in the world's coastal zones is increasing the potential for marine pollution through direct discharge to estuaries and coastal areas through ocean outfalls.

River flows also contribute contaminants from discharge points far upstream; the contamination of blue fish in Chesapeake Bay by Kepone released into the James River many miles above the mouth is an example. This incident resulted in the closing of the commercial fishery. Marine transportation activities contribute to ocean pollution, not only through highly spectacular, but relatively infrequent, major oil spills, but also through a continuing low level discharge of contaminants from small spills of oil and other hazardous wastes, and as a normal part of tanker operations.

Barging of wastes, both industrial and municipal, to sea for dumping is another source of marine pollution. In recent years the United States, through both national legislation and international agreement, has curtailed the ocean dumping of waste materials, particularly municipal sewage sludges. U.S. legislation requires the phase-out of "harmful" sewage sludge dumping by December, 1981. The legislation also requires testing of other wastes, such as dredged material, to ensure that harmful materials are not being dumped.

Deposits of contaminants from the atmosphere is now recognized as a major source of pollution and may be the major contributor of many pollutants to the ocean. Various pollutants are reaching remote oceanic areas far from the point of production or disposal. This was vividly demonstrated when high levels of DDT were found in Antarctic penguins. Contamination of the marine food chain is another significant contributor to ocean pollution. The explosion in production and use of synthetic chemicals, many of which are toxic or otherwise harmful, has helped increase this type of pollution. Pollution is not the only source of stress to the marine environment. Physical changes also are impacting the oceans. For example, alterations of freshwater flow caused by river basin development are changing salinity patterns and other environmental conditions in many coastal areas, sometimes with major ecological consequences. A striking example is the construction of the Aswan Dam which, by reducing nutrients and sediments in the Nile, adversely affected Mediterranean fisheries and changed the nature of coastal beach and dune formation. Large engineering works, such as the Suez Canal, can significantly alter the composition of marine ecosystems by permitting transmigration of species. Additional sea level canals may be built in the future. Dredging and filling bays can also alter current patterns and change flushing rates.

Extensive loss of coastal wetlands reclamation has resulted in loss of habitat for important fish and wildlife species and has altered nutrient exchange. In addition to the importance of wetlands as nursery areas for commercially valuable fish and shellfish, recent evidence suggests that they may play an even more important role in geochemical cycling than had been previously recognized.

The effect of the harvest of fish on marine ecosystems should also be mentioned. Fisheries management has long focused on issues relating to the management of commercially harvestable stocks. However, in addition to the determination of maximum sustainable yield for various species and populations, broader questions are beginning to emerge. One is whether over-fishing might in some way irreversibly alter basic ecological relationships. In the North Atlantic fishery, for example, will continued harvesting of fish high in the food chain result in permanent displacement by species at a lower level? Recent proposals for large-scale krill harvesting in Antarctica would remove many tons of these organisms from the food chain of fish, marine mammals, and birds and raise the possibility of changes in the structure and function of ocean ecosystems.

We have long been aware of the potential impacts of development in the coastal zone. Now, however, development is pushing out into marine areas hitherto considered remote and inaccessible and frequently of great biological sensitivity and importance. Until a few years ago, development of oil and gas in the North Sea was regarded as perhaps the most extreme example of ocean engineering under hazardous environmental conditions. New offshore development under the ice of the Beaufort Sea and in other Arctic areas is being considered. Oil and gas exploration is now scheduled on Georges Bank, an area subject to severe storm hazards. Waste disposal from oil and gas activities, coupled with already massive and increased fishing, could hurt the productivity of the world's richest fishing grounds. Deep ocean mining for manganese nodules in the Central Pacific and proposals for a superport in Palau in the Southwest Trust Territory of the Pacific Islands, provide yet other examples of the fact that no ocean area can be regarded as so remote or isolated as to be immune from development.

Prospects for large-scale tidal power, and possibly even electric power generation through harnessing ocean currents such as the Gulf Stream suggest that our capacity to alter the marine environment through physical and engineering changes may increase dramatically in the future. Ocean thermal energy conversion facilities currently being studied as a source of power depend on temperature differences between surface and deeper waters. The discharge of the cooler bottom waters and their associated nutrients near the surface and the use of biocides, such as chlorine, to prevent fouling on the condensers could produce adverse environmental impacts.

Fortunately, governments at all levels have increasingly recognized the importance of ocean resources and the need to protect marine environmental quality. Environmental legislation enacted within the last decade in the United States provides for regulation of ocean dumping and discharge of wastes, for protection of coastal wetlands, for establishment of marine and estuarine sanctuaries, for cleaning up spills of oil and hazardous materials, for coastal zone management and establishment of environmental safeguards in development of superports, marine minerals, and Outer Continental Shelf oil and gas reserves.

The oceans are an international resource, and the protracted Law of the Sea negotiations attest to the importance placed on these resources. During the 1970's, international conventions on pollution by ships, on ocean dumping of wastes, and on protection of the Mediterranean Sea from pollution, as well as the laws of various nations regulating marine pollution, all demonstrated an awareness and willingness to address marine environmental problems. While we may take this awareness for granted today, it is a far cry from relatively recent times when the sea was considered a sink with unlimited capacity to assimilate man's wastes. This is illustrated by the fact that legislation to control ocean dumping in the United States was enacted only eight years ago, long after controls on conventional water pollution discharges had been initiated.

In implementing these laws, environmental managers have been, and increasingly will be, seeking information on the ecological consequences and trade-offs of their actions as a guide to many marine resource management issues they are confronting. Many of these questions deal with impacts and management options of a relatively limited scope. Others address issues which are global in nature, sometimes raising the spectre of possible "ecocatastrophies." From time to time there have been dire predictions of catastrophic changes in behavior of the oceans. For example, several years ago, an individual prominent for his activities in ocean exploration announced that the oceans were dying and could well be dead within 25 years. Most responsible scientists would probably dismiss such statements as wildly speculative at best. Few, however, would deny that the question of man's impact on the world's oceans merits serious attention and that,

should global impacts occur, the stakes could prove very high indeed. For example, should long-term reductions in photosynthetic capability result from man-induced stress, the impacts on food production in the oceans and on atmospheric oxygen content could both have profound impacts.

The kinds of questions being asked are: What is the capacity of the oceans to receive and assimilate wastes without threat of serious impact? How can we measure this assimilative capacity? Are there significant and wide-scale trends in ocean deterioration? Are subtle, long-term alterations in marine ecosystems occurring as a result of man-induced stress? What are the consequences of marine waste disposal in relation to terrestrial alternatives? How can we monitor and detect deterioration in marine ecosystems, particularly for early warning purposes?

Although advances have been made, the answers to many of these questions have not been forthcoming from the marine science community to date, due to a combination of resource constraints and scientific limitations. Our current understanding of the response of marine ecosystems to stress falls far short of that which will be required for sound environmental management over the long run. If we think of marine systems as a continuum—ranging from estuarine and inshore areas at one end of the spectrum, through large enclosed seas or semi-enclosed coastal areas, to open oceans in areas at the other end of the spectrum—we know most about the impacts of man in confined and localized areas and least in the open sea areas.

There have been many intensive studies on individual bays, estuaries and nearshore areas, and these have provided useful information concerning environmental impacts. Despite this, we are often hard pressed to quantify the impacts of major disturbances on more than a local scale. Enclosed seas such as the Baltic Sea and large coastal regions such as the New York Bight and Southern California Coast have also been studied to assess the impact of pollution and other marine alterations. However, even in the New York Bight, which perhaps has been more intensively studied than any comparable oceanic area in the United States and perhaps the world, many questions concerning more than isolated, localized, or relatively discrete impacts still remain largely unanswered.

Thus, while evidence for specific situations has frequently been sufficient to support regulatory judgments, little is known concerning the broader impact of man on the open oceans. It is known that contamination is widespread. Plankton tows in the Atlantic have routinely picked up substantial quantities of tar and plastic debris. There is a general consensus among many marine scientists that chlorinated hydrocarbons, toxic metals, and petroleum hydrocarbons are all ocean contaminants of potential global concern. However, while widespread distribution of these contaminants has been detected in pelagic marine environments, relatively little is known about their significance in terms of ecosystem impacts. For example, although increased low level contamination of the oceans by petroleum hydrocarbons has been well demonstrated, the ecological consequences are not understood. This lack of information has clouded international discussions concerning the levels of control that should be imposed on oil discharges from vessel operations.

Clearly, there are major difficulties in providing reliable information on trends in marine environmental quality. On the one hand, we are unable to demonstrate clearly far-reaching impacts; on the other hand, we have a haunting concern that damages might later appear, perhaps far from the source and with devastating effect. The problems are perhaps more ambiguous and less tractable than such comparable global environmental issues as desertification and loss of tropical rain forests, which can be inventoried and quantified by remote sensing techniques. Acquiring the necessary information may pose some dilemmas which, while not unique to marine systems, are particularly difficult because of the large-scale, open, complex nature of the oceans. Marine ecosystems may exhibit great spatial and temporal variability. At any given time, they may be responding to natural stress, such as the aftereffects of severe storms. Tremendous difficulties have been encountered in attempting to establish baseline and monitoring approaches which can detect departures from a norm, particularly for early warning purposes.

So one dilemma marine scientsts face is that of trying to predict and detect increments of man-induced change in a dynamic, constantly changing natural environment. This poses a number of basic conceptual problems. A basic problem in detecting change is the so-called "noise-to-signal" ratio. That is, are we actually detecting a uni-directional change, or are we somewhere within the hands of cyclic or other natural variability? For example, is the substantial loss of submerged aquatic vegetation currently being experienced in Chesapeake Bay the result of pesticide runoff, Hurricane Agnes, or a cyclic natural event?

Then there are problems determining causal relationships. Once we have detected a change, is it in any way related to the stress we are monitoring? This is complicated by the fact that a number of stresses, both man-caused and natural, may be simultaneously impacting the system under study. Failure to identify the correct cause of change could result in either regulation or failure to regulate.

There is also the problem of defining the significance of effects. If we have detected a change and find it is man-induced, what is its significance? Is it irreversible? Is it catastrophic? Is it important? An example is the destruction of estuarine or anadromous fish populations by electric generating plants. We may be able to estimate that a plant is reducing the numbers of fish eggs and larvae by 50 percent through its water intake system, but how significant is such a loss of eggs and larvae in determining the size of the mature population? We do know that populations may compensate to some extent for such losses through increased survival rates of the remaining eggs and larvae. Another example is found in questions dealing with bioconcentration of pollutants in food-chains. We can determine if biomagnification occurs and predict whether this may have an impact on selected populations. But impacts on or risks to man are much more difficult to determine.

All this, of course, says nothing about the question of how much environmental damage society is willing to accept. This obviously is a public policy, rather than scientific determination. But sound understanding of "significance" may assist in resolving "acceptability."

There are inherent difficulties involved in providing clear-cut answers to many of these questions. In laboratory experiments, scientists can control the variables and obtain clear-cut results, but how do laboratory findings relate to what actually exists or will exist in nature? Yet, when we try to study the marine ecosystem itself, we have a hard time controlling the variables and distinguishing the impacts. And, if we conduct microcosm studies such as the EPA-sponsored studies at the University of Rhode Island, which are using large tanks with natural seawater and communities of organisms from nearby Narragansett Bay to provide controlled experimental ecosystems, then we still must question whether or not we have really replicated the environment or whether we are measuring experimentally induced anomalies.

In the final analysis, to make progress in this area, we must seek to improve not only our ability to predict the consequences of marine pollution, but also our ability to detect, measure, and understand the significance of damage after it has occurred. Improved predictive capability will depend upon an integrated approach to the use of such research approaches as laboratory toxicity studies, ecosystem simulation models, and field investigations. Our predictions must then be complemented by improved monitoring capability which can detect actual impacts, and serve as a feedback mechanism with respect to the accuracy of our original predictions and adequacy of our regulatory actions.

