

Now that KMS is an official government research contractor, it seems that a new era of peacemaking may succeed the old era of contention. The AEC would probably not have granted KMS such a fine contract (the KMS facility can produce eight laser shots per day, so only a few weeks work may be involved), but with the coming of ERDA, the official attitude of the atomic establishment seems to have softened significantly, and

laser fusion administrators have apparently decided that it is in the national interest to join forces with KMS.

According to the head of the ERDA laser office, James McNally, the new contract is part of a trend toward greater participation in laser fusion research. The coming years, he says, may see the level of funding for industrial and university centers rise from 10 to 15 percent of the federal program.—W.D.M.

Auto Emissions: EPA Decision Due on Another Clean-up Delay

On 3 March Russell Train, administrator of the Environmental Protection Agency (EPA), will announce his decision on whether to grant auto makers an additional 1-year suspension, under the Clean Air Act of 1970, of emissions standards scheduled to go into effect for the 1977 model year. He will also be making long-term recommendations to Congress that could affect the rate at which cleanup efforts proceed, as well as the nature of the technology that is brought to bear on the problem.

EPA officials say this may be the toughest set of decisions the agency has yet confronted. In the past, says one, the attitude has been, "If the technology is there you go ahead" with enforcing the law. But now, with the economy in shambles and fuel prices going out of sight, the name of the game more than ever is trade offs. Public health and environmental needs must be weighed against fuel economy (mileage per gallon) goals, rising car prices, and the need to keep the auto industry—which contributes 16 percent of the gross national product—financially viable.

The Clean Air Act originally mandated that regulated emissions from automobiles be reduced by 90 percent from 1970 levels by 1975. This amounts to a goal of 0.41 gram of hydrocarbons (HC) per mile, 3.4 grams of carbon monoxide (CO), and 0.4 gram of oxides of nitrogen (NO_x). Since then, manufacturers have twice been granted reprieves. Currently, the law says the CO and HC standards must be met by 1977 and the NO_x standard by 1978 (Table 1). Train must decide, taking available technology and the public welfare into account, whether to give auto makers until 1978 to get their CO and HC emissions into line.

EPA research, backed by studies by the National Academy of Sciences, leave little doubt that achievement of statutory emission standards is technically feasible. The public welfare question is trickier—auto makers claim that the costs to both the industry and the car-buying public would outweigh the benefits of marginally cleaner air in 1977. (The introduction of catalytic converters in 1975 models to bring emissions down to the interim 1975 and

1976 standards has achieved 83 percent of the final goal.) Manufacturers claim that more advanced and costly emission control devices needed for the 1977 and 1978 standards are the last thing the country needs to get Detroit moving again; that they will have to stop production of some model lines, which will add to unemployment; and that they need more time to perfect various techniques for improving mileage and cleanliness and for developing workable alternatives to and refinements of the internal combustion engine.

These arguments were advanced by industry during several weeks of hearings EPA held to consider the suspension request. Auto manufacturers also used the hearings as a forum to push for what they really want, which is a 5-year freeze, starting in 1977, on emission standards as they now apply. Since the ultimate cleanup standards have already been pushed back from 1975 to 1978, amendment of the law to conform with industry's desires would amount to a 7-year rollback of the original deadlines.

President Ford, with the apparent prematurity that has marked some of his other actions, in January offered auto makers a compromise deal. In return for a pledge to improve fuel economy by 40 percent between 1974 and 1980, he suggested a 5-year freeze (1977 to 1981) at the emission levels for HC and CO now mandated in California. These are tighter than those prescribed for the rest of the nation but not as tight as the statutory levels. He recommended that the NO_x standard be allowed to stay at the current level of 3.1 grams per mile (the California standard is 2). Train, also somewhat prematurely, expressed sympathy with the Ford idea, as did auto makers.

All of this would seem to make the subsequent suspension hearings some-

Table 1. Current and projected auto emission standards (grams per mile).

