Radiation Standards: Are the Right People Making Decisions?

Last month the National Council on Radiation Protection and Measurements (NCRP) issued a reassuring report which concluded that existing radiation standards are adequate, with minor exceptions, to protect the public and radiation workers from harmful exposure. Lauriston S. Taylor, president of the NCRP, commented that a 10-year study by his organization had found "no basis for any drastic reductions in the recommended exposure levels despite the current urgings of a few critics." Taylor also charged that two of the most outspoken of these critics—namely, John Gofman and Arthur Tamplin of the Lawrence Radiation Laboratory—have been guilty of making "highly irresponsible" statements when they suggest that the existing standards could ultimately result in some 32,000 extra cancer and leukemia deaths and some 150,000 to 1.5 million extra genetic deaths in the United States each year.

The NCRP had barely issued its report, however, before Gofman was counterattacking the organization for its alleged pronuclear bias. "The NCRP represents the radiology profession, the Atomic Energy Commission, the Defense Department, Westinghouse, and General Electric," Gofman told *Science*. "It's very difficult to conceive of an organization with a greater vested interest in the preservation of high levels of radiation. I know of no reason why the organization exists unless you want to label it a public relations firm."

Thus the sharp national debate over radiation safety seems likely to continue despite the NCRP's efforts to lay the matter to rest. But the exchange between Gofman and the NCRP has served to focus attention on the important question of how radiation protection standards are set. Previous articles in this magazine have discussed the scientific basis of the dispute over existing standards (*Science*, 6 February 1970) and a subsidiary controversy involving charges by Gofman and Tamplin that they have been harassed by the Atomic Energy Commission (*Science*, 28 August 1970). This current article will discuss such matters as who sets the standards, how they go about their business, and how adequate the whole mechanism appears to be.

The three most important bodies affecting standards in this country have been the NCRP, the International Commission on Radiological Protection (ICRP), and the Federal Radiation Council (FRC). The first two are private groups whose recommendations are, in theory at least, purely advisory. The ICRP was formed in 1928 by medical experts whose chief goal was initially to devise some means of protecting doctors from the hazards of handling x-rays and other radiation tools. The NCRP was set up a year later in an effort to give the United States a unified voice at meetings of this international group. Such unity was sought because, at the first international meeting in 1928, competing delegations from two American radiological societies had each claimed to be the authoritative body representing this country, with the result that no agreed upon American position was possible and recommendations prepared by a British protection committee were adopted by default.

Over the next two or three decades, these two organizations—the NCRP and the ICRP—held almost undisputed sway over the setting of radiation standards used to protect workers and, ultimately, the general public in this country. Their recommendations were by and large accepted by the medical profession, by industry, and by various government agencies. The NCRP's recommendations were issued in handbooks bearing the name of the National Bureau of Standards and they were widely regarded as government policy, but the government took no official responsibility for the standards and considered itself merely the "publisher" of NCRP's reports. It was not until 1959, after the advent of the atomic age had aroused public fears over fallout from nuclear weapons, that the government suddenly realized that it was relying primarily on private organizations to determine acceptable radiation protection standards. As a result, a new governmental organization, the Federal Radiation Council, was established to promulgate more "official" guidelines. The FRC—which came to consist of the heads of seven major agencies, namely, Atomic Energy, Defense, Commerce, Labor, Health, Interior, and Agriculture—was empowered to recommend standards which, after promulgation by the President, would then become official guidance for all federal agencies dealing with radiation. Such a subordinate agency as the AEC, for example, would have to make its rules governing nuclear reactors compatible with the overall guides developed by the FRC. The FRC was recently abolished and its functions were transferred to the new Environmental Protection Agency (EPA), but the government will continue, through the new agency, to promulgate standards of its own.

