NUCLEAR RADIATION

Down to what's practicable

AEC

Fuel element: First line of defense.

The construction of nuclear power plants has run into stiffening opposition from individuals, organizations and even states. Minnesota has gone so far as to take a nuclear power plant owner to court because the state wants to impose more stringent standards of radioactive release on it than those of the Atomic Energy Commission. At stake is whether or not a state has the right to set its own radiation emission standards.

Hurried along to some extent by the Minnesota case, the AEC last week proposed new amendments to its regulations governing radioactive effluents in water-cooled reactors, the major type of reactor now being operated, built and planned. The regulations in essence direct nuclear power plant operators to reduce their radioactive emissions to levels "as low as practicable."

Present regulations require that the plants meet specific limits that are based on annual, whole body exposure: 5,000 millirems for occupational workers, 500 millirems for any one person in the population and an average of 170 millirems for a representative sample population group. These limits are about to be reviewed by the Federal Radiation Council (SN: 3/28, p. 311) and the suggestion has been made that they could be lowered.

The proposed amendments would in no way change these limits; as long as a plant keeps within the limits, it can continue to operate. Although there was some talk that the new amendments were a prelude to a forthcoming reduction in radioactivity limits, AEC Commissioner James T. Ramey states flatly, "This is not true." The proposed amendments are aimed primarily at the future, he says, when new equipment and plant design will permit new plants to reach lower levels than at present. The amendments would also act as tools to make sure that today's plants continue to operate well within the present limits.

In effect, the AEC regulations express, with more force than a verbal or written recommendation, the agency's determination to keep radiation levels as low as it thinks is practicable, regardless of what the published limits are. They also deflate the argument of those who say the limits are too liberal.

In practice, the nuclear power industry actually keeps the exposures to radioactivity down to a small fraction of the limit. As Lester O. Rogers, director of the AEC's division of radiation protective standards, boasts, "The actual releases are generally less than a few percent of the limits." This has prompted some individuals to seek reduction in the present standards; the operating experience gained as more power plants have come on line in the last few years has shown that lower levels are practical.

By practicable, the AEC does not mean possible. What is practicable will be determined mainly by the existing state of technology and cost. It might be possible to reduce radioactivity well below the present levels, but at a prohibitive cost. In that case, the AEC would probably agree that such a level was not practicable.

The present release levels—whether safe or not—have been achieved through the design and fabrication of the fuel elements and the waste treatment and handling systems in the power plants. The first line of defense in containing radioactive effluents is the nuclear fuel elements themselves, which consist of the fuel material packed into pellets and stacked end to end within cladding-metal tubes of zirconium or stainless steel alloys. Most of the radioactive fission products are contained within the fuel elements, but some leak to the water coolant, mostly through small cladding defects.

There are three sources of radioactive contamination of the coolant: gases, which get in through pinhole breaks or by diffusion; corrosion products, which come from corroded metal parts of the cooling system; and nongaseous fission products such as barium, iodine and cesium.

The radiation of most of the gases is short lived; the gases are retained from 30 minutes to over 30 days until they decay to acceptable radioactive levels. They are then vented into the atmosphere. Krypton 85, however, has a half-life of 11 years, so holdup methods are inapplicable. Being insoluble, it comes out of the coolant and is released into the air. Its quantities are regarded as insignificant by the AEC in terms of exposure.

Another special problem is tritium gas, with a half-life of 12 years. It is converted to tritiated water and so must be eliminated by the occasional bleeding of the closed cycle cooling system into a stream or lake. There it is supposedly diluted to harmless quantities, but environmentalists are uneasy over this point.

The corrosion and nongaseous fission products are removed by conventional treatment: filtration, precipitation, ion exchange and evaporation, which concentrates the liquid into a slurry that is solidified and eventually buried off site in steel drums (SN: 3/28, p. 312). Trace amounts of corrosion and fission products remain in the treated coolant and are released into rivers and streams. □

ENVIRONMENT

After the teach-in

The environmental quality issue has brought together some strange bedfellows. President Nixon gave prime attention to it in his State of the Union message and later pronouncements (SN: 2/14, p. 168). But student activists who bitterly oppose the President on the Vietnam War and other issues are also complaining about environmental degradation, and virtually everyone in between is on the bandwagon.

The questions are whether the issue can sustain widespread interest and whether the disparate elements now involved will eventually split off into the old factions. Student groups plan a nationwide teach-in on the environment for April 22. The response so far is enthusiastic and cuts across political lines, they say. But what will happen after April 22?

Denis Hayes, the 26-year-old Harvard law student who is coordinating the teach-in activities from a Washington, D.C., office, is convinced that the issue will not die. Although he admits that post-teach-in plans for his organization are not firm, he says that tangible, visible and well-publicized pollution will create outrage on the local level that will continue to be felt on all levels.

"An awful lot of tragic things are now being well publicized," he says. "We could almost have an oil spill of the week, for example. And there was the river in Ohio that caught fire. These things will keep people stirred up." The indications are that he may be right.

Environmental action at the University of Montana in Missoula, a small city at the confluence of several remote mountain valleys, has attracted more followers, on and off campus, than any issue ever, says Dr. C. C. Gordon, a university environmental scientist. Some 35 students of a student body of 7,300 were peace activists before the environmental issue became popular, he says.

Now about 200 students, including the peace activists, are working on environmental problems.

The students have recruited 50 professors from a broad variety of disciplines to conduct twice-weekly seminars on environmental problems, with the university administration furnishing seminar rooms and other logistic support. Townspeople are active also, and a broad political spectrum is represented. The main reason for concern is obvious: Air pollution from lumber and paper industries sometimes shrouds Missoula in choking smog for days at a time. The concern existed before the teach-in was announced and will continue after it, says Dr. Gordon.

