# Legal and Political Implications

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THE advent of the nuclear age has focused public attention on the serious problems connected with protecting the public from exposure to radiation in unhealthy or unsafe quantities. These problems exist not only in the military applications of science but also in civilian applications, particularly with regard to what is commonly termed "low-level radiation."

One of the problems that arises in talking about low-level radiation is defining it. It is used here primarily in the sense of low-level radiation *exposure*. I am making the assumption for purposes of this discussion that in talking about legal and political aspects of low-level radiation I mean those aspects which affect the health and safety of the public. So I take as a definition of low-level radiation *exposure* the following: Any radiation exposure, however received over a period of years, is low-level if the effects of the exposure require many years to become apparent. Thus an exposure of 1 roentgen per hour for five minutes once a month might well be considered low-level. I am speaking of radiation not in terms of activity but in terms of effects that might result from routine exposure, that is to say, routine handling without accident. I can go one step farther and say that I am speaking ordinarily of all radioactive materials and radiation sources and the resultant radiation exposure, handled according to radiation protection standards, barring accidents. One of the problems run into here, of course, is that standards may vary.

My next problem in talking about low-level radiation exposure is to name the possible origins of such radiation exposures and

decide which of these are hazardous. Again, I cannot speak independently of the protection standards, and I would like some idea of who controls these possibly hazardous sources of low-level radiation exposure.

Radiation exposure sources might conveniently be classified by the field of use of the radiation source itself. Thus we can speak of medical uses, industrial uses, commercial uses, and research uses. The U. S. Public Health Service has noted many of the uses in a report that appears in the print of the Joint Committee's hearings on fallout held in the spring of 1957. The report lists in a table the sources of radiation exposure in the United States about which information is available. Information concerning actual exposure levels is obtainable in many places (Medical Research Council, 1956; National Academy of Sciences, 1956). Here are some typical origins of exposure:

1. Medical x-ray exposures originate in diagnostic procedures (including fluoroscopy) and therapy. The chest x-ray unit is a common example.

2. Industrial x-ray exposures originate from inspection procedures involving radiography and fluoroscopy in industries from foundries to rubber tires and vacuum cleaners, to say nothing of food processors and post offices and prisons.

3. Commercial x-ray exposures originate, of course, from the familiar shoe-fitting machines.

4. X rays in research fields involve many specialized activities such as x-ray diffraction studies, and electron microscopy and exposures originate accordingly.

5. Radioisotopes, produced by AEC or elsewhere, are similarly used in many industrial and medical and research applications. Exposures originate there and in the preparation of the isotopes themselves. Food and drug sterilization is a source of exposure.

6. Radium is used in many applications similar to those above, as well as in such special applications as the luminous dial

industry. Radium-exposed patients constitute virtually the only type specimens upon which much of the presently established standards of MPD and MPC rest. Polonium and thorium are similarly used.

7. Nuclear reactors and particle accelerators as such constitute an exposure source in research, educational, industrial, medical, commercial, and military applications.

8. Radioactive wastes, whether solid, liquid, or gaseous, are exposure sources.

9. Those AEC plants dealing with radioactive materials are, of course, radiation exposure sources.

10. Weapons fallout, both local and stratospheric.

11. Finally, one should not forget the exposure that everyone gets to one degree or another: exposure to naturally occurring radiation, whether from cosmic rays or from naturally radioactive materials.

It should be noted that, in the United States, radiation exposure to the population as a whole comes from natural background radiation, medical radiation, weapons fallout, and radiation from atomic plants and wastes.

With this brief description of the term low-level radiation as used here, I would like to turn for a moment to the scope of this paper and describe what it will cover, or perhaps, more correctly, what it will not cover.

First of all, I would like to make clear that no attempt will be made here to arrive at precise answers to the many and complex scientific and legal problems associated with low-level radiation. We are at far too early a stage in our studies of this problem to warrant the drawing of any firm conclusions.

In our search for answers to some of these questions it may be useful at this time to attempt to block out in broad terms some of the problem areas with which we must contend and to seek clarification of some of the major issues which appear to be involved. I shall take these up first from the point of view of

domestic aspects here in the United States and then sketch briefly a few of the international considerations.

It might be worth noting, in this regard, that the Joint Committee is planning to devote extensive discussion in the coming session of Congress to certain aspects of low-level radiation and related problems. Separate hearings will probably be devoted to the following: (1) waste disposal, (2) workmen's compensation for normal radiation hazards, and (3) possible federal-state relationships. The American scientific community will have an important role to play in these discussions, as it did in the Joint Committee's hearings on fallout last spring.