New and innovative approaches will be required to monitor and detect subtle and long-term changes in ocean ecosystems. One promising approach is biomonitoring. An example of biomonitoring is the Mussel Watch program. This effort utilizes mussels and oysters as sentinel organisms for recording relative levels of pollutants, such as heavy metals, petroleum hydrocarbons and halogenated hydrocarbons, in coastal environments. These organisms have the ability to bioconcentrate these pollutants, which makes analysis much easier, and to integrate pollutant exposure over time. This program has been used to identify pollutant "hot spots" around the coast of the United States.

Other organisms can also serve as bioindicators. For example, a conference held several years ago on long-term ecological measurements identified seabird populations as important potential indicators of marine environmental quality. The conference report discussed the fact that many marine birds are long-lived, widely dispersed during much of the year, but highly concentrated during their nesting seasons. Because of their role high in the food chain, marine birds are potential accumulators of contaminants as well as integrators of ocean ecosystem conditions. It might be feasible to design long-term sampling programs which could combine tissue analysis with the monitoring of nesting areas through aerial photography, thus sampling populations representing a vast coverage of ocean conditions in a very small space and possibly providing a vehicle for detection of widescale oceanic change. This approach still remains to be tested.

In addition to the conceptual and scientific problems involved, marine pollution studies present major organizational challenges. The very nature of ocean systems calls for investigations which are integrated, truly inter-disciplinary, and sometimes international in scope. This requires major manpower and financial resource levels and logistical support, as well as organizational skills more characteristic of the space program than of most environmental research. In this regard, it is encouraging to see studies such as the Coordinated Mediterranean Pollution Monitoring and Research Program, supported by the United Nations Environment Program, which involves a sustained and integrated attack by scientists of various nations.

I have described the difficulties involved in providing answers to some of the questions concerning marine pollution facing decision makers. I would like to conclude by stressing the importance of making progress in this area. For the present, concern about the future of the oceans, coupled with the technical difficulties of monitoring and detecting harmful effects early enough to assure they will not become irreversible, has been great enough to result in adoption of a cautionary approach to many marine environmental issues. Under current legislation, many existing pollutant discharge regulations are technologically based, rather than reflecting ecological cause and effect. That is, they require adoption of waste controls that are feasible from an economic and engineering standpoint, rather than defining what is required to avoid unwanted environmental impacts, based upon analysis at a particular site. However, a concern on the part of some communities that secondary waste treatment requirements for waste discharges to the ocean could impose unnecessary costs in relation to environmental results led to enactment of Section 301(h) of the Clean Water Act of 1977. This section of the law allows EPA to issue permit modifications which will let municipalities discharge less than secondary treated wastes to the marine environment provided they can demonstrate that significant environmental damage will not occur. Reviews of applications for this type of permit modification are currently underway. Conversely, in other cases, technology-based regulatory controls may not provide enough protection, and marine environmental problems may result.

Perhaps even more significant is the question of whether excessively stringent controls on marine waste discharges may impose unnecessary costs or greater burdens on some other sector of the environment. Increasingly, however, we are recognizing the need to examine environmental trade-offs; for example, wastes not discharged at sea may require land disposal or incineration, causing environmental problems elsewhere. As pressures mount on such issues as ultimate disposal of toxic wastes, protection of groundwater from leachates from land disposal sites, the atmospheric effects of waste incineration, the energy costs of waste disposal, and others, decisions based on a more quantifiable relationship between environmental control requirements and environmental response increasingly will be required. The need for better information about the ecological consequences of waste disposal in the ocean will be even greater than it is today.

Efforts to address questions such as those outlined above provide the basis for EPA's current research activities relating to marine pollution. Although EPA's research programs and resources in this area are relatively limited, we are working in close cooperation with other agencies and research institutions. We know that we can never hope to find solutions for all the problems of our impact on the oceans, but we are attempting to provide information which will greatly assist in making more rational and informed management decisions. □

*Oil-smeared bird is victim of pollution.*

*Dr. Hirsch is EPA's Deputy Assistant Administrator for Environmental Processes and Effects Research.*

# EPA and the Marine Environment

The need for data on ocean pollution is of growing importance to EPA and other agencies responsible for marine protection and management. EPA is especially concerned with the need for regulation to curb ocean pollution and for research to furnish the scientific basis for regulatory decisions.

EPA's marine and coastal activities are carried out under several laws: Clean Water Act; Marine Protection, Research, and Sanctuaries Act; Toxic Substances Control Act; Federal Insecticide, Fungicide, and Rodenticide Act; Deep Sea Hard Mineral Resources Act, and the Ocean Thermal Energy Conversion Act. (For EPA's role in international marine agreements, see article on page 8.)

EPA's research is conducted by the Office of Research and Development at the Agency's laboratories at Gulf Breeze, Fla.; Narragansett, R.I.; Newport, Ore., and Grosse Ile, Mich. Other EPA-supported research is done at universities throughout the U.S. and a Marine Center of Excellence at the University of Rhode Island.

EPA research and regulatory activities related to marine and coastal areas are listed below.

EPA-supported research, which provides the technical basis for regulatory decisions, is focusing on marine waste disposal, energy impacts, toxicity studies, wetlands, the Great Lakes and Chesapeake Bay, and monitoring. Research activities include:

- determining the impact of municipal wastes disposed of through ocean outfalls.
- developing procedures to measure the toxicity of dredged material and to determine levels of pollutants in sediments.
- determining the impact of drilling fluid disposal from oil and gas drilling activities.
- examining the effects of oil in the marine environment.
- developing and testing oil spill prevention, control, and cleanup devices and procedures.
- determining the impact of chlorine in discharges to the marine environment.
- developing procedures to measure the toxicity and impact of pollutants such as pesticides and toxic substances.
- determining the impact of carcinogens on the marine environment.
- investigating the fate and effects of pollutants in simulated marine ecosystems.
- developing procedures to define wetland boundaries for legal purposes.
- studying wetlands to determine their function and value in the environment.
- conducting studies on toxics, submerged aquatic vegetation, and nutrient enrichment in the Chesapeake Bay.
- examining pollutant input, cycling, fate and effects in the Great Lakes.
- assessing the use of mussels and oysters as a technique for monitoring pollutant levels in marine coastal areas.
- developing methods to monitor pollutant exposure at specific sites in marine environments over relatively short periods of time.

In addition to these research efforts, EPA is also involved in regulatory activities affecting the following areas:

- ocean dumping of municipal, industrial and radioactive wastes.
- disposal of dredged material.
- discharge of municipal and industrial effluents from ocean outfalls.
- discharge of wastes from oil and gas drilling operations, deep sea mining activities, and offshore thermal conversion facilities to produce energy.
- oil and hazardous materials spill prevention, cleanup, and damage assessment.
- development of water quality criteria for hazardous materials.
- registration or reregistration of pesticides.
- premarket testing of toxic substances.

Interagency coordination regarding the marine environment is carried out both formally and informally. Formal planning for and dissemination of information on marine research activities for the Federal Government is coordinated through the interagency Committee on Ocean Pollution Research, Development and Monitoring. □

*Heron wading in ocean surf at Padre Island, Tex., with offshore oil well in background.*

# Underwater Scientists at Gulf Breeze

By Betty Jackson

Marine biologists at EPA's Environmental Research Laboratory in Gulf Breeze, Fla, are taking a leaf from diving techniques to supplement laboratory research on the effects of pollutants on marine life.

Divers there have been conducting biological surveys underwater, collecting organisms and samples for use in laboratory tests, and even transferring portions of the sea floor into the laboratory for experiments that attempt to simulate natural conditions.

Laboratory Director Henry F. Enos foresees an expanded role for the scientific diver in response to increased demands for field validation of laboratory experiments and on-site biological surveys for environmental problem-solving.

"To fulfill this role, divers at our laboratory needed intensive advanced training in the use of sophisticated equipment and in the management of diving accidents," Dr. Enos explained. "Therefore we set up a workshop in advanced diving technology that was conducted by instructors of the National Oceanic and Atmospheric Administration."

The workshop curriculum was designed to help Gulf Breeze scientists expand their research periphery and extend their work from the laboratory bench to the underwater environment. They were also instructed in diving physiology, uses of underwater equipment, and safety procedures.

At the conclusion of the training, laboratory Diving Officer Jim Patrick was certified as a diving supervisor and dive master. Six laboratory staff members were certified as operational divers: Joel Ivey, Dana Morton, Jim Spain, Patrick Borthwick, Norman Rubinstein, and Wiliam P. Davis. Biological Aide Jeff Wheat qualified as a surface support tender.

"Our team is the first within the Environmental Protection Agency to meet diving standards of the National Oceanic and Atmospheric Administration," Dr. Enos said. "Certification of our divers will be a continuing exercise and will be subject to periodic review by their instructors."

As more and more scientists combine laboratory research with underwater investigations, guidelines for their health and safety has become a concern of the Occupational Safety and Health Administration. Jim Patrick, Gulf Breeze's diving supervisor, hopes that the exercise guidelines and procedures used in the certification and training of his team can be useful in developing safe diving requirements for EPA divers.

"We consider ourselves pioneers in the development of a safe diving code for the Agency that will be applicable to scientific divers who monitor pollution or document damage caused by pollutants," Patrick said.

In addition to intensive training in lifesaving procedures, instructors Ed Clark and Richard Rutkowski, assisted by Marc Kiser, and Michael A. Heeb of EPA, taught Gulf Breeze divers the use of sophisticated dry suits designed for cold or contaminated waters. Divers using the dry suits are supplied air from the surface through two types of face masks. Both mask systems are full-face, underwater breathing devices that protect the diver from contaminated water and provide direct two-way communication between the diver and a surface tender.

The dive team also was introduced to an underwater television system that can record behavior of marine life and any changes in biota and the physical environment caused by people. Divers learned how underwater video television technology can aid in communication with topside support personnel who monitor divers for safety and assist in the evaluation of results.

Divers received training in the latest collecting techniques for capturing delicate animals in nets, cages, and devices such as the airlift—a long pipe equipped with an air venturi that transports sediment and organisms to a collecting bag.

These techniques will be applied to, or modified for research projects being conducted by members of the dive team.

Microbiologist Jim Spain, operational diver, relies on other members of the team to assist him in the collection of sediment and water cores for tests to determine the fate of toxic chemicals in the aquatic environment.

The cores are collected carefully to preserve bottom sediment, an area of intensive microbial activity. Divers collect the cores in an apparatus designed to transfer sediments intact to the laboratory for experiments with pesticides. The test system, called the Eco-core, was developed at Gulf Breeze to measure the rate of microbial degradation in contaminated sediments. Results aid in predicting the fate and persistence of toxic organic chemicals in the marine or estuarine environment.

Cores for the tests are collected from various underwater sites in the Gulf of Mexico, Pensacola Bay estuary, and rivers, often under difficult conditions. Spain, like the other scientists at Gulf Breeze Environmental Research Laboratory, believes that scientific training and intimate knowledge of the test procedures and objectives are essential to the performance of such diving tasks.

This view is shared by other members of the team. Jim Patrick, who is currently involved in studies with the belted sandfish, *Serranus subligarius*, has found that diving is the only method of collecting the animals unharmed. Each fish, a type of hermaphrodite, can produce both viable eggs and sperm. Mating pairs are identified by behavioral interaction and by subtle differences in pigmentation. Thus scientific expertise is required to identify and collect the pairs needed for laboratory tests to determine whether the species can be used in reproductive studies.

Joel Ivey, a biological technician, and a member of the dive team, aided in the design of community tests that use benthic or bottom-dwelling communities established in habitats placed underwater and later retrieved by divers. The organisms are lifted to the surface with the aid of air-filled lift bags controlled by the divers.

With the assistance of other divers, Ivey can transfer habitats that contain such communities from the seafloor to the laboratory for tests designed to determine the toxicity of oil-well drilling fluids to bottom-dwelling organisms. The test species, including annelids, arthropods, molluscs, crustaceans, and nematodes, settle in the habitats that contain sand taken from the sea bottom. After eight weeks, the habitats and the developed communities are transferred to the laboratory for toxicity tests with drilling fluid components. Results of such tests are used to validate tests with benthic communities that have been developed in the laboratory.

