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Kenneth Kasschau, Director, Office of Research and Medicine

October 24, 1952

C. S. Shoup, Chief, Biology Division, Office of Research and Medicine

MEETING OF THE BIO-MEDICAL PROGRAM DIRECTORS, OCTOBER 13-14, 1952, AT RICHLAND, WASHINGTON.

SYMBOL: ORB:CSS

This quarterly meeting of the Bio-Medical Directors was attended by C. S. Shoup, AEC; Alexander Hollaender and K. Z. Morgan, ORNL; and Marshall Brucer, ORINS, representing the biology and medicine program in the Oak Ridge Operations Area. Comments follow on the significant papers presented at this meeting:

1. Donaldson, L. R., Director, Applied Fisheries Laboratory, University of Washington, Seattle. - In the 1942 OSRD requested the University of Washington to establish a laboratory where a program of study could be initiated on the action of radiation and radioactive effluents upon aquatic organisms, principally fishes. Basic studies have been made on the effects of physical changes in the environment caused by radioactive materials, by thermal changes, and chemical pollution. Field examinations have been since 1946 on the effects of radiation contamination at Bikini and Eniwetok Atolls. Both aquatic plants and animals have been studied in the laboratory. Projects carried out with cooperation from the Aquatic Biology Unit of Hanford Works were mentioned without detail as to results or progress.

2. Roesch, W. C., Biophysics Section, Hanford Works. - RADIOLOGICAL SCIENCES PHYSICS PROGRAM: Gamma ray calibration at Hanford is done with radium, and this has necessitated determination of correction factors at special energies. Ion chambers have been made for the high-energy gamma from N^{16}. The low x-ray energies from plutonium require free air chamber measurements. At all gamma energies the personnel film badge offers many problems which are being investigated. The requirement of handling plutonium metal has led to measurement of surface doses due to gamma and x-irradiation, and the possibility of detection of small amounts of plutonium by the x-rays emitted is being examined. Most beta measurements from the surface of uranium metal have been done with an extrapolation chamber. Detailed studies are being made of the aging characteristics of GM counters. Efforts are being put into accurate dosimetry for fast neutrons.

3. Adley, F. E., Industrial Hygiene, Hanford Works. - RESPIRATOR TESTING: A test apparatus has been built which simulates the airflow characteristics of normal human respiration. This apparatus permits determination of overall penetration of atmospheric contamination into the facepiece, and characteristics with respect to leakage.

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4. Eisenacher, P. L., Instrument Development, Biophysics, Hanford Works. - TRITIUM MEASUREMENT TECHNIQUES: The paper dealt with design of equipment for the rapid determination of low concentrations of tritium oxide in aqueous solutions. In the apparatus, water and tritium compounds are converted into hydrogen and tritium by reaction with metallic calcium. The resultant gas mixture is counted in an externally quenched geiger counter. A relatively unskilled operator can run 1000 samples a month with this equipment, analyzing 5 ml. samples containing as little as 0.005 uc, per ml. of tritium. Survey equipment for tritium detection was mentioned, said to be accurate to 10^{-5} uc. per ml.

5. Thompson, R. C., Metabolism Unit, Biology Section, Hanford Works. - RECENT STUDIES ON TRITIUM: Progress was reported on studies of percutaneous absorption of tritium oxide vapor and tritium gas, and its in vivo incorporation into biological compounds. Tritium oxide moves thru the human skin area at the same rate as thru the lungs. Humidity changes seem not to influence this absorption of the oxide. However, it is noted that tritium gas is absorbed through the skin much less rapidly than thru the lungs. A clearly-defined isotope effect has been detected in comparison of tritium and protium in algae when growing in a tritium oxide solution. Deuterium may behave more like tritium than like protium. Only 45% of the theoretically-possible T_3 has been taken up by algae from a tritium-labelled water. In bean plants grown in tritium water, the plant-water shows less tritium present as one progressed from the roots to the leaves. 87% of the tritium from the nutrient medium is found in the roots, and 46% is present in the transpiration water. Sheep which have been treated with tritium and studied over 280 days post-injection, show retention factors for the isotope larger than those found for the rat.

6. Schwendiman, L. C., Environmental Hazards Unit, Hanford Works. - NUCLEAR TRACK EMULSIONS USED IN LOW LEVEL PLUTONIUM ANALYSIS: A method for the analysis of plutonium in urine has been worked out, using alpha track plates which have been held in contact with eletrodeposited Pu on stainless steel discs. This method of counting is believed to be precise when followed with experienced operators.

