

APPENDIX "B"

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APPENDIX 3.1

The proposed animal breeding colony is primarily a project of the Naval Medical Research Institute which is willing to underwrite the cost, estimate at \$150,000 if the Bureau of Medicine approves. It is prepared, subject to general approval, to commence this undertaking within 60 days. Definite data is not immediately available concerning the reproductive activity of the conventional laboratory mammal, under the climatic conditions that exist at Eniwetok. There seems to be no question of the desirability of accimatizing the test-species in advance of exposure. The length of time this may take is not known with certainty by the proposers. Capt. Draeger is prepared to present the views of his associates in this matter, and discussion and a decision is solicited from the committee.

As proposed the animal colony would ultimately provide approximately 5,000 mice, 5,000 rats, 2,000 quinea pigs, 2,000 rabbits, 500 dogs and 500 swine. Suggestions as to strains best adopted for radiation study and tropical acclimatization are invited.

This subject - the Animal Breeding Colony - was discussed with Alvin C. Graves, Director of J. Division, at a meeting with service representatives at Los Alamos on 12-13 April. Mr. Graves made this comment:

"There is no strong objection to the establishment by the Navy of an animal farm on the island of Japtan provided sanitary conditions are maintained. This decision might wait for a determination of the scope of the biological program since its size and justification may depend on this scope. I should like to request the Navy to consider a location on Kwajalein (300 miles, 24-30 hours by boat) for this colony in order to decrease the required logistic effort. My engineers indicate that no buildings on Japtan are worth reconditioning, and using them as they are is

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not safe.... However, this decision (i.e. Japtan or Kwajalein) should be made by the biologist concerned, and I would defer to their judgement."

The trip from Japtan to the test site would require about one hour by boat.

APPENDIX 3.2.1.2.

"Mammalian experiments...consist of exposure of reasonably large but not unwieldy groups of mice (and perhaps one other mammal...) in immediate proximity to physical measurement sites. Some of these animals would be shielded from various component radiations, and all would be afforded blast protection. Immediately after detonation, these animals would be picked up and returned to the base animal laboratory for study. Study would merely consist of frequent observation to determine the time of death in acute lethal effects, with possible preservation of the carcasses for future histologic study in the United States. Surviving animals would be shipped to a laboratory in the U.S. at a later date for longevity studies."

Institute of Radiobiology, University of Chicago

Proposal by Dr. Franklin C. McLean

APPENDIX 3.2.1.3.

"Determination of lethal dose under short burst conditions, compared with lethal dose at normal dose rates. If feasible, this should be done separately for fast neutrons and for penetrating gamma radiation, by selective shielding."

Hanford Engineer Works, letter from H.M. Parker, Manager
Health Instruments Division

APPENDIX 3.2.2.1:

"A knowledge of particle size distribution as necessary in order to predict inhalation and retention of particles by animals."

"The Cascade Impactor is the instrument of choice...the

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APPENDIX 3.2.2.1.

instruments manufactured in large numbers by a die-cast method... would cost approximately \$25.00 each....perhaps a thousand might be needed, depending on the scope of the plan, and some hundreds of personnel...as operators. We have about 10 personnel acquainted with instrument who could train another hundred in about 2 weeks... If a meteorologic group is interested, a collaborative program could be worked out."

University of Rochester, Atomic Energy Project.

Letter from Henry A. Blair, Director

APPENDIX 3.2.2.2.

"Object: to determine distribution, movement and aggregation of radioactive particles within the pulmonary system."

"Method: Rats would be exposed at sites at which measurements would also be made...by the Cascade Impactor. The animals would be sacrificed serially, and the pulmonary tissues studied by radio autography and by particle counting following protein digestion or micro incineration.

"The total number of animals required for the toxicity experiments would be about 12 goats and 500-1000 rats. Six to 8 personnel from here would be required along with about 20 others who could be trained in 2 weeks in the field."

University of Rochester

Letter of Henry Blair, Director

APPENDIX 3.2.2.3.

"Object: Although the distribution and excretion of certain individual materials resulting from a bomb explosion have been studied, it seems possible that a mixture might be handled differently...Consequently, it is proposed that a few large animals.. goats, and a larger number of rats be exposed and followed by serial sacrifice. The distribution of radioactive materials to various organs would be studied and some attempt made to determine

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the chemical species from radioactive decay measurements and micro analysis. Some animals could be carried for long periods and examined for tumor incidence and other long term effects."

University of Rochester
Letter of Henry A. Blair

APPENDIX 3.2.2.4.

"Determination of the deposition and subsequent fate of radioactive particles, and the animals containing them. It is visualized that this could be done profitably with animals in drone planes if an airburst test is made. Especially valuable would be a comparison between the effects of exposure close to the explosion site, and in the drifting cloud of radioactive particles several hours later. Such experimentation, would be valuable to steer our normal operating control of the emission of radioactive particles, and to establish more realistic protection in the event of a catastrophe at the Hanford Works."

Hanford Engineer Works
Letter of H. H. Parker

APPENDIX 3.2.3.1.; 3.2.3.2.

