but prior to 1933. Another five schools did so between 1938 and 1940.

20. Selectivity of colleges in terms of the mean academic aptitude of entering freshmen in the middle 1960's is available in A. W. Astin, *Predicting Academic Performance in College* (Free Press, New York, 1971). If one can assume that selectivity levels have not changed between the periods of my study and 1965 to 1966 (a rather hazardous assumption), analysis of the schools in my study shows (i) that the denominational schools are somewhat unselective as compared to the other schools, (ii) that the marked differences in productivity between the denominational schools cannot be attributed to differences in selectivity (with the partial exception of the Quaker schools), and (iii) that even highly selective Roman Catholic colleges are not much more productive than their unselective counterparts, and are very unproductive compared to most other denominational schools.
21. Interestingly, through the years of this study there was a strong movement within this faith for social action (war relief and rehabilitation, peace education, community and interfaith activity), reflecting an emphasis upon the "social gospel" [R. E. Sappington, *Brethren Social Policy 1908–1958* (Brethren Press, Elgin, Ill., 1961)].
22. K. K. Bailey, *Southern White Protestantism in the Twentieth Century* (Harper & Row, New York, 1964).
23. H. H. Cheetham, *Unitarianism and Universalism* (Beacon, Boston, 1962).
24. G. W. Cooke, *Unitarianism in America* (American Unitarian Association, Boston, 1902).
25. M. Zborowski, *Social Forces* **29**, 351 (1951); *Harv. Educ. Rev.* **19**, 87 (1949).
26. Survey data are from S. M. Lipset and E. C. Ladd, Jr., in *American Jewish Yearbook* **72**, 89 (American Jewish Committee, New York, 1971). Unfortunately, the survey grouped all Protestant faculty together. As my study shows, the variation between Protestant denominations is so great that very significant differences are masked and meaningful analysis is prevented.
27. Nobel laureate data are from E. Van den Haag, *The Jewish Mystique* (Stein & Day, New York, 1969), p. 22.
28. On the importance of secularization, see Lipset and Ladd (*26*), and McClelland (*29*).
29. D. C. McClelland, *The Achieving Society* (Van Nostrand, Princeton, N.J., 1961), p. 336.
30. For discussion of related sets of values, see (*7, 8*), also B. Barber, *Science and the Social Order* (Collier Books, New York, 1962), p. 95.
31. R. T. Wootton, thesis, University of Utah (1956). In contrast to the frequently reported departure from the parental faith among Protestant and Jewish scientists (*1, 5, 16, 26, 29*), 72 percent of the Mormon scientists in Wootton's study were actively affiliated as adults.
32. Partial support for this work was given through a Brigham Young University Faculty Research Fellowship. I thank Richard Weaver for patience and competence in performing the computer analysis, and staff personnel of the U.S. Office of Education and many college registrars in supplying missing baccalaureate data.

**NEWS AND COMMENT**

# Nuclear Testing Violations: Keeping It All in the Family

In the 11 years since the United States and the Soviet Union signed the Limited Test Ban Treaty of 1963, there have been no indications that either side has detonated a nuclear explosion anywhere but underground, as the treaty requires. Nor has either of the nuclear superpowers ever publicly accused the other of violating the test ban treaty.

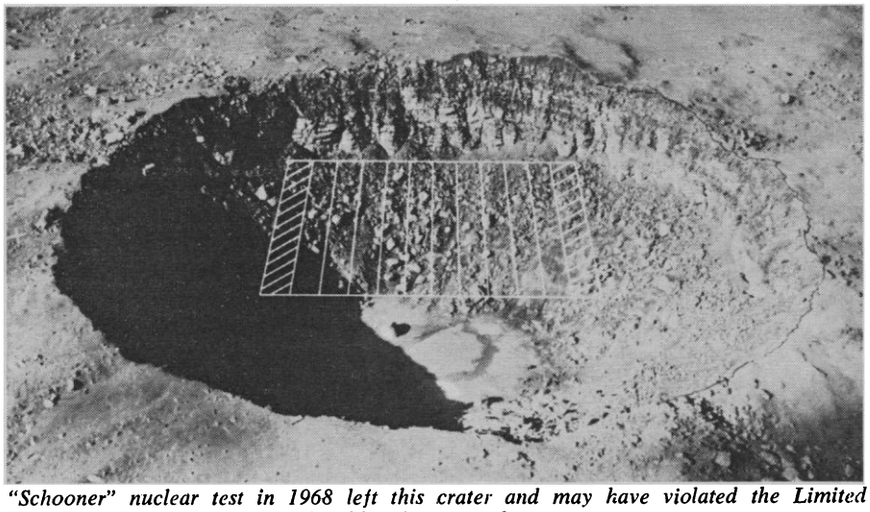
But there have been violations—almost certainly on both sides, but substantially more on the part of the Soviet Union than the United States. According to four authoritative sources with direct knowledge of these incidents, approximately a dozen of the 92 nuclear tests the Soviet Union is known to have conducted since August 1963 have vented "appreciable" amounts of radioactivity into the atmosphere and across Soviet borders in northern Europe and the Far East.