The work of these standards setting groups has been greatly assisted by various studies of the biological effects of radiation carried out by the U.S. National Academy of Sciences, the British Medical Research Council, and the United Nations Scientific Committee on the Effects of Atomic Radiation, among others. Thus it must be acknowledged that the existing standards carry an impressive imprimatur from some rather prestigious national and international organizations. When asked by a Congressional committee for his opinion of the NCRP and ICRP Lee A. DuBridge, President Nixon's first science adviser, replied: "There certainly is no group that has any greater expertise than they or greater access to technical information."

The standards promulgated by these various groups are remarkable in their unanimity. The standards are expressed in a variety of ways—allowable whole body exposure, dose limits for critical organs, allowable body burdens for particular isotopes, maximum permissible concentrations of these isotopes in air, water, and food that may be ingested, and so forth—and different dose limits are recommended for radiation workers, for the general public, for pregnant women, and for other categories of the population. But, according to almost every expert who has testified before Congress in recent years, this bewildering array of numbers issued by the various standards-setting groups is by and large consistent.

The significance of this unanimity can be looked at in two ways. Officials of the standards-setting organizations

argue that the unanimity underscores the validity of existing standards, for different bodies of the world's leading radiation experts have all looked at the relevant scientific literature and reached essentially the same conclusions as to allowable exposure levels. However, critics of the standards charge that the various groups are so similar in outlook and have such overlapping memberships that they are merely different parts of the "nuclear energy lobby" wearing different hats and rubber-stamping each other's decisions. Perhaps the leading hat wearer of them all is Lauriston Taylor, who was key radiation protection official at the National Bureau of Standards for several decades, has been head of the NCRP ever since it was established, served on the ICRP from its formation until 1969 (he's still a member emeritus), was heavily involved in the FRC until the mid-1960's, and served on a radiation committee of the Public Health Service.

Taylor readily acknowledges that there is considerable swapping of experts and expertise among the various groups, but he believes this has simply enabled each group to avail itself of the latest knowledge without in any sense turning the groups into mere "rubber stamps" of each other. As an example, he cites a situation which developed in 1956–57 at the time of the last major revision in recommended standards. He recalls that a National Academy of Sciences committee recommended a tightening of standards based on genetic considerations, a British Medical Research Council group came to essentially the same conclusion, and the ICRP and the NCRP, which were both aware of these developments, made similar recommendations. "A lot of things happened simultaneously because there was so much cross membership, so it's pretty hard to say who did what first," Taylor says. "But I regard all four actions as independent. No one or two or three persons could swing a position on any of these groups."

Figuring out which, if any, of these organizations is the most important force in developing standards is difficult, but several experts believe it is probably the NCRP. Paul C. Tompkins, former executive director of the FRC and now acting head of the division of criteria and standards in EPA's radiation program, told *Science* that "NCRP is the most important organization without doubt." Similarly, Lauriston Taylor told *Science* that, although

Academy Panel Kicks over Traces

The Port of New York Authority (PONYA) has announced that it will not build additional runways for John F. Kennedy Airport into Jamaica Bay. In making the decision, PONYA followed the recommendation of a report it commissioned from the National Academy of Sciences–National Academy of Engineering. The report concluded that the runway expansion under consideration would cause major irreversible ecological damage to the bay.

The study group displayed initiative rarely found in Academy committees, which usually apply themselves to the formulation of answers to specific technical questions. The team, made up of 27 scholars and environmentalists, was initially expected to deal only with the consequences of new runways in the bay. However, encouraged by letters from the departments of Transportation and the Interior, they took the bit in their teeth and came up with a comprehensive document that not only deals with the future of the entire bay, but also aspires to be a national guide for airport planning and economy.

During the course of the investigation, the study group fell into some warm disputes with the Academy's Environmental Studies Board, which was worried that the committee was exceeding its mandate. The Board also took issue with some of the report's more ambitious recommendations and reacted uneasily to the subjectivity of many of the opinions expressed in it. But the committee held firm, and its recommendations have been presented unaltered.

The report summarizes in 11 recommendations a policy that would strengthen the federal hand in airport planning and site designation, cut down on aircraft noise, regulate traffic flow, and develop Jamaica Bay for conservation and recreation.