7. Katz, J., Biology Section, Hanford Works -- PLUTONIUM RESEARCH IN BIOLOGY: To reassess the accepted MPC for Pu^{239} in liquid media (1.5×10^{-6} uc/ml.), a study has been undertaken of chronic feeding in very low concentrations, of plutonium which becomes absorbed from the GI tract, and subsequently deposited in the skeleton and soft tissues. Radiochemical analyses of tissues from rats fed a

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solution corresponding to 0.04 tolerance concentration (on mass basis), showed no detectable deposition. In rats receiving 0112, 0.42, and 1.29 times tolerance concentrations, the deposition in soft tissues was not significant, but bone deposition was in excess of that found in control animals. The percentage of fed plutonium absorbed and deposited in the skeleton from these last three groups of dosages, was respectively 0.0021, 0.0028, and 0.0024. Biological half-life studies show that in rats receiving 1.29 times tolerance doses, no significant decrease in bone radioactivity was detectable 250 days after feeding was stopped. In spite of this low turnover, it is suggested that the MPC for Pu in liquid media may be somewhat too low.

Studies of zirconium citrate therapy for removal of plutonium shows a good removal from the skeleton but not from soft tissues. The treatment must be given soon after or during Pu administration. Studies of skin decontamination of Pu seem to show the detergents to be the most effective removal agents.

8. Schubert, Jack. Argonne National Laboratory, Chicago. -- ZIRCONIUM SALTS AND PLUTONISM: Dr. Schubert was one of three invited speakers from other installations. He reviewed the studies undertaken with zirconium citrate as a chelating agent for the removal of heavy metals, including plutonium, from the body. This covered about the same ground as expressed earlier during the Argonne meeting, May 28-29, 1951.

9. Foreman, Harry. Los Alamos Scientific Laboratory. -- CALCIUM ETHYLENEDIAMINE TETRACETIC ACID IN THE TREATMENT OF HEAVY METAL POISONING IN THE HUMAN: Dr. Foreman reviewed the instances where CaEDTA has been successfully used in animal experiments and in the human for removal from the body of lead, mercury, and plutonium. These metals replace calcium in the compound as it is eliminated from the body. Injection of CaEDTA will at once increase Pu excretion by 10-20 fold.

10. McHenry, J. R. Soil Science, Environmental Hazards Unit, Hanford Works. -- GEOLOGY AND SOILS STUDIES IN THE HANFORD WORKS AREA: Groundwater mounds are forming near sites in the HW 200 areas. Sodium and nitrate are used as indexes of ground water movement, but it is estimated that 1500-2000 years must lapse before there is a contribution to the Columbia River. Studies were described on soil retention of plutonium and cesium. Cooperation is acknowledged with the Columbia River Advisory Group.

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11. Rediske, J. H. Botany Section, Plant Metabolism Unit, Hanford Works. -- ABSORPTION AND TRANSLOCATION OF FISSION PRODUCT AND PILE EFFLUENT RADIOACTIVITY IN PLANTS. Nutrient cultures are used to study the absorption of strontium, ceasium, yttrium, and iodine in the bean plant and in barley. Plot studies are made with pile effluent irrigant, containing 100% and 50% effluent concentrations. 90% of the strontium from nutrient solutions becomes adsorbed on the roots and becomes available for absorption. 1.4 times the strontium concentration in the nutrient medium is bound in the bean plant. 1.7% of the strontium in natural soils can be removed by barley plants.

12. Carey, Z. E. Control Laboratory, Hanford Works. -- PILE EFFLUENTS: The predominating beta emitters in Hanford Works pile effluent water are Cu^{64}, Mn^{56}, Na^{24}, Si^{31}, As^{76}, P^{32}, and a group of fission products. The first named are believed formed by (n,gamma) reaction on target materials retained in film deposited on the reactor tubes. The fission products are probably formed from fission of uranium introduced into the tubes by cooling water, rupturing of slugs, or by uclean slug surfaces. Slides were shown indicating variations of these emitters in drinking water at Pasco and Kennewick with the river flow rate, efficiency of the filtering system, and concentration of emitters entering the river.