The way the State Department and the Soviet embassy in Washington have treated these venting incidents provides an instructive glimpse at the difficulties involved in enforcing arms control agreements in general, and test ban treaties in particular. Critics of the partial ban on underground testing signed at Moscow in July believe the new agreement may raise similar problems.

In addition to banning nuclear explosions everywhere but underground, the Limited Test Ban Treaty also prohibits tests under any circumstances that would cause "radioactive debris to be present outside the territorial limits" of the nation conducting the test. On this ground, sources say, the State Department has considered the Soviet ventings to be breaches of the test ban treaty. However, the U.S. attitude during both the Johnson and Nixon administrations has been that periodic puffs of radioactivity floating out of the Soviet Union were the product of careless testing, not of attempts to evade the treaty.

"There has been some disregard for the letter of the law" on the part of the Soviet Union, an intelligence official who has served both administrations said. But, like other sources, he added that none of the infractions had seemed serious enough to jeopardize the treaty or to warrant public criticism.

Detailed information is sketchy, partly because the ventings extend over a long time and memories have faded, and partly because the State Department and the Atomic Energy Commission, as a matter of policy, do not discuss them. It is known, though, that they occurred as long ago as 1965 and as recently as 1971. Ventings have occurred at both Soviet nuclear testing sites—one at the southern end of the arctic island of Novaya Zemlya and the other in the central Asian desert just south of the city of Semipalatinsk. The vented clouds have consisted mostly of radioactive krypton and other gases that tend to remain high in the atmosphere, although some clouds have distributed particulate fallout. In every case, the sources say, the overall



*"Schooner" nuclear test in 1968 left this crater and may have violated the Limited Test Ban. Drawing of football field indicates scale.*

amounts released were substantially greater than the minimum amount detectable by sensitive ground and airborne instruments.

Possibly the biggest and dirtiest release resulted from a test of a "peaceful" thermonuclear device near Semipalatinsk on 15 January 1965. Touched off just beneath the ground surface, the blast had a yield estimated at 100 to 150 kilotons and was used to dam a river.

"That was a real rip-snorter," one former intelligence officer at the State Department recalled. "After the stuff circled the earth a couple of times we called them on it."

A similar, though apparently smaller, venting occurred on 27 October 1966. According to another former intelligence official, "one or two" more have occurred since 1970 for a total of about a dozen. Three other sources agreed that this total was approximately correct.

Most ventings, sources believe, were caused by a consistent failing of the Russians to bury their bombs deeply enough to completely contain the explosion. One possible motive in doing so would be to explode their weapons in loose alluvium or other uncompacted strata near the surface. This would tend to muffle an explosion's seismic signal and lead foreign listening posts to underestimate the weapon's yield. But a more likely explanation is that Soviet nuclear testers are simply unwilling to spend the kind of time and money the AEC does to keep its explosions underground.

"They're less concerned about venting than we are," says a former State Department official. "They're less inclined than we are to spend lots of money burying everything."

Most of the venting incidents are said to have led to protracted and inconclusive conversations between the State Department and the Soviet embassy "at the highest level," presumably the Soviet ambassador and an Assistant Secretary of State, if not the Secretary himself. Typically the language would be polite and circumspect. Said one former official who followed these conversations closely:

"The general spirit was, 'Look, we want the test ban carried out fully by all parties and we assume that's what you want too. And we have some information that raises a question and needs clarification.'"

