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March 7, 1952

To: File

From: Karl Z. Morgan

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C. S. Shoup, AEC

A meeting was held at the Wright Patterson Air Base in Dayton on March 6, 1952, to discuss "Medical Aspects of Nuclear Powered Aircraft." Persons attending from the laboratory were Dr. Jacob Furth and Karl Z. Morgan, and the others from the area were Dr. C. S. Shoup, Chief, Biology Division, Office of Research and Medicine, AEC, and Dr. Cyril Comar, Director and Research Coordinator of the Laboratory, UT - AEC Agricultural Research Program. Also Dr. Andrew H. Dowdy from the Atomic Energy Project, University of California, was present at the meeting, and Dr. Franklin C. McLean, of Argonne National Laboratory. Enclosed is a copy of the program.

I did not take any written notes on the meeting, so what I will say is from memory. Most of the biological information had no relationship to radiation problems. A great deal of the discussion had to do with the present status of nuclear aircraft propulsion projects, engineering developments of various types, classified information about the forthcoming atomic tests, and a review of the biological programs. During the discussion of the various biological programs, Dr. Furth outlined for them the principal criteria that they might use as points of reference to biological changes of significance at the levels of radiation exposure anticipated in the operation of nuclear propelled aircraft. There were about 35 persons attending this conference, most of them colonels in the Air Force or local research personnel. In addition to the items listed on the enclosed program, Col. John M. Talbot outlined the various medical programs under his supervision.

Among the various items discussed, I was interested to note that they had given exposures ranging from 15 to 50 r (from 450 kv X-rays) total body to several different humans, presumably terminal cancer patients, and had observed no ill effects. In describing experiments with monkeys it was indicated that single dose exposures of a thousand and more r did not decrease the ability of the primates to follow through accurately rather complicated patterns which meant the proper choice in a long succession of pairs in order to pick up the right one of a final pair, under which was hidden a choice morsel of food. In fact, the animals could follow these patterns through accurately and efficiently up to a few hours before their death resulting from exposure to large doses of radiation.

Cosmic ray studies are being made in order to find out what tissue changes may result from the penetration of body tissue by high-energy heavy ions (with masses as high as iron and ranges of over 10 cm in tissue). Their respirator and filter studies are typical of those at other laboratories. The X- munition discussions and outline of plans for the forthcoming tests at Nevada and Eniwetok led them to reveal some very interesting but highly classified information (the details of which I try to forget).

As the last item on the program, Col. John Talbot stated that he had heard that discussions had been held in Oak Ridge in the interest of a proposed project to check the 25 r permissible exposure per flight mission. To lead off this discussion, one of the colonels gave the following values for the breakdown of the flux:

3 Mev gamma 0.19 r/hr (3.5×10^5 $\gamma/cm^2/sec$ = 1 r/hr)

5.3 Mev n 0.0841 rem/hr (2×10^4 $n/cm^2/sec$ = 1 rem/hr)

He was not quite certain whether this was inside the personnal compartment or just outside, and whether the neutron value was in reps or rems. It is my understanding that we are thinking in terms of exposures inside the personnal compartment as follows:

0.75 rem gamma $\sim$ 0.75 rep gamma

0.25 rem n_f $\sim$ 0.025 rep n_f

I do not know what the corresponding mean energies are in this case.

At this point in the discussion I took the floor and emphasized the importance of a series of experiments to determine the consequences if humans are exposed to 25 rems per flight mission when these missions may be repeated perhaps once a week to the accumulation of as much as 200 rems in 2 months.

I indicated the importance of experiments that would duplicate the exposure rate, the repetition of exposures, and exposures to the proper spectral distribution of gammas and neutrons. I suggested that it might be relatively simple to make use of the swimming pool reactor and a bathysphere in exposing animals to meet these requirements. I stated that (in addition to the swimming pool reactor) we have the further advantage as a place to carry on these experiments that Oak Ridge National Laboratory was the only laboratory at present equipped to make accurate dose measurements of fast neutrons. I described briefly the G. S. Hurst - R. H. Ritchie dosimeters, and particularly the cavity chamber based on the Bragg-Gray principle, using the simplified integrating circuit with an infinite memory, which has the advantage in that it measures the fast neutron dose (or the product of the flux times the energy times any other weighting factor we wish to incorporate as a function of the energy). When the radiation comes from any direction, such chambers could be made very small and placed at various locations on the surface of the animals and inside the animals (or phantoms) in order to get the isodosage and depth-dose curves for the neutrons. In addition, Failla chambers could be used in combination with and without cadmium to get the total rep dose without and with the thermal neutron contribution, respectively. They seemed to be very enthusiastic about such a program and wanted to know how they could get it under way. One of the colonels remarked that he could get $300,000 for the program. I stated that we were not there to ask for money for the program, but rather to indicate our thinking and find out if they were interested in having such a program undertaken. Dr. Shoup pointed out that the next step was for them to arrange a meeting with AMDC and Dr. Shields Warren and determine whether or not they were interested in such a program being established at Oak Ridge National Laboratory.

In discussions I had with Col. John Talbot and one of his research men, Capt. G. Tohma, following the meeting, they indicated that when and if our program got under way they would like to consider the possibility of bringing some of their primates here for exposure. We could furnish them a model of the bathysphere at their home base in Texas (Randolph Field), where they would accustom the animals to entering this compartment. Then they would fly the animals to Knoxville, accompany them to the laboratory, remain here during the course of the exposures, and take the animals back with them to Texas; observing them over a long period of time for chronic developments. During the course of the stay in Oak Ridge some provision would have to be made to keep the animals at the University Farms Experimental Station or elsewhere, since doses of 25 rems per day might be repeated for successive weeks over a period of a few months and since some of the primates might be given very large accumulated exposures. The primates would be in conjunction with experiments on other animals (rats, mice, dogs, etc., that have a known pattern of response to radiation).

Karl Z. Morgan, Director
Health Physics Division

KZMimcf
Encl. - program

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CONFERENCE

THE MEDICAL ASPECTS OF NUCLEAR POWERED AIRCRAFT

Time 0900, 6 March 1952, Auditorium Building 196, Area B

Chairman - Colonel Robert H. Blount

Clearance - Formal Secret

[redacted]

0900 Introduction - Col. R. H. Blount

0915 The Current Status of Aircraft Nuclear Propulsion - - - - - - - -
- - - - - - - - Colonel J. Hood, Colonel D. Lay, Mr. J. Jones

1015 Coffee

1035 Effect of Weapons Upon Aircraft Structure - - - - - - - - Major J. Kelley

1115 Radiological Warfare Protective Program - - - - - - Colonel B. Witwer

1200 Aero Medical Laboratory Progress - - - - - - - - - - - Dr. J. P. Henry
- - - - Captain E. E. Ballinger

1230 Lunch

1330 General Discussion Period - - - - - - - - - - - - - - - - - Those Present

1615 Summary - Colonel R. H. Blount

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