Research biologist Patrick Borthwick sees diving as a useful tool for locating and collecting new test species for laboratory acute toxicity studies. Under water, the scientific diver can observe and collect live specimens in various stages of develop-

ment from specific aquatic habitats. In his search for novel test species, he hopes to develop a battery of sensitive organisms representing several types of marine life for screening pollutants.

Diving is important in the study of crabs and other shellfish. These commercially important species are oriented to the ocean bottom and are often difficult to sample with conventional traps.

As in recent years, divers from the Gulf Breeze Laboratory this summer collected arrow crabs (*Stenorhynchus seticornis*), at Stage I, a Navy research platform in the Gulf of Mexico 12 miles south of Panama City, Fla. The animals will be used for field and laboratory studies of the effects of drilling fluids on the offshore environment. The research effort, supported by grants, contracts, and interagency agreements, focuses on the effects of drilling fluids on animals and plants normally found near offshore oil and gas rigs. It also seeks to determine the impact of drilling near areas of high biological activity, such as coral reefs and the communities they shelter.

The divers frequently are consulted by fellow scientists on design and procedures for sub-sea experiments. Their underwater observations are useful in evaluating the effectiveness of sampling devices and determining whether the sampling site is unusual or representative of a larger sampling area. Field validation by divers is important in verifying results of laboratory tests and demonstrating that test conditions reflect those existing in nature.

Divers at the Gulf Breeze Laboratory predict that diving technology will be useful in future attempts to monitor changes in aquatic ecosystems at dumping sites or at ocean outfalls. The need for basic data about the environmental health of the nation's water resources holds the promise of a bright future for scientific diving. □

*Betty Jackson is a technical writer for the Gulf Breeze Laboratory.*

*Scientist at EPA's Gulf Breeze, Fla., laboratory prepares to dive in marine pollution research project.*

# Burning Wastes at Sea

By Charlotte Garvey

*The hazardous waste incinerator ship Vulcanus at sea.*

Burning chemicals at sea may be a key part of the answer in disposing of some kinds of hazardous and toxic wastes.

Incineration at sea is environmentally safe, economical, and should be encouraged, concluded the recent report of an interagency task force.

The Interagency Ad Hoc Work Group, composed of members of EPA, the Commerce Department's Maritime Administration, the U.S. Coast Guard, and the National Bureau of Standards, has been studying expansion of technology in the area and has issued a report on the topic, "Report of the Interagency Ad Hoc Work Group for the Chemical Waste Incinerator Ship Program."

The group recommended amending the Merchant Marine Act of 1936 to permit substantial Federal assistance and funding to build and operate privately-owned U.S. flag waste incinerator ships.

"This country has an enormous hazardous waste problem and Americans have to face up to it," said former EPA Administrator Douglas M. Costle. "Everybody wants hazardous wastes picked up, but no one wants them put down. Incineration, both on land and at sea, gives us a major option for effectively dealing with hazardous waste. We need to be as supportive of these new technologies as we can."

The government has two options, depending on how many private firms apply for Federal assistance to build incinerator vessels over the next year, said Russel Wyer, EPA's co-chairman of the interagency task force. One option is to stimulate private industry to build ships themselves through financial incentives including subsidies and Federally-guaranteed loans. In return, industry would allow EPA to set up research stations on the vessels themselves to advance the state of the art.

If few applications for Federal assistance are received, another alternative the government will consider is building and operating its own vessel for possible later sale or charter to private industry.

Wyer said that the at-sea program would supplement incineration operations on land, with an estimated capability to handle only a fraction of total hazardous and toxic wastes, even at maximum capacity.

The report recommends giving top priority to setting up "funding mechanisms which encourage private entrepreneurs to build and operate incinerator ships" in the United States and to "place the cost of constructing a vessel in the United States on a parity with foreign construction costs" either through proposed subsidies or tax incentives.

The Vulcanus, a Dutch incinerator ship used extensively throughout Europe, in 1977 successfully destroyed three shiploads of Herbicide Orange, a toxic defoliant used by the United States in the Vietnam War. The average destruction efficiency of this process for dioxin, a highly toxic substance in the herbicide, was greater than 99.9 percent. The burn took place about 1,000 miles southwest of Hawaii.

Burns take place on the high seas at least 100 miles from shore. Under EPA regulations, an Environmental Impact Statement (EIS) must be issued for each incineration site to assess in detail what effect the operation could have on the environment.

The Vulcanus is the only vessel capable of at-sea incineration now available for commercial use that can travel from continent to continent. It was converted from a cargo ship to incinerator capability.

Waste Management, Inc., of Oakbrook, Ill., has since purchased the Vulcanus from its German owners, Hansa Lines. Ocean Combustion Services, a subsidiary of Waste Management, operates the vessel.

EPA has plans for the Vulcanus this year. The Agency wants to destroy one and a half shiploads of Silvex, which has shown the potential to cause miscarriages, birth defects, and have other adverse reproductive effects. EPA also plans to destroy half a shipload of DDT at the same time and is considering use of the Vulcanus for destruction of PCB's.

The interagency group has also drawn up a prototype model incinerator ship which, unlike the Vulcanus and other at-sea incinerator vessels, would have the capacity to destroy solid as well as liquid wastes. Wyer said equipment now on the vessels is limited to liquid waste and the addition of a rotary kiln incinerator to destroy solid waste needs to be tested.

The model ship would have an 8,000 metric ton capacity compared to the Vulcanus' 4,000 metric ton capacity. Wyer says an alternative to building new ships is to convert existing ships to incineration capability, but the vessels would be much smaller than the prototype.

A single prototype ship at full capacity could destroy up to 200,000 metric tons of waste a year.

Costs for constructing a single vessel are estimated at $75 million in 1980 dollars, plus $25 million for incineration equipment.

EPA estimates in 1978 indicated the U.S. generates almost 350 million metric tons of industrial waste a year, and projected at least 57 million metric tons of hazardous waste would be produced nationally in 1980.

Wyer said that incineration at sea offers an attractive addition to the range of methods now used to dispose of chemical wastes. The other methods are landfill disposal, chemical detoxification, and land-based incineration.

An EPA comparative study in 1978 showed at-sea incineration to be the least costly means of disposal. Incineration at sea also is as effective as land-based incineration, often destroying 99.99 percent of hazardous materials contained in waste.

Wyer said there are a number of other advantages to burning at sea, explaining:

"Because the ship destroys wastes away from populated areas, you avoid any risk to nearby communities."

He also indicated at-sea incineration has minimal impact on the environment. "Acid emissions from the incinerator ships can be directly dispersed into the ocean without the 'scrubbing' process needed for land-base incinerators. The ocean water neutralizes most of the acids so the emissions mix harmlessly with the water," he declared.

A gap could soon develop in incinerator ship operations around the world when the Vulcanus' certificate of fitness, approving the vessel's condition for use, runs out in 1982, possibly before any other vessel has been constructed or retrofitted with similar capabilities.

Wyer said that Waste Management hasn't indicated plans for the Vulcanus in the future, but it is possible to rebuild the existing ship.

"It's getting tight," he said. Retrofitting a vessel could take up to a year and half, according to Wyer, and to build a ship from scratch, at least two years. He said that so far, the government hasn't received many applications for assistance.

To get things moving, the interagency group held a meeting on the project in December attended by members of the private sector. The purpose of the meeting was to exchange ideas, suggest possible directions for the program, and help the board estimate the potential number of applicants for Federal financial assistance.

Wyer said that the government's preferred option is for private industry to construct and operate the vessels, because it would keep management of the operation in the private sector and stimulate job opportunities as well. □

*Charlotte Garvey is an editorial assistant with EPA Journal.*

# Guarding the Sea

By Jean-Michel Cousteau with Paula DiPerna

Off the coast of Canada's island of Newfoundland, the ocean waters are clear and cold, some of the most biologically productive waters in the world. To pursue the numerous whales of these great seas, the Basques of the 16th century traveled in wooden ships many days across the forbidding North Atlantic. To fish the plentiful cod of the Grand Banks, fleets of merchant ships from England and France in the 17th and 18th century followed the Basque tradition. Fortunes were made and lost; colonies were established and warred over. Eventually, exploitation of the resources of this ocean helped lead to the settlement of the North American continent. In short, it is not far-fetched to suggest that the resources of the global oceans have shaped, in fact propelled, history.

Today, we tend to lose sight of how closely our destiny as nations is linked to the vitality of our oceans, even when we are awed by the now legendary NASA photograph of our small planet earth seen from our dry moon, even as we see this fragile blue sphere, 70 percent covered by water, the only known habitable place in our solar system.

We think of ourselves as the generation of options. We are sometimes heady over our inventions and our truly impressive technological advances. But where the oceans are concerned, we are quite optionless. We cannot create another one, nor a technological substitute. We are married to the ocean we have, and the problems we have created of the union are by no means simple. Every problem is a web of problems.

Take, for example, the tale of the tiny capelin—the fish which is the fulcrum of

*Fish drying in the sun on the beach in West African fishing village.*

the food chain in the North Atlantic. This summer when we were filming from our vessel *Calypso* off Newfoundland, we watched thousands of these silvery fish washing up on the beaches to die after spawning, glinting like flakes of mica as the waves turned them over onto shore. It was a festive occasion for the local people, who came down to the coves in high boots. They stepped into the shallow water and hurled out circular nets. One throw yielded pounds of capelin. As we watched these people following a centuries' old custom, standing literally shin deep in flickering fish, it was hard to believe there could ever be a capelin shortage.

But there seems to be, and sharing the coves with us was the leviathan evidence—graceful mighty humpback whales, an endangered species, swimming closer than usual to shore. In the past several years, the capelin stock appears to have dropped —perhaps for natural reasons, but probably as a result of overfishing by foreign fleets in Canadian waters—and these whales which depend on capelin for food have audaciously followed what remains of the capelin stock inshore. But the story does not end with hungry whales, it ends with *trapped* whales because by coming close to shore, the whales risk becoming entangled in the leader nets of cod traps set in the sea by fishermen who must also draw their livelihood from the coves. The whales swim unexpectedly into the nets, becoming roped into them, often ripping them apart in a frantic attempt to become free. The fishermen are understandably furious at the loss of their equipment—$3 million in damages and lost fishing time in 1979—and the world perhaps loses yet another member of this endangered species, as trapped whales drown.

We have witnessed the underwater scenes of this tragedy. One of our divers, Bernard Delemotte, approached a trapped young humpback whale, trying to avoid being struck by her flailing fluke. Eventually, he was able to calm her by stroking her body and her snout. Finally he succeeded in freeing her from the ropes which were cutting into her mouth and in gratitude, we might conjecture, the whale allowed Bernard to ride on her back for about one mile! An extraordinary climax to events that had begun with the depletion of a small fish six to eight inches in length.

Take also, for example, the case of the coastal zone. Here most of the life of the seas congregates, but here too our rivers discharge, our plumbing systems exit, discharging inland pollution. Each year, we dump from the United States alone hundreds of thousands of tons of sewage sludge and untreated sewage. We add millions of tons of river sediment—much of it transporting dangerous chemicals and heavy metals discharged by industries or carried by soil run-off. We fill in our marshlands, destroying vital ocean nurseries. We "develop" virtually everything that is not protected by zoning or legislation.

In the open oceans, the inventory of insults includes oil—leaked and dumped —approximately 6 million metric tons a year according to the generally accepted 1975 estimate of the National Academy of Sciences, a figure currently being updated. Whether the ocean can process such amounts of oil is highly debatable. Certainly a coating of oil on the ocean surface can interfere with photosynthesis, and even more certainly, migrating seabirds or marine mammals trapped in an oilspill cannot survive being coated by petroleum once the oil has interfered with their natural body insulation systems. And tourists who pay premium vacation rates will not return

*continued on page 39*

## Calypso Finds A New Home

The 142-foot oceanographic vessel, Calypso, is now using Norfolk, Va. as her new operations base following a decision by Captain Jacques-Yves Cousteau to establish a new center in that city

The Cousteau Society, a non-profit organization with some 170,000 members, will use the center to house its future activities. The facility is temporarily located in quarters for merly occupied by the Tidewater Community College but plans are underway to construct a "Cousteau Oceans Center" for an estimated $20 million on the Norfolk waterfront. Visualized as a combination educational and recreational attraction, the center is being backed by city officials as the centerpiece of downtown renewal efforts.

