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Washington, D. C.
June 10, 1949

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Dr. Shields Warren, Director,
Division of Biology and Medicine,
U. S. Atomic Energy Commission,
Washington, 25, D. C.

Dear Doctor Warren,

1. In your letter of May 10, 1949 you appointed an Ad hoc Committee "for planning biologic aspects of future atomic bomb tests". This Committee was charged with "the important responsibility of setting up the protocol for observations in the field of Biology and Medicine which it is desirable to make in future tests."

2. The Committee met in Washington on June 7, 8 and 9 to evaluate proposals for tests submitted by the National Military Establishment and certain facilities of the Atomic Energy Commission. We now submit to you our selection from these proposals, arranged into a series of eleven projects which, in our opinion merit investigation. To complete the protocol requested we are also submitting a tentative recommendation for the laboratory facilities that this program will require, as well as a statement of the estimated logistic effort as regards personnel.

3. Our findings and our plans are contained in the attachments to this letter, as follows:

- A. Agenda: a short description of each of the several proposals, with an excerpt of its relevant features.
- B. The complete minutes of the three day session.
- C. The program of tests approved by the Committee after consideration of the proposals.
- D. A tabulation of the minimum physical facilities required to provide adequate conditions for the conduct of the program.
- E. A tabulation of the personnel who will be available for the conduct of the tests.
- F. A summary of the estimated logistic effort as regards personnel.

4. We would like to call your attention to three resolutions that were passed unanimously by your Committee:

- A. Resolved: that it is desirable to conduct atom bomb tests on animals whose response to ionizing radiation is well known from laboratory studies.
- B. Resolved: that an animal breeding colony should be established on Eniwetok Atoll to provide an adequate supply of acclimatized, calibrated animals.
- C. Resolved: that the biological and medical research laboratory should be on the same island as the animal colony.

Future tests

Dr. Shields Warren, cont'd.

5. The Committee is pleased to acknowledge the many kindnesses of your associates in the Division of Biology and Medicine.

Respectfully submitted,

W. D. Armstrong,	University of Minnesota
S. L. Clark,	Vanderbilt University
D. B. Dill,	Edgewood Arsenal
R. H. Draeger	Naval Medical Research Institute
Jacob Furth	Oak Ridge National Laboratory
L. O. Jacobson	University of Chicago
W. J. Langham	Los Alamos Scientific Laboratory
F. K. Sparrow	Brookhaven National Laboratory
R. E. Zirkle	Argonne National Laboratory

G. V. LeRoy,	Northwestern University
Chairman	

G. V. LeRoy M.D.

Attachments:

- A - Agenda
- B - Minutes
- C - Approved Tests
- D - Facilities Required
- E - Personnel Required
- F - Logistic Estimate

Att. C: THE PROGRAM OF TESTS APPROVED BY THE AD HOC COMMITTEE

Proposal*
Number

Project 1: Animal Colony

- 3.1 Responsible Agency: National Military Establishment (NMRI)
Objective: To provide an adequate number of mice, dogs and pigs. These animals would be acclimatized to the total environment. Their LD50 for 250 KV x-ray would be determined after acclimatization. It is planned to provide 5,000 - 10,000 mice of the CF-1 strain; 500 dogs, preferably the Rochester beagle strain; and 500 pigs of the U.S. Department of Agriculture "hairless" strain.
Procedure: If approved, a Naval party will establish the colony at once to permit approximately 18 months of breeding. A veterinarian, indoctrinated in genetics, will accompany the party. New animals will not be introduced into the colony later than one year before the expected date of the tests. Sufficient animals will be bred to provide adequate controls. A reserve colony of equal size will be developed at the NMRI, in case of accidents. After the tests, representatives of the species, and survivors of the tests will be returned to NMRI for further study.

Project 2: Study of Acute Radiation Injury

- 3.2.1.1 Responsible Agency: National Military Establishment
Objective: To expose enough animals in enough positions to obtain valid statistical data for a study of acute lethality, vs distance and dose; LD50 vs distance and dose; and survival vs distance and dose.
Procedure: Mice, dogs and pigs will be placed in containers suitably shielded from heat and blast. These will be placed in the water and on land at predetermined distances from zero point; and are to be located so that they may be retrieved promptly. Animals will then be observed, sacrificed serially, etc.
- 3.2.1.4. Responsible Agency: Argonne National Laboratory
Objective: To attempt to separate the effects of prompt nuclear gamma radiation, neutron radiation, and gamma radiation from the fireball.
Procedure: Mice will be placed in heavily shielded containers with collimating slits directed toward the detonation point, and toward the estimated location of the fireball. Acute lethality, LD50 and survival will be studied.
- 3.2.4.1 Responsible Agency: National Military Establishment
Objective: To obtain animal tissues at the earliest possible time after exposure, and serially thereafter, for detailed histologic and hematologic study. There is a lack of information from Japan and Bikini on this early period.
Procedure: Animals exposed as in 3.2.1.1 will be retrieved at once. Some will be sacrificed at once, others serially at appropriate

*Refers to Agenda

intervals thereafter. The tissues would be fixed and preserved for study in the Naval Medical Research Institute, the Army Medical Center, and the Army Institute of Pathology. Blood studies would be made in the Island laboratory.

