uncertain, and that the Russians would have a harder time in their rubber-based suits than the allies in their lighter, charcoal-based equipment.

The debate over binaries is somewhat confused by the fact that criticisms of the new program are intermixed with criticisms of the whole concept that U.S. chemical capabilities can deter the Russian use of chemicals.

Saul Hormats, 37-year veteran of Edgewood Arsenal, now retired, is one critic who believes there is no point in having an in-kind deterrent at all. First of all, say Hormats and others, U.S. build-up of chemical deterrent may undermine the nuclear deterrent by causing Soviets to doubt NATO willingness to go nuclear if necessary. (The other side of that argument is that chemicals offer more escalatory flexibility and could buy a delay before the nuclear option was invoked.) He says history shows that any Soviet invasion of Europe would be a massive one with millions of soldiers. If, in the event of a stalemate, they decided to push through with a nerve gas attack, they would have 4 or 5 hours to inflict casualties before allies had a chance to go into a protective posture. Any counterattack would be against a fully protected enemy and would only be "symbolic." Then, says Hormats, since gas only works against unprotected soldiery, the Russians could immediately revert to normal high explosives, thus enjoying a significant temporary advantage over allied troops while they still had a portion of their munitions tied up with ineffective chemical agents.

One rationale given for maintaining a deterrent stockpile is historical: the Defense Department claims the reason the Germans never used gas in World War II was because they knew the allies could retaliate. Hormats disputes this. He says that when he was at Edgewood during the war a group of seasoned military men from the United Kingdom spent months field testing and puzzling over the uses of chemical munitions. They concluded that they had no decisive military function and their only purpose would be to slow down the battle, thus ultimately creating more casualties. He says talks with German officials after the war indicated that the Germans had arrived at the same conclusion. The real fear Europeans had during the war was of massive gas attacks on cities. But that notion has been retired with the advent of strategic nuclear weapons.

The politics of the current situation are somewhat puzzling. A 1980 Defense Science Board study of chemical warfare, which endorsed the binary program, may have added some legitimacy to the idea. The suspected use of chemical agents in Southeast Asia and Afghanistan is widely believed to be an additional influence, although Administration officials insist there is no connection.

The military-minded Reagan Administration appears to be engaging in unilateral logic rather than responding to larger political and military considerations. It shows no concern that bad-mouthing the existing chemical arsenal will persuade the Soviets that the United States now lacks a credible deterrent. Nor does it appear to take seriously the concerns of critics that a new round of nerve gas production will jeopardize the ability of European governments to hold together support for modernization of Theater Nuclear Forces (the cruise and Pershing II missiles scheduled for deployment in Europe). There are already signs of a backlash—the ruling German Social Democratic Party has passed a resolution asking their government to kick out the nerve gas stocks now based in Germany.

The binary program also makes a questionable fit with NATO policies on chemical warfare. Although NATO has been greatly concerned about upgrading its chemical protective posture, Julian Perry Robinson has written that the diversion of resources into poison gas manufacture "would run directly contrary to current trends in NATO armament, where the emphasis is on greater precision, greater kill probability, and reduced collateral damage."

Finally, there is the question as to whether American activities will lead to a renewed chemical arms race with the Russians. Says former Ambassador James Leonard, who participated in the chemical warfare talks before they stalled in 1980, "we get a lot of credit for refraining from building these things," and the Soviets are sure to respond with stepped-up activities. The Administration does not seem to feel that a binary program will be seen by the Soviets as particularly threatening. Says Hoeber, quoting former Defense Secretary Harold Brown: "Whenever we build up the Soviets build up, and whenever we don't build up they build up."

The Administration's position on chemical weapons, as on nuclear ones, is that the only way to gain Soviet cooperation is to threaten to do something they don't like. But despite Soviet statements indicating willingness to resume the chemical talks that broke down in 1980, the Administration has made no move to initiate further bilateral negotiations.

—CONSTANCE HOLDEN

NRC Reports on Ginna Nuclear Plant Accident

According to investigators from the Nuclear Regulatory Commission (NRC), the ultimate cause of the radioactive steam leak at the Robert E. Ginna plant last January may have been poor workmanship. At a briefing for the NRC on 14 April, the authors of a 300-page staff study (NUREG-0909) reviewed what they had found at Ginna. They focused in some detail on a collection of metal debris in the plant's steam generators.

The accident began at 9:28 on the morning of 25 January when one of the thousands of small pipes that carry hot, radioactive water through the steam generator burst without warning. Small pipes such as this, used to circulate heat from the reactor into the steam generator, have caused problems in many pressurized water reactors. The tubes are subject to corrosion, denting, and pitting. The Rochester Gas and Electric Company, like other plant owners, has had to spend a lot of time and money maintaining Ginna's steam system. Sludge must be removed regularly to keep corrosion to a minimum. Weak tubes must be reinforced with metal sleeves. Tubes damaged beyond repair must be plugged.

During one of the periodic maintenance sessions several years ago, it appears, a workman allowed a piece of steel plate to fall into the bottom of one of Ginna's steam generators. There it stayed until the accident in January. The NRC report says that this metal plate (about 4 by 6 inches) matches a section of plate which was repaired in 1975. After falling down among the tubes, it may have rattled around in the vessel, agitated by strong eddies of boiling water.

