could be made to serve the state's interests as well as the nation's. The state coastal zone management plan prepared late in his administration gave explicit support to the "concept of a single, major crude petroleum receiving and transfer facility at or west of Port Angeles."

But Governor Ray, Evans' successor, took office with quite a different set of perceptions and predilections with respect to tanker traffic and pipelines. She was, and is, convinced that fears as to the consequences of an oil spill in Puget Sound have been much exaggerated. A marine biologist herself, she believed—contrary to the thinking of many of her former colleagues at the University of Washington—that such a spill would be by no means catastrophic.

In keeping with this sanguine view, she chose to support the ARCO proposal to establish a major oil port on the sound and adapt the Trans Mountain Pipeline for the eastward movement of Alaskan crude. To that end, she proposed to strike from the coastal management plan the statement of policy against such a project; she also expressed disagreement with the law passed by the Washington legislature in 1975 prohibiting tankers of greater than 125,000 deadweight tons from entering the sound.

The legislature, disturbed at these attitudes on the part of the new governor, moved to kill the ARCO project, but good. It passed a bill restating, in flat statutory terms, the prohibition against major oil transfer facilities on Puget Sound. Ray vetoed this measure, but soon found herself outflanked. The state legislators and environmentalists prevailed upon Senator Warren Magnuson (D–Wash.), one of the powers-that-be on Capitol Hill, to push through an amendment to the Marine Mammal Protection Act which does precisely what the legislature had sought to do. For this, Ray called Magnuson a "dictator."

Both the governor and the senator are now saying somewhat the same thing about the possibility of oil transfer facilities anywhere in state coastal waters. Such facilities, they say, would serve no state need and are unwanted. But the governor in particular has indicated that, if President Carter delares such a facility to be in the national interest, this would carry great weight with her. If the President does in fact decide the Northern Tier project is needed, it will be up to the governor herself to grant or withhold state permission to build the facility once she gets a recommendation from the Energy Facilities Site Evaluation Council.

The circumstances in which the Sohio project at Long Beach now finds itself illustrate how important—and volatile—local opinion can be in deciding the ultimate outcome of even an oil port and pipeline proposal that enjoys support at the highest political levels, including the White House. If this project fails to survive the forthcoming municipal referendum, the project could be dead. For Sohio, this would be the bitterest kind of setback, for there is no doubt that the company has, however slowly and reluctantly, made concession after concession to meet the demands of the California Air Resources Board (ARB).

Both the ARB and the U.S. Environmental Protection Agency apply a rigorous "trade-off" policy in cases where a new industrial facility is to be established in a region such as southern California which does not meet ambient air quality standards. What this means is that, besides providing assurances that its own emissions will be kept within prescribed levels, the company seeking an ARB permit must also agree to more than offset those emissions by providing the wherewithal to allow another industrial entity in the region to lower its own emissions below the levels permitted.

Sohio has agreed to a trade-off package that will cost the company up to $82 million. The Southern California Edison Company alone will receive some $60 to 65 million to install a sulfur dioxide scrubber at an oil-fired electric generating plant near Long Beach. Also, Sohio will pay for a "de-nox" unit (for removal of nitrogen oxides) to be installed at this plant and for equipment to allow three large dry-cleaning establishments to reduce their emissions of hydrocarbons.

On the strength of these commitments to improved air quality, Sohio is hoping that the citizens of Long Beach will be persuaded that their interest will be best served by allowing the Pactex project to go ahead. But, as matters stand, what the voters will do is said to be anybody's guess.

As must now be all too clear to the North Slope producers and the rest of the oil industry, the comfortable assumption of several years ago that all would be well once TAPS was built was dead wrong. Indeed, with the benefit of hindsight, some oil industry people may be thinking in their heart of hearts that they could have spared themselves a lot of misery by agreeing to move the North Slope oil across Canada to the Midwest rather than insisting on landing it on the West Coast.—LUTHER J. CARTER

Environmental Assessment Sought for Federal Actions Abroad

In 1976 the Export-Import Bank authorized some $644 million in loans and loan guarantees to the Philippines for a nuclear power reactor. Later, after that country asked the Nuclear Regulatory Commission for help in evaluating preliminary site investigation reports, it was ascertained that the Philippines lie in an earthquake belt, and also in a volcano belt; that the plant site was near a live volcano; that there were no stable salt formations in which to bury nuclear wastes; and that cost per kilowatt of nuclear power was considerably higher than geothermal, hydropower, or coal alternatives.

The future of this project is not certain. However, it can be argued that the prior availability of detailed information on the potential environmental impacts would have been helpful to the Filipinos.

This is a striking example of the kind of situation that could be avoided, or at least foreseen, if this country extended its evaluation of environmental impact of federal projects to actions abroad.

Now, 9 years after the enactment of the National Environmental Policy Act (NEPA), the White House is preparing to issue an executive order requiring some form of environmental assessment of "major federal actions" in foreign countries. (This would not apply to actions by the private sector.)