- 3.2.4.2 Responsible Agency: National Military Establishment
Objective: To obtain animal tissues at the earliest possible time after irradiation, and serially thereafter for histochemical studies. Such studies are being performed on tissues irradiated by conventional means, but none have been done on tissues exposed to atom bomb radiation.
Procedure: Tissues as obtained in 3.2.1.1 and 3.2.4.1 will be quick frozen at -55°F, and stored and transported in this condition to the Army Medical Center for histochemical study.
- 3.2.4.4 Responsible Agency: National Military Establishment
Objective: To obtain animal tissues at the earliest possible time after irradiation, and serially thereafter for studies of tissue enzyme systems. Such studies have been performed with x-radiation; none with the intense atom bomb radiation. Knowledge of pattern of change of tissue enzyme systems is sought.
Procedure: Tissues obtained as in 3.2.4.2 will be quick frozen at -55°C and transported in this state to the Army Medical Center for enzyme system studies.
- NCI** Responsible Agency: National Cancer Institute
Objective: To study the effects of the atom bomb radiation on the hematopoietic system, on longevity, as a source of genetic effect, and as a carcinogenic agent for mice.
Procedure: Animals would be exposed as in 3.2.1.1 at distances where sublethal doses could be expected. Long term follow-up, and breeding studies would then be conducted after returning the animals to the National Cancer Institute.

Project 3: Study of Thermal Injury

- 3.2.3.1 Responsible Agency: National Military Establishment
Objective: To study the relation of the mortality to surface area burned and to the degree of the burn.
Procedure: An attempt will be made by suitably timed shields to separate the majority of the thermal exposure from the ionizing radiation exposure. Suitably shielded pigs will be placed where burns of varying severity can be anticipated. The influence of the burn on mortality, and as a complication of radiation injury will be studied.
- 3.2.3.2 Responsible Agency: University of Rochester
Objective: To compare atom bomb flash burn with material from Bikini, and with flash burns produced in the laboratory.

** Proposal submitted too late for action by Committee

Procedure: Suitably shielded pigs will be placed where burns of varying severity can be anticipated. The histological character of the burns, and related phenomena will be studied in an attempt to evaluate other atom bomb flash burns, and laboratory flash burns.

- 3.2.3.5 Responsible Agency: Argonne National Laboratory
Objective: To analyze histologic changes in the skin of pigs exposed to thermal radiation, for comparison with the findings in the skin of the victims of the Los Alamos accident.
Procedure: Young pigs would be exposed, suitably shielded from blast, and by timing devices from some of the ionizing radiation. Specimens of skin would be removed, fixed and returned to the U. S. for study.

Project 4: Study of Blast Injury

- 3.2.3.3 Responsible Agency: National Military Establishment
Objective: To study blast injury using improved containers based on experience at Inyokern and Bikini. There were serious discrepancies at Bikini between the degree of injury and the estimated overpressure, with lethal effects from peak pressures that are not lethal with H.E. Further study of this is desired.
Procedure: Small animals, shielded from thermal radiation would be exposed in various positions related to blast measuring devices. They would be sacrificed as soon as recovered for study of blast effects.

Project 5: Study of Simulated BW Agents

- 3.3.7 Responsible Agency: National Military Establishment
(Part M-5) Objective: To study the effect of atom bomb radiation of the simulated BW agents currently under study by the Chemical Corps.
Procedure: Simulated agents, protected from thermal radiation would be exposed at various stations where predetermined radiation intensity is anticipated. Bacteriologic studies of the growth characteristics of these agents would be conducted at Eniwetok and in the U.S.

Project 6: Study of Hematology of Radiation Injury

- 3.2.4.5 Responsible Agency: National Military Establishment
Objective: To perform certain routine hematologic examinations for comparison with results obtained at Bikini and in the NMRI. To study the nature and the course of the hemorrhagic tendency in irradiated animals.
Procedure: Routine, complete studies of the hemogram will be made in the surviving large animals. The studies of the hemorrhagic state will be confined to histologic examination of appropriate tissues, and to biochemical studies of plasma, quick frozen at -55°F, and returned to NMRI for fractionation, etc.