The proposal from the University of Rochester, submitted by Dr. Herman Pearce (also submitted to Armed Forces Special Weapons Project) is essentially paraphrased in the NEE proposal. Certain details are included in Dr. Pearce's prospectives, as follows:

"Object: The primary purpose...is to obtain data in field tests that can be used to plan laboratory studies. A secondary purpose is to compare the results already obtained in the laboratory with those produced in the field.

Local Burn Studies: Animals should be exposed at graded distances so that sublethal and lethal burns are produced. It is felt that if sufficient specimens are obtained to study adequately:

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the pathological changes in the skin, this will suffice...more complicated studies of the local lesion, such as bacteriological and chemical observations can be deferred for laboratory investigation if one knows that the lesion produced in the lab is the same as that produced in the field.....

"It is possible that satisfactory studies (i.e. of mortality) can be made in a peripheral zone (comparable to 1.5 - 2.5 Km at Hiroshima) where these complications (i.e. blast and radiation effects) will be minimized.

"A study of all the systemic pathological and chemical changes from burns would require equipment too elaborate for field use. If only the essential observations of urine, blood counts, hematocrit and plasma proteins are made, then these can be used as a check against more detailed studies....in the laboratory.

"The pig is the best test animal. Rats and guinea pigs are next best and should be used. The pig's skin is more nearly like human skin than any other animals....It appears necessary to devise suitable shelters....that will shade the animal but not shield him from thermal radiations of the bomb...It...(is).... desirable to have all test animals acclimated for a short time before tests are made....small pigs are easier to handle than large ones."

University of Rochester

Letter of Henry A. Blair

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See attached drawing of tanks for exposure of pigs and other animals. It is planned that teams of pathologists from the Naval Medical Research Institute and the Army Medical School will be on hand to perform serial autopsies at the earliest time possible after the blast to obtain tissues for histologic study. At the same time, tissues would be quick frozen for transmission to the Army Medical School where studies of various enzyme systems, and histochemical studies would be conducted.

The freezing method contemplated is a special deep freeze chamber containing dry ice. Air transportation to Washington would be provided.

See also 3.2.4.3, following.

Personal Communications,
Colonel William Stone, M. C.

APPENDIX 3.2.4.3

"Dr. Doherty suggests an experiment on the effects of bomb blast on enzymes invitro and invivo. His proposed experiment would be concerned with prompt isolation of enzyme systems from irradiated animals and determination of activity changes. Purified enzyme systems invitro would be exposed and the effects determined at once." Equipment list included.

Oak Ridge National Laboratory
Letter of Alexander Hollaender

APPENDIX 3.2.4.5

It is intended that this study will consist of:

- a) Study of vascular and other changes in methological preparations obtained throughout the radiation experiment and studied in the U.S.; and
- b) Studies of the chemical constituents of the clotting mechanism in plasma frozen on the spot and transported to the Naval Medical Research Institute for assay.

This procedure is proposed because of the elaborate equipment needed for detailed studies of blood clotting; and because of the

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APPENDIX 3.2.4.5 (Cont'd)

many technical problems that such a study entails.

Personal communication, Dr. Cronkite

APPENDIX 3.2.5.2

"Some of the recent work being done in Dr. Howland's Division on antibiotics suggest that they may be of considerable use (in therapy). If this is confirmed by subsequent work a proposal along those lines could be submitted later."

University of Rochester
Letter of Henry A. Blair

APPENDIX 3.2.5.3

Therapeutic studies proposed by the NME are of a very limited character, and as planned at present do not involve a large series of animals (perhaps 20). The attitude of the NME is similar to that adopted in Mr. Blair's letter: "No suggestions are made to expose animals for studies of penetrating radiation (as regards therapy) because it does not seem likely that they could add anything to the results of work done under controlled laboratory conditions. There is one possible exception to this in the field of therapy....."

Personal communication, Capt. Draeger

APPENDIX 3.3.1

"If it were decided to study mammalian genetic effects, it might be necessary to expose a few more animals (than the ones for acute lethality, etc. see: 3.2.1.2) females.... provided it appeared mandatory to breed exposed females. This would be to avoid complicating longevity studies on surviving females through superimposition of obstetrical and post-partum fatalities on the data. There appears to be no good reason why the surviving males could not be used both for breeding and longevity studies.the mammals should be bred as soon after exposure as possible to determine the percentage and types of mutation, and then bred later to determine recovery, if any with subsequent maturation of germ cells.

University of Chicago
Proposal of Dr. Franklin C. McLean

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APPENDIX 3.3.2

"Drosophila should be exposed and genetic effects studies. These studies should be done immediately after exposure Because of the difference in relative efficiency of neutrons and gamma rays for the production of (dominant lethals and recessive lethals) it should be possible to find the proportion of fast neutrons to gamma rays at the point of exposure.

