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(Insert proper classification)

2 August 1949

TO: Norris E. Bradbury, Director

FROM: Alvin C. Graves, J-Division Leader

SUBJECT: 1951 TEST PROGRAM

REFERENCE: SD-346

Planning of experiments to be performed at Eniwetok during February, March, and April 1951, has now reached the point at which formal approval of the scope of the programs by the Laboratory and the Atomic Energy Commission appears to be indicated. Broadly speaking, the experiments to be performed in 1951 fall in the following three categories:

(1) those in which the Atomic Energy Commission is primarily interested;

(2) those in which the National Military Establishment is primarily interested; and

(3) those in which the Atomic Energy Commission and the National Military Establishment appear to have a joint interest.

The experimental programs (Enclosures A and B) for which approval is now sought are in the first and third categories, respectively, and cover Los Alamos and Biomedical experiments. The experiments in the second category are scheduled for consideration on 1 September 1949, and 1 October 1949, and will be the subject of a separate request for approval.

It should be noted that these Enclosures represent the current thought on the subjects involved. They have been considered by the interested persons on the basis of necessity and reasonableness, feasibility, and over-all scope. It should be recognized, however, that approval at the present time should not bar the later inclusion of other experiments or the deletion of some of those currently planned, so long as the over-all programs are not jeopardized by such changes.

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If you approve these programs, it is requested that they be forwarded through channels to the Atomic Energy Commission for consideration by the Commission and, if necessary, the General Advisory Committee, so that their approval may be obtained.

If it appears to be necessary, I shall arrange to be present when these programs are considered by the Commission and the General Advisory Committee. Dr. Shields Warren, of the Division of Biology and Medicine, Atomic Energy Commission, Washington, D.C., has agreed to assist in the presentation of the Biomedical experiments.

It is desirable that the consideration of the Commission be given to the Enclosures as soon as possible, in order that detailed planning for the experiments and for the necessary construction can be accomplished.

Original signed by
ALVIN C. GRAVES

ALVIN C. GRAVES,
J-Division Leader

Enclosures A and B

Distribution:
- Bradbury
- McCormack (2)
- Tyler
- Warren
- File (2)

WITH ENCLOSURES A & B

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EXCLUSION A

LOS ALAMOS SCIENTIFIC LABORATORY
PROGRAM

The following is a listing of the Los Alamos Scientific Laboratory experiments planned for the 1951 operation at Eniwetok:

1. GAMMA RAYS

1.1 Prompt Gamma Rays

1.1.1 Prompt Gamma Rays used in the Measurement of Alpha.

Ionization chambers and fast vacuum photocells in conjunction with phosphors will be used in this measurement. The latter detector may make it possible to measure variable alphas. If so, alpha as a function of time will be measured. The mean free path of prompt gamma rays will be obtained.

1.1.2 Measurement of Transit Time.

The time from firing of detonator to the appearance of prompt gamma rays will be measured.

1.2 Delayed Gamma Rays

1.2.1 Spectrum

An attempt will be made to measure the spectrum of delayed gamma rays probably by use of a beta-ray spectrometer.

1.2.2 Time Dependence

Intensity of delayed gamma rays versus time will be measured.

1.2.3 Spatial Distribution

Spatial distribution of the gamma rays will be measured. It is hoped that these measurements of the delayed gamma rays

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will give an additional absolute determination of yield.

1.3 Total Dose

A measurement of total dose of gamma rays as a function of distance will be made in poor geometry.

2. NEUTRONS

2.1 Neutron Spectrum

2.1.1 Threshold Detectors

Threshold detector measurements should give an indication of an increase in the number of neutrons in the neighborhood of 14 Mev for the easy determination.

2.1.2 Photographic Emulsion

It is planned to make a determination of the neutron spectrum using recoil protons in photographic emulsions.

2.2 Spatial Distribution

The above measurements will be made at various distances from zero.

2.3 High Energy Spectrum

High energy spectrum measurements will be attempted by a time of flight technique.

3. BLAST

3.1 Free-air Peak Overpressure versus Distance

3.1.1 This measurement will probably be made by means of instruments suspended from a balloon.

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3.1.2 Measurements may also be made by means of the optical observations of the shock front intersecting with wires.

3.2 Overpressure versus Time as a Function of Distance

Measurements near the ground of the pressure-time-distance characteristics of a nuclear explosion will be made.

3.3 Observation of Mach Phenomena

Measurements relating to Mach effect, e.g., path of triple point, will be made if feasible.

3.4 Peak Overpressure versus Distance

This quantity will be measured chiefly by means of observation of shock velocity and sound velocity, pressure gauges will be used for high pressure regions and indenter gauges for low pressure regions. Pellusters will be used as a backup.

3.5 Density and Temperature versus Time

A measurement of these quantities is being considered.

3.6 Asymmetries

Photographic observation of the shock wave from aircraft is planned to indicate shock wave asymmetry.

3.7 Measurement of Pressures near Monolithic, Rigid Structures

It is planned to measure diffraction effects of the blast wave around several such structures.