Standard	Hydrocarbons	Carbon monoxide	Oxides of nitrogen
Interim 49-state standards for 1975 and 1976	1.5	15	3.1
California interim standards	0.9	9	2
President's recommendation for 1977 to 1981	0.9	9	3.1
Statutory 1977 standards	0.41	3.4	2
Statutory 1978 standards	0.41	3.4	0.4

what redundant. Most observers assume the suspension request will be granted, but the hearings may influence the longer-term recommendations Train makes to Congress. A 1-year suspension is no big deal in itself because it would not affect standards presently applicable for 1978; however, it could cause legislators to be more sympathetic to pressures to loosen up the Clean Air Act, particularly if Train decides to push the presidential recommendations.

Senator Edmund Muskie (D-Maine), chairman of the air and water pollution subcommittee of the Senate Committee on Public Works, is said to be unlikely to favor giving Detroit any more leeway. But if EPA fails to urge holding the line on the statutory standards, Congress might well succumb to the arguments coming out of Detroit.

What Detroit says sometimes needs to be taken with a grain of salt. In 1973, for example, General Motors said that installation of oxidation catalysts in their 1975 models was really out of the question. Now GM has these catalysts in 85 percent of its cars and it loves them. Catalysts have turned out to be a boon—they handily achieve emission reductions required by 1975 interim standards, and the added cost is more than compensated for in enhanced fuel economy (engines had to be detuned to achieve emission reduction but now they can be tuned to maximum efficiency because the catalyst takes care of the added residuum).

Now, however, auto makers are trying to make the case that further tightening of standards will require much more expensive catalysts and will impede further efforts to improve fuel economy. This may be something of a red herring—EPA itself has said that there is "no inherent relationship between exhaust-emissions standards and fuel economy," and it is common knowledge that vehicle weight is the greatest single factor affecting gas mileage.

Presumably, it is the public health and environmental considerations that should settle the matter, but there is still very little known about the relationship between various levels of ambient air quality and public health. No one knows whether the ultimate standards set for mobile source emissions are really the right ones.

A study by three universities—Columbia, Massachusetts Institute of Technology, and Harvard—paid for by

the National Science Foundation, recommended last fall that enforcement of the ultimate standards be delayed. The reasoning was that, otherwise, auto companies would be locked into the catalyst as the way to go and would not have the resources to devote to alternative engines. On the other hand, experience has shown that the only way to get auto makers busy on new technology is to make standards mandatory. Former EPA official Stephen Miller, now a freelance consultant, says, "What Detroit is saying is, 'Give us time and we'll come up with a better engine,' but," he adds, "they've been saying that since the 1950's."

For the next 5 years at least, there will be no new fuel-efficient clean-burning engine available for mass production. So it looks as though catalysts will be around for a while.

There are basically three kinds of catalysts. The simplest, and the only

one now in mass production, is the oxidation catalyst. This works only to reduce emissions of HC and CO by injection of air which breaks them down to water and carbon dioxide. NO_x, an entirely separate problem, is kept down by means of exhaust gas recirculation.

A more advanced model is the dual, or reduction, catalyst. This is actually two catalysts, an oxidation one preceded by a catalyst to chemically reduce the NO_x. This is said to involve some fuel penalty because there must be a rich air-fuel mix to make the reduction component work properly.

The most sophisticated kind is the three-way catalyst. This is a single unit that reduces all three kinds of emissions when the engine is operating at the stoichiometric ratio (optimal burning mixture) of 14.7 parts air to 1 part fuel. This catalyst requires an oxygen sensor to ensure that there is just

Briefing

Signs of Life from the FCST

Historically, the Federal Council on Science and Technology has been one of the feeble arms of the government's science advisory apparatus, but the FCST—nominally, a top policy coordinating group—is showing some new signs of life. The most recent vital sign is a 165-page "Report on the Federal R & D Program" for fiscal 1976, a handy compilation and analysis of proposed spending for R & D next year throughout the government (except, of course, for intelligence agencies).

The FCST report exudes much the same upbeat tone as the R & D analysis put out by the Office of Management and Budget, but it goes beyond OMB's terse summaries in providing a more detailed view across agency lines of spending in such areas as energy, food, oceans, health, and social sciences.