Project 7: Study of Particulate Fission Products

- 3.2.2 Responsible Agency: University of Rochester
Objective: To study the distribution in lungs and other tissues of radioactive fission products, of dust containing induced radioactivity; using animals exposed at various sites.
Procedure: As amended, selected tissues from animals exposed in 3.2.1.1 would be available for preservation for radioautography, microincineration, and other suitable studies. (See original proposals 3.2.2.2; 3.2.2.3; 3.2.2.4; and 3.2.2.4.1.)
- 3.2.2.5 Responsible Agency: National Military Establishment
Objective: To study the distribution in animals of fission products inhaled and ingested in areas of fall-out.
Procedure: Where fall-out is expected shielded laboratory animals would be exposed for varying intervals of time; and in known areas of fall-out laboratory animals and indigenous forms would be collected after exposure and studied for the distribution and variety of fission products in the lungs and body.
- UCal* Responsible Agency: Crocker Laboratory, University of California
Objective: To investigate the behavior of radioactive aerosols produced by nuclear detonation, using experimental animals (rats); to evaluate and estimate the possible hazards to humans inhaling radioactive dusts and mists.
Procedure: Animals would be placed down-wind, suitably shielded from bomb radiations. If possible others would be placed in drone aircraft. Studies of chemical species of radioactive aerosols, their distribution, etc., would be performed using alpha, beta and gamma counters, electroscopes, etc.

Project 8: Biological Dosimetry

Objectives: This series of proposals involves the use of certain biological agents as dosimeters, on the basis of extensive laboratory studies.

Procedure: The dosimeter material would be placed in suitable containers, and in all the animal exposure containers. It would also be placed behind experimental shields, and in the high dose range. It is planned that the dose range: 20 - 600 r would be monitored by Tradescantia; 50 - 600 r by the CF-1 mice; 500 - 5000 r by Neurospora; 5000 - 20,000 r by Aspergillus; and 5000 - 50,000 r by Zea.

Responsible Agencies:

- 3.3.3 Tradescantia Oak Ridge National Laboratory, and NME
- 3.3.4 Zea U.S. Department of Agriculture, and NME
- 3.3.5 Aspergillus Oak Ridge National Laboratory, and NME
- 3.3.9 Responsible Agency: Los Alamos Scientific Laboratory
Objective: To use alterations of the size of spleen, thymus, and

*Submitted too late for
action by Committee

changes in the ratio: white pulp/red pulp after 250 KV x-ray as an indicator of equivalent radiation. It is proposed to attempt biological monitoring of atom bomb radiation in certain localities by taking advantage of this effect.

Procedure: Mice whose response to 250 KV x-ray is well known would be exposed in the approximately 50 - 600 r range in locations where integrated dose measurements are desired, as behind shields, in drones, etc. Approximately 5 days after exposure the animals will be sacrificed and the measurements made.

✓ Project 9: Genetical Effects of Atom Bomb Radiation

Objectives: This series of proposals involves the exposure of biological material whose genetic response to conventional forms of ionizing radiation and to atom bomb radiation is known. It is hoped to extend and complement earlier studies of mutations, mutations rates, etc. In the case of Neurospora, reversal of mutations obtained at Bikini will be sought; and additional chemical mutants will be looked for. The problem of the high incidence of chlorotic kernels in corn exposed at Bikini will ~~xxx~~ be studied further.

v Procedure: Most of these materials will be exposed also as biological dosimeters; but also samples will be placed in the very high dosage range. Most of the materials will be returned to the U.S. for further study. Aspergillus and Neurospora will be cultured in the Island laboratory before the tests.

Responsible Agencies:

- 3.3.4 Zea, and other U. S. Department of Agriculture, and NME cereals
- 3.3.5 Aspergillus terreus: Oak Ridge National Laboratory, and NME
- 3.3.6 Neurospora cressa: Oak Ridge National Laboratory, and NME

Project 10: Effect of Atom Bomb on Local Fauna and Flora

- 3.4.1 Responsible Agency: U.S. Department of Agriculture and NME
Objectives: To study the thermal and blast effects of atom bomb blast on local fauna and flora, to extend observations at Bikini and Eniwetok. Naturalists, qualified in a number of fields: birds, insects, plants, etc. may be available.

Project 11: Dosimetry with Mineral Substances

- 3.4.2 Responsible Agency: National Military Establishment
Objective: To conduct further studies on certain minerals: Vikor glass, activated halides, etc, which are affected by ionizing radiation. Preliminary studies at the NMRI and at Bikini suggest that these agents may be useful, rugged, integrating dosimeters for personnel, and other purposes.
Procedure: Samples of these calibrated radiation-sensitive materials will be placed in all animal containers; and at a number of other stations where very precise physical measurement by other means are being made; and at stations where high intensity is expected.