13. Foster, Richard F. Aquatic Biology Unit, Hanford Works. -- BIOLOGICAL PROBLEMS OF PILE EFFLUENT IN THE COLUMBIA RIVER: Dick Foster gave a short general talk on the work of the Aquatic Biology Unit on young salmon, on the plankton, and on the bottom organisms of the Columbia, with some tabulations of the general uptake of radioactivity. It struck me that the biological effects found were largely due to chemicals introduced with the effluents, such as dichromate, rather than an action of radioactive isotopes. As in our case with Whiteoak Lake, they have not been able to demonstrate changes in river populations or any abnormalities that can be attributed to presence of normal reactor effluent. Concentrated reactor effluent causes changes due to the presence of increased amounts of dichromate or chromates, as noted above.

14. Barad, M. L. Meteorology, Environmental Hazards Unit, Hanford Works. -- FIELD STUDIES OF DIFFUSION IN THE ATMOSPHERE: Relatively high ground dosages are found when an effluent is emitted from an elevated source during superadiabatic conditions. Experiments were mentioned in which oil fog aerosols were used, and emitted from a generator mounted 185 ft. above ground on the meteorology tower at Hanford. Measurements were made of the average concentrations of puffs of oil reaching the ground near the tower within short sampling times, and those at distances up to a half-mile from the tower over longer time periods. The sampling technique was based on fluorescence of the oil. It is collected on filter paper, washed through, and the weight of the oil collected is determined by a fluorophotometer.

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15. Honstead, J. F. Methods Section, Environmental Hazards Unit, Hanford Works. -- SCOPE OF IODINE-131 CONTAMINATION IN THE ENVIRONMENT OF HANFORD WORKS: The history of Iodine-131 emission shows peaks and valleys in step with changes in operations. During July, 1947 to April, 1952, there were wide variations, ranging from peak months of May, June, and July, 1951, with an average emission of 5000 curies per month, to low periods in 1948 and 1949 having emissions of less than 50. Vegetation through the affected region shows concentrations ranging from 1×10^{-4} uc. per gram to more than 1×10^{-2} uc. per gram. Equipment was described for monitoring stack gases for iodine.

16. Bustad, L. K. Toxicology Unit, Experimental Animal Farm, Hanford Works. -- CHRONIC TOXICITY OF RADIOIODINE: This is the large and ambitious large animal program at HW, the work being done mainly with sheep. Daily feeding with radioiodine varies from 0.005 to 240 uc/day of carrier free material. No definite sign of damage occurs in test animals fed 5 uc/day or less over a 30-day period. Manifestation of toxicity in adult ewes at the 240 uc/day dose includes lethargy, clumsy motion, constipation, bloating, and dry coarse fleece. Failure of the thyroid to concentrate Iodine-131, a depression of the leucocyte count in increase in non-protein nitrogen were also found. First-year lambs from these ewes exhibited a depression of haemoglobin, serum calcium, and an increase in serum inorganic phosphorus and serum creatinine. Considerable growth retardation, atheroschlerosis, oral ulceration and variable alopecia were also seen. Although the original ewes fed 240 uc/day all conceived during the second breeding season, their off-springs were stillborn or failed to survive beyond two days. Generally changes observed in sheep following thyroid abalation by chronically-administered radioiodine resemble those described for sheep following thyroidectomy, but with the additional characteristics of lymphopenia, trachael constriction, alopecia and ulceration of the mount.

New groups have been added during 1951 at the administration rates of 15, 45, and 135 uc/day to further define the toxic level. Thyroids in off-spring from 45 to 135 uc/day have shown evidence of histological damage.

As customary, following the presentation of papers, the group was addressed by the Director, Division of Biology and Medicine, Washington, Dr. John C. Bugher: Dr. Bugher reviewed some features of the recent progress of Biology and Medicine, noting that considerable time of late has been spent in meetings with various investigating groups from the Congress and from the Bureau of the Budget. The house Appropriations Subcommittee has been especially active in investigation. Apparently with the coming-of-age of the Commission we can expect more searching study of our program and expenditures. There is little to indicate that the 6000 Program can anticipate an enlarged budget.

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Dr. Bugher spent some time speaking of plans for forthcoming weapons tests. It is expected that Knothole in the spring of 1953 will have two shots suitable for biological test exposures. Laboratories have been asked to submit suggestions for test-site experiments. These are being reviewed by a screening committee of the Division of Biology and Medicine. Apropos of this, I should mention that the original plans of ORNL, Biology Division, have been cut drastically since B&M will have only a small portion of the earlier-anticipated funds to spend on testing. It is hoped, though, that despite smaller funds than expected, that laboratory people will continue to follow information on biological exposures at the test site, and will offer suggestions for biological study of weapons effects. An invitation is extended to all sites to provide personnel on loan for help in the fall-out studies including the ones made close in under the direction of Kermit Lersen, UCLA, and the long-range studies.