The report also draws attention to some small but interesting nuggets of information easily overlooked in the OMB's voluminous main budget documents. Some examples: The Justice Department plans new research on "official corruption"; the National Oceanic and Atmospheric Administration will admin-

ister the coup de grace to its long-suffering oceanographic buoy program; and the State Department's Arms Control and Disarmament Agency, the victim of some severe budget-cutting during the Nixon presidency, will get a 31 percent increase to \$1.7 million for research next year, now that nuclear proliferation is once again a hot topic.

The FCST has for many years been a somewhat somnolent coordinating committee of R & D chiefs in the federal agencies, under the chairmanship of the President's science adviser. Thus this job provides a third hat for H. Guyford Stever, who is officially President Ford's science adviser as well as director of the National Science Foundation. Stever has been trying to revitalize the council, and it was he who suggested late last year that a summary report on R & D spending be put out under the council's name. Material submitted by the various agencies was compiled by staff in the NSF's Science and Technology Policy Office. The result, according to an accompanying press release, represents a kind of "annual report on science and technology."

The next step in reviving the FCST will be to hire an executive secretary, a job that STPO chief Russell Drew has been filling on an acting basis. At least one candidate is in line.—R.G.

enough air to allow oxidation of HC and CO but not enough to encourage formation of NO_x.

Currently occupying center stage in the standards disputes are sulfates and NO_x. Sulfates became a matter of great concern in 1973 (*Science*, 26 October 1973) when it was discovered that

sulfur from gasoline was oxidized by catalysts into sulfuric acid. Sulfur dioxide from tail pipes eventually turns into sulfuric acid anyway, but usually in the upper atmosphere. With catalysts, it comes straight out of the tailpipe in amounts up to ten times as great as in cars not equipped with

catalysts. Sulfuric acid is bad for people with respiratory and lung problems.

For a while some people thought the oxidation catalyst might turn out to create more evil than it eliminated, but now, according to an EPA researcher at Research Triangle Park, North Carolina, it's beginning to look as

Antarctica's Future: Will Oslo Talks on Resources

The global sweepstakes for scarce fuel and minerals could one day change the character of Antarctica, which has been reserved hitherto by treaty for scientific and environmental activities. Since the energy crisis began, interest has been growing both here and abroad in Antarctica's minerals and its untouched continental shelf, which could contain large reserves of oil and natural gas. This week in Oslo, Norway, the 12 nations who are parties to the Antarctic Treaty, which governs the area but says nothing on the question of resources, will debate the subject.

Embarrassingly, the United States will probably go to the Oslo meeting with no position on the question of Antarctic resources. The U.S. government is divided as a result of internecine warfare among agencies, some of which want the United States to press for an international solution. The federal energy agencies want this country to keep open the option of unilaterally recovering the resources. It is still a tossup in government circles as to whether political pressure generated by the energy crisis will succeed in reshaping American policy toward the icy, almost deserted, South Pole continent.

The current meeting is a preliminary session to a regular biennial meeting, scheduled for next June in Oslo, of the parties to the treaty. By then, the 12 governments involved must decide their own positions. They could seek to rule out any exploitation of Antarctic resources in the near future on the grounds that the continent should be saved for environmental and scientific uses. Or they could decide to open the door to eventual resource development by working toward an international regime or some other mutually acceptable arrangement. But if these countries fail to agree, there is some chance that nations having territorial claims, which the treaty holds in abeyance, will decide to assert them so they can get the resources themselves. Then the treaty would be meaningless and international conflict could break out.

The stakes involved in Antarctica are large. One U.S. government estimate puts the resources of the western continental shelf at 45 billion barrels of oil and 115 trillion cubic feet of natural gas.

There is an environmental stake, too. Waters formed in Antarctica supply nutrients to the oceans of the world as far away as the Northern Hemisphere; the global impact of a series of oil spills could be enormous. Politically, the 12 treaty nations have a stake in maintaining their rather remarkable track record of keeping the continent demilitarized and peaceful.

