HON. CHET HOLIFIELD
OF CALIFORNIA
IN THE HOUSE OF REPRESENTATIVES

Wednesday, October 7, 1970

Mr. HOLIFIELD. Mr. Speaker, in the Medical World News of September 11, Dr. Robert D. Moseley, Jr., a leading radiologist with many distinguished degrees answered a series of questions on the subject of radiation standards. Dr. Moseley is now serving as chairman of the department of radiology at the University of Chicago School of Medicine. He is also chairman of the American College of Radiology's Commission on Public Health; chairman of the Atomic Energy Commission's Advisory Committee on Biology and Medicine; and a member of the National Council on Radiation Protection and Measurements.

His long background of experience and knowledge in this complex area makes his remarks, which follow, very pertinent:

In Defense of Present Radiation Limits while the Standards Have Been Under Sharp Attack Lately, A Leading Radiologist Finds Them Not Only Safe but Conservative

The standards generally accepted for the safe use of ionizing radiation in medicine and industry have been under attack recently. Critics charge that the present permissible levels of radiation exposure are too high. They maintain that advisory bodies such as the Federal Radiation Council (FRC) have been complacent, failing to act upon evidence suggesting that the permissible levels are too high. In addition, many critics point to the public dangers of even low levels of radiation.

These critics have attracted plenty of publicity in testifying before the Joint Congressional Committee on Atomic Energy. Less in the public eye are the many responsible radiologists and scientists who insist that current exposure standards are reasonable safeguards and that the criticism of them and of the advisory bodies is distorted and misleading.

In the interest of balance and without attempting to answer the critics, Mr. Holifield has asked one of the defenders of current radiation guidelines to present his view. He is Dr. Robert D. Moseley, Jr., chairman of the department of radiology at the University of Chicago's Pritzker School of Medicine; chairman of the Atomic Energy Commission's Advisory Committee on Biology and Medicine; and a member of the National Council on Radiation Protection and Measurements.

Q. Dr. Moseley, who has the responsibility for setting radiation exposure guidelines and safety standards?

A. The International Commission on Radiological Protection was established in 1926. In 1929, a similar committee was formed in the U.S., and this group has been in continuous operation since that time, becoming the National Council on Radiation Protection and Measurements. The council and a large number of its scientists and physicians participate in its efforts on a voluntary basis. In 1950, the FRC was set up to establish standards for government agencies on radiation safety.

Q. Do the recommendations of these advisory groups have any legal standing?

A. Those of the FRC do for federal agencies. The Atomic Energy Commission, operating under FRC guidelines, has the power to regulate the use of atomic energy. In addition, most states have laws regarding radiation standards incorporating or following the guidelines of the NCRP.

Q. What are these guidelines?

A. The maximum permissible exposure recommended by the national committee in the 1920s was 0.1 r per day for radiation workers (about 30 r a year). This was less than 1/100 the dose needed to produce skin damage, which was one of the standards then used to measure biological hazard. In the late 1940s, the committee made the first modifications in this standard; subsequently its recommendations were accepted internationally. The recommended maximum permissible exposure for workers was lowered under this modification to 0.3 r per week. It is significant to note that this low-estimation of the biological damage was based on new biomedical information; there was no new evidence whatever of injury at the previously accepted levels. It was lowered in recognition of the increase in the number of radiation sources due to the development of atomic energy, and of the presence of many different kinds and quantities of radiation.

The most recent changes of any significance were made in 1957, when the NCRP recommended the maximum level of 0.5 r per year for individuals in the general population—a maximum dose level one tenth that considered safe for radiation workers. It was lowered enough expressed in slightly different terms, are, in fact, the standards recommended by the FRC.

Q. What is your opinion of the current guidelines? Do they reflect an adequate margin of safety?

A. They are, if anything, conservative, although there is no reason to recommend that they be increased. It is possible for society to have the benefits of radiation within these limits, so they should be maintained as an added margin of safety. The best current experimental evidence indicates that the NCRP in 1957 over-estimated the genetic hazard of ionizing radiation at low-dose levels and rates. It was underestimated as many critics are now challenging.

Q. Are these recommended maximum levels ever exceeded to any significant degree either by workers or the general public?

A. No. Barring accidents, workers and the general population are exposed to only a fraction of the permissible maximum dose levels.

Q. Are there any new data, experimental or clinical, to indicate that acceptable levels are too high?

A. The only new and reliable data of which we are aware tend to support the existing conclusion. Recent work suggests that there is a recovery rate for genetic material that is quite significant not only for somatic tissue but also for genetic material. It has never been assessed in developing studies of genetic material that the relationship between dose and effect was anything other than linear or that there was any recovery, even though experimental evidence at the low-dose range is lacking.