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Att. D PHYSICAL FACILITIES REQUIRED FOR THE BIOLOGICAL AND
MEDICAL LABORATORY TO ASSURE SATISFACTORY
WORKING CONDITIONS FOR THE PROGRAM

1. Buildings:

a. Laboratory: Two (2) units, 24' x 80' placed side by side. Each of these units should have a corridor 4' wide on one side of the building; and each should then be divided into 5 basic laboratory units, 20' x 16' each. The purposes for which the small rooms would be used are as follows: large animal pathology, small animal pathology, blood collection and sample preparation, hematology, biochemistry, x-ray therapy unit, counter and calibration of instruments, office and storage.

b. Mouse Colony: One unit 24' x 80', without subdivisions to house the animals, in proper cages, on proper racks; and one shed, 24' x 20' equipped as wash house with running sea water for washing, cleaning and sterilizing the cages.

c. Storage Building: One unit, 24' x 40' for general storage of dried food, equipment, etc.

d. Shed to cover diesel generators.

e. Shed to cover walk-in refrigerators.

2. Services:

a. Two (2) 75 KW, 3 phase, 220 VAC, diesel generators.

b. Fresh water supply system: a storage tank of at least 2000 gals capacity, with a distribution system; and facilities for pumping water from water barges.

c. Salt water supply system: a heavy duty pump and piping to provide sea water for washing animal facilities

d. Two (2) 900 cu. ft. walk-in type refrigerators: one for storing specimen carcasses; the other for fresh feed; capable of holding contents at 35 - 40°F.

e. Three (3) Carrier deep-freezes, 9 cu feet, capable of holding a full load at -55°F.

f. X-Ray therapy, 250 KV apparatus

g. Incinerator: diesel oil operated, flash type for disposal of excreta-soaked shavings, etc.

h. Sewage system: for disposal of laboratory and human wastes;

1. Water distillation apparatus, for drinking water:
Capacity of 500 - 1000 Gal/day.

j. Runways, wire fencing, and half-shelters for large animals.

3. Communications:

a. Three telephones connected with the inter-island telephone system are required.

4. Transportation:

a. Two (2) jeeps with trailers, and one weapons carrier.

b. Two (2) LCVP type boats.

There is no plan to have living quarters or messing facilities on the island with the laboratory and animal colony.

Att - E.

ESTIMATE OF PERSONNEL AVAILABLE/REQUIRED FOR

BIOLOGICAL AND MEDICAL PROGRAM

Project	Proposal	Proposer	Scientists	Technicians	Man Days	Time on Island*	
			Officers	Enl. Men		Pre	WKS Post
1	3.1	NME	2	37	20,000	72	10
2	3.2.1.1	NME	6	12	1,620	12	6
	3.2.1.4	ARG	2	4	420	8	6
	3.2.4.1	NME	**				
	3.2.4.2	NME	**				
	3.2.4.4	NME	**				
	NCL	NCI	1	2	210	6	6
3	3.2.3.1	NME	1	2	240	8	6
	3.2.3.2	ROCH	1	2	240	8	6
	3.2.3.5	ARG	1	2	240	8	6
4	3.2.3.3	NME	1	4	450	12	4
5	3.3.7	NME	1	2	120	4	4
6	3.2.4.5	NME	2	8	1,000	12	6
7	3.2.2.2°	ROCH	1	2	210	6	6
	3.2.2.3°	HAN #	-	-	-	-	-
	3.2.2.4°	ARG	1	2	210	6	6
	3.2.2.5	NME	**				
	UCal	UCAL	1	4	350	6	4
8,9	3.3.3	OAK	2	4	420	8	4
	3.3.4	USDA	1	4	200	4	4
	3.3.5	OAK-NME**	2	4	360	6	4
	3.3.6	OAK-NME**	2	4	360	6	4
	3.3.9	LA	1	4	300	8	4
10	3.4.1	USDA-NME**	1	2	240	8	6
11	3.4.2	NME	1	2	210	8	4
<u>Totals</u>		8	<u>31</u>	<u>107</u>	<u>27,400</u>		

References: * Maximum estimated time, weeks
 ** Personnel included in other estimates
 ° No commitment of personnel

<u>Sources of Personnel:</u>	<u>Sci-Off</u>	<u>Tech-EM</u>	<u>Man Days</u>
A.E.C.	12	28	2400
N.M.E	16	71	7400
Other US Govt	3	8	
Administrative	4	22	

MINUTES OF AD HOC COMMITTEE

June 7, 1949

The meeting was called to order at 10:15 A.M., June 7, in the conference room 320 of the Atomic Energy Commission in Washington, D.C. The following members were present: Drs. Langham, Jacobson, Zirkle, Furth, Armstrong, Dill, Sparrow and Clark, and Capt. Draeger and his associate Dr. Lee. The Chairman read the following opening statement: "Gentlemen, first may I thank you very much for agreeing to serve on this committee with ^{me} ~~them~~. I have attempted to make the task of selecting a program for biological tests in connection with future atom bomb testing a little easier for you by preparing the proposals in some sort of order so that you can consider similar projects together.

