professionally competent outsiders. If a proposal is approved, the project must get the blessing of the Academy council, which is made up of Academy members and is the governing board and conscience of the Academy.

Handler says when he assumed the presidency of the Academy he found a number of members who were concerned about the growth of the NRC and "didn't know what it did." The exercise of control by the Academy of the NRC has been an issue almost from the creation of NRC. Concern about this was an element in the decision to combine the office of NAS president and NRC chairman when Bronk took over in 1950. It was a strong factor in the move to make Frederick Seitz, Bronk's successor, the first full-time president. And Handler was elected to the presidency with an implicit mandate to modify the structure and management of the NRC.

The problems facing Handler in carrying out his mandate are formidable. The "trustees" of the NRC are the 840 plus members of the Academy. A group of that size is, of course, too unwieldy to serve as a policy-making body, even if the range of its members' opinions and prejudices are ignored. Only an estimated 225 Academy members currently serve on NRC committees, so that membership as a whole is far from perfectly informed.

The Academy council, which is elected by the membership, by and large is made up of men who combine professional distinction with a fair familiarity with the corridors of power. But the council meets for 2 days every 2 months, whereas the staff is there every day and has the civil servant's edge of a knowledge of detail.

In the last decade, the officers and council have taken steps to improve the lines of communications into the NRC and its powers of quality control. Most notably, as the broader public consequences of scientific and technical decisions became apparent, the Academy established outside NRC a Committee on Science and Public Policy (COSPUP), and the NAE was to create a parallel Committee on Public Engineering Policy (COPEP). A second article will discuss these efforts at exerting quality control and moves made toward a restructuring of NRC and also the major obstacles to change, particularly that created by the failure of the NAS and NAE to find a satisfactory modus vivendi.

Some of the problems are imposed by the congenital reliance of the NRC on part-time talent. There is a real question as to whether the increasingly complex work of the NRC can be done on the basis of gentlemanly volunteer work. Institutionally, there are also critical questions about the way committee chairmen and members are chosen and about handling of conflict-of-interest problems that arise in some areas.

Inevitably, when there is so much discussion about the various categories of contemporary "consciousness," the attitudes of an organization whose dominant majority is on the far side of the generation gap becomes a legitimate issue. Academy members are predominantly physical and life scientists devoted to their disciplines through long careers and at least mildly suspicious of the "soft sciences." They tend to be genuinely dedicated to maintaining the standards of the Academy and are appalled at the prospect of value judgments having a part in Academy studies.

Much is being made of Academy weaknesses these days, but it would be unwise to ignore its strengths. At its best, the committee system works superbly, with men of the highest competence giving disinterested advice as a public service. Unfortunately, the system works best on straightforward technical issues. And as Handler concedes, the NRC record is least impressive in the arena of the environment.

It is in this area that the greatest public sensitivity has developed. And the Academy finds itself with a new constituency—and the new experience of being judged. (Udall concluded his remarks at the AAAS meeting by urging consumer advocate Ralph Nader to conduct a study of "the Academy and the whole scientific enterprise in this country." Nader and his associates decided to undertake the project and Philip M. Boffey is leaving the *Science* news department to head the study.)

NRC was shaped in an expansionary era of American science and still reflects the spirit of that era when, in effect, it was considered as important for national scientific institutions to serve the needs of science as the needs of society. But now the Academy, like other American institutions and particularly institutions occupying monopoly positions, is having its authority questioned and is under pressure to redefine the ways in which it is to be responsive and responsible.

—JOHN WALSH

CBW Ban: Nixon Would Exclude Tear Gas and Herbicides

Forty-five years ago the Senate refused to ratify the 1925 Geneva protocol banning chemical and biological warfare—and this year it is likely to refuse again.

The American chemical industry and the Army Chemical Corps brought sufficient pressure on senators to halt U.S. acceptance of the treaty in 1926. This year, however, the difficulty stems from the Nixon Administration's insistence that the protocol exclude herbicides and tear gas.

Between 5 March and 26 March, the Senate Foreign Relations Committee held 6 days of hearings* on possible Senate approval of the protocol. Following the hearings, committee Chairman J. William Fulbright (D–Ark.) announced that he would lay the protocol aside "for awhile" to give the Administration a chance to reconsider its position. Fulbright and some other members of the committee apparently fear that the treaty might fail to obtain the necessary two-thirds approval on the Senate floor, due to the controversy over herbicides and tear gas. The treaty is one of the world's oldest and most successful arms control agreements. And critics of the Administration's position contend that U.S. ratification with the reservation that nonlethal chemicals are excluded would

* The published hearings may be obtained free of charge after 1 May from Senate Foreign Relations Committee, United States Senate, Washington, D.C. 20510.

erode the force of the agreement. Administration officials, on the other hand, have threatened not to participate in the treaty at all if the Senate ratifies it with an amendment that tear gas and herbicides are included.

