RADIOLOGY

Radiation: Questions & Answers

The good and evil of radiation are the hope and despair of this era. This paradox raises fundamental questions concerning exposure and control, Lillian Levy reports.

➤ RADIATION, paradox of good and evil, is at once the hope and despair of this era.

It is the source of all life and growth on earth; but exposure to it can stunt and retard the development of plants and animals.

Radiation causes cancer. It is used to treat cancer.

Radiation can supply awesome energy for productive peaceful uses or for war.

Radiation is sunshine. It is fallout.

The coexistence of benefit and risk raises many questions concerning the character of radiation, exposure effects and the need for control measures. Some of these questions and answers follow:

Q. What is radiation? A. It is the energy released from internal changes in molecules and atoms which occur spontaneously in nature or are artificially induced by man.

Q. At what levels of exposure is radiation hazardous to health? A. According to the U.S. Public Health Service, exposure to radiation at any level is a risk to health. Since there is no limit or threshold of safety, the risks must be measured against the benefits.

Q. What are the sources of radiation to which man is exposed? A. Sources of radiation may be medical, occupational and environmental.

Q. Are these sources equally hazardous? A. No. Effects of exposure are varied. So are the benefits and risks.

Q. What are medical sources? A. Medical sources include primarily X-rays which are used for diagnosis and treatment. X-ray exposure is voluntary and authorities agree that the health benefits from such exposure far outweigh the risks. Only a fraction of the total world population is exposed to medical radiation.

Q. What are occupational sources? A. Occupational sources include atomic plants and laboratories, industrial atomic wastes and uranium mines. Exposure to these is limited to only a fraction of a percent of the total population; but health risks for this minority group are far greater than for the general population. Benefits are economic. Studies have shown that the risks involved in atomic occupations often are not fully understood by the non-professional average atomic worker.

Q. What are environmental sources? A. Exposure to environmental sources of radiation are essentially involuntary and all plants and animals on earth are subject to it. These sources are both natural and man-made. Natural or background radiation is energy from the sun and other cosmic particles as well as from radioactive materials naturally present in the earth's crust and water. Man-made radiation comes from radioactive debris or fallout from atomic weapons tests, from nuclear installations and atomic wastes. Environmental radiation, whether natural or artificial, is present in food, water and air.

Q. Is natural or background radiation hazardous? A. Ten percent of all cancers are caused by natural background radiation, according to studies by the United Nations Scientific Committee on the Effects of Atomic Radiation and the U.S. National Academy of Sciences.

Dietary Antidote Studied

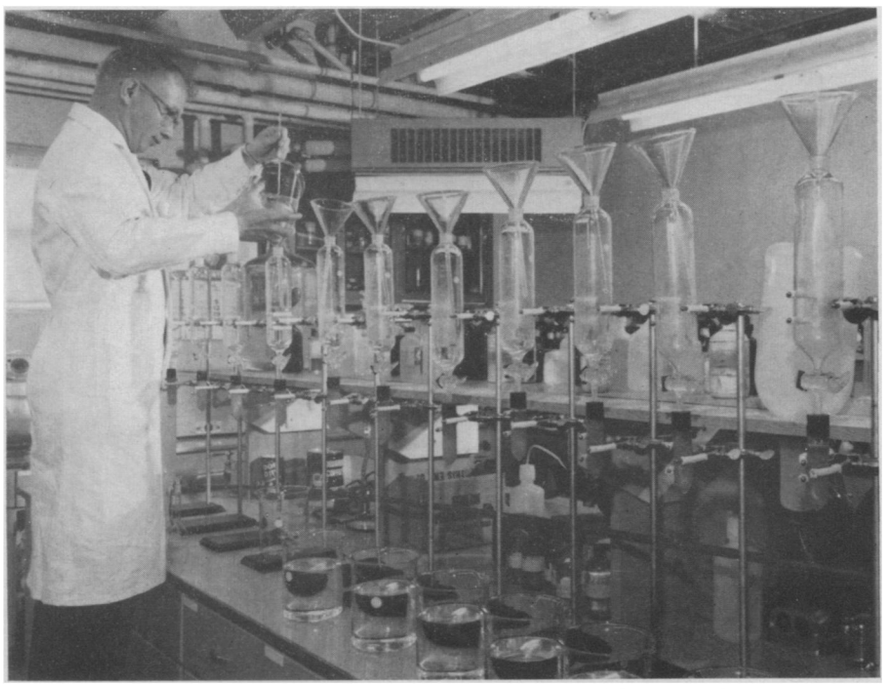
Q. Can exposure to natural radiation be reduced? A. Research has thus far yielded no way to reduce significantly the effects of such exposure. Studies are presently underway to determine the potential of dietary antidotes against low-level ionizing radiation and the possible use of anti-radiation pills.

Q. How dangerous are the artificially produced elements of environmental radiation due to fallout as compared to natural background radiation? A. A recent report of the Federal Radiation Council on the health implications of fallout from nuclear weapons tests through 1961 said that the whole body burden dose over the next 30 years would amount to less than five percent of natural background radiation. However, there are periods following a series of atom bomb tests when radiation levels from fallout have been 25% of natural background; and during such periods the burden of environmental radiation to which man is exposed must be assumed to be proportionately that much higher.

Q. When is radiation from fallout at highest levels? A. Generally, the first and second year after the explosion of atomic weapons. For example, in 1958 and 1959, after U.S. and USSR tests in 1956 and 1957, fallout levels of contamination were so high that whole body exposure and exposure to reproductive organs ranged from 10% to 25% of natural background. Dosage to bone marrow during this period was 20% to 40% of background and for bone, 23% to 60%.