## DOMESTIC ASPECTS

The purpose of this section is to discuss the nature and scope of the low-level radiation problem in the United States, the various activities of federal and state governments that are affected by these problems, the federal and state regulations that have been established to deal with these problems, and problems encountered in the evaluation of the federal and state responsibilities in the future.

The problems of radiation exposure, of course, are not new. Numerous radiation sources were in existence long before the first controlled nuclear chain reaction was achieved at Chicago. These include, among others, x ray, radium, and nonreactor-produced isotopes. The total exposure of the population to these sources of radiation still is substantially greater than the exposure to radioactive sources that have been developed under the atomic energy program. A report by the Public Health Service (U. S. Government Printing Office, Pt. I, p. 475) indicates that there are in the United States more than 125,000 x-ray units for medical diagnosis and therapy, approximately 2000 x-ray units (both radiographic and fluoroscopic) in industrial use, some 10,000 shoe-fitting fluoroscopes, and about 1500 x-ray diffraction units, in addition to radium and nonreactor-produced isotopes for medical and industrial uses.

## PEACETIME APPLICATIONS OF ATOMIC ENERGY

In the atomic energy field, there are today two general categories of peaceful uses of atomic energy: radioisotopes and power. At the present time, approximately 4300 firms and institutions are licensed by the United States Atomic Energy Commission to use radioisotopes. These cover a large variety of uses. They include numerous uses for medical research and therapy, for instance, for treatment of leukemia, thyroid disorders, and certain kinds of cancer. Secondly, there are many agricultural uses of these byproduct materials in improving crops, in devising new means for the destruction of diseases and pests, and in manufacturing more effective fertilizers. Thirdly, are the rather extensive uses in industrial processing, such as uses in thickness gauges, in wear studies, and in determining defects in castings by radiography techniques. Finally, there are a number of uses that will be of direct interest to the consumer, such as the sterilization of drugs and medical supplies, food preservation, and numerous manufactured articles containing minute sources of radiation, such as photographic meters and air ionization chambers. The list of uses of radioisotopes is steadily increasing.

In addition to the radioisotopes licenses, the Atomic Energy Commission has licensed approximately 1300 persons to use source material and 100 persons to use special nuclear or fissionable material.

The second general type of peaceful application of atomic energy is its use for producing power, both at stationary power plants and in propulsion units. Twenty-four licenses have been issued by the Commission for reactor and other nuclear facilities. In addition, there are some sixteen construction permits outstanding for such facilities. The development of nuclear power plants results in a whole spectrum of uses of nuclear materials leading up to the actual construction and operation of the plants themselves. There must be plants to produce, fabricate, and

process the special nuclear materials. There is also widespread research and development utilizing the radioactive materials.

In addition to licensee facilities and materials, the AEC operates a number of facilities throughout the United States. Approximately 6600 persons are employed directly by the AEC, and its contractor personnel number about 112,000. Many of these people, of course, are not exposed to radiation other than natural background to which all of us are subject.

## Protection of Workers and Public

The large variety of uses of radioactive sources both within and outside of the atomic energy field suggests the numerous ways in which people may be exposed intentionally or unintentionally to radiation. It is essential that both those working with radioactive materials and the general public be protected from injurious exposure to radiation. While this is an easy principle to set forth, the problems of carrying it out are extremely complex. In the first place, the public must be protected from release of fission products from large nuclear facilities, such as nuclear power plants and chemical reprocessing plants. As indicated in a recent report of the Brookhaven National Laboratory, prepared at the request of the Joint Committee, the personal injury and property damage that could result from a nuclear incident in a large atomic power plant could be exceedingly serious. The chances of such an incident are remote, but it must be recognized that such a possibility exists.

Secondly, the public and those working with radioactive sources must be protected during normal operations. The problems here are first to determine acceptable radiation exposure levels and secondly to assure that these levels are adhered to. The latter portion of this task requires the establishment of a careful inspection program to assure compliance with the necessary procedures and controls by the users of radioactive sources. The establishment of adequate radiation exposure levels requires an understanding of the effects of exposure to the many kinds of radiation

that we now know. Although there is clinical experience to determine the levels of exposure that are likely to cause observable physical damage, the difficulties lie in the long-range effects of exposure to radiation. These include a shortening of the life span by increased susceptibility to diseases, such as cancer and leukemia, and by premature aging and genetic effects. Because serious concern over injury due to radiation is a fairly recent development, information concerning these long-range effects of radiation obviously are limited and cannot be relied on with a high degree of certainty. Thus, in determining safe levels, some guesswork is involved, and considerable caution is essential.