America's failure to ratify the treaty, now agreed to by 96 other countries, has been a regular issue in the debate, during the past few years, over chemical and biological warfare. While declaring a ban on U.S. stockpiling of biological weapons in 1969, President Nixon announced he would resubmit the Geneva protocol for Senate approval. But 10 months later, in the actual message seeking the advice and consent of the Senate, Secretary of State William P. Rogers said, "It is the United States' understanding of the protocol that it does not prohibit the use in war of riot control agents and chemical herbicides. Smoke, flame, and napalm are also not covered by the protocol."

At issue is a section of the treaty that prohibits "asphyxiating, poisonous, or other gases and . . . all analogous liquids, materials, or devices." The Administration's interpretation of that statement is shared by few other countries. On 16 December 1969, the United Nations' General Assembly approved by a vote of 80 to 3, with 26 abstentions, a resolution declaring that the use of any chemicals in war is contrary to the protocol. Only Portugal, which has used gas and herbicides in its war against guerrillas in Angola, and Australia, which has used them in Vietnam, joined the United States in opposing the measure.

Even though the hearings before Fulbright's committee may not lead to ratification of the treaty, they did provide one of the rare public discussions of America's policies of chemical and biological warfare. During testimony at the hearings, Rogers announced that all programs of crop destruction in Vietnam would be terminated, and that defoliation by herbicides would be "phased out." During the phase out, Rogers said, defoliation will be limited to "remote, unpopulated areas" with "no spraying from fixed-wing aircraft."

American forces will continue, however, to use tear gas at a "level to be determined by relevant military and economic considerations."

G. Warren Nutter, an Assistant Secretary of Defense, told the committee that the Administration "has shown profound concern over the problem of developing a sound national policy on chemical and biological warfare and related research." This sound policy, according to Nutter, now includes a renunciation of any use of biological weapons, including toxins. The United States, however, will maintain large stocks of chemical weapons of all types. Rogers requested that, in addition to the total exclusion of herbicides and tear gas, the Senate attach a formal amendment to the Geneva protocol reserving the right of the United States to retaliate with chemical weapons if attacked with either chemical or biological weapons.

Thus, the American government has proclaimed that it will not be the first to use "lethal" or "incapacitating" chemicals, but all other chemicals are to be considered "legitimate" weapons. Neither the Administration nor its critics contend that tear gas should be

Handler Dissents on NSF Budget

While the Administration's proposed 1972 budget for the National Science Foundation (NSF) has encountered general if not ardent approval in the scientific community, Philip Handler, president of the National Academy of Sciences (NAS) and former chairman of the National Science Board (NSB), has voiced objections to shifts in the budget that will emphasize applied research while subtracting funds for graduate science traineeships and fellowships.

In testimony before the House subcommittee on science, research, and development, Handler warned that the current budget request "starts down the trail of complete elimination of NSF training and fellowship programs." Two programs have been eliminated outright: first-year graduate traineeships, and the Secondary Science Training Program for high school students.

While the budget has grown considerably, Handler noted, most of the increment will go for picking up programs that have been dropped by other agencies. The rest, he said, is being funneled into the new applied research program, Research Applied to National Needs (RANN), whose budget is being doubled to $81 million. The year-old program (formerly known as Interdisciplinary Research Relevant to Problems of Our Society, or IRPOS) was inaugurated amid misgivings on the part of the NSB, said Handler. He said he still regards RANN as "experimental," noted that it has not yet produced any significant contributions to the solution of national problems, and reiterated his fears that too much emphasis on applied research might turn NSF into a "job shop."

Handler emphasized that he was speaking only as NAS president and not for the NSB, of which he is still a member. Apparently, he is a minority voice on the board. Its current chairman, Herbert Carter, said the proposed budget was endorsed by the board and that he regards the RANN program as extremely important for helping universities set up new interdisciplinary curriculum units.

While the proposed NSF budget of $622 million means an increase of $116 million over last year, the new money does not represent a substantial increase for any NSF programs except RANN. Most of the money—$74 million—will be used to pay for programs transferred from other agencies, chiefly the Department of Defense (DOD), and for picking up projects which mission-oriented agencies like DOD and the Atomic Energy Commission have had to drop for budgetary reasons.

Handler's budget complaints reflect the conflict that has bubbled up from time to time between him and the Administration over concepts of science funding (*Science*, 25 December 1970). Handler believes that cutbacks in graduate student support reflect a lack of faith in the future of the economy, and he is fearful that too much applied research will erode the country's basic research capability. The Administration, on the other hand, would prefer to hold the line on student support until the employment picture brightens, and is eager to encourage the conversion of technology to more socially useful ends.—C.H.

outlawed from use in civil disturbances.

The reason American troops use tear gas in Vietnam (and, consequently, the reason it should not be outlawed by international agreement), Rogers declared, is "because we think it is more humane than napalm or other methods of warfare." According to other testimony before the committee, however, the gas is most frequently used to flush enemy troops out of hiding so they can be killed by bombs and artillery. When Fulbright asked Rogers if such use of tear gas does not amount to "lethal use of a nonlethal weapon," Rogers replied, "if you did not use the tear gas, you would be using two lethal weapons, say napalm and something else."