Clarification was often slow in coming and was usually less than illuminating. One former official said that during the 1960's "we never got any satisfaction for our inquiries. They never said they were sorry. They just denied everything."

Other sources, however, say that more recently—perhaps in the spirit of detente—the Russians have tended to acknowledge their obligations under the treaty and have indicated an interest in stopping the ventings.

The State Department has consistently kept these discussions confidential in the belief that publicizing them would only serve to "muddy the waters" in arms control talks. But two other motives for constraining pressure on the Soviets may also have been at work.

For one, Soviet carelessness has probably worked to the advantage of

## Critics See Verification Problem

Arms control advocates who have denounced the Threshold Test Ban Treaty signed in Moscow on 3 July as a "sham" and a "mockery" are saying now that Soviet compliance with the treaty may be impossible to verify.

The treaty would limit nuclear weapons explosions to those with a yield of 150 kilotons or less (*Science*, 19 July and 2 August). A protocol to the treaty calls for each nation to detonate two "calibration" explosions and to disclose the yield, depth, precise location, and geologic environment of these shots. The objective is to enable each nation to translate accurately the magnitude of seismic signals into explosive yields.

But at a news conference on 25 July, the Federation of American Scientists and the Arms Control Association (ACA) contended that there is no way of independently and accurately verifying the data the Russians provide, and that their compliance with the treaty would therefore be impossible to verify.

"This is such an obvious loophole I don't know how the negotiators missed it," said Herbert Scoville, Jr., a former chief of science and technology in the Central Intelligence Agency and later in the State Department's Arms Control and Disarmament Agency (ACDA). Scoville, an officer of the ACA, said the Soviet Union could detonate 300-kiloton calibration shots, call them 150 kilotons, and no one would know the difference.

In a statement, the FAS added that even though seismologists can't accurately measure the yield of a distant nuclear blast, they can identify man-made explosions as small as 2 kilotons. This is because wave features of explosion noises differ from earthquake vibrations. "Paradoxically," the FAS statement said, "it is easier to monitor a complete test ban since . . . one only needs to know whether an explosion has occurred at all—not its size."

The FAS and the 3-year-old ACA strongly advocate a comprehensive test ban.

A State Department arms control official who was asked to comment on the verification question said the United States does have independent means of checking the Soviet data. "We're not starting with a tabula rasa here," he said, and added that enough is known about the geology of Soviet test sites to permit a rough translation of seismic magnitude into explosive yield. Beyond that, the official said, "the data can be cross-checked by national intelligence means."

Scoville was highly skeptical. "How are they going to check the yield? Somebody doesn't know the intelligence business very well."

Other government sources said that the Soviet data would be used only to "refine" present seismic detection capabilities. But in a later interview, Jack F. Evernden, a leading Pentagon seismologist from 1969–71, agreed with Scoville: "He's essentially right. They can fudge a bit here."

One mitigating factor, Scoville said, is that "the threshold is so high, there may not be any incentive to cheat."—R.G.

American intelligence. Whiffs of radioactive gas picked up by Air Force tracking planes (which is how the first Soviet test was discovered in 1949), as well as by Scandinavian and Japanese sniffing posts, have undoubtedly helped confirm seismic hints of nuclear tests. Moreover, painstaking analysis of isotopes present in the vented gas may have provided clues about the design and performance of Soviet weapons. The AEC, in fact, has censored such information from U.S. government reports of occasional ventings at the Nevada Test Site.

And too, the Golden Rule may have operated here, for the AEC's slate is not entirely clean. Out of 259 publicly announced nuclear tests since August 1963, the AEC has reported that 22 vented "minor levels" of radioactivity beyond the boundaries of the Nevada Test Site. Eighteen were accidental ventings from weapons tests and four were Plowshare cratering experiments expected to cause some fallout. The AEC isn't saying how many of these

# Briefing

## The White House and the Cancer Board

The presidentially appointed National Cancer Advisory Board has six new members—almost. Although they showed up for the board's most recent meeting and were formally introduced, the President has yet to get around to making their appointments. The situation is a source of some embarrassment to the brass at the National Cancer Institute (NCI), who are supposed to be fighting cancer without red tape.

Feelings about the present lack of presidential responsiveness are compounded by the fact that the White House did care enough about the new appointees to take an active role in their selection in the first place. There are those at NCI who see that as unhealthy political interference.