"Rather than ask you to begin immediately on your evaluation I have planned some orientation material for you. This will consist of a statement by Dr. Wright Langham of the Los Alamos Scientific Laboratory concerning the general geographical situation of the Eniwetok Atoll Proving Grounds. He will follow this with a general review of the physical and administrative plans for the tests, and he will also outline to you briefly the philosophy, so to say, of the use of the atomic bomb in biological testing. He will present the views that have developed among the weapons group at Los Alamos who are responsible for the conduct of the test. Following this Capt. R. H. Draeger (MC) USN of the Naval Medical Research Institute will speak to you briefly about the practical experience that he has gained at Inyokern, Bikini and Eniwetok tests. I hope that he will dwell mainly on the difficult condition encountered in a broad general way. Immediately after luncheon we shall go over to the Navy Building and see an official film of the previous tests at Eniwetok, so that you can form an image of the overall physical conditions out there, particularly the conditions to which the subjects of the tests may be exposed.

"I would like to ask you to bear in mind four things when you are considering the proposals.

1. Is the atomic explosion the only possible source of radiation for the type of study in question.
2. Are the allied conditions of the bomb burst: the heat, blast, contamination with fission products; and induced radioactivity such that a just evaluation of the radiation effect under study will be difficult or impossible.
3. Are the climatic conditions of Eniwetok and the test conditions such that the results may be compromised or nullified.
4. I do not think that you should worry too much about the logistic problems, the expense, or the apparent mechanical difficulties that suggest themselves to you. It is my observation that such things can be solved if there is a good reason for solving them.

"After that I would like you to go to your quarters and read carefully and critically the material of the agenda. It is obviously synoptic in character, but your familiarity with the design of experiments, the weighing of evidence and the evaluation of the intangibles of experimentation should permit you to formulate views on the proposals. Tomorrow morning we shall assemble at 8:30 A.M., promptly, and will then consider each item separately and serially. I believe that some parliamentary order is desirable and I would like after a free discussion to call for a vote on each proposal, with a simple majority of those voting being sufficient for group approval. It is absolutely essential that decisions be made as to the projects to be selected. Your recommendations will be passed to Dr. Warren's Medical Advisory Board for review. After that the projects become the biological and medical program for the tests subject to the final approval of the Scientific Director, Dr. Alvin C. Graves. It is apparent that so far as possible final decision should be made in the next two days."

Dr. Langham than reviewed the organization and the policies of the test programs and presented a general description of the geographical conditions at Eniwetok as well as a preliminary outline of the character of the test.

Dr. Zirkle asked whether the physical data would be useful to the biologist; specifically would there be data concerning the energy spectra and would the physicists present the data as dose measurements. He would like to have measurements in rep. If this is not to be available can the biologist make their own measurements?

Dr. Langham assumed that considerable measurements would be made. If they were inadequate, the biological section would then have to make their own. However, it is not contemplated that the biologist would establish an extensive measurement program.

Dr. Draeger discussed the experience that he had gained at Inyokern, Bikini and Eniwetok. He covered the following topics:

1. Objections to choice of animals from antivivisection groups and others.
2. Climatic problems.
3. Blast problems
4. Thermal radiation problems
5. Radiation injury study problems.
6. Difficulties in identification of animals.
7. Hematology: small animals studies have not been profitable, those on large animals have.
8. Maintenance of records.
9. Exact conditions of exposures, temperature, blast effects, etc.
10. The experience with containers at Eniwetok - thermal changes, the tank type container, packaging problems, etc.

Dr. Zirkle asked if sufficient small animals and other type containers could be anchored in the lagoon which would satisfactorily stand the Blast. Dr. Draeger thought they could.

Dr. Zirkle also wondered if the LD 50 changed any under the conditions of life in the tropics. It was the general opinion that some sort of study should be made to determine whether there was a change.

The meeting adjourned at 12:15 P.M.

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At 1:30 the special film was shown at the Navy Department following the return to the conference room, there was general discussion and the meeting adjourned at 3:30 P. M.

Respectfully submitted,

George V. LeRoy

MINUTES OF AD HOC COMMITTEE (CONT'D)

June 8, 1949

The ad hoc committee came to order on June 8 at 10:15 A.M. in the conference room 320 of the Atomic Energy Committee, Washington, D.C. The following members of the committee were present: Dr. Langham, Jacobson, Zirkle, Furth, Armstrong, Dill, Sparrow, Clark, Capt. Draeger and his associate Dr. Lee.

Since the previous meeting of the members of the committee have studied the agenda (attached) and discussion of the various proposals and voting on them commenced at once. A transcript to the proceedings was not kept but in the minutes relevant comments will be found preceding the action of the committee. All proposals after discussion were voted on. A majority of those voting were considered sufficient for approval of the project. It will be seen that in some instances the scale of the project has been altered and then voted upon, contingent upon the change in scale.