4. THERMAL RADIATION

4.1 Attenuation by the Atmosphere

Measurements will be made of the transmission of the atmosphere as a function of frequency.

4.2 Variation with Time

Measurements of the variation of thermal radiation with time with 100-microsecond resolution are planned.

4.3 Spectrum from Bomb

Spectral composition of thermal radiation from an atomic bomb as a function of time will be measured.

4.4 Spatial Attenuation

Spatial attenuation of thermal radiation will be measured.

5. VISIBLE RADIATION

5.1 Ball of Fire Observations

Measurements will be made at various camera speeds of the growth of the ball of fire.

5.2 Dimensions

The time of the occurrence of the minimum in the light curve from the expanding ball of fire will be observed. From scaling laws this can give relative yields.

5.3 Growth and Size of Atomic Cloud

These quantities will be measured photographically.

5.4 Nitrogen-Oxygen Compounds (Absorption Lines)

Measurement of absorption lines of such compounds will be made.

6. RADIOCHEMISTRY

6.1 Absolute Determination of Yield

Radiochemical yield determinations will be made on samples collected by drones. Other sample-collection techniques will be investigated.

6.2 Study of Utilization of Materials

An attempt will be made to separate the energy generation of the bomb between the various bomb components.

7. MISCELLANEOUS

7.1 Common Timing

Common timing to millisecond accuracy or better will be available to tie various records together.

7.2 [redacted]

An experiment in which the nuclear explosion is used to send material down a tube and cause a thermonuclear reaction of small magnitude in deuterium is under study.

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ENCLOSURE B

JOINT ATOMIC ENERGY COMMISSION AND DEPARTMENT OF DEFENSE
MILITARY ESTABLISHMENT BIOMEDICAL TEST PROGRAM

A. OBJECTIVE

The fundamental objective of the biological program is to provide information which can be used in planning effective medical care for victims of atomic warfare and for victims of industrial accidents in nuclear energy plants. Such planning must depend on radiological studies which utilize the unique radiation of atomic explosions. A satisfactory biological test program should provide data which can permit evaluation of atom bomb radiation injury in terms of the injurious action of roentgen, gamma, and neutron radiations of a character that can be produced by conventional means in laboratories. Adequate medical planning cannot be anticipated until it is possible to translate laboratory conditions to field conditions with a high degree of certainty.

B. PROGRAM

The program has been approved by the Division of Biology and Medicine, Atomic Energy Commission, by J-Division of the Los Alamos Scientific Laboratory, and by the Joint Proof-Test Committee.

1.0 Animal Colony

This colony will provide an adequate number of animals for use by all experimenters at shot time. These animals will have been born and raised on Eniwetok Island and should be acclimated to the total local environment. Suitable control studies will be performed prior to the shots. The response

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of the animals will be tested with 250 KV x-rays after residence in the tropics. The plan provides for 12,000 mice of the LAV1 strain; 120 American foxhounds; and 120 Duroc "hairless" pigs.

2.0 Study of Acute Radiation Injury

These studies will form a basis for a comparison of biological response to short-burst radiation from atomic bombs with the response to ionizing radiation delivered at conventional rates.

2.1 Study of acute lethality, LD_{50}, and survival dose versus distance. (all species)

2.2 Study of histologic changes in tissues obtained by serial sacrifice after exposure. (all species)

2.3 Study of histochemical changes in tissues, as in 2.2.

2.4 Study of changes in enzyme systems in tissues, as in 2.2.

2.5 Study of protective agents on LD_{50}. (mice)

2.6 Study of effect of atom bomb radiation on longevity and carcinogenesis in survivors. (mice)

3.0 Study of thermal Injury (Pigs)

3.1 Study of time relationships of burn to atom bomb detonation.

3.2 Study of action of various components of thermal radiation and ionizing radiation in causation of burns.

3.3 Comparative study of changes in skin due to atom bomb burns and laboratory flash burns.

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4.0 Study of Hematologic Changes Due to Atomic Bomb Radiation (Large Animals)

4.1 Routine hemogram on all large animals.

4.2 Study of hemorrhagic tendency in large animals with acute radiation injury.

5.0 Study of Distribution of Fission Products

This study will utilize animals exposed in Project 2.0.

6.0 Biological Dosimetry

The responses of Tradescantia, Neurospora, mice, Aspergillus, and corn will be studied to provide "checks" with the physical dosimetry.

7.0 Study of Genetical Effects of Atom Bomb Radiation

This study will utilize the Neurospora, Aspergillus, and corn exposed in 6.0 and will extend previous observations of the same sort.

8.0 Observations of Effects of Atom Bomb Detonation on Local Fauna and Flora by a Qualified Naturalist.

6. [redacted]

The biological test program is planned to be a cooperative activity involving representatives of the Atomic Energy Commission and the National Military Establishment. Individual studies will be performed under contract with the Atomic Energy Commission. It is contemplated that all biological research groups will obtain their animals from the animal colony and will share the facilities of the biological laboratory. As a corollary, they should also share in the cost of the biological test program. The design of the majority of the experiments is such that most of the studies on the exposed material can be performed in the United States.

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