The new members of the board are William O. Baker, president of the Bell Telephone Laboratories; G. Denman Hammond, director of the cancer center at the University of Southern California School of Medicine, Los Angeles; virologist Werner Henle of the Children's Hospital of Philadelphia; and radiologist William E. Powers of Washington University in St. Louis. Philanthropist Mary Lasker of New York, originally appointed to the board for a 2-year term, was reappointed. So was Joseph H. Ogura, chairman of otolaryngology at Washington University, who was appointed in mid-1972 to fill a vacancy.

According to persons close to the situation, Ogura's reappointment was managed by the White House and could have become the focus of a dispute between the people running the cancer program from Bethesda and those running it from 1600 Pennsylvania Avenue had it not been for Stanford biochemist Paul Berg.

The story, pieced together from various individuals, seems to be this. Ogura, known as an outstanding head and neck surgeon, was not among the persons on NCI's original list of candidates for the six openings simply because of a desire to put new people on the board rather than rename existing members. But word filtered back to NCI that the White House wanted Ogura, allegedly because he has strong Republican connections in the Midwest. It looked for a time as if Hammond, whom many persons were particularly anxious to have on the board, would not be asked to serve. It is not clear just how far the NCI would have pushed its feelings about this matter, but as it turned out, it never had to, because Berg unexpectedly said "No" when he was asked if he would be willing to join the board. This created what amounted to a vacancy.

Berg's decision to reject an opportunity to be on the board was not made as a protest against the cancer program or the Administration but rather as a protest against "administration." Berg, who says his decision not to serve on the board was one that caused him real anguish, realizes that by remaining out of the fray he has lessened his right to criticize the policies others make but in the end his commitment to his research took precedence. Having just resigned the chairmanship of the department of biochemistry in order to spend time in the laboratory, he concluded that it would hardly make sense to take on the time-consuming administrative duties that go with being a board member.

And so, what might have become a minicrisis for the NCI passed.

Ogura, for his part, says that, although he is a Republican, he is not politically active in any way and has no connections with highly placed members of the Administration, least of all, the President. The most likely reason for his reappointment, he suggests, is that having been named to fill a vacancy, he has not had sufficient time to contribute fully to the board's activities.—B.J.C.

## Law Sets Study of Biomedical Research

There is going to be a major review of the role of the federal government in biomedical research. This monumental task is to be undertaken by a panel of seven wise persons who will have about a year and a half to complete their labors.

During the last few months, persons in Congress and the Administration have called for a study of biomedical research. Senators Edward Kennedy (D–Mass.) and Jacob Javits (R–N.Y.), for example, wanted to establish a permanent panel on biomedical research that would report directly to the President, as does the three-man Cancer Advisory Panel. They wrote a bill to this effect and attached it to routine legislation to amend the National Cancer Act of 1971 (*Science*, 5 April). Health, Education, and Welfare (HEW) Secretary Caspar Weinberger said that if the bill was not dropped in Senate-House conference on the cancer legislation, he would recommend that the President veto the whole package, and the President indicated he would take Weinberger's advice.

Not long after that, it became known that Weinberger himself had proposed establishing a commission appointed by the President to assess the state of biomedical research in this country, with special emphasis on the government's role in supporting it, but he did not want the commission to be a permanent body (*Science*, 14 June).

releases, if any, sprinkled fallout over the Canadian or Mexican borders, but circumstantial evidence points to two tests and less certainly to a third—all smaller than Soviet releases.

The first such test was the "Pike" shot, a blast rated at less than 20 kilotons and detonated on 13 March 1964. According to a U.S. Public Health Service report* radioactivity began seeping into the air shortly after the test and was followed by a tracking plane southeast into Arizona and California.

Pike delivered the highest gamma ray dose to populated areas in the United States of any accidental release since the Limited Test Ban Treaty went into effect—55 millirems at Cactus Springs, Nevada, or about 10 percent the maximum dose allowed under

* Offsite ventings are monitored by the National Environmental Research Center at Las Vegas, Nevada, now operated by the Environmental Protection Agency. Summaries of data are published monthly by the EPA in *Radiation Data and Reports*.