In addition to housing submer sibles, underwater cameras and other equipment previously located in Mar seille, Los Angeles, and Hilton Head, S.C., the center will provide expedition and administrative support for the Calypso. The converted mine sweeper is scheduled to make expeditions this year to the Caribbean and later to the Amazon River. Cousteau said the presence in the Norfolk area of several universities and Federal agencies involved in marine research influenced his decision to locate there. □

# Around the Nation

## REGION 1

### Conference Set

The third annual New England Environmental Conference will be held at Tufts University in Medford, Mass., on Saturday, March 28, and Sunday, March 29, 1981. The conference will be sponsored by the Lincoln Filene Center for Citizenship and Public Affairs.

The conference will bring together business leaders, labor, environmental organizations, government, advocacy groups, and other interested citizens who have an active concern for the future of New England.

Thirty to forty workshops will explore such problems as groundwater supply, aquifer protection, energy conservation, environmental leadership training, Georges Bank exploration, renewable energy, historic preservation, coastal resources, and endangered species.

### Vermont Approved

Vermont has become the first New England State to receive interim authorization from the EPA to conduct its own hazardous waste management program. The Vermont program will be administered by Richard A. Valentinetti, Chief, Air and Solid Waste Programs, Vermont Agency of Environmental Conservation.

The Phase I interim authorization was granted to the State under the Resource Conservation and Recovery Act. EPA determined that Vermont's program, including statutes, regulations and enforcement authority, is substantially equivalent to the Federal hazardous waste program.

## REGION 2

### Ocean Site

EPA is seeking comments on its proposal to designate a site in the North Atlantic Ocean for the high temperature incineration of hazardous wastes. An ocean-going incinerator vessel would serve industry throughout the Northeastern United States.

The Agency has prepared a draft environmental impact statement for the proposed site, which is beyond the Continental Shelf, and approximately 140 nautical miles from Delaware Bay.

According to the draft statement, there is a growing need for acceptable incineration locations to serve the Northeastern U.S. when land-based disposal methods are environmentally unacceptable because of the toxicity of the wastes or potential health risks.

EPA estimates that, by 1989, nearly 271,000 metric tons of toxic organic wastes will be generated on the East Coast annually.

### Firms Cited

Region 2 cited two firms in New York and one in New Jersey for violations under new air pollution regulations which make payment of penalties mandatory if the source is still out of compliance with emission control requirements after January 1, 1981.

Notices of Noncompliance were issued to the Niagara Mohawk Power Corporation in Oswego, and Boise Cascade, Inc. of Beaver Falls, both in New York. The Anchor Hocking Corporation in Salem, New Jersey, was also cited.

Region 2 officials said that under this regulatory program companies in violation of environmental rules will pay penalties based on what they have saved by not complying with the law. The penalty formula is designed to deprive companies of any financial benefit gained from avoiding the cost of compliance.

## REGION 3

### Proposed Brewery

Region 3 has proposed approval of a permit application for the planned Coors Brewery near Harrisonburg, Va. Based on information provided by the Adolph Coors Company, the Agency made a preliminary determination that the construction and operation of the proposed plant would meet the four conditions required under EPA's Prevention of Significant Deterioration permit regulations. These conditions specify that:

- All pollutants must be controlled by the best available technology.
- Any increase in pollutants must not exceed national air quality standards.
- Sulfur dioxide and particulate emissions must not cause violations of air quality class increments in the area to be impacted.
- Emissions must not adversely impact soil, vegetation or visibility in the vicinity of the source.

To satisfy these conditions, Coors provided twelve months of air monitoring data, meteorological reports, visibility studies, and other technical data and modeling studies that show how its proposed control technology will control pollution.

EPA will decide whether to issue an actual permit to Coors after reviewing comments made at a public hearing in Harrisonburg.

## REGION 4

### Asbestos Removal

The School Asbestos Removal Program is continuing to gain momentum in the Southeast. Several State programs are setting the pace. In Tennessee, a recent survey resulted in the closing of a school gymnasium while highly friable (soft and crumbly) asbestos-containing material was removed. A number of bags holding the same material was found in a school district warehouse in the same community. Parts of other school facilities in Tennessee have had to be closed temporarily because of the asbestos problem.

Damaged or deteriorating asbestos materials release asbestos fibers into the air where they may be inhaled into the lungs creating potentially serious health risks.

Information on the school asbestos program in Region 4 may be obtained by calling (404) 881-3864.

## REGION 5

### Cleanup Pact

The largest single air pollution control retrofit ever undertaken in the United States, thus far, will result in a reduction of 75,000 tons in particulate matter emissions a year at the W. H. Sammis plant of the Ohio Edison Company in Stratton, Ohio. Ohio Edison's nine other plants will reduce particulate emissions by an additional 41,000 tons per year as part of an agreement between EPA Region 5 and the electric utility which calls for installation by the company of some $500 million worth of air pollution controls in its power plants. The agreement was formalized in a consent decree signed recently by EPA and Ohio Edison and lodged with the Federal District Court at Columbus, Ohio.

The company has also agreed to pay a civil penalty of $1.5 million for past violations of the Act, and EPA has agreed that the decree will settle all outstanding legal actions against the company for particulate emissions violations.

## REGION 6

### University Cited

The Regional office issued a complaint against Brayton Fire Training School, Texas A&M University, for violations of the Toxic Substances Control Act. The complaint alleges that the school unlawfully failed to mark a polychlorinated biphenyls (PCB's) transformer, failed to provide proper storage for the transformer, and failed to maintain PCB records.

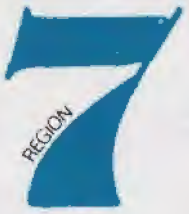
The complaint proposed a civil penalty of $26,000 for failure to mark ($10,000), improper storage ($10,000), and no records maintained ($6,000). Negotiations toward settlement of the complaint are in progress.

### Hazardous Waste Authorities Delegated

With the exception of New Mexico, all States in Region 6 have received ap-

proval from EPA for management of hazardous waste programs by State agencies. The State of New Mexico and Region 6 worked out an agreement to share the responsibility.

Arkansas, Louisiana and Texas were three of the first six States in the Nation getting approval. Oklahoma was approved at the end of 1980.




**PCB's**

EPA and the Kansas City Power and Light Company have entered into a consent agreement and order regarding alleged violations of Federal regulations governing the handling, disposal, and record-keeping of polychlorinated biphenyls, known as PCB's. This toxic substance, believed to cause cancer, came under Federal regulations in May 1979.

In an administrative complaint issued in February 1980, EPA charged the electric utility with marking and storage violations at various company facilities as well as an improper disposal violation and two record-keeping violations. The violations were first observed by the Agency on September 4 and October 30, 1979, during inspections of a repair shop and two power plants in Kansas City, and the utility's LaCygne power plant in Kansas.

Under the agreement, the company agreed to undertake extensive remedial actions in an effort to comply with the regulations, as well as several measures beyond those called for by law. These other measures include the conversion of an existing boiler at one of its facilities into an high efficiency boiler capable of burning and destroying low levels of PCB-contaminated oils in concentrations less than 500 parts per million, and allowing EPA use of a PCB storage space facility in emergency situations.

The original proposed penalty of $55,000 was reduced to a fine of $2,750, partly because of the remedial actions to achieve compliance with Federal PCB rules and because of the measures and actions the company has agreed to under the consent agreement.


**Toxics Burn**

EPA has given conditional approval to the Department of Energy's plan to burn one gallon of polychorinated biphenyls, known as PCB's, at Rocky Flats, located 15 miles northwest of Denver, Colo., as a trial disposal procedure.

According to Region 8 officials, EPA made this decision after carefully evaluating the potential risks and considering input from State and local health officials as well as from citizens at two public meetings. The citizens' major concern, Agency officials said, was not the trial burn, but rather that PCB's might be incinerated there in the future. Region 8 officials stressed that the approval was only for the trial burn and this action in no way provides or endorses future incineration of PCB's at Rocky Flats.

According to the Agency, the burn, expected to destroy 99.9999 percent of the PCB's, would release no detectable amount of PCB's into the urban air.

**Disposal Standards**

Ultimate control of 26 million tons of radioactive uranium mill tailings in the West came one step closer recently with EPA publication of proposed standards covering disposal of the wastes. This is an important step, and will help in the eventual disposal of the tailings at Durango and Grand Junction, Colo., Region 8 officials said.

Tailings from abandoned uranium mills cover 1,000 acres of land in 10 States: Arizona, Colorado, Idaho, New Mexico, North Dakota, Oregon, Pennsylvania, Texas, Utah and Wyoming.

While Congress charged the Department of Energy with cleaning up the sandy radioactive wastes at abandoned uranium mills, it gave EPA the task of setting the standards for health and environmental protection that Energy Department remedial measures would have to meet.


**Buy Quiet**

Several cities in Region 9 recently participated in a "Buy Quiet" program jointly sponsored by the National Institute of Governmental Purchasing, the National League of Cities and EPA. The "Buy Quiet" program is a non-regulatory, market-based program designed to encourage the promotion and purchasing of quieter products.

The cities included Tucson, Ariz., and in California, Monterey Park, Ventura, Oakland, and National City. The products involved were quieter lawnmowers which were loaned to State and local agencies for demonstration purposes during the grass cutting season. Many of the cities reported excellent results with the quieter lawnmowers. It is anticipated that other quieter products, such as garbage trucks, vacuum cleaners, chain saws, and typewriters will be involved in similar demonstrations.

Purchase descriptions for quieter models of various products are available to State and local governments upon request through the National Institute of Governmental Purchasings Data Bank for quieter purchasing. Call (703) 920-4020 for more information.


**Results**

Region 10's successful litigation against the Georgia-Pacific Corporation's pulp and paper mill in Bellingham, Wash., is producing results. The prosecution in U.S. District Court of Georgia-Pacific for the mill's delayed compliance with its wastewater discharge permit produced a civil penalty of $25,000. In addition, the installation of the required pollution control equipment is already paying dividends in terms of improved water quality. In a before-and-after study conducted by the Washington State Department of Ecology, dissolved oxygen in the Bellingham Bay area increased from a range of 0 to 5 parts per million in early 1979 to a range of 8 to 10 parts per million in 1980. Corresponding improvements were also noted in acidity and water discoloration. As recently as 1979, anaerobic conditions in the water prevailed and many pilings were devoid of any form of marine life. A year later, the same pilings were showing signs of rapid recolonization by invertebrate species. □

**States Served by EPA Regions**

**Region 1 (Boston)**
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
617-223-7210

**Region 2 (New York City)**
New Jersey, New York, Puerto Rico, Virgin Islands
212-264-2525

**Region 3 (Philadelphia)**
Delaware, Maryland, Pennsylvania, Virginia, West Virginia, District of Columbia
215-597-9814

**Region 4 (Atlanta)**
Alabama, Georgia, Florida, Mississippi, North Carolina, South Carolina, Tennessee, Kentucky
404-881-4727

**Region 5 (Chicago)**
Illinois, Indiana, Ohio, Michigan, Wisconsin, Minnesota
312-353-2000

**Region 6 (Dallas)**
Arkansas, Louisiana, Oklahoma, Texas, New Mexico
214-767-2600

**Region 7 (Kansas City)**
Iowa, Kansas, Missouri, Nebraska
816-374-5493

**Region 8 (Denver)**
Colorado, Utah, Wyoming, Montana, North Dakota, South Dakota
303-837-3895

**Region 9 (San Francisco)**
Arizona, California, Nevada, Hawaii
415-556-2320

**Region 10 (Seattle)**
Alaska, Idaho, Oregon, Washington
206-442-1220

# Update

A review of recent major EPA activities and developments in the pollution control program areas.