The bay, surrounded by Brooklyn, Queens, the airport, and the Rockaways peninsula, harbors a wildlife sanctuary and several thousand squatters in its marshy center. As urban bays go, it is described as "moderately polluted." The National Park Service wants to make the entire bay part of a Gateway National Recreation Area, but the study group, to the surprise of many environmentalists, turned thumbs down on this idea. Instead, it advocated the more difficult and expensive course of developing city park and recreational areas around the inner bay in a 10-year program that would include the extension of mass transit connections and a stepping-up of the sewage treatment program.

The committee's airport recommendations cover everything from site selection to landing fees. They suggest that the Secretary of Transportation be allowed to acquire land and to use all powers necessary for the construction of needed airports in cases where local agencies are unwilling or unable to carry out his recommendations. The committee urges more research on vertical and short takeoff and landing systems and on ground access systems. For traffic control, it proposes consolidating flight schedules to promote more efficient use of fewer airplanes. (One member notes that dozens of half-filled planes wing their way daily to Chicago, when two 747 flights could carry the same passengers.) Another recommendation, bound to elicit loud protests, is that a landing fee of $100 be imposed on private planes during peak hours.

Strong measures are put forth to conquer the noise problem which, at Kennedy, is monstrous. In addition to causing widespread insomnia and irritation, jet noise robs many thousands of schoolchildren of an hour of teaching time a day. The report asks for new construction standards that include soundproofing and for the installation of acoustically treated engine pods on all aircraft by 1975.

The report, at the very least, has caused PONYA to drop any idea of building more runways into the bay; at best, it is a far-reaching environmental policy statement which will make a significant contribution to future airport planning.—CONSTANCE HOLDEN

the ICRP generally set the pace from 1928 until World War II, the NCRP took the lead in the postwar period and was dominant until about 1956 when, as mentioned above, a number of organizations more or less simultaneously brought about the last major revision in standards. Thus it seems appropriate to take a closer look at the NCRP to see just what kind of body it is that has been dominating the standards-setting business.

When the NCRP was first established in 1929 it tended to represent medical-radiological interests and industry. Taylor, who was at the National Bureau of Standards, was the first chairman of the organization, which then had the title "Advisory Committee on X-Ray and Radium Protection." The rest of the committee consisted of representatives appointed by two radiological societies, the American Medical Association, and the x-ray equipment manufacturers. According to Taylor, the three societies and the electrical manufacturers continued to appoint the members until after World War II, when the NCRP's operations grew to such a point that new procedures had to be worked out. Finally, in 1964, the NCRP was granted a federal charter and the members then serving became a self-perpetuating body, responsible for electing their own new members. Thus the medical and industrial interests that originally dominated the organization lost their direct voice in its affairs, but they have continued to exercise a powerful indirect influence. The NCRP operated last year on a budget of about $140,000, most of which came from government contracts, and contributions given by more than 20 medical and industrial groups. According to Taylor, each of the various collaborating groups has one of its members on the NCRP—though that member is not considered a representative of his organization and is not necessarily even nominated by his organization. And while the collaborating groups have no veto power over the wording of NCRP reports, they are frequently consulted and are kept posted on the progress of reports and studies.

Currently, the NCRP has some 65 members plus an additional 150 or more participants who serve on the Council's 36 scientific committees but are not full-fledged members. Taylor estimates that about two-thirds of the committee chairmen are NCRP members, with the remaining third being outsiders of unusual competence in particular areas. Taylor believes the group is reasonably broad-gauged. He told *Science* that one recent breakdown indicated the NCRP itself consisted of 15 health physicists (mainly industry oriented), 11 radiological physicists (mainly medically oriented), 8 physicists (mainly specialists in measurement rather than protection), 10 medical doctors, 17 radiobiologists, 4 general biologists and pathologists, 4 public health specialists, and 3 geneticists. (The total adds up to more than 65 because some members qualify in more than one specialty.) Breaking the Council down another way, Taylor said that 33 members—a majority—are from the universities, 4 are from government agencies, 12 are from government contract laboratories such as Argonne or Brookhaven, and the remaining 16 are split up among various sources, including industry.