The years of highest dose from the recent massive Russian tests will be 1962 and 1963 and from the current U.S. tests, 1963 and 1964. Because of weather patterns, the United States and Canada will get the largest share of fallout from the Russian tests. Debris from U.S. tests will be distributed more evenly on a worldwide basis.

Q. Has the Federal Radiation Council made annual estimates of the dosage effects of fallout on the basis of actual levels? A. No. It has instead averaged actual and anticipated exposure levels and the effects over periods of 30 and 70 years on the basis of present total population. According to its calculations, in the next generation only 100 cases of gross physical or mental defects,



ANALYSIS OF RADIATION IN FOODS—U.S. Public Health Service technician analyzing food and other material for radioactivity as part of the San Juan Physiological Research Project at Farmington, N. Mex.

such as congenital malformations, blindness, deafness, feeble-mindedness, hemophilia and mental diseases, may be expected from fallout deposits through 1961. The Federal Radiation Council does note that fallout may cause minor abnormalities such as impairment of physiological functions and reduced resistance to infection and other stresses of life; but no attempt has been made to estimate these effects which "may cause substantial damage in the aggregate."

FRC estimates of somatic damage from fallout through 1961 are limited to leukemia and bone cancer. During the next 70 years the cases of leukemia will increase by 2,000, bone cancer by 700.

Q. How much additional damage to health will result from fallout from the recent Soviet tests and current U.S. tests? A. Estimates must be based on the amount of radioactive materials formed during both test series and these have not been revealed. It is certain, however, that additional damage to health will result from the tests.

Q. How dangerous are present fallout levels? A. The U.S. Public Health Service does not believe that present levels or those in the near future warrant any action to reduce human intake of contaminants from fallout.

No Fallout Danger Standards

Q. What are the standards upon which U.S. public health officials base their judgments on fallout danger? A. No standards for radiation protection for the general public exist. There are only so-called Radiation Protection Guides (RPGs) recommended by the Federal Radiation Council and approved by Executive Order. RPG is defined as "the radiation dose which should not be exceeded without careful consideration for doing so."

Q. For what hazardous elements in environmental radiation have guidelines been recommended? A. Strontium-89, strontium-90, iodine-131 and radium-226. The first three are in fallout; radium-226 is part of natural background.

Q. Why are these nuclides specially considered? A. Strontium-89 and strontium-90 are known causes of bone cancer and leukemia. Children are twice to four times as susceptible to exposure to these nuclides. Strontium-90 is more dangerous since it has a half-life of 27 years, which means it loses half its remaining radiation every 27 years. Iodine-131, with a half-life of eight days, is a cause of thyroid cancer. Children again are most susceptible to this isotope. There have been periods in previous tests as well as from current tests which levels of iodine-131 in certain areas have far exceeded the recommended RPG. Radium-226 is a more dangerous source of lukemia and bone cancer than either strontium-90 or strontium-89.

Q. In what environmental sources are these nuclides most concentrated? A. Milk is the greatest source of human intake of radioactive strontium and iodine. Studies made of infants and children show that 80% of their exposure is from milk. Approximately 50% of adult exposure is from milk and milk products. Water is the source of radium-226.

Q. What countermeasures can be employed to reduce exposure to these nuclides? A. One countermeasure against iodine-131 would be to place all young children, nursing mothers and pregnant women on evaporated milk or powdered dry skim milk. Two months is the average time it takes for evaporated and powdered milk to reach the consumer. Because of the short half-life of iodine-131, almost all contamination would be eliminated in about 60 days. No nutritional loss is risked by the substitution. The dairy industry has the capacity to supply quantities needed by women and children. As a precaution, families could keep a supply of evaporated or powdered milk on hand.

Ion-exchange methods have been developed by the Federal Government and by research institutions to eliminate strontium and iodine from milk. If radium-226 reaches dangerously high levels in water, similar ion-exchange procedures could be used to decontaminate water supplies. These methods still are under study.

What to Do

Q. What can the average person do? A. Washing and peeling fruits and vegetables thoroughly will reduce surface contamination substantially, according to studies by the Food and Drug Administration. Substituting evaporated and powdered milk for whole milk is another effective countermeasure against idoine-131. It will not eliminate strontium-90, however. Eating refined grains and white bread will cut down substantially strontium-90 contamination in grains. The Public Health Service has warned against modification of approved dietary practices since nutritional deficiencies which may result might be more damaging than the effects of exposure to radiation.

Q. How widespread would contamination of the environment be in the event of a nuclear war? A. In a 20,000 megaton (the equivalent of 20 billion tons of TNT) nuclear war involving Russia, the rest of Europe and the United States, at least 50% of the survivors would suffer abnormalities and sterility. As much as eight percent of births in non-target nations would be defective. Radiation sickness from contaminated air, water and food, cancer incidence, other disease would be widespread. No nation is in any way prepared to deal wtih the consequences of nuclear warfare.

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Most population records have indicated a significant association of coronary *heart disease* with genetic or familial characteristics, excess body fat, increased blood pressure, cigarette smoking and high serum lipo-protein content.

Supercooled *clouds,* which form at below freezing temperatures, occur with increasing frequency from the upper half of the United States northward to Alaska.

The average adult *weight* in the United States is about 15 pounds above the weight that corresponds with the best health records.

Vacuum in spacecraft causes fluid leakage to a much greater degree than occurs in the earth's atmosphere.