## AIR

**Fly Ash**
EPA has proposed guidelines encouraging the Federal Government to buy cement and concrete mixed with fly ash, which would help the electric utility industry save disposal costs for nearly one-third of the fly ash waste produced each year as a by-product of coal combustion.

Fly ash has been produced in large quantities since utilities began using pollution controls on coal-burning boilers to capture the ash rather than allowing it to be dispersed through the air. Fly ash has been substituted for a portion—typically, 20 percent—of the cement contained in the concrete used in many buildings.

**Diesel**
Diesel soot from trucks, buses, and other heavy-duty diesel vehicles could be reduced as much as two-thirds per vehicle by 1995 under a new particulate emissions standard recently proposed by the EPA.

The proposed standard would apply to 1986 and later model year diesel vehicles over 8,500 pounds gross vehicle weight. Standards for particulates from diesel cars were promulgated in 1980. A public hearing will be held on the proposal for trucks and other heavy duty vehicles.

**Chemicals**
The EPA has proposed three air pollution regulations that would reduce smog-forming emissions from the synthetic organic chemical manufacturing industry and from metal coil surface coating operations. The rules would also cut benzene emissions from petroleum refineries and chemical manufacturing plants. The proposed rules would affect only new sources.

## ENFORCEMENT

**Automakers**
EPA has granted waivers under the Clean Air Act to six automakers, allowing additional time for certain engines to meet auto emission standards.

EPA has given General Motors, Ford, Chrysler, and American Motors until 1983 for seven of their engine lines to meet the 1981 standard for carbon monoxide (CO) of 3.4 grams per mile (gpm). Meanwhile, cars using these engines will be allowed to meet a standard of 7.0 gpm.

The vehicles affected by this action include some now in production as well as some that will be introduced for the first time in 1982. These cars include GM's J-cars, Ford's Escort/Lynx, most Chrysler models, and AMC's Spirit/Concord.

EPA granted the waivers to give the financially troubled companies flexibility to improve the competiveness of these cars. Agency officials said that no significant adverse effect on air quality will result from the action.

EPA also granted waivers to General Motors, and to two Japanese auto companies—Nissan (Datsun) Motor Company, Ltd. and Isuzu Motors Ltd. —until 1983 for two diesel engine families to meet the 1981 nitrogen oxides standard of 1.0 gpm. In the meantime, these engines will have to comply with a nitrogen oxide standard of 1.5 gpm.

**Gasoline**
An investigation was conducted in the Detroit area late last year in which six EPA investigators inspected 90 branded and unbranded retail gasoline stations and took fuel samples from unleaded pumps. The investigation resulted from a complaint that leaded gasoline was being sold as unleaded at many retail stations in the area.

EPA said that laboratory tests of the gasoline samples showed lead content higher than permitted by Federal regulations at 12 service stations. The Federal standard for unleaded gasoline restricts lead content to not more than 0.05 grams of lead per gallon. Generally, leaded gasoline contains from 1 to 2 grams of lead per gallon.

The investigators also found nozzles in violation of Federal requirements for leaded gasoline pumps at three stations.

The EPA also announced that it has filed an administrative complaint against Southwest Wholesale Cooperative of Phoenix, Arizona, charging that the firm used leaded gasoline in company vehicles which are required under the Federal Clean Air Act to use unleaded fuel, and improperly equipped a leaded pump with an undersized nozzle.

The complaint, which seeks a penalty of $65,300, also charges Southwest Cooperative with not properly labeling leaded gasoline pumps and failing to display warning signs in the pump stand areas.

**Recall**
General Motors Corp. will voluntarily recall approximately 120,000 of its 1978 passenger cars because they may be failing to meet Federal tailpipe air pollution standards for nitrogen oxides (NOx).

Vehicles recalled are 1978 GM models with 151 cubic inch displacement (CID) engines including the Chevrolet Monza, Monza Wagon, Pontiac Sunbird, Sunbird Safari Wagon, Phoenix, and Oldsmobile Starfire. Vehicles built for sale in California are not included in this recall. Vehicles in the above model lines with other than 151 CID engines are not subject to the recall.

**Hearing Request**
Volkswagen of America has requested a public hearing to contest EPA's October 24, 1980, recall of approximately 140,000 1977 Volkswagen vehicles. This is only the second time a manufacturer has challenged an EPA-ordered recall.

The recall, which includes 1977 Rabbit and Scirocco models, is based upon EPA's determination that these vehicles fail to meet the Federal exhaust emission standards for hydrocarbons (HC) and oxides of nitrogen (NOx).

Under the Clean Air Act, a vehicle manufacturer may request a hearing if it disagrees with EPA's determination that the vehicles are not in compliance with emission standards. At least 30 days prior to the hearing, EPA will publish a notice in the Federal Register indicating its scheduled time and location.

## HAZARDOUS WASTE

**Actions**
From November 19 to December 19, EPA conducted 383 inspections of hazardous waste generation and disposal facilities, sent out 26 notices of violations, 18 compliance orders, and levied $7,500 in fines for violators of new regulations which ensure that hazardous waste is han-

dled in a way which protects the public and the environment. The regulations were effective Nov. 19, 1980.

The new EPA regulations require hazardous waste producers to assume responsibility for the ultimate disposal of the waste they generate, transporting it according to EPA/Department of Transportation standards to a pre-determined facility designed to handle the waste safely. A newly-instituted tracking system is designed to ensure that the waste actually arrives at that facility.

## NOISE

**Initiative**
Regulatory officials from more than sixteen countries have agreed upon a new initiative to coordinate and align international noise measurement and test procedures.

Proposed and hosted by the United States, the international meeting of regulatory officials Dec. 9-12 was designed as a working session of those officials with policy responsibility for the adoption of noise measurement procedures in their respective countries. The meeting was coordinated by the EPA Office of Noise Abatement and Control.

The country representatives agreed at the conference to complete the listing of present or forthcoming regulations where measurement procedures may offer potential technical barriers to trade and to indicate each country's recommendations for priorities in dealing with these problems.

**Motorcycles**
EPA has proposed to amend the testing requirements of the final motorcycle and motorcycle exhaust systems noise regulations which were recently announced.

The proposed amendments would require manufacturers to take one additional step in their testing program over and above what is required of them as a result of the final regulations. Specifically, under the proposed amendment, manufacturers would be required to remove all easily removable components from their exhaust systems before conducting the tests necessary to show compliance with applicable standards. These amendments are expected to encourage manufacturers to design exhaust systems in ways which will reduce the incidence of tampering by motorcycle owners and mechanics.

## TOXICS

**Export**
A final rule designed to help foreign governments become aware of possible hazards associated with certain chemicals they import from the United States has been issued by EPA.

Under the rule, each year exporters must notify EPA the first time they export or intend to export from the U.S. certain chemicals on which the Agency has taken action to avert potential health or environmental problems. EPA would then notify affected foreign governments.

## WATER

**Iron and Steel**
EPA has proposed new water pollution controls for existing and future iron and steel production plants, including both carbon and specialty steel mills.

The proposed rules, called "effluent guidelines," include a variety of limits on different water pollutants caused by the manufacture of these metals. The rules would require an initial clean-up level called "best practicable technology" (BPT). These standards would take effect as soon as possible after the proposals are issued in final form later this year. After 1984 the proposals would require tougher clean-up levels for toxic pollutants to be achieved by using the "best available technology." Tougher clean-up requirements also would be applied to discharges of oil and grease and suspended pollutants through the use of "best conventional technology."

In addition, "pretreatment" standards would be applied to harmful wastes released from the mills to sewage treatment plants, and new iron and steel plants built after the EPA proposals would have to meet certain "new source performance standards."

**Coal**
New controls on discharges of acidic water and other wastewater from existing and future coal mines and coal cleaning plants have been proposed.

EPA's proposals would apply to all underground and surface coal mines and coal cleaning plants in the country. Cleaning or preparation plants, usually built near the mines, remove sulfur and other undesirable elements from coal to make it more acceptable for burning in the boilers of electric power plants and other industries.

**Pulp and Paper**
EPA has proposed new water pollution controls for present and future pulp and paper mills.

The proposals, known as effluent guidelines, are required by 1977 amendments to the Clean Water Act and by a legal agreement between EPA and several environmental groups. The Agency proposals are expected to be issued in final form sometime in 1981, after public comment.

The EPA rules would require that pulp and paper mills use the "best available technology" to control the discharge of toxic pollutants from their operations.

The new proposals also would tighten current controls on oxygen-demanding materials and suspended particles that result from the manufacture of paper products.

## AGENCYWIDE

**Plain English**
EPA recently honored several employees with "Plain English" cash awards for producing documents meeting high standards of clarity and organization.

The Office of Planning and Management's Henry Beal, director of the Standards and Regulations Division and the Steering Committee, reviewed 35 documents authored by EPA employees, judging them on sentence structure, logical organization, and the ease with which non-experts can understand them.

David M. Feldman of the Office of Assistant Administrator for Enforcement won the $500 first prize.

A $250 prize went for a paper prepared by Glenn Passavant and John Anderson of the Motor Vehicles Emissions Test Laboratory in Ann Arbor, Mich. Richard Johnson, Joseph Panetta, Lynn Brown, Cathy Kessler and Jeffrey Kempter, Office of Toxic Substances, won $250 for their draft. Richard McAllister and David Mayer of the Office of Toxic Substances won a $75 honorable mention for their work. Laura Campbell of the Office of Assistant Administrator for Enforcement also won a $75 honorable mention. The Agency plans to offer plain English awards quarterly. □

# Making Pollution Prevention Pay

By Michael G. Royston

*In November 1979, the ministers of the environment from the European countries and representatives from the United States and Canada met in Geneva under the auspices of the Economic Commission for Europe on the Protection of the Environment. Their purpose was to decrease pollution from industrial wastes. Long-range transboundary air pollution, or "acid rain," from the world's metallurgy and power plants was thought to be damaging northern lakes and forests and had grown into a major international issue. The ministers and representatives signed a resolution to "limit, gradually reduce, and prevent" this form of pollution. They also adopted a declaration stating that "economic development and technological progress must be compatible with the protection of the environment" and advocating the use of no-waste technologies in their countries' industries. In this article, an authority on business and the environment augments the discussion begun at this important international meeting. He offers considerable evidence that alert companies can turn pollution prevention into profit and make their growth and survival congruent with environmental protection.*

*Copyright © 1980 by the President and Fellows of Harvard College; all rights reserved. Reprinted by permission of the Harvard Business Review. Making Pollution Pay by Michael G. Royston, Nov. Dec. issue.*

Some businesses have long understood that environmental protection and economic progress can go hand in hand. Consider the following examples:

• Ciba-Geigy, the chemical complex in Basel, Switzerland has, with little capital investment, been able to eliminate up to 50 percent of the pollution from its operations and save an estimated $400,000 a year. By changing its manufacturing processes and recycling its water and solvents, it has saved not only money but also energy.

• A plant producing atactic polypropylene waste in Japan has a waste recovery and utilization plant with capital charges and operating costs amounting to $100 a ton. The value of recovery energy at $140 a ton yields an annual profit of $500,000.

• In the Federal Republic of Germany, Reffelmann Metallverarbeitung KG has recovered its electroplating liquors and made a 40 percent profit on them. ENKA-Glanzstoff is increasing its marginal profit by 30 percent in recovering zinc from its rayon plant effluents.

