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The practice of public health, although not often recognized, is a very broad concept of all environmental factors which may in any way have a deleterious effect on individuals and the public as a whole and the provision of necessary measures to guard and protect individuals and the public from harm. In the words of Dr. Bergsma, Commissioner of Health of the State of New Jersey, in a recent speech he stated "It is not often, during a lifetime, that a major new public health hazard appears. However, during the past decade with an ever-increasing use of nuclear energy for both peaceful and military purposes the entire world has become concerned with ionizing radiations. To meet this new challenge, public health workers must learn a new language — the technical speech of the radiation physicist; they may learn a new set of protective technics — using space or shielding to protect all from injurious radiation; and they must learn how to tell the public about these new developments in a way that will not frighten — but will persuade and encourage people to support proper protective measures."

One need not be a radiation physicist nor a radiologist to be prepared to accept the new challenge of assembling and acquiring information concerning the problem of radiation as it may influence legislation, regulations and the necessary public controls which may become needed from time to time to protect adequately all persons likely to become adversely affected and to provide for the beneficent uses of the new techniques, tools, and substances for the benefit of mankind.

On Tuesday, December 15, 1959 the Director of the Division of Sanitary Engineering attended a conference of representatives from the various New England states, New York, New Jersey, and Deleware, who are in charge of radiation control activities for the various states, with representatives of the United States Public Health Service at New York relating to the problems and responsibilities which may be created by Section 274 amending the Atomic Energy Act of 1954, as amended, which was signed by the President on September 23, 1959.

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The conference was arranged under authority of the Secretary of Health, Education and Welfare, a member of the Federal Radiation Council, for the purpose of ascertaining the present level of radiation controls and capabilities of the delegated officials of the various states, whose responsibilities may now be or may be expected to be, to whom such activities are or may be assigned if agreements are adopted as indicated by the above Section 274. It was brought out —

1. That agreement of the Governors of the various states with the Atomic Energy Commission may very well be entered in at a reasonably early date so as to assist in developing adequate monitoring and regulatory facilities and for stimulating the recruiting and training of adequately trained personnel.

2. That any proposed agreement should be carefully reviewed by the legal representatives of the Governors for the purpose of indicating that in making any such agreements the various states do not relinquish any constitutional rights or prerogatives conferred by the Constitution of the United States.

It was thought by representatives of the Public Health Service that the Atomic Energy Commission's activities in relinquishing to the state local controls was an honest effort to improve supervision and regulation for public safety and not an effort to absorb states' rights. It is believed that the expansion of the use of atomic energy will be so great that the states will have to prepare regulatory personnel which if done on the federal level will require numerous personnel and expansion not presently contemplated by either the U. S. Public Health Service or the Atomic Energy Commission.

3. Any agreements or delegations of activties to be co-ordinated with state atomic energy co-ordinators when such officials are provided.

4. It was brought out by representatives of the State of Massachusetts that state regulations or legislation

would be in effect for all persons and areas in the state excepting federal government reservations, and that any federal regulations or controls would be in addition to but not superseding state laws or regulations. Existing users of atomic energy so far have simply tried to comply with both federal and state laws and regulations.

It was recognized by all present that very few states now have in existence adequate staffs for the control of atomic energy products, plants or users of radioactive materials, but that a rapid expansion of such uses may be expected in the relatively near future and that all agencies will need to develop both personnel and facilities which presently are not available from any federal agency but that the Atomic Energy Commission and the United States Public Health Service will be in a position to assist in training and developing such personnel and facilities in such a manner as may be expected to be provided by future acts of Congress.