A third area of difficulty in assuring proper protection of the health and safety of the public is that of disposing of radioactive wastes. The problems here stem from the fact that certain of the radioactive materials, which may be contained in wastes, decay over long periods of time.

## Legal Implications

In addition to regulating, licensing, and inspecting for purposes of protecting the public from injurious exposure to radiation, numerous related problems are created. There are the difficult questions with which the courts will be faced in personal injury or public property actions for damage resulting from exposure to radiation. The courts will have the problems of the rule of law to apply and difficult matters of proof. Likewise, workmen's compensation boards will be faced with novel questions. Workmen's compensation laws probably will require review to determine their adequacy in covering injury incident to radiation exposure in the light of such possibilities as that injury may not manifest itself immediately; injury may result from cumulative overexposure during the course of employment with several companies and may also result in part from intentional exposure during medical treatment; and injury may not result in immediate loss of earning power but may have some long-range effects such as those described above.

Because of the tremendous liability that could occur as a result of a serious nuclear incident, there must be protection to both the newly emerging atomic energy industry and the public. In recognition of this, Congress enacted legislation to provide governmental indemnity against liability for accidents for nuclear power plants of up to $500 million over and above the financial protection required of persons operating nuclear facilities. Some administrative and regulatory problems can, of course, be expected to arise in putting this legislation into effect.

In addition to questions of liability, there will be a number of problems in dealing with a nuclear incident, including carrying out emergency procedures, which will require close coordination between federal, state, and local authorities, and compensating people for property that is condemned to prevent any spreading of contamination.

Because of possible public fear of the health and safety hazards stemming from exposure to radiation, there is the important task of promoting public understanding. Public acceptance is essential to the emergence of a dynamic atomic energy program.

I might add, at this point, that some distinction should be drawn between the problem of liability arising out of nuclear accidents, particularly large-scale ones, and liability resulting from the cumulative effects of low-level radiation over long periods of time, which may or may not have been above permissible levels. The legal consequences of the two problems may be somewhat different, and we should keep this in mind.

### Federal Regulation

Protecting the health and safety of the public from injurious radiation exposure, as I have stated, requires careful regulation. The primary responsibility for accomplishing this objective in the atomic energy field has been vested by Congress in the federal government through its agent, the Atomic Energy Commission. While protecting the health and safety of the public in a field normally considered as one within the police powers of the

states, assigning initial responsibility to a federal agency was necessary because of the way in which this industry grew. It has evolved from a federally owned and controlled industrial complex. Thus, the logical approach when Congress in 1954 decided to ease the control of atomic energy to permit the growth of a peacetime industry in this field was to assign responsibility for protecting the health and safety of the public from radiation exposure to the Atomic Energy Commission which had been established as the civilian-controlled successor to the old Manhattan District.

The growth of the atomic energy industry, of course, is the reverse of the normal process of development of a new industry. Most industries have grown at a local level, and only after a long period of time do they begin to affect interstate commerce to an extent that requires regulation at a national level. However, there is at least one parallel to the growth of this industry, namely in the field of aviation.

The Atomic Energy Commission, in accordance with the mandate of Congress, has established a system of regulation to protect the health and safety of the public from injurious exposure to radiation. This system of regulation includes control over the possession and use of source, byproduct, and special nuclear materials; control over the construction and operation of nuclear facilities; and control of those persons who manipulate the controls of nuclear facilities.

This system of regulation has two general facets. The basic part is the establishment of radiation standards that are applicable to all licensees. These standards prescribe the maximum permissible radiation dosages to which any person can be subjected. In addition, certain administrative controls are provided to assure compliance with the permissible radiation levels. These levels are based by and large on the levels devised by the National Committee on Radiation Protection, which had concerned itself with the problems of radiation protection long before the advent of the atomic bomb and the atomic energy program.

The second part of the regulatory system is to require persons who propose to receive, possess, transfer, or use nuclear materials to establish that they are competent to engage in the proposed activities and that they have incorporated adequate safeguards to provide reasonable assurance that their activities will not constitute an undue risk to the health and safety of the public. With respect to nuclear facilities, such as reactors and chemical processing plants, the Commission undertakes a detailed hazard analysis of the facility. This includes an analysis of the safety feature of the proposed system, possible accidents, and administrative procedures and built-in mechanisms proposed by the applicant to minimize the possibility of such accidents occurring.

One of the problems at the federal level of administration is the separation of functions question, that is, whether regulation and inspection functions should be exercised by the same agency which is also a proprietor and a promoter. This question has been raised in connection with discussions of detection and protection against nuclear weapons fallout, i.e., whether the Atomic Energy Commission should be responsible for monitoring weapons tests as well as conducting them (U. S. Government Printing Office, 1957, Pt. II, p. 1265). It has also been raised in connection with studies on whether the Commission should be the promoter and proprietor of reactor development as well as the regulator (Joint Committee, 1957). To a lesser extent, the question of separation of functions applies to isotope production and regulation.