• In France, 22 factories have been converting their production wastes into useful, salable products. The Elf Oil Refinery at Feyzin, for example, has turned its hydrocarbon pollution into an annual profit of $1,320,000. The Société Alimentaire Equilibrée at Commentry has turned a methionine mother-liquor pollution problem into an annual saving of $600,000. The Sacilor steel works in Gandrange has recovered its iron dust residues and saved $200,000 a year. The Société Lacto-Centre in Bas-en-Basset has recovered its whey residue that was previously polluting local rivers and made a gross profit of $180,000 a year on it.[1]

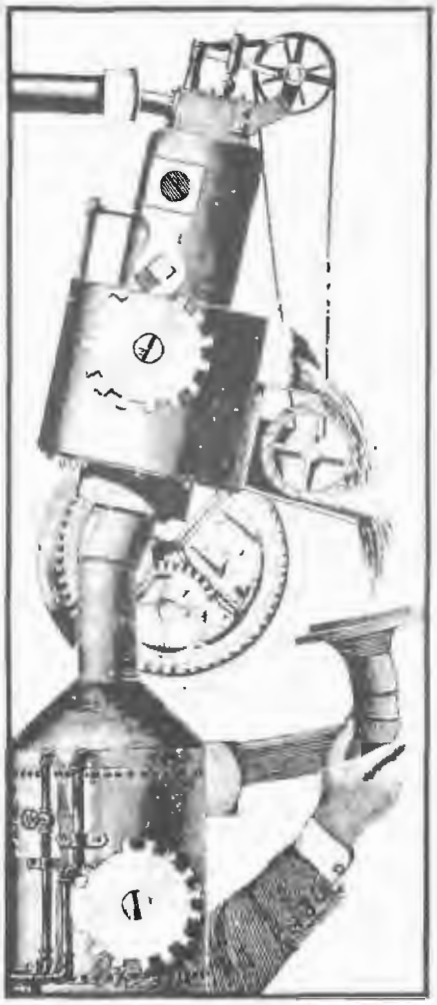
• In the United Kingdom, North British Distilleries, near Edinburgh, has turned its highly polluting still bottoms into nutritious animal feed and has had an annual return on investment of over 100 percent. Toma-

tim, another distillery in Scotland, is raising $6 million worth of eels in its hot water effluent. An ICI plant is saving $600,000 a year in fuel bills by segregating and burning its wastes.[2]

• Minnesota Mining and Manufacturing Company, the multinational based in the United States and known as 3M, has since 1976 expanded production by 40 percent and significantly reduced its annual pollutant load. Its liquid effluent has gone from 47 tons to 2.6 tons, its gaseous effluent from 3,000 tons to 2,400 tons, and its solid waste from 6,000 tons to 1,800 tons. This cleanup has resulted in a cost saving of $2,400,000 a year.

By 1976, this company had realized that the cost of meeting increasing demands for pollution control was threatening its profitability. It decided to attack the problem at its root by applying the philosophy that pollutants plus know-how equal potential resources and new profits. The company initiated this approach under the slogan "Pollution Prevention Pays" (3P).

In the first nine months of operation in 15 countries, 3P programs eliminated 70,000 tons of air pollutants and 500 million gallons of waste water. Instead of expending money, 3M saved $11 million. By viewing pollution as an indicator of waste and an opportunity for profit rather than as a costly threat, the company had, by 1979, saved over $20 million.[3]



Karen Watson

## New No-Waste Technologies

The savings possible from such no-waste approaches vary widely from industry to industry and from plant to plant. Most of the old technologies and processes in use were selected when the costs of energy, water, and raw materials were much lower than they are now and when the costs of waste disposal were either very low or could be ignored. Designs were selected to maximize the discounted cash flow, so long-term running costs tended to be sacrificed in favor of reducing initial capital costs. Thus, many existing plants and processes in all industries tend to have a good margin for improving efficiency, reducing costs, and minimizing waste and pollution.

Even the best managed and most efficient businesses are finding opportunities to improve their efficiency, to the benefit of both the economy and the environment. Many of these examples are to be found in Europe because it has a history of high energy and raw material costs as well as long-standing environmental concern. There, for example, the cogeneration of process steam and electric power, much discussed recently in the United States, has been routine practice for many years. Many industrial and municipal installations in Europe convert wastes into energy in specially designed incinerators and use waste heat from power plants for district heating.

It was there, in Finland, that the metallurgical industry developed the Outokumpu process, which since 1947 has been turning 98 percent of the damaging sulfur dioxide fumes arising from copper smelting into salable sulfuric acid.[4] It was there that the "systems approach" of integrating one type of processing plant with another to take care of wastes resulted in combined treatments that are clean, productive, profitable, and capable of generating 50 percent of their own energy needs. *Exhibit I* on page 35 shows how integrating various processes in a system can produce useful products and at the same time reduce waste.

It is in Europe, again, that a new technology known as fluidized-bed combustion has eased the acid rain problem. Scotland has been using this technique on a large scale to burn coal at 97 percent combustion efficiency and retain 90 percent of the sulfur in a bed during the burning of coal containing 3.5 percent sulfur.

In the extraction and building industries, English Clays has been using its china clay wastes to make prefabricated houses.

Germany's steel industry has recycled 99 percent of the water it uses and converted over 90 percent of its solid wastes into other useful materials. It is in Germany where coke ovens are being moved to enclosed quenching zones to recover gas and steam as energy sources and to eliminate air pollution, where the aluminum industry is using a closed fluoride cycle, and where the rubber and plastics industries have a large number of schemes to recover, resynthesize, and reuse waste materials as fuels by a variety of specalized pyrolysis and incineration techniques.

In the chemical industry, the Soviet Union has been using energy conversion and water recycling to cut the costs in an

ammonia plant to $40 or $50 a ton.

In the food industry, France has been getting a 30 percent return on investment from the recovery of protein from slaughterhouse wastes.

The process industries in general are able to turn half their gross pollution load to profit before having to pay for the hard task of cleanup, and many of them are in North America.

Hylsa, the steel company in Mexico, is using the sponge iron process to implement direct reduction technology and prevent the massive pollution of coke ovens, which cost U.S. Steel over $600 million to clean up recently at its Clairton works.

Shell Oil in Canada has been disposing of its refinery sludge by ploughing it into the prairie and increasing barley yields from 18 percent to 31 percent. In a pulp mill at Thunder Bay on Lake Ontario, the Great Lakes Paper Co. Ltd. has for the past three years been using the Rapson-Reeve process, which is neither as dirty as a conventional mill nor as uneconomic as one retrofitted with expensive pollution control equipment.[5] It is based on closed cycle operation and produces pulp more cheaply than a conventional plant does.

In the United States, the paper companies have begun to look at their industrial wastes as ways of making money.[6]

Union Camp, for instance, which used to sell its mill wastes for eight cents a pound, now turns them into flavors and fragrances worth more than a dollar a pound. It has boosted its chemical sales to $100 million a year.

As a by-product of processing at its Bellingham, Wash. plant, Georgia Pacific is producing 190-proof alcohol "so pure and potent" that the Treasury Department has stationed men in the plant full-time to make sure that none of it is converted to drinking liquor before its sale to industrial users.

Westvaco has found the conversion of mill wastes into other products so profitable that it has created a chemical subsidiary with four processing plants and a research center staffed with 80 scientists. In the past five years, Westvaco's chemical sales have doubled to $45 million, all from materials that the company used to dump.

Other U.S. industries are now doing similar rethinking.

Dow Corning has found that recovering chlorine and hydrogen previously lost to the atmosphere in making silicon can reduce operating costs by $900,000 a year. A $2.7 million capital investment in equipment is producing a 33 percent annual return on investment.

Hercules Powder spent $750,000 to reduce solids discharged into the Mississippi River and is now saving $250,000 a year in materials and water costs.

Process improvements in a Goldkist poultry plant have cut water use by 32 percent, reduced wastes by 66 percent, and produced a net annual gain of $2.33 for every $1.00 expended.

The chairman of the Hanes Dye and Finishing Company has testified that "cleaning up our stacks and neutralizing our liquids was expensive, but in the balance we have actually made money on our pollution control effort. EPA has helped our bottom line."

All these examples confirm the impression that in many industries a good deal of pollution stems simply from inefficiency and waste—waste that could be turned into profit.

## Organizing for Profit

How can companies best exploit their own pollution prevention opportunities? The key to 3M's success has been giving corporatewide recognition to the importance of technological innovation in making the company efficient and profitable, delegating responsibility and initiative to the shop floor, and rewarding all company personnel who get involved in 3P programs.

Joseph T. Ling, as vice president of environmental engineering and pollution control, heads up the corporate effort at St. Paul, Minn. and works directly with the corresponding managers of the overseas companies. In the United Kingdom, for example, Ling works with the manager of engineering services and a central energy and environment committee. The manager serves as chairman, and an accountant, the central engineering manager, the manufacturing manager, the maintenance engineer, and the public relations manager serve as the five other members of the central committee.

Each 3M factory has its own plant energy and environment committee comprising the plant engineer as chairman, the manufacturing supervisor, the process engineer, the maintenance supervisor, the control engineer, the division engineer, and an industrial engineer. Their job is to set targets for waste avoidance, establish programs with shop floor personnel, report progress to management, audit savings, and report to the central committee.

At 3M all corporate personnel from the shop floor upward are mobilized to contribute their knowledge and observations to the pollution abatement programs adopted. To qualify as a 3P program, a proposal has to eliminate or reduce a pollutant; bring about reduced energy use or more efficient use of raw materials like water; include some innovative feature; and bring monetary benefit through reduced or deferred controls or manufacturing costs, increased sales of existing or new products, or reduced capital or running costs. Pollution has been efficiently lessened, not by installing pollution control plants but by reformulating products, redesigning equipment, modifying processes, or recovering materials for reuse.

Good housekeeping has been the basis for successful pollution prevention at most of the companies I have mentioned. Often, however, they feel they have arrived at the best programs possible through computer optimization. They have looked at their intuitive proposals singly and in combination through sophisticated computer programs and have reached rank orderings of returns on investment for each degree of pollution abatement.

They have found that the economic way to abate pollution is not to call in equipment suppliers but to detect waste in their operating conditions; establish material, energy,

Exhibit

**Examples of no-waste technologies**

| Integrated systems | | | Wastes avoided |
|---|---|---|---|
| Copper smelting | Sulfuric acid | Fertilizer | Sulfur dioxide, heat, resources |
| Garbage disposal | Power generation | Drinking water | Land, heat, resources |
| Garbage disposal | Fuel production | Metal recovery | Land, resources |
| Paper | Alcohol | Protein | Water pollutants |
| Food preparation | Protein | | Water pollutants |
| Food preparation | Chemicals | | Air pollutants, resources |
| Steel production | Municipal waste water | | Water pollutants |
| Hog production | Cheese | | Water pollutants |
| Electric power | Sulfuric acid | | Air pollutants |
| Domestic water | Industrial water | Pollutant recovery | Water pollutants, resources |
| Whiskey production | Animal feed | | Water pollutants, resources |
| Timber | Plywood | Pulp | Water pollutants, resources |
| Heat | Power generation | | Air pollutants, heat, resources |
| Metallurgy | Paper | | Air pollutants, heat, resources |
| Aluminum | Cryolite | | Air pollutants, energy, resources |
| Alloy steel tubes | Pigments | | Water pollutants |
| Titanium dioxide | Pigments | Magnetic tape | Water pollutants |
| Steel production | Ceramics | | Solid wastes |
| Phosphates | Plasterboard | | Water pollutants |
| Mining | Building materials, (bricks, cement, aggregate) | | Solid wastes |
| Electric power | Insulating bricks | | Solid wastes |
| China clay | Prefabricated houses | | Solid wastes |
| Mining | Recreation | | Land |
| Electric power | Heating for homes, fish ponds, fields | | Heat |
| Animal waste | Gas | | Water pollutants |

and water balances; take note of legislative trends; and predict future waste treatment costs in the light of present expenses. Action based on this approach includes reducing energy consumption through heat reuse; coupling heat-producing and heat-consuming processes; integrating heat and power production; reducing heat and cold losses; and modifying temperatures, compressor and pump loads, and boil-up rates.

The next stage after they have eliminated substantial amounts of their waste has been to sell as much of that waste as possible to someone else and, with the residual pollutants, to build extra plants to convert them into useful raw materials or products. Then they have appraised the self-cleansing and dispersing power of their local environments and, with state authorities and local communities, have established appropriate discharge conditions for final residues.

