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1204

TRENDS IN RESEARCH PROGRAM

Biophysics Branch

September 8, 1954

I. Radiation Effects on Biological Systems

AEC-NRC conference on Basic Mechanisms of Radiobiology (May 1953) proposed theories on energy transfer from ionizing radiation to tissue components. It is expected that these theories will be tested experimentally. A new field of research is developing in the use of high energy particles produced by the Betatron, Cosmotron, and other accelerators to study their effects on organs and tissue components such as the effect of protons on pituitary glands and chromosomes. Present dearth in research proposals in this area is likely to end with increased interest and activity resulting from new experimental techniques.

II. Weapons Testing Program

A. Monitoring fallout

1. Close-in. Analyses of CASTLE series greatly underlined the need for better quantitative measurement of close-in fallout. Telemetering techniques and other new procedures to play an important role in future monitoring.
2. World-wide. NYOO gummed paper program, Weather Bureau's prediction of trajectories from meteorological data and AFOAT -1 aircraft verification of trajectories to continue. Use of balloons and/or rockets employing scavenging and telemetering devices to be tried more extensively in monitoring radioactivity in the atmosphere.

B. Gabriel

Some changes in emphasis - little change in program objectives anticipated.

Aureole. Increased efforts will be made to determine extent of hazard to populace within 500-mile radius and develop workable theories enabling the prediction of amount and place of fallout to any given area. Objectives are to develop an early warning program on hazards of fallout in the event of hostilities. Computing machines to have an important part in this endeavor.

Effect of storage of atomic debris in upper atmosphere on local or world climate is drawing more interest among weather experts.

Sunshine. Most important recent change is that I-131 can now be regarded as one of the very important radioisotopes in Sunshine project. Additional research on effects of I-131 on developing embryo and infant growth is indicated. Re-evaluation of permissible doses in milk may be in order. Sr-90 program to continue on present basis. More emphasis by Libby of the University of Chicago in the analyses of skeletal tissues likely. Cheese, soil,

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water, leaf sampling and analyses to continue by Kulp, of Columbia University, and NYOO. Additional information needed on the adhesion of fallout to foliage. Relative hazards of soft gamma, hard beta as a contribution to total hazards of atomic debris will be analyzed from existing fallout data. Comparison of dose obtained by inhalation, ingestion and external radiation to be made with special consideration to close-in fallout.

III. Permissible Body Burden for Radioisotopes

Emphasis on research will be influenced in part by changing weapon and reactor designs. A program on bio-assay is seriously needed. Except for a very few isotopes, a reasonably accurate determination of body burden from excretion data cannot be made. In most cases, permissible exposure to internal emitters is an arbitrary function of what can be measured in excreta, rather than a function of body burden. This field is wide open for tracer experimentation in humans, and for improved chemical techniques. It is a program in which Canadians and English are both greatly interested, and in an area where technical cooperation would be most valuable to all participants.

Trends in research efforts to arrive at permissible dose levels for important radioisotopes are:

For strontium 85, 89 and 90, the principal changes will be in experimental procedures. Administration of permissible dose levels to humans expected to produce important results on absorption, retention and excretion. Use of double tracer techniques ($Sr-85$) in both animals and humans to provide comparative metabolism with $Ca-45$, Ra and $MgTh$.

Plutonium. Present animal program adequate. Information will be sought on interaction between tissue and plutonium particularly where this information is required before its mode of transport, retention or excretion can be adequately understood.

Ba-140. Metabolism similar to Sr-89, 90. Shorter half-life reduces hazard relative to strontium and radium radioisotopes. Additional studies may be worked into present planned Sr-89, 90 projects.

Ru-106. Research on this radioisotope somewhat neglected in past. Several research projects initiated during past year. Additional studies to determine absorption, retention, excretion data of this element which has unique chemical characteristics - existing in four different valence states - making possible both cationic and anionic forms. Chemical forms from bomb or reactor to soil, food and tissue will be ascertained.

IV. Waste Disposal

The problems with disposal of radioactive wastes are more chronic than acute. Sea disposal looms as the most important method for large scale disposal. Evaluation of transport and diffusion parameters in oceans, ground water, soil and air are continuing problems under study by on-site laboratories.

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V. Dosimetry

Increasing interest is shown in the design of calorimeters for measuring energy of ionizing radiation. Tissue equivalent chambers are reaching the development and production stage. Neutron detectors using boron, plutonium, uranium are in various stages of development. As instruments are designed for high energy or high intensity measurements the problems of correct interpretation become more complex. Dosimeters that partition one type of radiation from a spectrum (atomic detonation) need additional study.

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Research program trends on the following: radiation on biological systems; weapons test fallout monitoring; radioactive waste disposal. Atomic Energy Commission, 8 Sept. 1954. U.S.

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