The Environmental Protection Agency has always thought that the procedures established by NEPA—requiring the

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preparation of environmental impact statements (EIS) for actions significantly affecting the environment—were not intended for application solely in the United States. But with few exceptions this sentiment has been ignored. Now it seems the time is ripe for a determination on the matter. There are currently two lawsuits pending, against the State Department and the Ex-Im Bank, relating respectively to impact statements on the spraying of paraquat on Mexican marijuana (brought by the National Association for the Reform of Marijuana Laws) and the export of nuclear fuels (brought by the Natural Resources Defense Council).

Last January the Council on Environmental Quality (CEQ), which is responsible for overseeing the application of NEPA, drafted a set of regulations on foreign application of the act. They met with a veritable hurricane of objections from the State Department and other agencies—the Defense Department, the Treasury Department, the Commerce Department, the Agriculture Department, in fact, just about everyone. They all thought this was a case of CEQ trying to act as "environmental policeman for the world" (as one columnist put it), and foresaw endless delays and lawsuits and loss of foreign trade, particularly as regards export of nuclear fuels.

So in an attempt to reach a compromise, the White House in June directed that State and CEQ get together and work out a draft executive order. The draft, dated 26 July, is currently under scrutiny at the White House.

The draft order covers four types of "major federal actions": (i) those "significantly and adversely affecting the environment of the global commons" such as the oceans, Antarctica, and the upper atmosphere; (ii) those bad for the environment of a nation that is otherwise uninvolved with the transaction (innocent third parties); (iii) those providing a nation with hazardous or radioactive substances or facilities to produce such substances; and (iv) those that affect adversely "natural or ecological resources of global importance designated for protection . . . by the President" or in certain cases by the Secretary of State (this would mean major ecosystems such as rain forests or endangered habitats).

The order offers three possible procedures, in descending order of thoroughness: formal environmental impact statements (which would be mandatory only in cases affecting the global commons), bilateral or multilateral environmental studies, or some sort of environmental assessment.

Panel Throws Doubt on Vitrification

While the Department of Energy (DOE) continues its frustrating search for someplace where people will allow a permanent dump for spent fuel from nuclear power reactors, the most pressing waste problems have to do with the final disposition of so-called high-level liquid wastes (HLLW).

Most of the country's 265,000 metric tons of these highly radioactive wastes have resulted from the chemical reprocessing of nuclear fuels for the purpose of extracting plutonium for nuclear weapons. Some 600 tons were created by fuel reprocessing—now halted by the government—in the 1960s.

The DOE now has the waste, most of it over 20 years old, stashed in tanks at three principal locations: the Hanford Reservation in Washington, the Savannah River Plant in Georgia, and the Idaho National Engineering Laboratory. The DOE is feeling considerable pressure to get these wastes solidified and put in permanent storage. So, as part of an accelerated attempt to resolve the technical problems, the Nuclear Regulatory Commission asked the National Academy of Sciences to do a study on solidification of high-level radioactive wastes. That report was made public last week.

The bulk of the study, which was directed by Rustum Roy of Pennsylvania State University, addresses itself to the matter of vitrification of liquid wastes. Vitrification means immobilizing radioactive materials in glass. Glass has some 20 years of research behind it, and has come to be regarded, worldwide (says the report) as "the form of choice" for solidifying HLLW.

But, according to Roy's group, glass may not be the way to go. It has been assumed to be desirable because of its low leachability; however, this quality has been overestimated, and glass does not compare well with other substances, namely ceramics, in various measures of stability.

The matter of solidification is a complicated one because the optimal method depends on the potency of the wastes and on the nature of the other layers of containment. A whole containment system may consist of four layers: the primary bonding, which holds the radionuclides at the atomic and molecular level; secondary containment, which binds the primary particles in a matrix of, say, metal or cement; an external container; and the geological formation in which the container is buried.

The report decries the fact that R & D for primary containment has been almost exclusively centered on glass. Actually, it says, ceramics may be preferable in some cases. Ceramics are inorganic insoluble nonmetallics which are crystalline in structure or partly so. Glass is noncrystalline and therefore has inferior high-temperature properties.

"In the opinion of the materials community," says Roy, glass is relatively instable, thermodynamically bad, in short, it "chews up" easily. So "Why was glass chosen?" says Roy. "We asked that question all over the world. The panel says anybody in his right mind would bury it in crystals."

The panel does not recommend abandonment of glass; rather the general message to DOE is not to be in such a big hurry, to let its wastes cool off some more in temporary storage and not make any big decisions until considerably more R & D has been done on alternative containment forms.

The DOE, which is planning a yet-unauthorized $3 billion demonstration vitrification plant at Savannah River, has not yet responded in detail to the Academy recommendations. DOE's Goetz Oertel told *Science* that the report "doesn't give us any problems right now," but he acknowledged that there is a "definite disagreement" with the panel on the perceived urgency of the situation. "Defense wastes were generated by this generation," says Oertel, "and it should be taken care of by this generation. There is a certain amount of pressure to get the job done."

This conflict was probably the inevitable result of the fact that it took the government a long time to get really serious about problems of radioactive waste disposal. For a long time, says the report, HLLW management was regarded as a "minor engineering problem," and not until 1975 were there initiated any diligent research attempts to balance the "disproportionate emphasis on glass." The DOE recognizes the need to explore options, but it would also very much like to be able to claim that a final solution had been found in an area where solutions have so far evaded it.—C.H.

