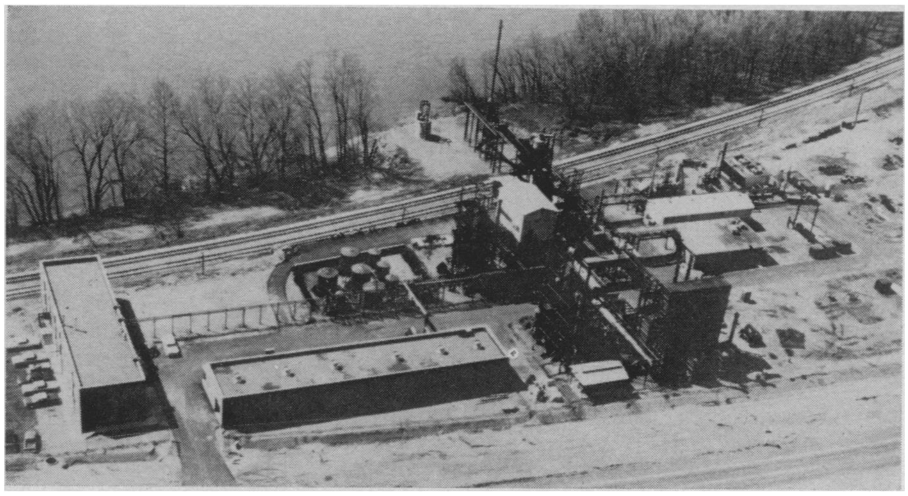
Clean air: An R&D gap

The current practice in environmental cleanup R&D often is to pass the buck



Office of Coal Research

Cresap plant: Bureaucracy may shoot down major antipollution technology.

Research and development are keys in the current effort to achieve a clean environment. Last year, for instance, a National Research Council report said the technology for abatement of sulfur oxide emissions from power plants and other sources has not yet been achieved (SN: 8/29/70, p. 187). And the automobile industry has complained that the 1975 deadline for the 90 percent improvement in auto emissions ordered in 1970 amendments to the Clean Air Act is unrealistic with the current state of the art.

But despite protestations from the Nixon Administration and industry of their devotion to a clean environment, there is increasing evidence that neither is spending near enough money in the critical area of R&D. The problem came to the fore last week when Sen. Robert C. Byrd (D-W.Va.) revealed that the Office of Management and Budget had cut funds for three Office of Coal Research projects by one-third. OMB told OCR to get the money from industry.

"Everyone supports the principle of contributions to research by the private sector of our economy," Byrd says. But he termed the OMB action "arbitrary and unwise," and he suggested that OCR simply would be unable to solicit the private contributions and that the projects would therefore go down the drain.

Any one of the three projects could have great environmental importance. One would involve revamping of OCR's Project Gasoline pilot plant in Cresap, W.Va. (SN: 1/30/71, 84), so it could be used for demonstrating the H-Coal Process developed by Hydrocarbon Research, Inc. The process would hydrogenate coal to produce a low-sulfur substitute for the residual fuel oil now extensively used in power plants on the East Coast. The fuel oil is hard to get and high-priced because it must be imported on tankers, which are in short supply. But there are abundant domestic supplies of coal for the H-Coal process.

The other two projects are for solvent-refining and gasification of coal. Both processes would significantly reduce the content of sulfur and other impurities in the final product, thus achieving the sulfur oxide abatement technology outlined in the NRC report.

The OMB action points up an attitude of "let the other fellow do it" that appears to apply almost across the board in the area of environmental R&D. The Nixon Administration's 1972 budget for the new Environmental Protection Agency was almost twice the 1971 level (SN: 2/6/71, p. 96). But the bulk of the increase goes to sewer grants and loans. The total for R&D is about $143 million, only $12 million more than 1971's $131 million. Or, taking a specific agency, the Air Pollution Control Office (APCO), its total budget for 1971 was about $109 million; for 1972 it is $125 million, a scant $16 million increase. This is far short of the doubling that, President Nixon suggested in his environmental message, was to apply across the board to antipollution agencies in EPA.

Metcalf: Utilities ignore R&D needs.

The OMB action was based on an earlier directive that gives Federal agencies a mandate to seek private R&D funds. But its wording is vague, and there are no suggestions about how the agencies are to go about securing the private funds. Previous experience has shown it is not easy.

Two weeks ago, for instance, W. Donham Crawford, president of the Edison Electric Institute, an electric utility trade organization, told a science writers' seminar that the electric utility industry has traditionally looked to electrical equipment manufacturers for technological innovations. However, APCO reports that in the crucial area of sulfur oxide abatement neither the utilities nor the manufacturers have spent significant amounts. Indications are that the utility industry has spent a total of about $7 million on sulfur oxide R&D in its entire history.

The track record of other industries may not be much better. APCO has never been able to extract from the automobile industry figures on how much it has spent for R&D on emission controls and unconventional power sources. One possible assumption, says Dr. Louis Schoen of APCO's Office of Science and Technology, is that the industry is withholding the information because the amount is so small. And a recent report by the National Petroleum Council says that pollution from energy industries is "an expense of society" which must be paid through higher taxes, various tax incentives to industry, higher prices or all three. In other words the public, not industry, must pay.

Although figures for expenditures by the auto and petroleum industries are not available, electric utility firms, as regulated monopolies, must file statements of expenditures with the Federal Power Commission. Unpublished figures for the utilities for 1969, secured from FPC by Sen. Lee Metcalf (D-Mont.) show that 1969 R&D expenditures by the industry were $41 million, a 6.9 percent increase over the 1968 figure of $38.4 million. In the same period, utility advertising expenditures went from $290 million to $324 million, an increase of about 12 percent. This compares with total utility revenues in 1969 of $3.2 billion.