Even the scientists' stake is significant: Scientists of many nations, including those of the Soviet Union, were engaging in cooperative research in Antarctica long before the present era of détente. If their governments started quarreling over conflicting territorial claims these relationships would deteriorate.

The Antarctic Treaty, which demilitarizes the continent, was drawn up largely at the instigation of the United States soon after the International Geophysical Year of 1957–1958. The treaty makes no ruling on the territorial claims that seven nations, but not the United States, have made in Antarctica.* It states only that "no acts or activities" shall take place asserting or denying territorial claims while the treaty is in force. This freezes the claims, so to speak, and thoroughly blurs the question of property rights on the continent.

On the question of resources, the treaty says not one word. Because of this silence, the New Zealand delegation at the 1972 biennial meeting suggested that the question of resource exploration be put on the agenda for the meeting in Oslo.

The United States, then, has had almost 3 years to formulate its position on the issue. As of this writing, it appeared that no agreement had been reached and hence that the American delegation might go to Oslo with instructions to keep quiet so as not to prejudice any position that the government might take later. In the view of some, silence on the part of the United States would be harmful, since other nations are used to this country's taking the lead in Antarctic Treaty meetings. "We are already arousing the suspicions of other countries," says one source.

Interviews with several officials close to the classified discussions prior to the meeting reveal the divisions among agencies. The Federal Energy Administration (FEA) and the Department of the Interior (DOI) seem to argue that the United States can adopt a wait-and-see attitude on the resource issue and on the Oslo negotiations. Leigh Ratiner, Director of the DOI Ocean Mining Administration, who speaks for DOI in the interagency discussions, told *Science* that, in his personal view, unilateral resource activity by one country is unlikely in the next few years. As to the Oslo meetings, "The United States can go to the meetings and listen. No

* They are: United Kingdom, France, Norway, New Zealand, Australia, Argentina, and Chile. The claims of the United Kingdom, Argentina, and Chile overlap and their conflicts over boundaries have never been settled. The other parties to the treaty are Belgium, Japan, the Soviet Union, and the United States.

though the risks have been overblown. The data on sulfates are pretty ambiguous and, he says, "we have only scratched the surface" on sulfate research.

Recent results of research on NO_x, however, are beginning to persuade some people that the dangers of these

emissions are greater than was previously thought. Nitric acid is believed to be even worse for the health than sulfuric acid, and recent studies have implicated NO_x not only in respiratory problems but in such other far-flung disorders as nephritis and increase in blood lipids.

What EPA and Congress finally decide about sulfates and NO_x will affect the direction of emission control technology. If an emission standard is created for sulfates, a move that is under consideration at EPA, this would limit the use of oxidation catalysts and force industry to move to the three-way cata-

Mean That Scientists Have to Move Over?

policy is going to be made there, as far as I know," Ratiner said.

On the other hand, the National Science Foundation (NSF), which has the main responsibility for U.S. activities in the Antarctic, and the environment agencies are said to be arguing that U.S. leadership is too important to the functioning of the treaty for this country to just sit back and listen. In a recent speech, James E. Heg, Chief of Polar Planning and Coordination at NSF, warned: "To the extent the United States can continue to maintain . . . its position of leadership in the consultative forum [the biennial treaty meetings] during the consideration of such potentially divisive issues as resource exploitation, the treaty will continue successfully to regulate the affairs of states in this unique and important area."

Apparently U.S. policy-makers were planning concrete suggestions at the Oslo meetings. According to well-placed sources, a 1973 classified National Security Decision Memorandum (NSDM) completed by all agencies involved concluded that the United States should actively seek an agreement that would exclude unilateral action by any one nation—including the United States. The NSDM allegedly also recommended that the United States discourage any exploitation-linked exploration and any exploitation in the near future, until the treaty nations had developed an approach. As of late 1973, all signs were that U.S. policy seemed to be chugging smoothly along toward an "internationalist" solution to the Antarctic resource issue.