Exemptions from or modifications of the requirements would be allowed for arms transfers, disaster relief, intelligence activities, and for various reasons such as national security, and commercial and competitive factors.

The draft order spells out several areas of disagreement between CEQ and State: by far the greatest difference is over nuclear exports. The State Department wants all exports of nuclear fuel to be exempt from the order. It fears that environmental assessments would cause interminable delays (compounded by possible court suits) and that our nuclear clients would decide we were unreliable and turn to other sources. This sentiment is backed up by a conglomeration of forces including the export and international trade community, the defense and intelligence people, and those opposed to nuclear proliferation (who, in the words of one official, "are increasingly hard to distinguish from the nuclear exporters").

The CEQ proposes that exemptions for nuclear exports be decided on a case-by-case basis and be applied only where nonproliferation objectives appear to be jeopardized, although CEQ chairman Charles Warren has contended that "there is no conceivable way that the preparation of appropriate environmental reviews for fuel shipments could have adverse effects on the Administration's nonproliferation policy."

Another difference between State and CEQ is over environmental assessments of physical facilities that produce toxic chemicals. State only worries about the export of chemicals; CEQ maintains that, in the words of chairman Warren, "We must be as concerned about the federal involvement in the export of a DDT plant as we are about federal involvement in the export of DDT."

Other matters await resolution. The State Department, in what CEQ regards as a last minute rug-pulling maneuver, wants to eliminate the EIS option altogether, leaving only the two less rigorous procedures. It objects to CEQ's desire that agencies involved in actions abroad be required to share their environmental information with other government agencies, and it has added wording under "rights of [legal] action" intended to discourage courts from thinking that the order creates a right to bring lawsuits to enforce compliance.

On the whole, the document would be a cautious one even if CEQ won out on all the disputes. Applying NEPA principles abroad would not necessarily result in the cancellation or alteration of any actions; nor would they apply at all to most environmental depredations carried on *within* a country with the aid of U.S. dollars.

The Environmental Protection Agency, which participated only marginally in the development of the regulations, is supposed to keep its official mouth shut until the White House has worked out a final version of the order. However that agency has always contended that NEPA does apply abroad (the Justice Department is supposed to issue an opinion on that soon) and there is reportedly a good deal of dissatisfaction at EPA with the loopholes, exemptions, and opportunities for agency discretion that are contained in the draft order.

Many observers believe the order would not precipitate a flurry of new lawsuits; on the contrary, some feel there will be even fewer after the Administration comes up with an explicit stand on this long-disputed subject.

—CONSTANCE HOLDEN

New Rulebook for Gene Splicers Faces One More Test

The gene splicing and cloning technique, first invented in 1973, is now in use in some 350 research projects financed by the National Institutes of Health (NIH). The researchers are subject to the safety guidelines drawn up by an NIH committee in June 1976, but for more than a year have been anxiously awaiting a major revision of the rules.

The proposed new rulebook was published in the 28 July issue of the *Federal Register*, but with it was the news that there is to be one more round of review before the rules become final. Secretary of Health, Education, and Welfare (HEW) Joseph Califano says he plans to hold a public hearing on 15 September. Comments received then and in writing will be reviewed by a four-man group chaired by HEW general counsel Peter Libassi. Other members are NIH director Donald Fredrickson, and two assistant secretaries of HEW, Julius Richmond and Henry Aaron.

Since Fredrickson has already conducted a public review of most of the revisions (*Science*, 6 January 1978), Califano's intention of repeating the exercise unavoidably looks like second guessing the NIH's judgment. (Libassi says that no second guessing is intended although the review group will inevitably be covering some of the same ground.) Libassi's review will also constitute the first time that anyone other than the NIH and its committees has had the power to change the guidelines. In return for accepting another round of review, the NIH seems to have persuaded Califano to promise that the final guidelines will be issued promptly and that there will be no extension of the 2-month period for public comment that started on 28 July.

The proposed new rules assume particular importance now that it seems increasingly possible that Congress will once again fail to pass any bill governing gene splicing research. The bill prepared by the House health subcommittee has yet to reach the floor, while the Senate is still awaiting a reply to the letter sent by six senators to Califano on 1 June.

If no bill is passed, and if Califano declines the senators' invitation that he invoke existing statutory powers to govern gene splicing, the present "voluntary" system would continue under the aegis of the revised rulebook. Features included in the new guidelines—such as a voluntary registry for industry—seem designed to make the NIH rulebook an arguably sufficient instrument for national governance of the research.

The new guidelines differ from the old in both scientific and procedural aspects. The three main scientific changes concern thinking about the bacterial host system for gene splicing, experiments with viruses, and "shotgun" experiments.

• *E. coli* K12. Many gene splicing experiments consist of splicing DNA from the organism of interest onto a virus or plasmid which can replicate in the human gut bacterium *Escherichia coli*. The inserted DNA is, as it were, xeroxed

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