## State Regulation

In addition to the role of the federal government in this field, the state governments have significant responsibilities as a result of the opening up of the field of peacetime development of atomic energy. Many important functions of the state governments will feel the impact of this development in the coming years. These include the state health departments, state industrial safety de-

partments, state utility commissions, state insurance commissions, state industrial development agencies, and local zoning boards. The states, of course, have had and continue to have the sole responsibility for protecting the health and safety of their local populace from exposure to the numerous radiation sources not controlled by the Atomic Energy Commission. These include x rays, radium, and nonreactor-produced isotopes.

To carry out their health and safety responsibilities in the radiation protection field, some thirty states have adopted some kind of statutory or regulatory control.* These vary from regulations limiting the use of shoe-fitting fluoroscopes or requiring registration of radioactive sources to comprehensive radiation protection regulations. Only five of these states have comprehensive regulations.†

With regard to atomic energy activities, the Council of State Governments in 1957 suggested state legislation in the form of a model atomic energy bill. The primary purpose of this bill is the coordination of activities within state governments to the extent that they are affected by the atomic energy industry. The bill includes the establishment of a state coordinator of atomic energy and places in him the responsibility for determining what changes may be necessary in state statutes, coordinating the activities of various state agencies, and cooperating with the Atomic Energy Commission. This bill appears to be a sensible first step in connection with the problem facing the states. I understand that approximately nine states have adopted a bill patterned along the lines of the bill suggested by the Council.‡

* The states are: Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Maine, Massachusetts, Maryland, Mississippi, New York, New Hampshire, New Jersey, North Dakota, Ohio, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, West Virginia, Washington, Wisconsin, and Wyoming.

† California, Connecticut, New York, Pennsylvania, and Texas.

‡ Arkansas, Connecticut, Maine, New Hampshire, Ohio, Rhode Island, South Carolina, Tennessee, and Washington.

## Federal-State Relationships

The Atomic Energy Commission, working in cooperation with the states, has proposed an amendment to the Atomic Energy Act of 1954 to define the role of the states in the atomic energy field. The proposed amendment has three objectives. The first is to clarify the Commission's authority to utilize state agencies in assisting it in the conduct of its inspection program. The AEC believes that this will avoid the establishment of a large federal inspection program. Secondly, the AEC is seeking authority to assist the states in training their employees in the field of radiation protection. Finally, and perhaps the most significant, is the recommendation that the states be given clear authority to adopt, inspect against, and enforce radiation protection standards. As I understand the Commission's position, it is not suggesting that state standards are inadequate. Rather, it believes that the states, because of their traditional responsibilities with the fields of health and safety control, should have an active role in the radiation protection field with respect to atomic energy activities.

This amendment may be given consideration by the Joint Committee during the next session of Congress. While this approach may turn out to be the best one at this time, it does not resolve the question of where the ultimate responsibility for radiation protection should lie. Consideration of this broader question must include factors such as the traditional roles of the federal and state governments in the fields of health and safety, the interstate impact of nuclear activities, the need for federal control of radiation exposure, and the competency at various levels of government for imposing controls in this area.

Obviously, this is not an easy problem. Precipitous action in reaching a solution will benefit no one. In the meantime, it is important that there continue to be a close cooperative relationship maintained in this field between all levels of Government. This is essential where the health and safety of the public is involved.

## INTERNATIONAL ASPECTS

Low-level radiation also has implications that cross national boundaries. The discharge of radioactive wastes into the air or into ocean currents can cause them to be carried to countries other than the originating country. In one corner of the field, the United Nations is already making a study of the low-level radiation—both from weapons tests fallout and natural background sources—through its Scientific Committee on the Effects of Atomic Radiation. This Committee, which has been in operation since 1955 has been carefully accumulating in one place a mass of experimental data on the amount of radioactivity present in all corners of the world. The burden of the research on this subject is carried by the fifteen nations which compose the Committee.*

While the work of this Committee has necessarily been basically concerned with the problems of the amount of radioactivity deposited on the earth from weapons tests, it has had to accumulate a large amount of background information in order to make accurate studies of this one problem.

Several of the specialized agencies of the United Nations have been interested in the work on problems of radioactivity in international areas. The Food and Agriculture Organization, the United Nations Educational, Scientific and Cultural Organization, the International Civil Aviation Organization, the World Health Organization, and the World Meteorological Organization have all been following the work of the Scientific Committee. Each is interested in the effects of radioactivity in its own particular sphere of competence. The World Health Organization and the International Labor Organization have had particular interest in the effects of radioactivity in international life—the WHO being concerned with general health and safety effects, and the ILO being concerned with radiation effects on employees.