"They [the utilities] are trying to meet massive technological problems by massive advertising and sales promotion—this despite the energy shortage—rather than by the needed massive research and development programs," charges Metcalf.

If the automobile industry is doing the same, the facts may be public knowledge soon. Under the 1970 amendments to the Clean Air Act, the auto companies must report to APCO—and, presumably, to a National Academy of Sciences committee set up under the amendments—on their R&D expenditures.

Where the solution to the R&D problem lies is still a matter of conjecture. APCO frankly acknowledges it probably never will have the funds necessary to carry on the needed programs for pollution control R&D for automobiles, and it is relying on the 1970 amendments to force the auto companies into compliance with the new emission standards. But a Metcalf staffer suggests that the utility industry may never be innovative enough to do the R&D job. "Maybe the government has to do it," he says. □

Scyllac in operation at Los Alamos

Attempts to achieve controlled thermonuclear fusion, to gain energy for power production from the fusion of atomic nuclei, are proceeding in a variety of devices with a variety of names.

The basic problem is that a plasma of ions and electrons has to be held, usually by confinement in a magnetic field, for a sufficient time at a high enough temperature and density for enough fusions to take place so that the energy coming out of the process is greater than the energy it takes to maintain it.

One sort of device attempts to hold a relatively thin plasma for a long time. Since confining the plasma in a magnetic field is probably the most difficult of the three criteria to achieve, another sort of device attempts to trade off a short confinement time against high density and temperature. These devices are pulsed rather than steady, since the densities and temperatures desired can best be achieved by short compressing pulsations. If energy ever comes out of them it will come in bursts like a reciprocating steam engine.

This week the largest of the pulsed devices yet built, the Scyllac (SN: 10/17/70, p. 321) at the Los Alamos Scientific Laboratory in Los Alamos, N.M., began operation. Preliminary tests leave its designers and builders well satisfied.

Scyllac is what is called a theta pinch. It will ultimately be a toroidal, or doughnut-shaped chamber, 15 meters in circumference. At the moment it is a curved section, about a third or so of that.

When plasma has been placed in Scyllac, it will be subjected to a pinch. That is, the strength of the confining magnetic field will be suddenly increased. This will cause both implosion and shock, driving the plasma to the center of the tube and heating it.

Experience with smaller theta pinches at Los Alamos and elsewhere shows that temperatures and densities in the range appropriate to controlled fusion can be approached by this method.

Scyllac is designed to approach controlled fusion more closely than previous devices. The present section of it was tested this week by making within it a pre-ionized plasma. This is a preliminary step to the application of the magnetic implosion, the theta pinch itself.

Scyllac repeatedly made pre-ionized plasmas to the satisfaction of the physicists working with it. Contrary to reports elsewhere, though gratifying, this is not a breakthrough on the way to controlled fusion. The real test of whether Scyllac can do what it is designed to do, the turning on of the theta pinch, will be tried sometime in the next few months.

If that test is satisfactory, the remainder of the circle will be built. Still later, the Los Alamos physicists plan to build a seven-meter straight Scyllac, and with this they hope to approach nearer to an actual controlled fusion reactor than anything on earth.

If controlled fusion experiments continue to go as well as they have for the last few years, the best guesses as to when fusion power can be expected to be commercially available are sometime in the 1990's.

HEAVY-ION ACCELERATORS

American physicists worry

Studies of atomic nuclei have made frequent use of single particles as probes. Beams of accelerated protons, electrons, neutrons, pi mesons and other particles are struck against nuclei, and the results are studied for information on the behavior and structure of nuclei.

Now physicists wish to use whole nuclei of heavy elements, or more correctly, heavy ions, as the impinging particles. Striking heavy nuclei against other heavy nuclei, they believe, will enable them to manufacture superheavy nuclei with atomic numbers beyond the currently known 105 and to study what happens when two objects containing many neutrons and protons come together. This could throw light on complexities of nuclear structure not decipherable by other means.

In various parts of the world heavy-ion accelerators are being built to enable this sort of work to be carried out. Only one such machine is under construction in the United States, the Superhilac at the Lawrence Radiation Laboratory in Berkeley, Calif. The paucity of the American effort dismays many specialists in the field.

"We are entering a period of planned deficiency of heavy-ion equipment in the U.S.," says Dr. Robert Beringer of Yale University in summing up the discontent. The single new American machine, the Superhilac, is somewhat old fashioned, he told the 1971 Particle Accelerator Conference at Chicago last week (see p. 183). It is a reconstruction of the existing Hilac (Heavy Ion Linear Accelerator), "a redesigned 1950's linac," says Dr. Beringer, "a foursquare state-of-the-art machine at modest cost." He would like to see completely new designs tried, but given the Government's financial priorities, he finds it difficult to disagree that under current conditions Superhilac is the best available.

Nevertheless, he worries that the United States will fall behind Western Europe and the Soviet Union, where newer designs are being pursued with more vigor.

Heavy ions can be accelerated in either linear accelerators or cyclotrons. Both sorts have their partisans, and some people see advantages in both. The first of the new generation of heavy-ion accelerators, the machine called Alice at the Orsay Laboratory in France, combines a linear accelerator and a cyclotron. Alice can accelerate ions of carbon or neon to energies of about 20 million electron-volts per nuclear particle (nucleon). Its heaviest ions are xenon, to which it can give about 3 million electron-volts per nucleon.