The train was derailed, however, when the energy crisis struck the country in the fall of 1973, and the new energy bureaucracy in Washington began looking at the question. Well-placed sources say that the FEA and the DOI became anxious that the United States not close off the option to recover resources from Antarctica unilaterally, and tried repeatedly to have the NSDM amended. Since, the White House has approved the NSDM but there is still enough disagreement among agencies on whether to implement it that the document's impact has been effectively neutralized. On paper, the United States has a policy; in reality, it does not.

Since the New Zealand delegation brought up the subject in 1972, the debate over future Antarctic policy has revolved around two main points. One is the question of how much oil and gas is down there and whether exploiting it is economically feasible. No one, to be sure, has ever found the offshore resources, although the

Glomar Challenger drilling team found traces of ethane, methane, and ethylene on the shelf in 1972, which could indicate the presence of oil and natural gas. The U.S. Geological Survey, which at one time estimated that 45 billion barrels of oil and 115 trillion cubic feet of natural gas could lie in the western shelf, has issued a new report which does not estimate volume but draws analogies between the Antarctic shelf and the shelves of Australia, South America, and Africa which do produce oil and natural gas.

On the other hand, the coastal waters of Antarctica are 500 meters deep, or more than twice as deep as most offshore drilling sites. Severe storms and huge icebergs would make oil drilling an order of magnitude more difficult than in the North Sea according to one NSF scientist. Moreover, a leak from a hole under the ice cap could take as much as a year to plug up. At what point recovery of oil and gas in Antarctica becomes economically feasible would seem to be anybody's guess.

A second debated issue is the environmental impact of resource recovery on Antarctica's fragile ecosystem. Its coastal waters are the site of the formation of so-called "dense" water, which is very cold and rich in nutrients and which slides downward off the shelf to the deep ocean bottom and then circulates northward into the North Pacific and North Atlantic, feeding organic life in these oceans. Extensive pollution of this dense water could possibly have an impact, albeit an unknown one, on the living resources of other oceans. In addition, the protein-rich crustacean, krill, in Antarctic waters, which is estimated to be equal to the amount of fish protein in the oceans of the world combined, could be affected by oil spills. Russell Peterson, Chairman of the Council on Environmental Quality, says, "It is clear that activities of any kind in the Antarctic must be undertaken with adequate considerations of environmental factors and the needs for environmental protection." However, those who favor facilitating development of the resources claim that the continent already doesn't deserve the epithet "pristine," which is often applied to it. They argue that scientists have done their share to pollute its ecosystem already.

Although government policy is still undecided, this much seems clear. The era when scientists could enjoy Antarctica as their unique playground is probably going to end. In the future scientists will probably have to share the continent with other interest groups, who will be playing a different ball game.—DEBORAH SHAPLEY

lyst, the only one that inhibits sulfuric acid production. If the tight NO_x standard of 0.41 is enforced, they will have to jump to the dual catalyst, the only one that now promises to reduce NO_x that far.

There is, of course, another way out: drastic reduction in automobile weight and engine size. This would automatically reduce emissions and improve mileage. It would also permit introduction of the stratified charge engine, which is now generally regarded as suitable only for small cars. The stratified charge engine was invented in the United States and developed by Honda of Japan. This is a lean-burning engine (that is, one using a high air to fuel ratio that permits oxidation of HC and CO), and Honda says it can meet all the U.S. statutory standards right now. A NO_x catalyst might be needed, which would involve some fuel penalty. But there are countless measures to offset that—improved design to reduce aerodynamic drag, radial tires, better carburetion, electronic ignition, fuel injection, and so forth.

Auto makers are busy developing these measures, but they have been having a very hard time thinking themselves into smaller cars. They have long argued that they make big cars because people want them. This is true, but it may not be as inalienable a right as the people in Detroit make it out to be. Besides, they complain about the costs and inefficiency of catalysts while continuing to build costly and frivolous “options” such as push-button windows, vinyl roofs, and air conditioning into many of their models.