How NCRP Operates

In assembling a report, the NCRP goes through an elaborate study and review process aimed at producing a consensus on the matters under consideration. Topics for study are usually generated within the NCRP itself, though occasionally a specific study may be undertaken in response to an outside request. Once the Council has identified an area needing investigation, the problem is referred to one of the scientific committees for a review of the relevant literature. The committee drafts a report and recommendations which are then reviewed by a handful of NCRP members who are particularly knowledgeable in the field. Approval by these "critical reviewers" is required before the report can go any further. Once past this hurdle, the report is sent out to all 65 NCRP members. According to Taylor, a "great majority" of the members, which is usually taken to mean at least three-fourths, must approve the report, but if someone with prime understanding of the problem does not approve, the report is not issued no matter how many others endorse it. Critical comments are also frequently sought from outsiders. The latest report from the NCRP—the one which asserts that existing standards are by and large valid—was ultimately approved by about 60 of the NCRP members, according to Taylor. The remaining members did not object to the report, Taylor said, but simply failed to return their comments. Thus the existing standards can be said to have the essentially unanimous backing of the NCRP. The report was even approved by NCRP member Karl Z. Morgan, a health physicist at Oak Ridge, who has been critical of some aspects of the standards-setting process.

How good is the system used to determine acceptable radiation standards in this country? Are the right people making the right decisions in the right way?

The nuclear critics say the system is biased in the direction of allowing excessively high exposures to radiation. They contend that the NCRP and ICRP are dominated by "vested interests" whose careers are dependent on the use of radiation or of atomic energy, and that such people will hardly be eager to restrict the development of their fields by imposing stringent safety standards.

Mental or Monetary Bias?

Egan O'Connor, a staff aide to Senator Mike Gravel (D–Alaska) who has played a key role in Gravel's attacks on the nuclear establishment, recently asserted that at least 25 of the NCRP's 64 members (one seat is vacant) are supported financially by the AEC, while another six receive grants from the Defense Department or work directly for Westinghouse or General Electric, two major manufacturers of nuclear reactors. She also deplored the fact that there are so few geneticists and public health experts on the NCRP, and asked: "Does it make sense to ask experts who have devoted their lives to promoting medical, military, and peaceful uses of nuclear energy for an objective analysis of its safety? My answer is: NO. It is human nature for such experts to have either a psychological or monetary bias—or both."

In rebuttal, however, Taylor argues that the experts on the NCRP are "inherently honest" and would cer-are "inherently honest" and would certainly not endanger the public merely because they are funded by the AEC or have other nuclear interests. Moreover, Taylor asserts that "if you are going to work in the radiation field and call on the experts, you probably can't put together anything but a very small committee if you are going to avoid people who supposedly have a vested interest."

Nevertheless, an arguable case can be made that both the NCRP and ICRP are dominated by people who are "pronuclear" (though whether this necessarily makes them antisafety is another question). The situation is much less clear, however, when one examines the memberships of some of the other standards-setting bodies. The now-de-

funct Federal Radiation Council, for example, had representatives from agencies, such as Health and Labor, that would seemingly be more concerned about the safety of people than about the promotion of nuclear energy. Indeed, the FRC was occasionally sharply split on safety issues, with the health-labor forces opposing the atomic energy–military–commerce forces. One member of the White House Office of Science and Technology who kept tabs on FRC affairs told *Science*: "The FRC was pretty broad-gauged. It had the health nuts as well as the technological development nuts." Whether the FRC actually exerted much influence over most standards, however, is a matter of dispute. The FRC essentially adopted the standards previously recommended by NCRP and ICRP. Taylor, who was a member of the FRC group, claims the FRC went over the NCRP/ICRP recommendations with "a fine tooth comb" and concluded it could not improve upon them. But nuclear critics have accused the FRC of "rubber stamping." And even members of other standards-setting bodies acknowledge that the FRC was often disappointingly passive.