Assistant Secretary of Defense Nutter told the committee that "it is the firm opinion of our military that the use of riot control agents has been a very important factor in avoiding unnecessary suffering and achieving legitimate military objectives." Nutter then listed several uses for the gas, including the dislodging of a dug-in enemy, rescuing downed airmen, fending off attacks, and routing enemy soldiers from tunnels and bunkers.

Other witnesses before the committee disagreed with the Defense Department's assessment of the military importance of the tear gas. Matthew Meselson, the Harvard biology professor who heads the AAAS commission on herbicide use in Vietnam, said that few of the American field commanders he interviewed felt that the gas was of any military value. According to Meselson, North Vietnamese and Viet Cong troops now carry gas masks and are trained to keep cover in the event of a gas attack. Thus, he claimed, gas could lead to increased civilian casualties, since civilians have no means of avoiding the gas and might then be unable to take cover from conventional weapons. A recent study by the RAND Corporation of the use of tear gas in Vietnam reached conclusions similar to Meselson's.

As for herbicides, Rogers, in referring to the Geneva protocol, said, "no one was talking about protection of plants, they were talking about protection of people." But a host of other witnesses before the committee argued that people are indeed affected by the plant-killing chemicals. Arthur Galston (Yale University), Arthur Westing (Windham College, Putney, Vermont), Victor Sidel (Montefiore Hospital, New York), Meselson, and Senator Gaylord Nelson (D–Wis.) all conjured up potential ecological catastrophes from continued massive use of herbicides.

The primary argument voiced by all of the witnesses except the Administration representatives centered on the possible spread of chemical warfare of all types as a result of the U.S. insistence on using tear gas and herbicides against the Vietnamese. As Meselson put it, "The example of the world's most modern army using gas for the first time in 45 years and deploying a whole panoply of newly developed gas munitions cannot help but stimulate the interest of foreign military establishments in the utility of similar weapons."

Many of the witnesses feared an escalation of chemical warfare because of what they saw as a lack of a clear distinction between "incapacitating" agents and the riot control agents. When pressed for a precise definition, Nutter admitted that in some instances it might be hard to distinguish between the two. In fact, according to the Administration spokesmen, the type of tear gas used by American troops is more powerful than that used by the police for civil disturbances. Called CS-2, its particles are finely pulverized to allow for penetration to the victim's lungs, and are coated with silicone to allow for persistence in a damp climate.

Bundy Joins Opponents

Among those opposing the use of tear gas and herbicides were two former government officials who once spoke in favor of their use. McGeorge Bundy, now president of the Ford Foundation, said that, as an adviser to President Johnson, he participated in the initial decisions to use the weapons. Now, however, Bundy believes that tear gas and herbicides should be outlawed by treaty. He emphasized that, while he can understand the pressures on the men in combat in Vietnam, "the man in the field and his immediate commander are not able to judge . . . exactly what the American government as a whole must not neglect—the question of the safety of Amercian lives in the future and indeed the safety of the human race." "This," he said, "is the question which is inevitably raised by the terrifying potential of these kinds of weapons."

Also speaking in favor of the ban on tear gas and herbicides was George Bunn, professor of law at the University of Wisconsin and former American negotiator at the 18-nation Geneva disarmament talks. As an official in the Johnson Administration, Bunn wrote the statement that American officials read to the United Nations justifying the use of the chemicals. Use of tear gas in Vietnam, said Bunn, was originally justified in humanitarian terms. Now, however, the use is rationalized as "saving American lives." The United States, Bunn said, at first claimed they were using herbicides "to control weeds and other uncultivated vegetation." But eventually, military authorities turned to crop destruction. Because of the likelihood of such escalation, he concluded, "the best policy would be to use no chemicals at all."

But the United States is still using tear gas and herbicides in Vietnam on a regular basis. As pointed out in the hearings, American troops drop gas in bombs on enemy positions, they shoot it in artillery shells, and they throw it in hand grenades. Nutter told the committee that neither Viet Cong nor North Vietnamese troops have yet used chemicals against American forces. Their policies might, however, be changing. According to the 12 April issue of *Time* magazine an assault on Fire Base Mary Ann that left 33 Americans dead and 76 wounded began with North Vietnamese commandos throwing tear gas grenades into the American bunkers.

Outside of the Administration spokesmen, no one involved in the hearings, neither the senators nor the witnesses, argued that the Geneva protocol should be interpreted to exclude gas and herbicides. Nevertheless, three Republican senators (Cooper of Kentucky, Javits of New York, and Aiken of Vermont) seemed inclined to approve the treaty, even though they disagreed with the Administration's interpretation. But Fulbright and his Democratic colleagues are insisting that the treaty ban herbicides and tear gas.

Their reasons were probably best stated by Senator Frank Church (D–Idaho) who said during the hearings, "It seems to me that the recent interest in the Geneva protocol is the result of the indignation elsewhere in the world over the use of certain gases and herbicides in Viet Nam. And we now feel, bound by the pressure of opinion elsewhere, that it is necessary to become a party to the protocol. Yet in doing so, we interpret it in such a way as not to apply it to gases and chemicals we have been using in Viet Nam. What a perfect circle. And what does it really accomplish?"—ROBERT J. BAZELL