The primary question of the desirability of biological studies of animals exposed to an atom bomb explosion was discussed. It was generally agreed that such studies were desirable when conducted on strains whose response to ionizing radiation in the laboratory was well known. A resolution to this effect was moved, seconded, and unanimously passed.

3.1* Animal Breeding Colony: This project was discussed extensively. It was agreed that the fundamental value of the colony was to have on hand strains of animals acclimated to the local environment and calibrated for the effects of ionizing radiation after a period of time on the test Atoll. It was the general opinion that "Acclimated" should be taken to mean acclimated to the total environmental conditions. It was pointed out that new diseases were the principal hazard especially for the inbred strains of mice. It was agreed that specific strains be selected

*Refers to numbers in the appendix prepared for the committee (see attached).

for the colony after all the proposals were evaluated; that these strains be introduced later than one year before the test; that a qualified veterinarian with genetic training be on hand; that the strains be calibrated against 250 Kv X-ray after at least 60 days residence in the tropics; and that a reserve breeding stock of the same size and strains be built up in the United States in case of emergency.

3.1 was approved

3.2.1 This group of studies have a two-fold purpose; a) the study of lethal dose, survival, and LD 50 of well calibrated laboratory animals exposed to atom bomb explosion at varying distances. b) to provide material for special histological and histochemical studies described below. It was emphasized that the weapons effect is the sole purpose of the bomb and that the characteristics of atom bomb radiation should be studied to assist in planning radiological defense and the medical care of atom bomb casualties. The difficulties of dosimetry were explored and it was the consensus of opinion that biological dosimetry (see below) could complement and supplement the physical measurements. It was proposed that enough animals should be exposed in enough positions to assure reasonably valid statistical results for a study of lethal dose, LD 50 and survival.

3.2.1.1; 3.2.1.4 were approved (3.2.1.2. and 3.2.1.3 were duplications and were suggestions rather than actual experimental proposals).

3.2.3.1; 3.2.3.2 and 3.2.3.5 This group of projects are concerned with the study of atom bomb flash burn. The purpose of the study is to correlate the effect of the weapon with laboratory studies of flash burns (3.2.3.1 and 3.2.3.2); and to compare the atom bomb flash burns with changes in the skin of victims of accidents at Los Alamos Scientific Laboratory (3.2.3.5). It was agreed that studies of atom bomb flash burns should

be made and that the pig should be the only animal used.

3.2.3.1; 3.2.3.2 and 3.2.3.5 were approved.

3.2.3.3 This study is based on the fact that studies of atom bomb blast injury at Bikini revealed effects out of proportion to the extent of overpressure as compared with conventional explosives. Further studies are desired for military and medical purposes.

3.2.3.3 was approved

3.2.3.4; 3.3.7. These studies involve actual and simulated bacteriological warfare agents. It was the opinion of the committee that the facts sought could be studied in the laboratory; that the experiments would not be critical; and that they would introduce potential hazards into the test.

3.2.3.4 was disapproved; 3.3.7 (Part M-3) was disapproved; but Part M-5 involving exposure of harmless simulated Bacteriological Warfare agents was approved.

3.2.4.1; 3.2.4.2; 3.2.4.4. These studies are related, and concern the rapid procurement of exposed animals for serial sacrifice. The object is to obtain pathological, histochemical, and enzymic material as soon after exposure to atom bomb radiation as possible. This information is needed to provide the medical profession with information concerning early effects of atom bomb radiation for comparison with similar animal material exposed to conventional radiation. Such animals would be exposed at sea, could be recovered rapidly, autopsied, and the tissues processed, or quick-frozen for despatch to laboratories in the U.S. for study. Others similarly exposed would be sacrificed serially for the same studies.

3.2.4.1; 3.2.4.2; 3.2.4.4 were approved.

(Comment: The committee suggested that the planning of these studies should include consultation with authorities on histochemistry, as

Seligman of Boston and Gomori of Chicago).

3.2.4.3 This proposal involved the acquisition of material as in 3.2.4.1, etc. and a study of isolated enzyme systems in a special laboratory on Eniwetok. It was the consensus of the group that this was not feasible.

3.2.4.3 was disapproved.

3.2.4.5 This study involved a study of the hemorrhagic manifestations of atom bomb injury by means of materials frozen or fixed on the spot and returned to U.S. for analysis. It was agreed that limited trials of special anti-hemorrhagic agents should be approved if developed prior to the test.

3.2.4.5 was approved

3.2.4.6 This study was concerned with the action of atom bomb radiation on dental structures. The committee recommended that the proposal to investigate special strains of animals and cariogenic diets be deleted; and that the study be confined to material returned to the U.S. for other pathological studies.

3.2.4.6 was disapproved.

