Court Order Puts EMP Test Program on Hold

Many facilities have been shut down and others are being operated at low power pending assessment of claims that they could pose hazards; critics of program called misinformed

THE Department of Defense has been forced to halt work at many facilities where military hardware is tested for its ability to withstand powerful electromagnetic pulses (EMPs) like those generated by high-altitude nuclear explosions. Other EMP test facilities will be allowed to operate at only a fraction of their usual power.

The restrictions are spelled out in a negotiated settlement of a lawsuit that challenged the legality of operating the facilities without first conducting a thorough assessment of their potential impact on the environment. According to the settlement, the testing program will remain constrained until the Defense Department has analyzed and documented every conceivable impact of the test facilities on the surrounding environment.

Under the testing program, items ranging from individual components to whole ships and aircraft are exposed to EMPs generated by massive simulators. The tests play an important role in understanding the potential impact that a high-altitude nuclear explosion may have on weapons and communications systems, and they help develop ways to protect critical equipment.

A nuclear blast above the atmosphere over the United States would cause a strong electromagnetic pulse at ground level across the entire continent, potentially knocking out the electronic brains of unshielded computers, command and control centers, and weapons systems. Four years ago, a committee of the National Academy of Sciences urged the Pentagon to step up its EMP testing program in view of the serious threat posed by even a single nuclear explosion (*Science*, 24 August 1984, p. 816).

The suit was filed last year by the Foundation on Economic Trends, a Washington, D.C.–based organization headed by Jeremy Rifkin, and the Potomac River Association, an environmental group. They contend that the electromagnetic fields generated by the facilities could potentially harm wildlife and disrupt electronic equipment outside the test areas, a contention vigorously disputed by the Defense Department and most outside experts. For example, Allen Peterson, an EMP expert at Stanford, called arguments about off-site effects of EMP simulators "rather strange," noting that "effects of nearby lightning are far more severe."

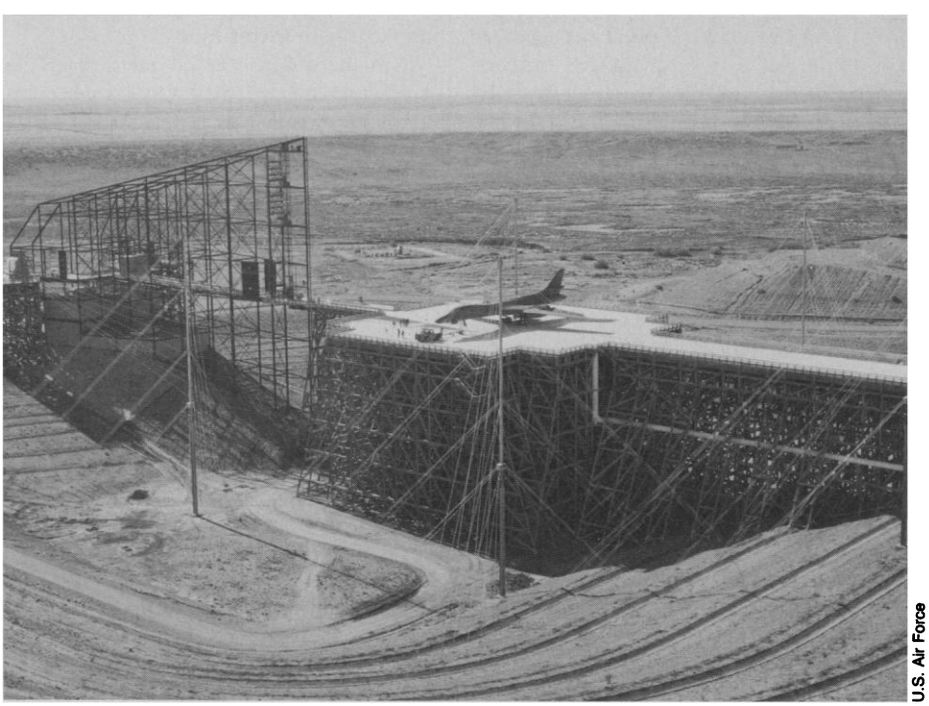
The Defense Department agreed to the restrictions, however, in order to settle the suit. Under a court order signed by federal judge John Garrett Penn on 13 May, the Army has agreed to shut down for the time being all its EMP simulators at the Harry Diamond Laboratories in Woodbridge, Virginia; Redstone Arsenal in Alabama; and White Sands Missile Range, New Mexico. The Navy will shut down a simulator called Empress I on the Chesapeake Bay and has agreed for now not to operate a second device called Empress II. Other Navy simulators at Patuxent, Maryland, will temporarily be operated at low power. None of the facilities can resume full-power operation at least until formal documents called environmental assessments have been prepared. That could take several months.

The Army simulators at Woodbridge will have to wait even longer before they can resume normal operations. Once an environmental assessment has been prepared, they can be turned back on, but electromagnetic fields at the periphery of the facility must be kept below 1 kilovolt per meter. According to a laboratory spokesman, that will require running the simulators at between one-third and one-half their usual power. It is the lowest level at which any useful results can be obtained, he said. Full-power operations cannot be resumed until an exhaustive assessment, formally known as an environmental impact statement, is completed. That could take at least 2 years.

The only EMP simulators now running normally are those operated by the Defense Nuclear Agency and the Air Force at Kirtland Air Force Base in New Mexico. Rifkin says he agreed to let the Kirtland facilities operate for now because they are in a relatively remote area, but he indicated that he may go after them later.