On the national level a number of bills have been introduced into Congress, some of which undoubtedly will be passed and which will have effects upon the general public. Reference is made to one of these, House of Representatives, Document 7214, which provided as follows: "To amend the Atomic Energy Act of 1954, as amended, with respect to cooperation with States.** That, the following section be added to the Atomic Energy Act of 1954, as amended:

"Sec. 272. COOPERATION WITH STATES. —
"a. It is the purpose of this section —

"(1) to recognize the interests of the States in the peaceful uses of atomic energy, including but not limited to radiation hazards regulated by the Commission under this Act;

"(2) to recognize the need, and establish programs, for cooperation between the States and the Federal Government with respect to control of radiation hazards;

"(3) to promote an orderly regulatory pattern among Federal and State governments respecting radiation hazards and nuclear development and use;

"(4) to establish procedures and criteria for discontinuance of certain of the Commission's regulatory responsibilities, and the assumption thereof by the States."

On the part of the Department of Health and Welfare recent action has been taken and regulations were adopted in December, 1958 relating to radioactive materials, x-radiation and other forms of ionizing radiation. This was believed, with other states, needed and necessary for current activities and also to be prepared when and if Congress changes the existing federal controls and the Atomic Energy Commission transfers or releases to the states supervision of the lesser problems of control, registration, licensing, waste disposal and similar activities to the states. Even now the states are being asked to join with representatives of the Atomic Energy Commission in making inspections and surveys of present uses of radioisotopes and instruments based on them which are presently finding increasing use in industry as well as by medical users.

This problem has also been brought to attention by a new law which was passed by the 99th Maine Legislature, promoted by Representative Sumner T. Pike, a former member of the United States Atomic Energy Commission. This refers to Chapter 287, Public Laws of 1959, and is an amendment to Chapter 31 of the Revised Statutes, Section 69, the occupational disease law. Essentially, the law adds to the list of occupational diseases disability due to radioactive properties of substances or exposure to ionizing radiation; also any process involving the use of or direct contact with radiation or radioactive substances or the use of or direct exposure to Roentgen rays (x-rays) or ionizing radiation. It also provides special provisions relating to disability due to radioactive properties. Notwithstanding any of the provisions of this chapter, the employee need not be exposed to radioactive substances for a period of 60 days or more, as otherwise stated under section 62, and the time for filing claims shall not begin to run in cases of incapacity under section 69, item 17, until the person claiming benefits knew, or by exercise of reasonable diligence should have known of the casual relationship between his employment and his incapacity, or after incapacity, whichever is later. Another law passed in 1959 abolished the use of shoe-fitting machines (Chapter 78 of the P. L. 1959) and read as follows:

"No shoe-fitting device or machine which uses fluoroscopic, x-ray or radiation principles shall be operated or maintained. Whoever violates the provisions of this section shall be punished by a fine of not more than $100."

Most people are familiar with x-radiation and perhaps have heard or read a great deal concerning its hazards and potential dangers, but in practice these are balanced against the more important benefits which may be obtained from proper uses of this equipment, for example, the monitoring service provided by this Department in the nature of film badges for detecting exposures of technicians and physicians. To indicate how this service grows, when it was started five years ago 350 films were developed. Last year the program had increased to 3400 films per year, with continuous records being kept for over 300 persons.

Consideration of the problem of "fall-out" which is one of the several sources of radiation exposure to the total population results in the following observations:

In small amounts radiation is a phenomenon of nature to which every living creature is subject. Cosmic rays from outer space, gamma radiation from radium and its radioactive decay products in the earth's crust, and alpha, beta and gamma radiation from radium and the radioactive isotopes of hydrogen, carbon and potassium which occur naturally in the human body, combine to give body tissues an average radiation dose equivalent to about one-tenth of a roentgen of x-rays per year. To what extent such small doses of radiation may be

harmful, it is not known. Certainly the human race has developed and prospered in an environment of which this has been one of the more stable characteristics.

In much larger amount, radiation results in observable injury to all living things. For example, an exposure to four or five hundreds of roentgens of gamma rays will result in radiation sickness and would, under unfavorable conditions, be fatal. At best, several months would be required for more or less complete recovery from apparent effects. Such recovery does not preclude the possibility of delayed effects such as leukemia or reduction in life span, nor of genetic mutation.

