

UNIVERSITY SOURCE	
University of Washington	
Manuscripts and University Archives Division	
RECORDS SERIES TITLE	
Herbert M. Parker Papers	
ACCESSION NO.	3616
FILE CODE NO.	
CARTON NO.	Box 5
FOLDER NAME	Stone (Robert S.)
NOTES	65 pages
FOUND BY	

COPY

724949

This document consists of 5
pages and 0 figures. No. 17
of 20 copies. Series B

- Series A -
- | | |
|----------------|-----------------|
| 1. A.H.Compton | 6. K.S.Cole |
| 2. A.H.Compton | 7. Chgo.Files |
| 3. R.S.Stone | 8. Central File |
| 4. R. L.Doan | 9. Readers File |
| 5. H.J.Curtis | |

DEPARTMENT OF ENERGY DECLASSIFICATION REVIEW	
SINGLE REVIEW AUTHORIZED BY:	DETERMINATION (CIRCLE NUMBER(S))
<i>De-las Authority 4/1/95</i>	1. CLASSIFICATION REQUIRED
REVIEWER (ADD): <i>HRB</i>	2. CLASSIFICATION CHANGED TO:
NAME: <i>Dennis W. Murphy</i>	3. CONTAINS NO UNCLASSIFIED INFO
DATE: <i>6/1/95</i>	4. COORDINATE WITH:
	5. CLASSIFICATION CANCELLED
	6. CLASSIFIED INFO BRACKETED
	7. OTHER (SPECIFY):

- Series B -
- | | |
|-----------------|------------------|
| 1. L.O.Jacobson | 11. K.Z.Morgan |
| 2. K.S.Cole | 12. W.H.Ray |
| 3. J.J.Nickson | 13. J.G.Hamilton |
| 4. C.L.Prosser | 14. S.L.Warren |
| 5. J.E.Rose | 15. H.E.Friedel |
| 6. A.Brues | 16. S.T.Centril |
| 7. H.J.Curtis | 17. R.S.Stone |
| 8. R.E.Zirkle | 18. Central File |
| 9. P.S.Henshaw | 19. Readers File |
| 10. J.E.Wirth | 20. Central File |

March 24, 1945

A. H. Compton

H. J. Curtis

BIOLOGICAL WORK AT CLINTON LABORATORIES

Dr. Stone suggested I write you regarding some of the results which have been obtained by the biological group at Clinton to supplement his recent letter to you on the aims and accomplishments of the biological program. From the purely biological side, our task here has been to investigate the biological effects of external radiations and other hazards which might exist in the neighborhood of a production pile.

It has been necessary to devise methods for exposing animals to the various radiations in pure form and over a wide range of intensities. The plan of the experiments has been to expose groups of animals to high intensities of a particular radiation and establish the acute lethal dose, and with this knowledge extend the work to lower and lower exposures extending over longer and longer periods of time. Specific findings and the present status of the work with the various radiations are as follows:

Gamma Rays: This radiation has been considered as equivalent to x-rays, about which a good deal is known medically. The other radiations have been compared then with this, both for acute and chronic effects, in order that results could be more easily applied to man. Many experiments are now in progress, essentially acting as controls for experiments with the other radiations.

Fast Neutrons: It has been found that for acute (30 day) death this radiation is 3.0 times as effective as gamma-radiation for equal energy absorption. When administered at a rate of 13 n/day and 4.5 n/day animals

~~SECRET~~

1173641

University of Washington	
Manuscripts and University Archives Division	
RECORDS SERIES TITLE Herbert M. Parker Papers	
ACCESSION NO.	3616
FILE CODE NO.	
CARTON NO.	Box 5
FOLDER NAME	Stone (Robert S.)
NOTES	65 pages
FOUND BY	

COPY

~~CONFIDENTIAL~~

-2-

die after accumulating about three times the acute lethal dose (90 n) but at 1.15 n/day after only 1.7 times the lethal dose. This is faster than for gamma radiation but how much faster is not known since the corresponding gamma ray series are not yet complete. Histological and hematological effects are almost identical with those produced by gamma rays, but the long term series are not complete. For acute effects, gamma rays and fast neutrons are completely additive.

Slow Neutrons: It has been found that 50% of mice will die in about 21 days following an 8 hour exposure to a slow neutron flux of 3×10^8 neutrons/cm²-sec. About one-fourth of this effect is due to capture gamma radiation from hydrogen, and the remainder presumably to proton and C^{14} recoil from the reaction $n^{14} (n, p) C^{14}$. These latter are produced preferentially in the nuclei of cells, and so produce maximum damage. Radioactive isotopes formed in the body as a result of exposure are a secondary hazard, of which phosphorus is the most important element, with Na, K and Cl playing minor roles. A few preliminary results on long term effects seem to indicate that this radiation may have very potent carcinogenic action, a hint of which has also been received from histological studies.

Beta Rays: In order to produce death it is necessary to apply about twice as much of this radiation as with gamma rays as measured on an equal energy basis. However, the absorption of gamma rays is proportional to the volume of the animal while with beta rays it is proportional to the surface area. Thus the acute lethal dose of beta rays for mice is 4500 r, for rats 7500 r, and for rabbits 20,000 r at the surface. However, since in this work the real danger from beta rays probably lies in damage to the skin of the hands leading to skin cancer, one, therefore, cannot reason that beta rays are less dangerous than gamma rays. Beta ray ulcers have been produced by local exposure which heal only after several months, and skin cancers have been produced in mice after only a single exposure. Histological studies show a heavy thickening of the skin following recovery, and metabolic studies show that large quantities of body fluids are lost through the damaged skin. Beta rays produce no effect on the blood count.

Other potential hazards in the neighborhood of the Clinton pile have fortunately been found to be negligible. All animals in the buildings and around the grounds are normal in every respect and this work will soon be discontinued. Rabbits have been exposed to the undiluted pile stack gases for about 15 months and are still normal in every respect. From studies on fission recoil isotopes obtained by placing bare uranium foil in the pile, it has been found that the hazard due to the inspiration of these products is a very minor one, and if such products were released in the air the danger would be from external beta and gamma radiation.

It can then be said that perhaps our hardest task, that of developing exposure methods, is complete and that many of our hardest biological

1173642

~~CONFIDENTIAL~~

DOCUMENT SOURCE	
University of Washington	
Manuscripts and University Archives Division	
RECORDS SERIES TITLE	
Herbert M. Parker Papers	
ACCESSION NO.	3616
FILE CODE NO.	
CARTON NO.	Box 5
FOLDER NAME	Stone (Robert S.)
NOTES	65 pages
FOUND BY	

COPY

-3-

~~CONFIDENTIAL~~

~~SECRET~~

problems have been solved. Since July 1944 we have been observing the prolonged effects of radiations, and the longer these observations are continued the more information we will have. Results already obtained from these experiments have indicated the desirability of starting a number of new series. I feel that this laboratory is almost uniquely equipped to continue these studies, and that it would be a mistake to curtail them.

H. J. Curtis

HJC/jr

~~SECRET~~

1173643

~~CONFIDENTIAL~~