# Briefing

The Secretary's view prevailed in that the biomedical research panel called for in the law will be a temporary one. Anticipating the law, which the President signed on 25 July, the staff at HEW has sent Weinberger recommendations on how the panel might be organized. One of them is a recommendation that there be subpanels to help with the job that may be too overwhelming for seven individuals alone.

HEW staffers have been busy gathering names of persons that they will suggest be appointed to the panel (not more than five of the seven can be scientists) and have passed them on to Weinberger. He will pass them on to the White House where they may or may not be accepted. In any case, the White House is going to get other advice on the matter, and some of it will come from Benno Schmidt, chairman of the cancer panel, who is named in the law to be one of the seven.

—B.J.C.

## Score One for Dow

In a move which environmentalists are terming an alarming shift in policy toward industry, the Environmental Protection Agency (EPA) has withdrawn from proceedings to cancel commercial registration of the herbicide 2,4,5-T. The herbicide, made only by the Dow Chemical Company, is sold in the United States for use on rice crops, rangeland, and rights of way. The government in 1970 thought the hazards of the chemical were sufficient to prohibit its use around homes, gardens, and recreational areas. The problem with 2,4,5-T is that it contains a manufacturing impurity, tetrachlorodibenzoparadioxin, or simply dioxin, which is highly teratogenic in mice and considered one of the most toxic substances known.

EPA had embarked on a lengthy, formal, administrative procedure known as a cancellation proceeding to determine whether the remaining uses of 2,4,5-T should also be banned. But on 24 June, in a move which surprised many, EPA Deputy Administrator John Quarles announced that it would be "inappropriate" to keep this administrative procedure rolling along so long as "evidence which would in large part determine the outcome of these proceedings remains scientifically unavailable." He was referring to the fact that new test procedures for finding dioxin in tissue and in the environment in very small portions were more problematic than EPA had anticipated, and that a national monitoring program begun by EPA was also experiencing difficulties.

The decision enraged the Environmental Defense Fund (EDF), which had been a party to the cancellation proceedings. The Washington counsel of EDF, William Butler, said in a blistering letter to Quarles that the decision shows that "EPA is willing to permit continued use of the environment as [the] registrants' laboratory, and the population at large as their unwilling guinea pigs." In EDF's view, "the mere existence of a substantial doubt as to whether a pesticide is injurious to public health is . . . sufficient grounds for . . . cancellation of registrations of the pesticide." More than enough suspicion exists already in the case of 2,4,5-T, environmentalists say.

More fundamentally, the decision, Butler said, portends "an ominous policy shift" by EPA—namely, that "the burden of proving or disproving newly appreciated hazards falls properly upon EPA, rather than upon the registrant, and that, if EPA cannot provide such proof, registrations must be continued."

It is interesting that the decision comes at a time when EPA is under the gun on two other controversial chemicals. The agency is now drafting a review of its 1972 ban on DDT at the request of the Mr. Pesticide who oversees EPA's budget, Representative Jamie Whitten (D–Miss.). And this fall, Shell Oil Company will begin the manufacture of next year's batches of aldrin and dieldrin, pesticides which have been indicated to be carcinogenic in animals. EPA threatened last spring to suspend registration of them, but has kept mum about the threat since.—D.S.

## Beagles Not Used for Nerve Vaccines

Beagles are not being used to test vaccines against enemy nerve gas and never have been, says a scientist at Edgewood Arsenal in Maryland. Ludwig Sternberger, head of the immunology program at Edgewood, says that contrary to what an Army information officer told *Science*, the development of nerve gas vaccines is not one of the programs for which beagles are used as test animals (*Science*, 12 July). The only test animals employed in the vaccine research have been rabbits and mice, says Sternberger—"Dogs never entered our mind. . . . I wouldn't let a dog into my laboratory." What's more, he says, the vaccines are not just for fighting men, as was indicated in the article (and by the information officer), but are designed to protect civilians against surprise enemy attack.

Sternberger says he is working with two vaccines against organophosphates (chemicals which interfere with nerve impulse transmission): one gives immunity against the insecticide Paraoxon; the other, still under development, offers partial protection against the nerve agent Soman.—C.H.

AEC regulations. Within 3 days milk samples taken at Yuma, Arizona—about 10 miles from the Mexican border—showed a sharp rise in iodine-131, a telltale sign of fresh fission products.