The standard that is most controversial today is one which stipulates that the radiation dose received by the general population should not exceed a yearly average of 170 millirems per person (exclusive of medical exposures and natural background radiation). This is the standard which has been specifically attacked by Gofman and Tamplin and which has been used in their calculations of the number of deaths that would allegedly result if the general public actually received this permissible dose. Significantly, both Taylor and Tompkins assert that this standard did not really originate with either the NCRP or ICRP but was essentially derived from a number originally proposed by a group of geneticists assembled by the National Academy of Sciences. The Academy's recommendation was put forth in a report issued in 1956 by the so-called BEAR committee, which studied the Biological Effects of Atomic Radiation under a special grant from the Rockefeller Foundation. The study was prompted by concern over fallout and was meant to provide an independent evaluation of the hazards of radiation. The key genetics committee was headed by Warren Weaver, of the Rockefeller Foundation, and included Nobelists George W. Beadle and the late H. J. Muller, as well as geneticists at AEC-supported laboratories. Defenders of the standards suggest that it is unfair to accuse this eminent group of a "pronuclear" bias.

Some critics carry the argument a step farther and claim that even if the scientists on the standards-setting groups have no nuclear biases at all, they are still not the appropriate people to make decisions on allowable exposure levels. Harold P. Green, a Washington attorney who specializes in nuclear matters, describes the standards setters as "a very narrow group" who are probably competent to estimate the risks involved in radiation but are hardly fit to decide what risks are "acceptable" to society. "The scientists don't have very much knowledge or experience with human values generally," he says. "Nor do they have any real degree of accountability to the public." Green suggests that the responsible groups should be more broadly representative, perhaps including economists, political scientists, sociologists, lawyers, theologians, psychiatrists, and others. But even that would probably not be enough, he suspects. "What is really needed is the kind of thing Gofman and Tamplin are doing—the stimulation of public debate," Green says. "Risk-benefit decisions are not scientific problems. They're political concerns and should be debated in the rough-and-tumble of the political process. What benefits does the public want and what risks is it willing to assume? The NCRP, in effect, has been saying to the public: 'You are going to have to assume these risks in order to have the benefits we say you want.' "

Neither the NCRP nor most other standards groups, it should be noted, deliberately sought this role. The literature of virtually all standards groups is laced with warnings that the standards involve value judgments and that the final decisions should be made by society, but thus far society has not really come to grips with the complex problem and the scientists have been left in charge by default.

As far as can be determined by the public record, the scientists have not really tried to perform a quantitative risk-benefit analysis in developing the standards. The various standards groups have refused to get involved in "the numbers game" of estimating how many deaths might result if the public received the radiation allowed by the standards. Nor have they tried to quantify the presumed benefits of atomic energy. Thus the public is left with little more than an assurance that the risk is "acceptable."

The standards are currently undergoing an intensive governmental review —the first in more than a decade. The new Environmental Protection Agency —which has assumed various radiation responsibilities from the old FRC, the Public Health Service, and the AEC— is coordinating the effort, and there will be input from the Academy and from the NCRP, among others. But there have already been charges that the Academy committee is biased, and there are continued grumblings about the closed-to-the-public nature of the process. Thus the review, whatever its findings, may not succeed in dissipating the reservoir of distrust in the public mind. A number of nuclear critics have suggested that there should be a searching public "trial" of the standards, with proponents and critics presenting their evidence before a neutral, qualified jury of some kind. That proposal has not gained much support. But it would seem highly desirable that some way be found to assure the public that its fate does not lie solely in the hands of a small group of scientists meeting behind closed doors.

—PHILIP M. BOFFEY

Health Insurance: Battle Focuses on Nixon and Kennedy Schemes

With the details of Administration policy spelled out in last week's Presidential message on health, Congress now has two major proposals from which to choose its solution to what President Nixon called in 1969 "the deepening crisis in American health care." A batch of health insurance schemes offered earlier have been incorporated into either Nixon's Health Insurance Partnership Plan or Senator Edward M. Kennedy's (D–Mass.)