Public attention was first focused on the EMP testing program about 5 years ago, when the Navy announced plans for Empress II. A large EMP generator towed by a barge, the device is intended to subject entire warships to strong electromagnetic pulses. The Navy planned to operate the simulator in the Chesapeake Bay, but local opposition, including protests from the governors of Maryland and Virginia, has so far stalled the project.

Although some concerns have been expressed about potential effects on marine life, much of the opposition has focused on



U.S. Air Force

EMP on a B1-B. *Effects of EMP on a B1 bomber being tested at Kirtland Air Force Base. The Kirtland facility is the only one still permitted to operate at full power.*

speculation that the fields generated outside the test area could damage electronic devices, including navigation equipment. There has also been criticism that, because shipping would be excluded from an area 2 nautical miles in radius around the facility during testing, the impact on fishing and shipping would be unacceptable.

Draft environmental assessments produced by the Navy were criticized, even by other government agencies, as being inadequate. The Navy has since sponsored tests on numerous organisms and found no effect from very powerful pulses, however. It argues in a final environmental impact statement published last month that fields generated outside the 2-mile exclusion zone would be so small that there would be no conceivable effect on electronic equipment.

Nevertheless, Congress last December passed legislation prohibiting the Navy from operating Empress II in the Chesapeake Bay unless the Secretary of the Navy determines that such testing is essential for national security and that alternative test sites are unsuitable. In the settlement of Rifkin's lawsuit, the Navy has agreed to conduct yet another environmental assessment if it chooses an alternative test site.

The skirmishing over Empress II apparently sparked Rifkin's interest in the whole EMP testing program. He says he filed suit in part to launch a campaign against what he calls "electronic pollution" in the United States, by which he means the hazards that some have conjectured from fields associated with high-voltage power lines, microwave transmissions, and the like.

Kosta Tsipis, an MIT professor who recently completed a study of the military implications of EMP, says equating the radiation from power lines with the transient fields produced by EMP simulators indicates "gross confusion" about the EMP program. Tsipis, often a critic of defense programs, says he reviewed data on Empress II, and "there was nothing in terms of environmental damage that we could see."

Rifkin has charged that the EMP testing program is designed in part to provide a database for the development of electromagnetic weapons. He cites in particular a program sponsored by the Strategic Defense Initiative (SDI) to develop electromagnetic guns and allegations by the Pentagon that the Soviet Union is developing electromagnetic weaponry. A Pentagon spokesman points out, however, that these have nothing to do with EMP. The SDI project uses electromagentic fields to accelerate projectiles, while the alleged Soviet efforts focus on high-power microwaves, which operate in an entirely different part of the spectrum from EMP simulators. ■ COLIN NORMAN

Norway: Boosting R&D for a Post-Oil Economy

Research spending lagged during the oil boom but it is now being reemphasized with focus on improving quality

Oslo

"It's been a bit like the arrival of winter," says an official in Norway's Royal Ministry of Cultural and Scientific Affairs. "Everyone knew that one day the oil money was going to start drying up; but it was still a shock when it started to happen."

The discovery of major oil fields in the North Sea in the early 1970s led to a boom in the Norwegian economy and to a relative decline in the country's interest in research outside the oil industry. The proportion of government spending devoted to research and development fell from 2.7% in 1972 to 2.3% in 1980; support for basic research dropped from 48 to 42% of the science budget between 1977 and 1980 alone.

In the early 1980s, a growing realization that the oil bonanza would not last forever and that the economy needed to diversify into the production of high-technology goods led to the beginning of a turnaround. Most of the increased spending, however, remained concentrated on applied research, much of it paid for by oil companies flush with excess funds.

With the collapse in oil prices over the past couple of years, these funds are becoming more scarce. The government is now stepping into the breach, putting a new emphasis on long-term fundamental research and moving to restructure its research funding procedures along lines already adopted by many other Western nations.

At the same time, it is also trying to maintain the social priorities embedded in its science policy—such as positive discrimination in favor of recruiting more women into science and a new boost to environmental research—that countries more wedded than Norway to a free market social philosophy are sometimes reluctant to adopt.

"Research is one of the top priorities of the present government," says Hallvard Bakke, Minister of Cultural and Scientific Affairs, pointing out that one of the first moves of the current Labor Party government when it came to power in May 1986 was to secure a 7.6% real increase in the nation's research budget for 1987. "Our main objective is to expand the possibilities of the Norwegian economy, and to give it more feet to stand on, so that it does not have to rely on oil and oil-related industries."

A similar increase has been promised for 1988. And although this may, like all other areas of government spending, be trimmed in the light of economic difficulties currently facing the government, officials in Bakke's ministry say they are confident that R&D spending "will probably be the only sector whose budget will increase."

Much of the government's strategy in selecting priority areas for research support follows a familiar pattern, for example its decision to boost funding for research in information technology, in new materials and biotechnology. However it has decided to go further than some in simultaneously stimulating both fundamental research in new technologies and their integration into society.

A prime example of this is the decision by the Department of Industry, in a country with only 4 million inhabitants, to launch an ambitious $170-million information technology program. "It is a unique program that does everything from basic research to stimulating new demands for information technology in the health sector," says Jens Erik Fenstad, professor of mathematical logic at the University of Oslo.

In the case of biotechnology, a special emphasis is being placed on the potential long-term contributions of genetic engineering techniques to one of Norway's newest and fastest growing industries, namely aquaculture. Last year, the government promised to increase aquaculture research funds by 31% in 1988. Already, intensive studies are being carried out of ways of using the unique environment offered by Norway's fjords to raise not only salmon, but also more mass-market fish such as cod and halibut.

Two other fields of research are being given special emphasis in the government's plans. One is the social sciences, a field with a long and distinguished history in Norway closely linked to the country's highly developed social welfare system. "As a result, we have a very strong base for carrying out