3.2.5 The three projects in this group involved experimental therapy of animals suffering from atom bomb radiation injury. The committee did not believe that such studies would be profitable or critical.

3.2.5.1; 3.2.5.2; 3.2.5.3 were disapproved.

3.2.2. This group of studies was concerned with the distribution of particulate fission products, and radioactive dust in the bodies of exposed animals. One portion (3.2.2.1) proposed extensive studies of particle size involving a large number of personnel to operate Cascade Impactors. The committee agreed that this was a very complex and difficult subject; and that useful, critical results were unlikely. It was recommended

that no special systematic particle studies be undertaken; but that animals sacrificed for other studies were available for autography, etc. which could be done, preferably in the U.S. The committee also recommended that collaboration be sought with U.S.A.F. units that might be interested in studies of animals in drone planes.

3.2.2.1 was disapproved

3.2.2.3; 3.2.2.4; 3.2.2.4.1 were disapproved as proposed, but the recommendations of the committee are to be called to the attention of the proposer.

3.2.2.5 This study depends on there being a fall-out of fission products from the cloud on some of the islands of the group. Studies would then be made of the uptake of this material by indigenous species, and by mice introduced into the area.

3.2.2.5 was approved contingent on the occurrence of such a fall-out.

3.3. This group consists of biological studies whose purposes are as follows:
a) fundamental genetic studies of biologic material exposed to very high intensity, short duration and mixed radiation; b) the use of certain biological agents for biological dosimetry, employing strains whose response to various ionizing radiation is well known. This would provide information in terms of equivalent to so many r of x-radiation, neutron radiation, etc.

3.3.1; 3.3.2 Deleted, since no definite proposal was submitted (mouse-drosophila genetics).

3.3.3. Studies of Tradescantia were proposed. The committee believed that the conditions of the experiment would make most of the proposals difficult of accomplishment. However, the committee believed that Tradescantia could serve as a useful biological dosimeter for the 20-600 r. gamma range; and that it should be used for this purpose. Collaboration of the groups proposing the studies was recommended.

3.3.3. was approved.

3.3.4 These studies of corn seeds, exposed to high intensity radiation were requested by the U.S. Department of Agriculture to supplement 3.3.4 was approved.

3.3.5; 3.3.6 Genetic studies of aspergillus spores, and Neurospora were proposed to supplement and extend earlier studies. Neurospora, in particular, is useful as a biological dosimeter.

3.3.5; 3.3.6 were approved

3.3.9 This series of projects involve a proposed system of biological monitoring of radiation expressed as "equivalent to 250 Kv x-radiation effect." The method is particularly applicable to a study of effectiveness of shields; integrated exposure of drone plan occupants, etc. 3.3.9 series was approved.

3.4.1. This project involves observation on local indigenous fauna and flora by specialists in entomology, botany, etc.

3.4.1 was approved

3.4.1.2 This was a proposal for a study of aquatic fauna and flora after atom bomb explosion.

3.4.1.2 was disapproved

3.4.2 This is a study of the use of activated crystals and other inert materials as integrating dosimeters. The committee recommended that these materials be placed with all exposed animals.

3.4.2 was approved

In summary: 35 projects were considered by the committee; of these 20 were approved - in some cases with recommended changes; 11 were disapproved; and 4 were deleted for various reasons.

The committee adjourned at 5:45 P.M.

MINUTES OF AD HOC COMMITTEE (cont'd)

June 9, 1949

The meeting of the ad hoc committee was called to order at 9:15 P.M., June 9, 1949 in room 330, Atomic Energy Commission, Washington, D.C.

The following members were present: Drs. Langham, Zirkle, Jacobson, Furth, Armstrong, Sparrow, Draeger and Clark.

3.1 (refers to agenda)

1. The question of the types of animals to be included in the Animal Breeding Colony was discussed in great detail. It was the consensus of the group that the majority of the radiobiological studies should be made with only one strain of mice. The CF-1 strain was selected because of the great amount of radiobiologic data available for this strain. It was agreed that sufficient animals should be bred under optimum conditions, to assure a supply of about 5000 mice of the optimum age: 7-12 weeks, at the time of the tests. The LD 50 with 250 KV x-ray for this strain is to be determined on Eniwetok.

2. For the large animal studies to provide materials for biochemical, hematologic, histologic and histochemical studies, it was agreed that the dog and pig should be used. The strain of dog which has been most carefully studied from a radiobiologic standpoint is the beagle strain bred for the University of Rochester. The LD 50 with 250 Kv x-ray for this strain on Eniwetok is to be determined.

3. The animal chosen for flash burn studies was the pig. This species will also provide material for histologic, hematologic and other studies to supplement and extend the observations made at Bikini. The strain recommended is the "hairless" one developed by the U.S. Department of Agriculture. The Ld 50 with 250 Kv x-ray for this strain, on Eniwetok, is to be determined.