Whenever possible, the companies have built treatment facilities jointly, as for example, Airco Alloy and a pulp mill in Sweden did and as Bass Charrington's giant brewery and the town of Runcorn in the United Kingdom did to profit from the compatibility of their mixed wastes. The treatment facilities have also usually been built with the companies' own manpower so as to develop the kind of environmental know-how that can be commercialized.

## Growth Boost

If taking such a positive approach to environmental protection can help companies maintain their profit, it can also help them grow. In the United States this year, environmental business has been almost a $50 billion affair and has recently been increasing 20 percent a year.

This new commercial area has brought in its wake a wave of new businesses. In the Federal Republic of Germany, more than 200 new companies have recently set themselves up to provide environmental products and services. In the United States, there are companies like Apollo Chemical Co., which started in the air pollution business some 15 years ago employing 10 people but which now employs over 400 and has subsidiaries around the world. Another is Waste Management Inc., a garbage-handling business based on a new technology that yields a turnover of $350 million.

Even more significant, many large companies have added divisions to provide environmental goods and services. In the United States, Boeing, FMC, Exxon, Dow Chemical, 3M, and Caterpillar Tractor all market environmental products and services. In Europe, Shell, BP, Ciba-Geigy, Krupp, and Philips market specialized environmental services. ICI, in the United Kingdom, has three environmental divisions—a general technical and instrument division, a division for deep-shaft waste treatment systems, and another for general biological services and marketing plastic filter medium. In Sweden, the PLM Company, formerly only in the packaging business, has diversified into the reclamation area and doubled its turnover to $500 million.[7]

In such diversification, it is as important as ever to link the new activity to an existing strength. Thus, in pyrolyzing garbage, the Danish firm Destrugas is producing fuel gas, Union Carbide is producing ammonia, and Occidental Petroleum is producing fuel oil.

New growth areas tend to stem from technological innovation, and innovation tends to result from external need or pressure. Environmental pressure generates innovation.

Environmentally induced economic activity continues to stimulate the economy. It is an estimated 2 percent of the gross national product in countries like the United States. The amount of employment engendered by all aspects of environmental protection in the United States was, at the 1977 Environmental Improvement Council Conference, reported to be 2 million jobs. Direct employment induced by the National Environmental Policy Act runs at about 75,000.[8]

A 1978 estimate of the economic impact of environmental policies in the United

*Exhibit II*

**Number of innovations in which environmental concerns have been considered**

| Industry | France | Federal Republic of Germany | Japan | Netherlands | United Kingdom | Total |
|---|---|---|---|---|---|---|
| Automobiles | 4 | 12 | 2 | | 10 | 28 |
| Chemicals | 9 | 12 | 6 | 5 | 12 | 44 |
| Computers | 5 | 9 | 7 | | 10 | 31 |
| Consumer electronics | 7 | 8 | 6 | 3 | 8 | 32 |
| Textiles | 10 | 6 | | 7 | 6 | 29 |
| **Total** | **35** | **47** | **21** | **15** | **46** | **164** |

*Source: National Support for Science and Technology: An Examination of Foreign Experience (Cambridge: Massachusetts Institute of Technology, 1976)*

States indicates that the annual benefits of improvements in air quality since 1970 have been $21.4 billion and that the total annual benefits in 1985 due to improved water quality will be $12.3 billion. It is further estimated that by the end of 1980 U.S. environmental regulations will have added 0.1 percent to the consumer price index, reduced unemployment by 0.4 percent, and increased gross national production by $9.3 billion.

Japan, in recession in 1974, used strict pollution control legislation to boost construction and engineering and hence restimulate the economy; 20 percent of its economic growth since then can be attributed to its new strict environmental legislation. Japanese companies are world leaders in supplying advanced pollution control equipment such as pyrolysis plants and flue gas desulfurizers.

Sweden used similar measures in 1970 when it faced an economic recession. The government introduced strict pollution control and offered industries cash grants of up to 75 percent of the purchase price of pollution control equipment installed before 1975. The result was a major improvement in the environment and a massive stimulation of the construction, equipment, and chemical industries. Sweden pulled out of the recession, and, like Japan, developed companies that are now leading suppliers of advanced pollution control equipment, chemicals, and know-how in the world."

## Survival of the Fittest

In determining the direction of their future growth, companies as well as nations will more and more have to take environmental concerns into account. The ultimate objective of the corporation is survival, and reaching that depends very much on the adaptation of the corporation to its environment.

Such major companies as Shell and BP are directing their development by forecasting from scenarios. They describe all the possible environmental conditions that might control their growth and make decisions accordingly. AKZO, the Dutch chemical multinational, constructs elaborate scenarios based on the social, political, physical, economic, and technological environments that it feels may prevail in the future and then determines which products and services will be most compatible with such conditions.

More and more companies are assessing the environmental impact of projects they are about to introduce. Some, such as DSM, the Dutch state coal mining enterprise that is now a large, successful multinational chemical company, go to the extent of simulating public hearings of impact reports. Company staff members play the roles of community and environmental advocates to identify the dangers and problems early so that remedies can be applied while cost and time penalties are still minimal. Under programs like this, enterprises accept the validity of environmental concern and encourage environmental awareness in their staffs. They can minimize the negative and maximize the positive impacts of their new projects.

They can also prevent their projects from being blocked by the courts or by citizen protest actions. By becoming concerned about environmental impact ahead of time, companies can avoid costly delay, bad press, and heavy financial burden.

## The Payoff

If a company looks at economic questions in an ecological way and at ecological questions in an economic way, it can make pollution prevention pay in relation to three corporate objectives. By focusing attention on waste avoidance and efficient operation, it can increase profit. By investigating new areas in which to develop products and services, it can grow. By avoiding conflict over new projects and winning acceptance for them by looking at them with an eye to the new environmental values, it can improve its chances of surviving. □

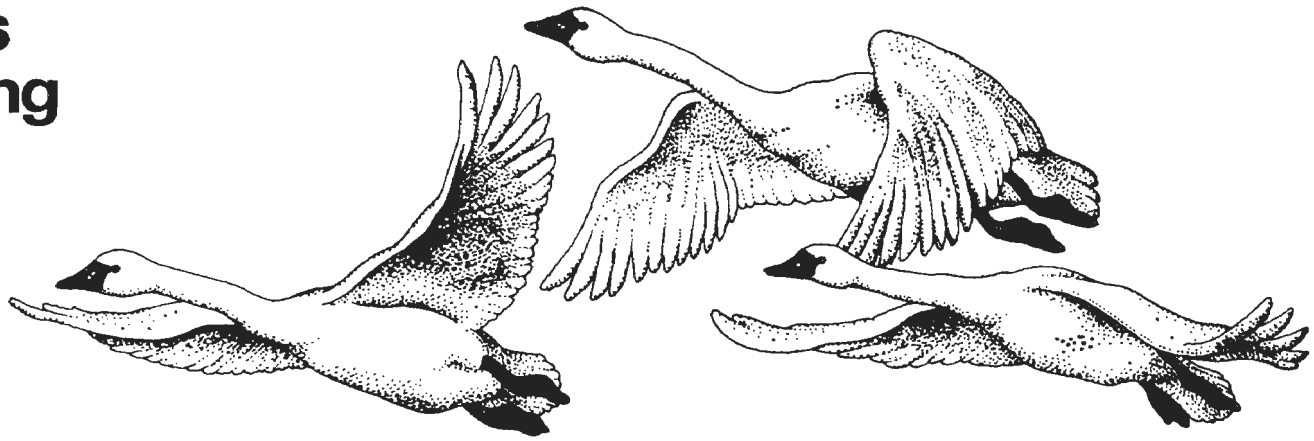
## Footnotes


1. See Ministère de la Qualité de la Vie, *Usines Propres* (Paris: La Ministère, 1976).
2. See my book, *Pollution Prevention Pays* (Oxford: Pergamon Press, 1979).
3. See Joseph T. Ling, "Developing Conservation Oriented Technology for Industrial Control," in *Non-Waste Technology and Production* (Oxford: Pergamon Press, 1978), p. 313.
4. S. Harkki, "The Outokumpu Flash Smelting Method," in *Non-Waste Technology and Production* (Oxford: Pergamon Press, 1978).
5. United Nations Economic Commission for Europe, "The Rapson-Reeve Process, A Case Study," *Compendium of Low-Waste and Non-Waste Technology* (Geneva: Palais des Nations, 1980).
6. United Nations, "Money from Wastes," *Development Forum*, January-February 1977, p. 3.
7. I. Flory, "Separation of Paper, Glass and Tinplate from Waste in Residential and Industrial Areas," ELMIA Conference, Jönköping, Sweden, October 1976.
8. *Eighth Annual Report of the Council on Environmental Quality* (Washington, D.C.: U.S. Government Printing Office, 1977), p. 332.
9. *Tenth Annual Report of the Council on Environmental Quality* (Washington, D.C.: U.S. Government Printing Office, 1980), pp. 655-662.
10. Organization for Economic Cooperation and Development, "Prevention Less Costly than Cure," *OECD Observer*, May 1979, p. 9.
11. Organization for Economic Cooperation and Development, "The Environment and Current Economic Problems" and "The State of the Environment," *OECD Observer*, May 1979, p. 29.



*Mr. Royston is professor of technology and environment at the Center for Education in International Management in Geneva, Switzerland.*

# Swans Winging North



With a thunderous slapping of wings and pattering of black-webbed feet on the water surface, flocks of whistling swans soon will be taking off from Chesapeake Bay and other eastern waterways for their extraordinary annual migration across the continent to Alaska and Western Canada.

After assembling together at various staging points along the East Coast these graceful white birds begin their vast journey often at dusk or by moonlight. They lift off whenever instinct tells the leaders the time has come to return to the rim of the Arctic Circle to breed and raise their young under the midnight sun.

As the great spring migration begins the swans will fly at heights ranging from 2,000 to 8,000 feet for as much as eight hours before landing on the first leg of their flight.

Sometimes they are caught and buffeted in severe storms and forced to land abruptly in farm fields. Occasionally these weary birds have landed on the Niagara River and have been swept over the mighty falls. When these mishaps occur the survivors have often been shot or clubbed to death by people who regard them as game birds.

However, the majority of the whistling swans successfully complete their migration and begin building large, crude nests of grass and other vegetation on the North Slope of Alaska or in marshy areas of Canada's Northwest Territories.

Dr. William J. L. Sladen, who has conducted extensive research on whistling swans (Cygnus columbianus), confirmed the flight of these birds from Chesapeake Bay to Alaska in 1970 when he and his pilot in a small airplane spotted a color-dyed swan swimming on an Alaskan lake.

After the plane landed, Dr. Sladen identified the bird by its numbered band as one of 48 swans marked the previous winter near Galesville, Md.

The flight of these birds can sometimes be hazardous to aircraft. In 1962 a United Airlines plane crashed in Maryland and all passengers were killed after a swan struck its tail.

This is one of the reasons why information on the migration of swans and other large birds is of more than academic interest.

Although named whistlers, these stately birds actually have a high-pitched "woo-HOW-woo" call that sounds like children playing Indians.

During the spring migration season in the Chesapeake region, you can sometimes see and hear masses of several different types of aquatic birds winging their way north on different flight levels at the same time.

In addition to the baying of the whistling swans, you can hear the quacking of mallards, the croaking of snow geese, and the honking of Canada geese, an unforgettable medley of sky music.

Whistlers wintering in the Chesapeake Bay region feed on aquatic vegetation and, when they can find them, thin-shelled clams.

However, in recent years the underwater greenery in the upper Chesapeake Bay has become scarce, forcing the swans to find food on land. When the swans feed on young shoots of winter wheat some farmers start to talk about the possibility of changing the law that now protects whistlers from hunters.

Research is being conducted by EPA, Maryland, and Virginia and various agencies on the reasons for the disappearance of the water vegetation.

One cause is that increased discharges of sediment from land development and larger flows of wastes into the bay are increasing turbidity. This reduces the sunlight needed by the aquatic plants for photosynthesis.