In routine activities involving exposure to radiation, there is concern with doses of radiation so small that, up to the present time, the resultant effects on health cannot be observed. Nevertheless, it is considered prudent to assume that even the smallest exposures to radiation involve biological hazards which are correspondingly small. However, no one so far as is known proposes that there should be *no* exposure to man-made sources of radiation. Rather, the problem of control of radiation hazards is to limit possible risks to acceptable levels. In principle, this appears to be feasible, since authorities are confident that it is possible to make the resultant hazards as small as one may wish by sufficiently limiting the exposure. While the actual hazards from exposure to low levels of radiation cannot be estimated with precision, it is believed that upper limits which the actual hazards are not likely to exceed can be estimated. The lower limit may, of course, be zero.

Any discussion of the biological consequences of radioactive fallout from nuclear weapons testing must be developed within the context of the present United States National Defense Policy and against a backdrop of what might happen in the event of an all-out nuclear war. Only with these considerations in mind is it possible to evaluate whether or not the weapons testing program with the fallout it has produced is resulting in a net gain for the people of this country and for those of the free world. The problem is made even more difficult because so much of the recent fallout in the North Temperate Zone has originated from tests carried out by the USSR.

An article on "Fallout Radiation" in the September 7 issue of the AMA News provides several interesting quotes:

"A comprehensive Congressional report warned that if frequent nuclear tests are resumed in the future, 'a hazard to the world's population could result.'

"However, the report by the Joint Congressional Atomic Energy Committee held that to date 'man's exposure to fallout radiation is and will be relatively small compared to the "normal background" radiation always existing.'

"*Harmful Effect*: Though generally optimistic about the current level of radiation, the committee cautioned that experts generally agree that 'any dose, however small, produces some biological effect and that this effect is harmful.'

"The report was based on testimony presented at hearings earlier this year before a joint atomic subcommittee headed by Representative Holifield (D. Calif.), and on statements presented by other scientists.

"Should nuclear tests over the next two generations follow the same pattern as in the past five years, the report said, 'the predicted average concentration in bone will be about 48 strontium units' — referring to radioactive strontium-90 which can cause bone cancer and leukemia.

"*Close Enough*: 'This is close enough to the maximum permissible body burden of 67 strontium units set by the international commission on radiological protection to suggest that a hazard to the world's population could result during this period.'

"The report contended that the administration of the government's research program in the field, particularly in sampling and analysis, 'has not received the high administrative-level support it needs to give it the necessary impetus. . . . Adequate radiation standards must be developed in cooperation with the various federal, state and private agencies.'"

Other highlights of the 42-page document:

"No resolution was reached on whether or not a threshold level of radiation exposure exists below which effects such as cancer and leukemia do not result.

"The content of strontium-90 and cesium-137 (which can cause genetic damage) in food has risen since 1957, even more rapidly than the total fallout.

"Radioactive carbon-14 from past weapons tests could constitute a genetic hazard . . . comparable to, and in some estimates, in excess of, the genetic hazard from other fallout isotopes. However, this problem would be spread over some 1000 years due to the long life of carbon-14. The report declared that strontium-90 and cesium-137 'are still considered to present the greatest hazard in world-wide fallout.'"

A very interesting popular article on "fallout" by John Pfeiffer published in the October issue of Coronet, and prepared for the general public, is so interesting that it is well worth reading. A statement from this article may be of sufficient interest to quote here:

"Preliminary research on past medical records among 300,000 'hot' water drinkers in Illinois shows no differences between them and their neighbors who drink low-radium water. This is one reason why the National Committee on Radiation Protection recently raised the maximum permissible level of strontium-90 in water by 25 per cent for industrial workers having continuous occupational exposure. (To be on the safe side, maximum permissible levels for the general population are one-tenth of the industrial level.)

"Yet even the fact that medical records show no bodily changes doesn't necessarily signify that nothing

is happening. For example, if radium caused only one extra bone-cancer death per year among the 300,000 people drinking high-radiation water in Illinois, that might well be a significant increase. (Only about 2,000 persons die of the disease annually in the entire nation.) But because of errors in diagnosis and other reasons, our records are not accurate enough to reveal such a small difference.