This was not the only debris in the steam generator. The NRC also found two long sections of severed tubing (30 inches long), a small rectangular piece of steel, a strip of metal, a piece of wire, and three tube fragments. Moreover, in the other steam generator, the one not involved in the accident, inspectors found a small rectangle of steel, a metal rod that looked like the used stub of a welding electrode, and a piece of wire. Although the NRC report gave no firm conclu-

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sion on this point, the authors suggested in their briefing that the loose tubes probably did the damage that triggered the accident.

Aside from the problem with metal debris, the NRC inspectors noticed few mechanical failures during this accident. There were some foul-ups, however. The main process computer shut down for 16 minutes during the crisis, for unknown reasons. Two valves stuck open. Recorders that indicate whether valves are open or closed failed to operate.

The report also noted some nonmechanical failures. The chief of these was that the specified procedures for dealing with a leak of this type did not explain how to cope with the bubble that developed in the top of the reactor vessel. In fact, the procedures gave unhelpful instructions. Being clever, the operators at Ginna quickly grasped what was wrong and improvised their own solutions, or as the report puts it, their "deviations from procedures." Thus they brought the plant under control within 4 hours of the first sign of a leak.

The small amount of radioactive steam that escaped at the peak of the crisis presented almost no risk to the general public, the NRC report concluded. The worst exposure a person outside the plant might have received was about 15 millirems. For comparison, a medical x-ray gives the average adult patient about 103 millirems.—***Eliot Marshall***

Scrap NSF, Slash NIH, Conservatives Urge

A coalition of right-wing groups has proposed an alternative budget that, among other things, would eliminate the National Science Foundation (NSF) and cut support for the National Institutes of Health (NIH) by 50 percent. The proposal is an attempt to keep the Reagan Administration, which the groups helped elect, to a hard-line conservative economic agenda. The alternative budget would cut domestic spending by 30 percent and boost defense spending by 20 percent.

The proposals for NSF and NIH were not spelled out in detail, but an official of the National Conservative Political Action Committee, one of the leaders of the coalition, said that "a lot of this research, if it really is beneficial, should be done in the private sector." He added: "Federal tax dollars are just keeping professors employed."—***Colin Norman***

GAO Ignores Flaw in Concept of Space War

The General Accounting Office (GAO) in a secret report* to Congress has urged the Pentagon to speed the development of laser battle stations. There is just one problem. The authors of the report did not address the question of whether a nuclear blast in space might knock the battle stations out of action.

The much-publicized report, an unclassified digest of which has been made public, told Congress that "a constellation of laser battle stations in space has the potential to provide a credible air and ballistic missile defense system for the United States." To implement the goal, it suggested the armed services establish an Aerospace or Space Force.

Not mentioned in the report, according to GAO officials, was the issue of nuclear survivability. Nevertheless, a single nuclear blast in outer space would instantly set up an electric pulse of up to a million volts per meter in hundreds of satellites and battle stations, zapping their solid-state circuits and ending their ability to wage war. The mechanism behind the threat is simple. In space, radiations from a nuclear blast travel unimpeded over vast distances at the speed of light. When radiations strike a metal object, they knock out electrons and create a strong electric pulse (*Science*, 12 March, p. 1372).

"We did not go into the issue of nuclear effects too much," says Bernard D. Easton, the GAO official who headed the report team. "We looked at survivability to some extent, but not much in the nuclear area." In particular, Easton said the group did not address the survivability issue raised by the electric pulse from nuclear radiations. Asked why, he said, "I really can't say any more. You are getting into areas that are classified."

Perhaps Easton was taking his lead from President Reagan, who on 2 April signed an Executive Order that for the first time makes the "vulnerabilities" of systems, installations, projects, or plans relating to the national security candidates for the classification category of Top Secret.

—***William J. Broad***

**DOD's Space-Based Laser Program: Potential, Progress, and Problems* (C-MASAD-82-10, General Accounting Office, Washington, D.C., 26 February 1982).

Trial Set for Louisiana's Creationist Law

The trial of the nation's second creationist law has at last been scheduled for 26 July in Baton Rouge, Louisiana. If the law is judged to be unconstitutional, as in the recent decision in Arkansas, future legislative initiatives by creationists are likely to be brought to a complete halt.

A long list of plaintiffs, including legislators, educators, and religious leaders, is asking for a declaratory judgment that the "Balanced Treatment" law is constitutional.

The defendants, which include the State of Louisiana Department of Education, the State Superintendent of Education, the Board of Elementary and Secondary Education, and the Orleans Parish School Board, are to be represented by the American Civil Liberties Union (ACLU). The ACLU will be hoping to repeat its success in Arkansas, this time aided by New York law firm Paul, Weiss, Rifkind, Wharton, and Garrison.

Although the wording of the Louisiana law differs from that in Arkansas, the ground covered in the trial is likely to be very similar to the case heard in Little Rock. Meanwhile, it is still possible that the Louisiana case will never reach the court. "We will move for summary judgment," says Jack Novik, lead counsel for the ACLU, "and the judge may be able to come to a decision based on written material, and this of course includes the Arkansas decision."

A tangle of lawsuits and motions by both sides makes the Louisiana situation far more complicated than the one in Arkansas, and it could well be that the trial will not begin as scheduled in July.—***Roger Lewin***