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UNITED STATES  
ATOMIC ENERGY COMMISSION  
WASHINGTON, D. C.

Monthly  
REVIEW  
of  
ACTIVITIES

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## II - BIOLOGY AND MEDICINE

### Weapons Test Activities ~~(CONFIDENTIAL)~~

Neutron dosimetry program Operation CASTLE. Arrangements are being made to incorporate neutron measuring techniques developed by the Oak Ridge National Laboratory into the program of neutron radiation measurements being undertaken by the Naval Research Laboratory during Operation CASTLE. The program will be of benefit to both groups and will involve little expense and effort.

The Oak Ridge research group has made use of neptunium, uranium, and plutonium fission detectors in studies to determine total neutron flux. Neutron measurements made during previous field tests have not covered the wide range of neutron energies of interest to the biophysicists. Such data derived from these fission detector measurements would be of considerable importance in interpreting the total neutron dose. (End of ~~section.~~)

### Research Activities (UNCLASSIFIED)

Cell-free photosynthesis. Photosynthesis, the process by which the energy of the sun is converted to food stuff, has always been studied in the intact cell. Recent experiments at Oak Ridge National Laboratory have involved use of the alga Chara which has very large cells from which the cytoplasm may be squeezed out, free of cell wall and cell sap. It was found that this preparation when placed in an atmosphere of carbon 14 synthesized carbohydrate. This discovery indicated that an essentially cell-free medium is capable of carrying out photosynthesis.

Effect of thermal neutrons on seeds. The number of mutations produced in barley seeds by doses of X rays and thermal neutrons has been compared with the amount of damage indicated by growth inhibition and the amount of visible chromosomal damage. At Brookhaven National Laboratory, it was found that the mutation frequency was closely correlated with the chromosomal damage but not correlated with growth inhibition. This fact means that with thermal neutrons many more mutations will be produced for

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a given degree of injury than for X rays, and thus thermal neutrons give great promise as a tool for genetic study.

Use of phosphorus 32 in sickle-cell anemia. Sickle-cell anemia, a serious blood disorder in which red blood cells assume an abnormal sickle shape, affects approximately one in 500 Negro children in the United States. Under a project with Howard University, a study is being made of blood from victims of this disease not only to increase an understanding of this condition but also to obtain information concerning protein synthesis and the dynamics of phosphorus transfer in the blood. Investigators in the use of phosphorus 32 have shown that phosphate exchanges across the red blood cell membrane are at a slower rate in sickle cells than in normal cells. The alkaline phosphatase in sickle-cell anemia plasma is significantly higher than that in normal plasma. Initial studies on phosphate transfer using metabolic inhibitors indicate the absence of a certain enzyme from the sickle-cell anemia blood. One of the most significant observations of this group on the problem is that one of the protein components of the plasma has a different mobility as determined by electrophoresis. This finding is being investigated further with additional electrophoresis equipment and under varying experimental conditions.

This work complements other investigations in which the globin part of hemoglobin in sickle cells is found to be different from that of normal cells.

Shielding studies. The problem of providing adequate shielding for personnel protection in equipment designed for radiation sources must be coupled with that of economies in operation. For lower energy ranges, shielding is not an expensive factor. However, in the use of higher intensity radiations, the problem of personnel protection involves high expenditures. This problem is being investigated under a cooperative project with the National Bureau of Standards to determine design factors of various types of equipment in which savings might be realized, and at the same time to determine with greater accuracy the validity of former assumptions so that more reliable calculations may be made in shielding design. The present work is concerned with the attenuation characteristics of a shield when the rays from the source enter the shield obliquely. To a first approximation, the effective thickness of the shield has been assumed to be the length of path of the ray in the shield - that is, the more oblique the direction of incidence, the longer the path and the greater the degree of shielding. In this study it has been shown that while oblique thickness of the barrier may be utilized in designing equipment to shield against the primary rays, the contribution of scattered radiation from within the shield may become appreciable. Scattered radiation increases significantly as the obliquity of the incident ray increases, because of the shorter path length for a number of the scattered rays.

Data obtained from these investigations will be applicable to the design of protective shielding for personnel operating cyclotrons, Van de Graaff generators, or handling cobalt 60 and radium sources which are used

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in research and therapy.

#### Radiation Instruments Program

Recent work under the cooperative agreement with the National Bureau of Standards for studies in the radiation instrument field includes:

Study of film dosimeters. A report has been completed on the evaluation of the several types of film dosimeters in use at the various AEC installations. The work consisted of two parts: (1) Study of the sensitivity, quality dependence, and maximum range of the film badge; and (2) a cross-calibration study.

Some 15 different AEC installations participated, and the findings show that most of these installations are able to get a fair degree of precision in measuring and interpreting gamma and X ray radiation doses over a wide range of energies and intensities. The survey has been important in pointing out areas where improvements may be initiated in order to reduce inaccuracies in film dosimeter measurements.

Testing of radioactive electric cells. Tests were made of two Model E-50 electric cells of the radioactive source type manufactured by the Radiation Research Corp. of West Palm Beach, Florida. These are the first cells of this type which have appeared on the market. Preliminary results indicate that the load characteristics are better than those claimed by the manufacturer. However, the voltage of the cells when no load is applied showed some dependence on humidity conditions. It is expected that electric cells of the radioactive-source type will find application in low-current devices where long storage and small battery dimensions are required.

#### General

The Advisory Board on Water Decontamination met at Oak Ridge National Laboratory in October to review the current status of the Oak Ridge project on water decontamination. The board was set up in 1950 to provide technical advice on the project which is under the nominal supervision of the U. S. Public Health Service at Oak Ridge. Representatives were present from AEC, U. S. Public Health Service, Department of Defense (AFSWP), New York State Waterworks Commission, and the American Waterworks Associations.

The meeting included discussions of the interim progress report submitted by the Oak Ridge research group, and the following subjects were covered: research on the decontamination of radioactive waters, the problem of radioactivity in water courses, reconcentration of radioactivity by natural agents, water decontamination, and instrumentation. The report will be revised to include further studies and later issued as an official document for distribution by the Oak Ridge National Laboratory. It contains comprehensive data on decontamination studies and will be of considerable value to all waterworks engineers in the country, in addition to having wide application in AEC operations.

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