* The countries are: Argentina, Australia, Belgium, Brazil, Canada, Czechoslovakia, Egypt, France, India, Japan, Mexico, Sweden, Soviet Union, United Kingdom, and the United States.

## Legal Problems

As the radioactive materials cross national boundaries the legal problems become much more complicated. With each new boundary that the radioactive material crosses there may be new laws of liability, new laws on proof of damage, new laws on the amount of damage, new problems of the proper court in which to sue, and new problems of service of process. The most complicating factor in all of this is the difficulties aroused by what the lawyers call the "conflicts of law," namely, those difficulties created by having different rules of law applicable at the place where the radioactive materials might have been liberated, from those rules of law at the place where the radioactive materials might have caused some damage.

This is one of the areas in which many of us hope the International Atomic Energy Agency will be of substantial help for the future of the world. Even though its jurisdiction is presently limited to those projects that voluntarily are brought under its jurisdiction, nevertheless uniform and sound rules for operation of atomic energy plants can be formulated which will be acceptable to all the large number of countries presently in the Agency. Through this process of arriving at the rules, the nations themselves will have accepted them and therefore they are likely to use them for all their atomic energy operations.

As the International Agency grows and is accepted, perhaps more nations will voluntarily bring their health and safety operations under the control of the Agency. The Agency, as presently chartered, does have authority to accept responsibility for safeguarding projects voluntarily put under its control by the nation.

It is going to have to meet and resolve many of these problems very early in its life. The Preparatory Commission has already recommended not only that the Agency begin active studies on health and safety rules, but that it begin active studies to find some way to resolve the problem of the international conse-

quences of a runaway reactor, which releases radioactive materials that cross national boundaries.

Undoubtedly the Agency will first want to conduct background studies. Then it will want to hold an international conference of all the nations interested in these problems in order to arrive at a treaty which will resolve many of the present legal tangles. With that experience behind it, and in cooperation with the United Nations, such specialized agencies as the World Health Organization and the International Labor Organization, and such technical bodies as the Scientific Committee on the Effects of Atomic Radiation and the Committee on the Law of the Sea, the International Agency should be able to extend its experience and its solutions to cover not merely the remote and exceptional case of the runaway reactor but to arrive at some intelligent and satisfactory solution to the more frequent and less harmful problems arising out of low-level radiation.

## CONCLUSION

It is evident from the many conversations I have had with members of the scientific community and the public in the past year that there is an increasing awareness throughout the country of the existence of radiation problems, both military and civilian, and of the need for working out plans for coping with these problems in the years ahead. To date, public attention has been primarily focused on fallout from weapons tests, which was the subject of extensive hearings in the past session by the Joint Committee.

But in our concentration on the fallout problem we should not allow ourselves to overlook the many and complex radiation problems which are inevitably associated with civilian scientific applications, most notably in the atomic energy field. These, too, will require intensive study over the next few years to enable us to proceed surely and safely into the new era of peacetime atomic energy applications on which we are embarking. Of particular

complexity will be the problem of low-level radiation whose implications, both scientific and legal, are extremely subtle and difficult to pin down.

In this regard, the Atomic Energy Commission in 1957 adopted new lower levels of permissible exposure to ionizing radiation in its own installations and those of its contractors. This was the first basic change since 1948 in lowering exposure levels and reflects, I believe, a growing sense of caution on the part of government officials toward a scientific area about which we as yet know all too little. This thought was best expressed, perhaps, by the National Committee on Radiation Protection and Measurement in explaining the reasons for its recommendations to lower permissible exposure levels, on which the AEC action is based. In a "preliminary statement," the National Committee observed:

"The changes in the accumulated maximum permissible dosage are not the results of positive evidence of damage due to the use of the earlier permissible dose levels, but rather are based on the desire to bring the MPD into accord with the trends of scientific opinion; it is recognized that there are still many uncertainties in the available data and information."

It is these uncertainties which we must explore intensively, particularly in those areas where short-term exposure is undetectable but where the possibility of serious damage exists from the cumulative effects of repeated low-level exposures over an extended period of time. With the prospect of large increases in radiation uses in the years just ahead, it is imperative that we make a start now.

May I reiterate, in conclusion, that the American scientific community can and should play a large role in the development of our policies in this field. Both the Joint Committee and the Atomic Energy Commission will need your full support in working out intelligent and farsighted plans for the future.

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