The same kind of concern is evident in urban areas. Dr. Ian McHarg of the University of Pennsylvania says every institution of higher learning in Philadelphia, as well as other groups, is involved in plans for the teach-in and related activities. "We have more volunteers than we know what to do with," says Dr. McHarg.

Cooperating in the Philadelphia effort are local television channels—which bring "gentle pressure" against industries unwilling to divulge information on pollution—the Chamber of Commerce, urban groups and even black juvenile gangs. "This is the first such nondivisive issue we've had here," says Dr. McHarg.

But Dr. McHarg admits that many of the volunteers cannot make up in enthusiasm what they lack in skills and knowledge in a field that requires more of both than the usual political activities. And whether the environmental issue is truly a unifying one is still moot.

Splits along the old lines will occur when radicals begin to tie the environmental crisis "to the same old general malaise caused by a system which puts profits in control," says a leader of the War Tax Resistance. "This will turn off the middle-class people."

And he adds that anything supported by such establishment figures as Sen. Gaylord Nelson (D-Wis.) creator of the teach-in idea, not to mention President Nixon, may fail to gain radical adherents.

Hayes admits, also, that efforts toward liaison with radical groups have been limited. A spokesman for the Mobilization against the War in Vietnam had not heard of the teach-in until asked about it.

But the environment issue is too powerful a weapon to be abandoned just because it is popular, and environmentalists are making a clear appeal to peace activists to stay with them.

"The people who pollute," says Dr. Gordon, expressing a sound radical dictum, "are the same ones who profit from the war." □

TROPICAL WEATHER

Shift in scene

For several years atmospheric scientists have been discussing the outlines of a plan for conducting a large tropical experiment in the Pacific Ocean as part of the Global Atmospheric Research Program.

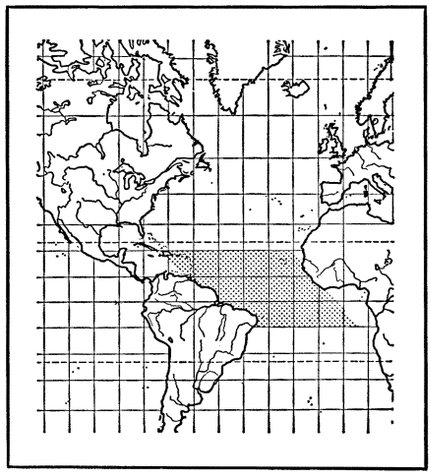
The international effort, now scheduled to begin no earlier than mid-1973, would attempt to achieve a better understanding of convection processes at work in clusters of tropical cumulus clouds, where large amounts of heat and moisture are transported up through the atmosphere. The experiment would also serve to check out some of the systems, methods and organizational machinery to be used during the first GARP global experiment some two years later.

A series of planning documents last year by the international GARP Joint Organizing Committee proposed a 6-million-square-kilometer area over the Marshall Islands in the Pacific for the most intensive observations in the tropical experiment. Last year's report of the U.S. GARP committee on United States participation (SN: 9/6, p. 185) went along with the Marshall Islands location. The region has a high frequency of tropical disturbances and is an area where cloud clusters undergo a wide range of development.

So it was quite a surprise when program officials gathered at a mid-March GARP planning conference in Brussels decided to switch oceans: the tropical experiment will be conducted in the Atlantic.

The basic problem was logistical. The United States and the Soviet Union were willing and able to participate in a tropical experiment wherever it was held. But many of the European countries, whose participation is essential, found themselves unable to take part in such a major field observation program halfway around the world. They enthusiastically supported an experiment in the Atlantic. Another objection was that there were no plans for a geostationary satellite to be in position over the Pacific at the time of the experiment—and an overhead space observing platform is essential for the effort.

The change in oceans will require some revisions in the nature of the experiment, but the effect of the change seems to be one that the scientists can live with. "All other things equal, I think the Marshall Islands would have been preferable," says Dr. Jule G. Charney of the Massachusetts Institute of Technology, chairman of the U.S. GARP committee. "But if we can understand the way things work in the Atlantic, we can understand them in the Pacific too."



Robert Trotter

Tropical experiment: To the Atlantic.

Continental effects are more pronounced in the Atlantic. The organization of tropical convection in cloud clusters occurs less frequently in the Atlantic. But clusters there are sometimes associated with easterly waves moving in from the African continent, and the study of these may prove fruitful. The exact area of the experiment will be selected later.

The tropical experiment will be carried out during a three-month period, between mid-1973 and the end of 1974. This is a slight slippage from earlier plans for 1972 or 1973. The exact period is to be designated by the fall of 1971. The experiment has to await the availability of a GOES geostationary satellite. The first is to be put into orbit over the United States in 1972. If all goes smoothly, a second one, for use over the Atlantic, may be launched by mid-1973.

There will be several polar-orbiting satellites, including one of the United States' Improved Tiros Operational Satellites, two of the Soviet Union's METEOR's, and possibly an experimental satellite of the United Kingdom's. France hopes to place a satellite over the tropical Atlantic in 1974.

As many as 24 fully instrumented research ships from eight countries may be available. "There was a tremendous amount of good will and agreement by the nations," says Dr. Joseph Smagorinsky, another American member of the Joint Organizing Committee. "The countries just couldn't wait to declare what they had to offer."

One remaining difficulty is in getting enough specially instrumented aircraft. "There just aren't many around," he says. □