Economy vs. Environment

The Clean Air Act was fashioned with public health and environmental protection as the prime considerations. Now that fuel economy has taken on almost equal importance, auto makers are saying that one objective can only be achieved at the expense of the other. As has been indicated, many observers think this is a phony argument. Chief among them are officials involved with environmental protection in metropolitan areas. The feeling expressed at the hearings by these individuals was that auto makers were getting the breaks, and that cities would have to pay the price to get ambient air standards within levels prescribed by law. Robert Low, head of New York City's Environmental Protection Administration, said it looked to him like a “double

standard”—cities had to keep up with timetables but auto makers were being permitted repeated delays.

(It might be remarked here that a precipitous drop in auto sales resulting from rampant price increases certainly wouldn't do air quality any good. The turnover of vehicles now on the road is estimated at 10 percent annually, so theoretically it will be a decade before virtually all auto emissions are controlled. A reduction of that percentage means that inefficient fume-belching models will continue to be operated long after owners would normally have turned them in.)

While EPA is agonizing over the recommendations it will make to Congress, a staff member of the Muskie subcommittee observes that Congress is pretty used to making up its own mind when it comes to decisions affecting the Clean Air Act. Congressional response to the presidential proposal, even if it is endorsed by Train, is likely to be cool. The staffer says that even the “Neanderthals” on Capitol Hill recognize that a lengthy freeze on emission standards in exchange for a “pledge” of increased fuel economy is a pretty bad bargain. For one thing, Detroit doesn't have a history of doing such things voluntarily; for another, most of the 40 percent improvement has already been effected in the 1975 models and evidence is that the goal—which would only attain an across the board average of 18.7 miles to the gallon—could be achieved without stalling any more on standards enforcement.

The Clean Air Act is scheduled for thorough retuning and overhaul this year. At present a drastic relaxation in the auto emissions standards seems unlikely. The basic purpose of the act was and is to protect public health. There will be particular pressure to raise the 0.41 NO_x standard but, according to the committee staff member, there is not as yet any evidence to justify that action. As for technological considerations, the staffer observes that “the technology-forcing aspect of the Clean Air Act was a key part of it,” so if auto makers don't think they can achieve the standards they will have to make a very strong case indeed.

Perhaps the worst effect of a 1-year suspension would be a psychological one. Repeated delays may just delay awareness on the part of manufacturers that the private automobile may not always remain a symbol of the American way of life and that, with the develop-

ment of mass transit, autos may indeed play a smaller part in America's future than they do in its present. Certainly Chrysler Corporation has not picked up on the notion. In its report announcing a stunning \$73.5 million loss in the last quarter of 1974 it managed to make a chipper conclusion, to wit:

“The increase in the number of new drivers each year and the development of suburban areas that rely heavily on motor vehicle transportation will continue to support the long-term growth of the automobile market.”

—CONSTANCE HOLDEN

APPOINTMENTS

Thomas C. Chalmers, director, Clinical Center, National Institutes of Health, to president and dean, Mount Sinai School of Medicine, City University of New York. . . . **John I. Sandson**, associate dean for health services, Albert Einstein College of Medicine, to dean, Boston University School of Medicine. . . . **William B. Boyd**, president, Central Michigan University, to president, University of Oregon. . . . **John G. Barker**, president, Marshall University, to president, Midwestern University. . . . **John K. Major**, professor of physics, New York University, to vice president for academic affairs, Northeastern Illinois University. . . . **Alexander L. Clark**, acting dean, School of Public Affairs, University of Texas, Austin, to vice president for academic affairs, University of Texas, Dallas. . . . **Samuel R. Powers, Jr.**, professor of surgery, Albany Medical College, to chairman, surgery department, Albany Medical Center. . . . **John T. Wilson, Jr.**, chairman, community health practices department, Howard University College of Medicine, to chairman, environmental health department, School of Public Health and Community Medicine, University of Washington. . . . **Jerome A. Feldman**, associate professor of computer science, Stanford University, to chairman, computer science department, University of Rochester. . . . **Peter B. Kahn**, professor of physics, State University of New York, Stony Brook, to chairman, physics department at the university. . . . **Grant Gross**, head, oceanography section, environmental sciences division, National Science Foundation, to director, Chesapeake Bay Institute, Johns Hopkins University.