There are an estimated 100,000 whistling swans in the U.S. They are one of three species of wild swans in this country. The other two are the trumpeter swan (Cygnus buccinator), a bird primarily of the West and which can be distinguished from the whistler mainly by its larger size, and the mute swan (Cygnus olor), the royal bird of England now sometimes found in the wild in this country, but which was introduced into the U.S. many years ago as an ornamental bird for parks.

The eggs of whistling swans hatch in June and by fall, the young, known as cygnets, are ready for their maiden flight to the wintering grounds.

An older male, called a cob, leads each wedge of the migratory flight. The ash-grey cygnets fly between their elders and are buoyed by the air turbulence generated by the leading birds on the way to Chesapeake Bay and other water bodies between Maryland and North Carolina, where they are still protected by law against hunters.

S. Dillon Ripley, Secretary of the Smithsonian Institution and a noted ornithologist, has commented on the value of whistling swans:

"To me the far-ranging whistler has always seemed a perfect symbol of the wilderness. The birds come and go on their own, without let or hindrance. They can be killed legally in three states and to what purpose? Swans are fortunately unpopular as table fare, and the trade in swanskins and swansdown has passed into history. I feel that only a fool would kill a swan, for to do so is to impinge on your birthright, to sully your natural surroundings, to scar your soul a little."
—C.D.P.

# People

**Edward A. Kurent**

He has been named Director, Enforcement Division, Office of Water Enforcement for EPA.

In his new position, he will be responsible for directing national water pollution enforcement and compliance monitoring programs, primarily those under the Clean Water and Safe Drinking Water Acts.

He was most recently the legal director of EPA's Hazardous Waste Enforcement Task Force. He previously served as special assistant to the Administrator for Enforcement, and as a staff attorney in the Office of Water Enforcement at headquarters.

Prior to coming to EPA, he served in the U.S. Navy Judge Advocate General's Corps where he was first a prosecution and defense attorney, and then a Special Court Martial Judge in the Republic of the Philippines. Before that, he worked in the federal Office of Economic Opportunity for two years before it was dissolved in 1973.

He received his bachelor's degree from Ohio Wesleyan University in 1968 and his law degree from the University of Cincinnati Law School in 1971.

**Lewis Crampton**

He has been named Director of the Management and Planning Division for Region 5. Crampton is in charge of the Region's planning processes, including budgeting. Among the areas under his direction are personnel management, general services, and the analytic center. Prior to joining EPA, Crampton was a senior consultant for Arthur Little Co. in Cambridge, Mass., where he led a team which prepared a major report for 300 clients in the private sector on the regulatory outlook for hazardous substances through 1985. From 1974 to 1977 Crampton served as Commissioner of the Massachusetts Department of Community Affairs. Crampton said that he hopes to make services provided by the Planning and Management Division oriented toward helping EPA program people to do their jobs better. His goal is to manage staff and budgetary resources more efficiently and to contribute to a more effective planning process.

A native of Boston, Crampton received an honors degree in public administration from the Woodrow Wilson School of Public Affairs at Princeton University, a master's degree in East Asian studies from Harvard, and a doctorate in urban and regional planning from MIT.

**Irwin P. Baumel**

He has been named as Director, Health and Environmental Review Division in the Office of Toxic Substances. The Health and Environmental Review Division is responsible for the detailed assessment of harmful effects of chemicals on human health and the environment in support of Office of Toxic Substances regulatory program activities.

Prior to his appointment, Dr. Baumel was Acting Director of the Division of Criteria Documentation and Standards Development for the National Institute for Occupational Safety and Health. He held several other administrative positions with that agency beginning in 1975.

He received his bachelor's degree in Pharmacy from Columbia University in 1963; a master's degree in Pharmacology from Northeastern University in 1967; and his doctorate in pharmacology from the University of Rhode Island in 1970.

Prior to entering government service, Baumel pursued an active research and teaching career at Yale School of Medicine and at Georgetown University School of Medicine, where he held an Assistant Professorship.

**Edward A. Klein**

He has been named Director, Chemical Control Division, Office of Toxic Substances.

He was most recently the Special Assistant to the Associate Solicitor for the Occupational Safety and Health Administration, beginning in 1974.

Prior to that, he was a trial attorney for the National Labor Relations Board.

He received his bachelor's degree in political science from the Pennsylvania State University in 1965, and his law degree from New York Law School in 1969. He is a member of the New York Bar. He is the author of the article "Caution: The Workplace may be Hazardous to your Health," which has appeared in several publications including the book *Toxic Torts* (1976).

**Thomas R. Hauser**

He has been named Senior Research Official at EPA's Environmental Research Center located in Research Triangle Park, N.C. Since 1977 Hauser has been Director of EPA's Environmental Monitoring Systems Laboratory at that location, and will continue in that post.

In his new role, he will be the principal spokesman for the complex of four major laboratories and two offices that make up the Center.

Since last May, Hauser has also served as Field Director and Coordinator for all EPA environmental monitoring studies at Love Canal in upstate New York.

He received an officer's commission in the U.S. Public Health Service in 1955, and he joined the National Air Pollution Control Administration at Cincinnati in 1958 as a research chemist.

In 1970 he transferred to Research Triangle Park as a supervisory research chemist in the National Air Pollution Control Administration's Health Effects Research Program. After this agency became part of EPA, Hauser was named Deputy Director of the Environmental Monitoring Systems Laboratory at Research Triangle Park.

He received his bachelor's and master's degrees in chemistry from Xavier University in 1953 and 1955 respectively, and his doctorate in environmental engineering from the University of Cincinnati in 1971.

**Donald H. Horstman**

He has been named Chief of the Clinical Research Branch of EPA's Health Effects Research Laboratory in Research Triangle Park, N.C. In his new role he will supervise a staff of approximately 25 physicians, physiologists, bioengineers, biochemists and immunologists in studies on the relationships between human health problems and air pollution. Their research focuses primarily on the levels of air pollutants commonly found in metropolitan areas, and subsequent effects on the human body.

Horstman will also assist in development of EPA's environmental health research programs.

Prior to joining EPA, he was a research physiologist for eight years at the U.S. Army Research Institute of Environmental Medicine in Natick, Mass., where he studied the effects of altitude, temperature and exercise on human physiology.

He received his doctorate in physiology from Pennsylvania State University at University Park. And he performed post-doctoral research as a fellow at the Institute of Environmental Stress at the University of California at Santa Barbara. □

## Guarding the Sea

*continued from page 27*

to a resort where they have walked in sand laced with tarballs, a phenomenon now noticeable on beaches from Micronesia to Cape Cod Bay, from Brittany to the south coast of Crete.

Where the oceans have been concerned, we who think of ourselves as master managers have been masterly at mismanagement. In 40 years, we have threatened the health of the seas more dramatically than any people in the preceding 4000 years, but we have only recently recognized the hidden costs of our errors, the long-term penalties to be paid.

And, our folly is not confined to salt water. Our fresh water management is in some ways worse because these water resources quench our thirst and bathe our bodies. What could be closer, more important to us? And yet rampant unplanned "development" gobbles up hundreds of acres of land a day, making increasing demands on our freshwater supply. And our urban planning does not always take fresh water needs into account.

Environmental protection does not mean we must sacrifice a quality standard of living. On the contrary, preserving our natural resources infuses our living standard with higher quality, a higher quality that is based not just on the exhilaration of the wilderness, or just on the beauty of a blue-green sea as the sun illuminates it; nor on just the pleasure of watching dolphins glide iridescent alongside the prow of a ship. It is the higher quality of life that accompanies knowing we have truly tried our best to husband the gifts we have.

Nowhere will the environmental challenge of the next years be more obvious than in the oceans which are so vast and so far from the view of most of us. These waters are truly our last earthly frontier. Most of them remain unexplored, and we have much to learn every day from them. Scientists have found new forms of life in the dark abyss, reaches of the sea which other scientists had long ago given up for dead. For nearly seven years, nations have squabbled over minerals and fishing rights of the oceans, battles which have at least culminated in a Law of the Sea, albeit incomplete. Eventually, ocean thermal conversion, tidal power, and salinity gradients —all energy sources from the ocean—will help ease our energy crisis. We will grow, in many respects, increasingly more dependent on the oceans.

*Sea gull in flight at Assateague Island in Maryland.*

Just as healthy vibrant seas once helped open whole continents to human activity and ingenuity, so human activity and ingenuity must be marshalled now to protect the seas. There are many encouraging signs, but just as many discouraging ones, and the next twenty years will sway the balance.

The choice is rather clear. We can either face out to the sea and guard it wisely and well, or we can lower our eyes to the responsibility and turn the oceans into mere recipients of the pollution and other problems we have on land. Finally, the challenge will be whether we can properly manage our ocean asset, this unique capital which has fueled a very rich part of our history, and on which so much of our future well-being will depend. □

*Jean-Michel Cousteau is the son of ocean explorer and environmentalist Jacques-Yves Cousteau. He is Vice President, Communications for The Cousteau Society, a group which is dedicated to the protection and improvement of life. Paula DiPerna is a writer for the Cousteau Society.*

# News Briefs

**Barber Named Acting EPA Administrator**

Walter C. Barber, 39, a career EPA Deputy Assistant Administrator and former examiner with the Office of Management and Budget, has been designated as EPA's Acting Administrator. Barber is an air pollution expert who has been recognized for his work with government and industry in dealing with national and international pollution problems. Ernst Minor, a member of the Reagan Transition Team assigned to EPA, has been named as executive assistant to Barber. Minor worked for seven years at EPA's research laboratory complex in Cincinnati, Ohio, before joining the Reagan-Bush campaign.

**New Approaches to the Environment**

*continued from inside front cover*

away to San Francisco just to get a permit to burn small piles of pear tree prunings. "This is ridiculous," he said.

He added that he also has difficulty understanding air pollution rules which restrict burning to certain winter days. He said that it seems to him that if farmers could burn when they needed to there might be less concentrated smoke pollution.

"While I'm no scientific expert on this, I don't believe smoke from agricultural burning is all that bad anyway."

Livermore said that when his ranch foreman, a conscientious man, asked for information on the exact rules about burning, he called the California Air Resources Board and asked for a copy of the rules.

"I got 150 pages of rules," Livermore noted.

On another aspect of clean air, Livermore said that he has difficulty understanding "why if the Japanese over the past several years have been producing cars that meet clean air standards, our Detroit auto manufacturers have so much trouble complying."

Livermore said that he favors extensive use of economic incentives to help encourage business to curb pollution. He said that in his opinion substantial savings can be realized by granting business greater flexibility in the methods used to reduce pollution.

On the subject of economy, Livermore also said that he believes that some small towns have been forced to build very expensive waste treatment plants which they couldn't afford. "There appears to be little question but that there have been excesses in that area," he added.

Livermore, a graduate of Stanford University, is currently serving as a member of the California Fish and Game Commission by appointment of Governor Edmund Brown. □

*Back cover: The incinerator ship Vulcanus burning hazardous wastes at sea. (Article on p. 24)*

*Opposite: A diver from EPA's Gulf Breeze laboratory in Florida collects bottom sediment and water for research into the impact of toxic chemicals on the aquatic environment. (Article on p. 22)*


## EPA Journal Subscriptions

Name-First, Last — Please Print

Company Name or Additional Address Line

Street Address

City | State | Zip Code

☐ Payment enclosed
☐ Charge to my Deposit Account No. . . . . .

Do you know someone in industry or in a civic group who wants to keep up with national environmental developments involving EPA? Let them know about EPA Journal. If they want to subscribe, give them this form. The subscription price is $12 per year and $15.00 if mailed to a foreign address. A single copy sells for $1.20. (Agency employees receive this publication without charge.) Anyone wishing to subscribe should fill in the form below and enclose a check or money order payable to the Superintendent of Documents.

Mail order form to:
(Superintendent of Documents)
Government Printing Office
Washington, D.C. 20402

United States
Environmental Protection
Agency
Washington D C 20460

Postage and
Fees Paid
Environmental
Protection
Agency
EPA 335

Official Business
Penalty for Private Use $300

Third Class
Bulk


Return this page if you do not wish to receive this publication (  ), or if a change of address is needed (  ), list change, including zip code.