Suggestions are welcomed with respect to dosimetry for LD/50 studies associated with weapons tests, and for use of the weapon as a large neutron source. Further fall-out studies on soils should be made, with respect to migration of fall-out materials into biological life-cycles.

The question was brought up, as is always the case at the conclusion of these meetings, as to the host site for the succeeding meeting. Dr. Hollaender and I have realized for some time that either the Advisory Committee for B&M or the Program Directors' meeting should shortly come to Oak Ridge. These groups have not met in ORO since 1949, and the cycle of meeting sites is just about to roll around to us again. I had mentioned earlier to Dr. Bugher that we might be in line for the Advisory Committee about next fall, say in September, 1953. In the case of the Hanford gathering, when volunteers were called for as to meeting sites, no group responded, and I felt all the assembled multitute was waiting for Oak Ridge to suggest itself! Therefore, following a hasty word with Drs. Brucer and Hollaender, I arose and welcomed the Bio-Medical Program Directors' Meeting to Oak Ridge. Following the adjournment, it was learned that B&M is uncertain as to whether the Bio-Medical Directors will continue to meet on a quarterly basis, or go onto a semi-annual meeting plan. If B&M retains the present arrangement, we can expect this group in the latter part of January, 1953. Should, however, B&M decide less-frequent meetings are in order, we can expect ourselves to serve as hosts in April or May, 1953. I have requested an early decision on this matter to facilitate our arrangements.

In concluding this report, allow me to emphasize the fact that considerable money has been expended in both biology and biophysics at Hanford Works. The group toured the facilities for aquatic biology, for general biological studies in the new Biology Building, the Animal Farm, and the new Biophysics Building. The Biology Building is a large four-story concrete block building near one of the reactors. Since this was not needed for its original purpose, the entire interior has been rebuilt,

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complete with air-conditioning, fluorescent lighting, a vast array of modern equipment, at a cost exceeding $1 million. The new Biophysics Building is located adjacent to the slug preparation area. It is a completely new building with an interior that is completely modern in every sense of the word, with up-to-date laboratory and office furniture and with humidity and temperature control. I believe the building cost was not high on a square-foot basis, and came out to be about $1.6 million. The estimated cost of the furniture and equipment was not ascertained. A new library building, also in quite moderistic design, has been recently completed nearby.

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Office of Research and Medicine

The Office of Research and Medicine consists of a Director, an Assistant Director, an administrative unit, a medical adviser and three operating divisions. The Office is responsible for the research and development programs at the Oak Ridge National Laboratory, the University of Tennessee AEC Farm and approximately eighty university type Washington designated contracts. In addition, the Office is responsible for the administration of the contract of the Oak Ridge Institute of Nuclear Studies. The Office serves as a liaison point between the Washington headquarters staff and the various contractors under the cogniznace of the Oak Ridge Operations Office.

The workload is divided among the several divisions in the Office in accordance with the major Budget classifications which, in turn, are responsibilities of a particular Washington Office Division. Thus, the Research Division is responsible for 5000 programs, Biology is responsible for 6000 programs and Reactor Development is responsible for 4000 programs. The Office is also responsible for some 2000 and 3000 programs which are assigned to the Division in accordance with the professional skills available within the particular division.

Inasmuch as the major contractor is the Oak Ridge National Laboratory, each division has a segment of the laboratory for which it has prime responsibility. In general, each member of the operating division spends approximately one half of his time at the laboratory maintaining

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professional contacts with various members of the contractor staff in order to keep abreast of current developments and also keep the Laboratory staff up to date on Commission views in technical matters.

The authorized personnel strength of the Office is twenty-nine. The actual strength as of October 1, was twenty-eight. These included thirteen individuals with a Bachelors' Degree or the equivalent or higher in one of the basic sciences or engineering and fourteen strictly administrative personnel and secretaries. This small scientific group administers an on-site program at ORNL, ORINS, U-T involving an operations budget of $30,000,000 per year exclusive of construction. The laboratory alone involves 3200 people of which 1250 are considered scientific and technical.

Formal delegation of responsibilities to the Office are inducted from the current OR Bulletin.

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