"Statisticians estimate that to trace the effects of radium we will have to follow 1,000,000 radium-water drinkers for ten years before any sufficiently large difference turns up —- and such a survey is now under way. Since radium resembles strontium-90 in its action, this survey may help us decide what role fallout may play in causing bone cancer, leukemia and other conditions."

In order to be prepared to measure radioactive fallout, both in the air and in rain, it was first necessary to secure special equipment and make determinations of the natural radioactivity of the area which is called "background radiation." This is always present and is part of the environment to which all have become accustomed throughout life. Some of this is from cosmic rays, some from the ground, minerals, and similar sources.

In making studies of the natural radioactivity of public and private water supplies it has been found that there are special areas in Maine that have unusually high activity. Some of them from deep wells in granitic formations have a sufficient amount of radioactive material to be called "hot wells." Present surveys indicate that there is a broad band of such radioactivity extending in a generally northwest to southwest direction from the vicinity of Rumford to the ocean at Brunswick or Georgetown. About 250 wells have been investigated and found to contain higher amounts of radioactivity than the maximum permissible level of 2000 micromicrocuries per liter established by the National Committee on Radiation Protection. A research project was undertaken during the summer in conjunction with the U. S. Public Health Service whereby the services of two graduate students from Georgia Tech. were secured. Samples were collected from as many sources as possible, centering the activities in the vicinity of Raymond but extending out from there to Brunswick on the east, to the west shore of Sebago Lake, and north through Paris to the Rumford and Mexico area. In a few months it is hoped to have a tabulation of their results which will extend the knowledge of the Division relating to this particularly "hot" area. Very few of the deep wells have been in use long enough so that any appreciable effects on the people in the area can be measured. A statistical study, however, has been started to determine, if possible, if there is any unusual evidence of traceable ill effects from these sources. This will be similar to the conditions of water taken from deep wells which are found in sandstone areas in the middle west where a considerable amount of radium-rich water has been in use for about 50 years.

The construction of the submarine "Swordfish" at the Portsmouth shipyard so-called, (in spite of the fact that it is located in Kittery, Maine), starting in January 1956, presented an additional problem. It became necessary to make radioactive determinations on harbor water in the vicinity of the Navy Yard, seaweed and shellfish, and because investigations of sea water had been limited up to that time it was necessary to develop original techniques for making these determinations. The "Seadragon," started in June 1956, continued the problem, although completion of this submarine was anticipated in December 1959. The "Thresher" started in April 1958 will be completed in December 1960, and the "Abraham Lincoln" started in November 1958 will probably be completed in December 1960. The "Tinosa" was expected to be started in November 1959 for completion in 1962, and the "Jack" to be started in March 1960 for completion in the fall of 1962. This is simply to indicate that the problem is not expected to decrease but rather will require increased activities in connection with these as well as other developments.

By showing these examples, and with a partial review of the literature, the necessity of continuing vigilance on the part of health officials concerning the problems involved by ionizing radiation, and the taking of desirable and suitable measures for maintaining the public safety are indicated.

This paper is intended to indicate, not only some of the present problems, but the fact that these may be expected to increase, and the need for additional monitoring service, investigations and control will be an expanding one which may not be avoided. Somebody will have to be prepared to investigate accidents and supervise the increased beneficial uses of various forms of radiation. Both laboratory facilities and trained personnel must be developed. So far as possible these should be under some trained supervisory control and preferably one which is presently connected with such activities. Means will need to be provided in some manner for carrying on a suitable radiological health program.

Only last month a meeting was held with representatives from the Portsmouth Navy Yard, the New England Interstate Water Pollution Control Commission, and the United States Public Health Service relating to the need for increased activity concerning radioactivity monitoring in connection with activities in the Portsmouth-Kittery Harbor area. The monitoring of shellfish, seaweed and sea water samples, which has been carried on for the past three years, is now considered inadequate and it is suggested that this activity be increased. It is hoped that a project can be developed to which the United States Public Health Service will contribute a portion of the expense for one or more investigators and perhaps some additional instruments.