There, practically within sight of the international line, the published data stop. An old joke among the cognoscenti holds that radioactive clouds "couldn't get through customs." Actually, of course, that's where the surveillance stopped.

The second prime candidate for a treaty violation was the "Schooner" shot, a 35-kiloton Plowshare blast on 8 December 1968. Schooner ripped a crater in the Nevada desert 200 feet deep and 850 feet across. Within 24 hours tracking planes over Nevada and Boise, Idaho, were picking up levels of radioactivity comparable to those last seen in 1962, the year that atmospheric testing ended in Nevada. The explosion sprinkled small but measurable amounts of radioactive tungsten north to Washington, South to Indio, California, near Palm Springs, and east to Joplin, Missouri, and Monroe, Louisiana.

Similarly, the 4.3 kiloton "Palanquin" cratering shot of 14 April 1965 caused a noticeable rise in radioactive iodine in milk as far north as central Montana and possibly, though not certainly, in southern Canada as well.

It could not be determined whether the Soviet Union had inquired about these possible violations. Canadian officials contacted by *Science* said that while one U.S. venting in the late 1960's had caused a "very small but significant" rise in radioactivity in Canadian territory, they could not recall the date or name of the test.

In any case, AEC officials say that improvements in testing procedures in recent years have enabled them largely to eliminate accidental ventings. Test shot holes are drilled deeper; more and better doors and safety devices are provided on access tunnels to explosion chambers. "We're keeping just about every atom in the ground now," says one AEC source. "I don't think the Russians are doing that well."

The lesson seems to be that treaties phrased in absolute terms are not always observed absolutely. But short of pulling out of a hard-won agreement altogether, there isn't much the complaining side can do about it.

—ROBERT GILLETTE

# Advising the Congress: OTA Council Faces Shakedown Problems

A dispute has flared up on Capitol Hill between the fledgling Office of Technology Assessment (OTA) and the council of outside experts which was created by law to give scientific advice to the congressional technology assessment effort*. The main issue is the role the council should play in advising the OTA permanent staff and in influencing the development of OTA projects.

The conflict has surfaced in the public meetings of the scientific council, where, as the transcripts of them have shown, council members have openly criticized OTA Director Emilio Q. Daddario and his office's handling of early projects. One cause of the friction is that the council is an unusually high powered group which, in the 7 months of its existence, has opted to be very vocal and active. As is apparent from the transcripts, two of the more concerned members of the council are its chairman, Harold Brown, president of the California Institute of Technology and former Secretary of the Air Force, and Jerome B. Wiesner, president of the Massachusetts Institute of Technology.

The OTA was set up under a 1972 law to provide Congress with an early warning system on emerging, technically related, national problems; but because of funding delays, OTA has only recently completed its first half year of activities. The legislation setting up OTA makes the OTA director and staff responsible to a board of directors comprised of members of the House and Senate whose chairman is Senator Edward M. Kennedy (D–Mass.). To assure technical oversight and public input, however, the law also provides for a council—formally known as the Technology Assessment Advisory Council. The law says that the council shall furnish advice and recommendations "upon request by the Board."

*Harold Brown*

But the law says nothing about what relationship should exist between the council and the OTA director and staff, an omission which has set the scene for the skirmishes over the council's role.

Council members generally claim they are investing more time and energy on the council than they have on other science advisory committees. Many, too, seem committed to the idea that the council's success is dependent on the success of OTA. Chairman Brown told *Science*, "If this thing falls on its face we are going to fall with it. . . . I had some very serious questions about it [OTA] right from the beginning and I still have them, although I see some hopeful signs. It is by no means a foregone conclusion that this is going to succeed."

At least some members of the congressional board know that the council is unhappy. Brown and Wiesner, for example, both say they have talked

* Council members are: Harold Brown, president, California Institute of Technology; J. Fred Bucy, Texas Instruments, Inc.; Hazel Henderson, author, Princeton, N.J.; J. M. Leathers, Dow Chemical Corp.; John McAlister, Jr., Stanford University; Eugene P. Odum, University of Georgia; Frederick C. Robbins, Case Western Reserve University School of Medicine; Jerome B. Wiesner, Massachusetts Institute of Technology; Edward Wenk, Jr., University of Washington; Gilbert F. White, University of Colorado. Ex officio members are Lester S. Jayson, Library of Congress, and Elmer B. Staats, Comptroller General.