4. Small numbers of other species may be introduced into the colony (but not bred there) for special studies approved by the Committee.

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5. At the termination of the tests, representatives of all species should be returned to the U.S. for further study in the Naval Medical Research Institute; for comparison with the control colony.

The foregoing proposals were voted upon and there was unanimous approval.

The plans for the location of the laboratories were presented by Dr. Wright Langham. At present it appears that the bio-medical laboratory is to be located on Parry Island; and the animal colony is to be on Japtan Island - about 2 miles, and 5-10 minutes distant, by water ferry. There was vigorous and unanimous disapproval of this plan to separate the laboratories from the animal storage areas. After general discussion it was the consensus of opinion that such a separation would make the bio-medical laboratory virtually non-functional. The following resolution was moved, seconded and passed unanimously.

Resolved: that the biomedical laboratory must be on the same island as the animal colony.

The minimum requirements of physical facilities for the support of the biological and medical research program were then discussed in great detail and at length. The following proposals for installations are to be considered as the minimum to permit a reasonable likelihood of successful execution of the test-program. In accordance with information provided by Dr. Langham, the building specifications have been given in multiples of the standard 24x4' prefab units.

1. Buildings:

a. Laboratory: Two (2) units, 24'x80' placed side by side. Each of these units should have a single corridor, 4' wide on one side of the building; and each should be then divided into 5 basic laboratory units 20'x16' each. The purposes for which each smaller unit would be used, are as follows: large animal pathology, small animal pathology, blood collection

and sample preparation, hematology, biochemistry, x-ray, counter and calibration; storage and office.

b. Mouse Colony: Two (2) units: one 24'x80' to house the animals in proper cages, on proper racks; and one 24'x20' equipped as a wash house for cleaning and sterilizing the cages.

c. Shed for Electric Generators: Sufficiently large to house two (2) 75 KW Diesel generators.

d. Shed for refrigerators: Sufficiently large to house two (2) 900 cu. ft. walk-in reefers: one for storage of carcasses, specimens, etc; and one for storage of fresh food for animal colony.

e. Storage Shed: 24'x40' for general storage of dried food, equipment, etc.

f. Fresh Water Supply System: A storage tank of at least 2000 gals. capacity with a distribution system; and facilities for pumping water from water barges.

g. Salt Water Supply: A pump and piping to provide sea water for washing animal facilities is required.

h. Sewage System: For disposal of laboratory wastes, and human sewage. A system with a maximum capacity of 100 persons should be adequate; using soakage pit, septic tank, or sea disposal.

i. Incinerator: Diesel oil operated, flash burner type of capacity sufficient to dispose of 200-300 lbs. of excreta soaked shavings from mouse colony, etc., per day.

j. Runways, and shelters for dogs and swine.

2. Communications: A maximum of three telephones, connected with the inter-island telephone system is required.

3. Heavy equipment: Exclusive of laboratory apparatus.

a. Diesel generators: 75 kw; 3 phase, 220 volt A.C. Two are required; one as spare.

- b. Water distillation apparatus: Capacity of 500-1000 gal/day.
- c. Walk-in type; 900 cu. ft.; gasoline or electrically operated reefers; capable of holding a full load at 40° F.; 2 required.
- d. Deep-freezer. Carrier model, 9 cu. feet; capable of holding contents at -55° F; 3 required.
- e. Therapy model, 250 Kv x-ray apparatus suitably installed for "calibration" of animal species for tests.

4. Transportation Facilities: 2 jeeps with trailers, 1 weapons carrier, and two LCVP type boats.

There are no living or messing facilities planned or contemplated; except temporarily for Navy Personnel while Parry Island development is underway.

A soil stabilization program is not necessary.

The foregoing plan was approved unanimously.

The chairman thanked the committee for their cooperation and their efforts.

Adjourned at 1 P.M.

George LeRoy
Chairman

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SUMMARY OF LOGISTIC EFFORT AS REGARDS PERSONNEL

<u>Type of Personnel</u>	<u>Scientist Officer</u>	<u>Technician EM, Labor</u>	<u>Total Man-Days</u>
Administrative	4	22	2400
Laboratory Staff	29	70	7400
Animal Colony (USN)	2	37	20000
Totals	35	129	29,800

PROPOSED ADMINISTRATIVE STAFF FOR LABORATORY

<u>Duty</u>	<u>Scientist Officer</u>	<u>Enl Man Labor</u>	<u>Duty</u>
Director	1	1	clerk-typist
Deputy Director	1	2	clerk-typist, telephone, etc
Supply Officer	1	3	
Engineer Officer	1	2	electricians
		4	water-detail
		4	motor pool, outside cleanup
		4	inside cleanup-janitor
Physician, dispensary (Assigned from other duties)***		2	corpsmen
Totals	4	22	