Q. To what then do you attribute the recent upsurge in concern over the radiation hazard, real and potential?

A. One of the most widely publicized charges made by critics of current radiation standards is that these limits permit the induction of thousands of human cancers every year. How do you answer that charge?

A. Most of these charges are based on extrapolations exercises based upon hypothetical extrapolations from the worst possible case assumptions. They have no basis in experimental, epidemiological, or clinical data. Recent work suggests that occupational and public radiation exposure are the many responsible for genetic material. It has never been assessed in developing studies of genetic material that the relationship between dose and effect was anything other than linear or that there was any recovery, even though experimental evidence at the low-dose range is lacking.

Q. What is meant by safe level of radiation?

A. This gets into the threshold problem, which is probably the crux of much of the criticism. In many cases, those between who feel there is no such thing as a tolerable level of radiation exposure and those, like myself, who maintain that the benefits of radiation are such that we can tolerate a certain minimum level. It is agreed that levels below a dose-effect relationship at low levels would be very prudent, and that, in fact, is the course that has been taken by the bodies making recommendations in this area.

A linear dose-effect relationship for genetic material is the conservative hypothesis that is assumed. Some critics argue that radiation safety standards assume a threshold. This is not true. At no point in any of the NCRP statements is there a threshold assumed. In fact, there is considerable discussion in NCRP documents defending the assumption of a no-threshold hypothesis.

Q. Do not believe that anyone working in radiation protection would deny that exposure to radiation should be held to the lowest possible level. You should remember that when we talk about low-dose levels, the operative word is maximum. It doesn't mean that all members of the society should, with impunity, be exposed to these levels, or that any significant number of them would be exposed to the maximum rate in any way corresponding with the actual degree of radiation exposure. The exposure to anyone working with a nuclear power reactor, for example, is approximately 1% of the permissible maximum dose.

Q. If there is no threshold for genetic material, what about somatic cells?

A. The repair process in these cells is better understood and there's much more re-
son to believe that a practical if not absolute threshold exists. There's good evidence that somatic cells do repair themselves. Nonetheless, the assumption has not been used as a hypothesis by the regulatory agencies.

Q. What about the factor of individual variability? Is it sufficient to negate any assumption of safe exposure levels in the general population? A. Interindividual variability is considerable. But intraspecies variability is not great enough to set up separate radiation protection standards for a given species such as man.

Q. Is diagnostic radiology overused? A. Yes, but I don't know to what degree nor do I know what radiologists can do to curb overuse other than to participate in the education of all physicians concerning radiation protection problems. Diagnostic radiology is an extremely powerful tool. But there is no way for the radiologist to hold down the number of diagnostic procedures since most of his patients are referrals from other physicians. Men who have the primary responsibility for the care of the patient and a more intimate knowledge of his history. There is also some minor abuse engendered by legal considerations. Q. Is there a threshold level below which there's good evidence that radiation is not a factor in setting up radiation protection standards for a given species such as man.

Q. In the survivors of Hiroshima and Nagasaki, there has been a rise in the incidence of leukemia and a few statistically significant increases in other somatic cancers. A. We live in a radiation world. The average dose per person from such sources of cosmic rays, radioactive phosphorus in food, and uranium in the soil, and other background sources is about 100 mr per year. In this country, the range is from 100 to 250 mr per year depending on where you live. The higher you up you are the more exposure you get. It's been calculated that the average genetically significant dose received by the average American from all radiologic examinations is about 66 mr. Thus, a person living at sea level with a genetic predisposition would receive no small x-ray examinations. I think this may help place the question of x-rays in perspective.

Q. Are physicians and hospital personnel sufficiently aware of radiation hazards and do they take precautions against excessive exposure of both themselves and patients? A. A case can be made that they aren't. But it would require an extensive educational program to fully inform the public. I do know, however, that the public is sufficiently protected from radiation hazards. Q. How many new and sophisticated techniques, but they account for only 5% to 5% of the total number of procedures performed.

Q. What about radioisotope procedures? A. These are increasing at a rate of about 16% per year. In 1964 survey showed no significant degree of radiation hazard from improper x-ray techniques, but indicated that there were still room for improvement. Q. Do the new diagnostic procedures contribute to an increase in the hazard of radiation exposure? A. No. There are many new and sophisticated techniques, but they account for only 5% to 5% of the total number of procedures performed.

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