University of Chicago
Proposal of Dr. Franklin C. McLean

The insect species that the NME project, M-11, proposes to use are not known at this time. Capt. Draeger's group at the Naval Medical Research Institute have devoted much thought to, and have had experience with containers which are suitable for exposure of small material of this sort. A drawing of the containers used in previous atomic tests is attached. Capt. Draeger will comment on the problems peculiar to this sort of study.

APPENDIX 3.3.3.

"Dr. Conger suggests tests on the effect of bomb irradiation on tridactantia chromosomes. This could demonstrate whether biological effects are predominantly from gamma rays, or from heavy particles (neutrons). The approximate radiation levels to be tested are from 20 - 200 r x-ray equivalent effect..... Plants would be placed at various distances..... and collected within 22-24 hours.... simultaneous exposures would be made of control plants to a burst of x-rays, or gamma rays, at a rate in excess of 200 r/minute... Need facilities for keeping plants in good condition until they could be placed (for exposure).... We would like to study as many as several hundred plants in pots Inflorescences could be put in vials in different locations (these) would have to be available for analysis a few hours after the blast. Equipment required: Small laboratory space, usual glassware for microscopic study, microscope.

Oak Ridge National Laboratory
Letter of Alexander Hollaender

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[REDACTED]

APPENDIX 3.3.3 (cont'd)

"Well calibrated test organisms appear to be mice, corn, Drosophila and Tradescantia. . . ."

"Tradescantia would appear to offer considerable interest if the plants can be obtained in flower at the time of the tests, since it has been extensively studied with regard to effects of x-ray, gamma rays and fast neutrons."

University of Chicago
Proposal of Dr. Franklin C. McLean

APPENDIX 3.3.4

"Exposure of selected corn seeds should be undertaken as a biological test, since this is ideal material for work under difficult conditions.

"There is considerable data available from the corn exposures at Bikini. One of the items of interest is a high proportion of chlorotic sectored plants grown from Bikini exposed seed. This lack of chlorophyll condition cannot be reproduced in the same proportions with x-rays. Pre-test data should be obtained as to whether or not such effects can be secured with neutrons alone, or with mixed radiations . . . from cyclotron or shielded and unshielded pile experiments."

University of Chicago
Proposal of Dr. Franklin C. McLean

APPENDIX 3.3.5

"The effects of radiation on mutation production in Aspergillus terreus. Mr. Stapleton is completing a comparative study of the efficiency of different types of radiation on inactivation as well as mutation production. Several hundred vials could be prepared with large numbers of fungus spores which would be placed at different locations. . . .the spores could be prepared on the spot and shipped back to Oak Ridge by air for further study. Facilities for sterile work would be necessary."

Oak Ridge National Laboratory
Letter of Alexander Hollander

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APPENDIX 3.3.6

"Dr. Giles suggests tests on the production of biochemical mutants in Neurospora (a) tests could be made for mutations from wild types to biochemical mutants by exposing microconidia dry, in tubes or packets, and making subsequent crosses to wild type Presumably, conidia would be returned to lab for this (b) Tests for reversions and reverse mutations at selected loci (c) Quantitative data on reverse mutation could be obtained with microconidial stocks, however, exposure would be difficult and would require immediate testing..... Usual Lab facilities for sterile work would be required."

Oak Ridge National Laboratory
Letter of Alexander Hollander

APPENDIX 3.3.9.1 - .2 - .3 - .4

Preliminary studies have been made on CF1 mice of the effect of 250 KV radiation on the spleen white pulp/red pulp ratio and splenic and thymic weights. It was found that between 3 and 8 days post irradiation, the weight change could be directly quantitated to the amount of radiation received. The change in thymic weight proved to be the most sensitive and accurate measure of radiation received. It is proposed that animals in suitable containers to protect from heat, blast and wind be exposed. Special containers would provide shielding for neutron flux.

In addition it is proposed to drop animals into radiated after explosion in adequate shields at specific time intervals.

The cloud studies would necessitate placing animals in the drone planes.

Estimate of personnel and laboratory facilities is included.

L. A. Scientific Laboratory
Dr. Robert Carter, et al

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APPENDIX 3.4.2

Methods have been developed at the Naval Medical Research Institute to obtain integrated radiation dosage measurements using certain activated crystal structures. Captain Draeger will present this material.

Personal communication from Captain Draeger

APPENDIX 3.5

Since the responsibility of this Committee is to provide a protocol for the biologic studies at the future atomic tests, it is proper for it to consider the logistic problem of the laboratories, and to make appropriate recommendations.

The National Military Establishment representatives have recommended the construction of suitable laboratory facilities; and it appears, at present, that the Navy is prepared to build and equip laboratories for the use of the Services. Unofficially, it also appears that they are willing to provide facilities to a reasonable extent for other research workers. It is realized that the entire plan cannot be drawn up now; yet it seems proper to attempt an estimate of:

- a) The overall laboratory space requirement
- b) The laboratory equipment requirement
- c) The number of personnel for the tests
- d) The animal housing facilities
- e) Special requirements for returning test material to the United States for study.

Discussion and specific recommendations are invited, within the limits of present plans.

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