December 13, 1948

A Few Notes on the Trip of K. Z. Morgan to Los Alamos, San Francisco and Hanford

The following is intended to list some of the places visited and meetings attended. If anyone is interested in detailed information on a particular subject related to the trip I will be glad to engage in discussion with such a person.

December 2 and 3 at Los Alamos

I visited Dr. T. N. White of the Los Alamos Health Physics group. I had discussions with a number of persons engaged in the solution of problems similar to those at Oak Ridge National Laboratory. Events of particular interest were as follows:

1. I gave a two hour discussion to a large group from the Health Physics, Medical, and Physics Departments on the particle problem.

2. I discussed problems of organization with the Medical Director, Dr. Shipman, and Drs. Whipple and White.

3. I inspected the instrument facilities and new instrument developments with Dr. Watts. I was especially interested in a new fast neutron fission chamber that we can use at Oak Ridge National Laboratory after adding a few improvements.

4. I inspected the Occupational Medicine and Industrial Hygiene Program of Dr. Schulte. I was especially interested in the liquid waste disposal studies of Drs. Newell, Christenson, Eltinger, and Robeck because their program ties in very nicely with a similar program under R. J. Morton in our Health Physics Laboratory.

5. A Mr. Leopold (an air filter expert) and I visited the CMR-10 Area to inspect a circulating liquid (water) column pilot plant used to study the efficiency of this method of removing radioactive particles from the air. Efficiencies greater than 99% were obtained with rather low pressure drop. The solid matter settles out in the bottom of the water tanks making maintenance a simple problem. The pH is automatically adjusted and the efficiency of the system can be increased by the use of steam. The operating cost is very low; they claim a high efficiency for particles of all sizes (experiments have not been completed to prove this point) and presumably it would work for air from chemistry operations as well as for pile cooling air.

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6. I inspected most of the health physics facilities with Dr. White. They have about 70 persons engaged in health physics operations and are at present in the process of expanding their research and development programs and extending the health physics survey coverage. They plan to develop their beta-gamma film monitoring along a plan similar to that used at Oak Ridge National Laboratory and to use the Oak Ridge National Laboratory method of neutron monitoring as soon as it can be set up. Dr. White (who has been at Los Alamos about one year) is doing a fine job in the improvement of the Health Physics Program. They have many radiation problems of a serious nature and he (according to some members of the Physics Division with whom I conversed) is the first person they have had who is systematically considering these problems one by one, and finding a solution for them. I saw a great deal of evidence of conditions that would create a serious particle problem there but so far they have not made any particle measurements.

7. I visited the fast reactor, water boiler, and several operations of high classification.

December 5 at San Francisco

I attended a meeting called by Dr. E. P. Pendergrass of about thirty physicists and radiologists from all over the United States to answer three questions, as follows:

a. What are the acute effects from 50 r whole body external radiation delivered as follows?

   1. Instantaneous
   2. At the rate of 20 r per hour
   3. At the rate of 10 r per hour

   The above should also be answered for 100 r, 200 r, 300 r, and 400 r.

b. How soon will the effects manifest themselves and when will the individual lose his efficiency to the extent that he will have to be replaced? The following factors are now on record and are submitted for your consideratic

   1. If delivered instantaneously, 100 r is the M. S.D. (Median Sickness Dose).

   2. If delivered at the rate of 20 r per hour, 150 r is the M.S.D.

   3. If delivered at the rate of 10 r per hour, 200 r is the M. S.D.

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4. Fifty per cent of the median sickness dose is considered to be a wartime military permissible dose. In other words, the Military Commander may assume that if his troops receive 50 r instantaneously, 75 r at the rate of 20 r per hour, or 100 r at the rate of 10 r per hour, he will have no sickness and thus no replacement problem.

5. The median lethal dose is considered to be 450 r instantaneous radiation.

6. The lethal dose is considered to be 700 r delivered instantaneously.

c. How much of these damaging effects should medical personnel accept in line of duty?

Many points of interest related to the above were discussed but before the meeting was over it was evident that no one knew the true answer to any of these questions. The real purpose of the meeting was to obtain information badly needed by the War Department and to furnish this information to Col. James Cooney. Because of the nature of the discussions, attendance at the meeting was restricted to those invited to attend.

British data indicated that the mid-lethal dose (M.L.D.) of radiation for man is about 150 roentgens. Stafford Warren gave data from the atomic bombed area of Japan that indicated that the M.L.D. was probably less than 300 roentgens for man, because those persons who lost all the hair (completely epilated) did not survive. Dr. Paul Rikers indicated that the M.L.D. for dogs was 300 to 350 roentgens. Louis Hempelmann gave data on the accidents at Los Alamos that indicated probable exposure as follows:

Case	Probable Dose in Rem	Remarks
1	290	Died on 24th day; nausea after 24 hr; hands in bad shape.
2	18	Fatigue shortly after exposure.
3	880	Vomited twice within 45 minutes; died 9th day; ice used to relieve pain.
4	180	Strength normal after 10 weeks--now completely normal.
5	108	Probably permanently sterile.
6	86	No symptoms at first (later some fatigue).
7	65	
8	22	
9	18	Nausea.
10	14	

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L. Robbins gave data on a man who had survived over 1000 roentgens. Thus the M.L.D. is probably somewhere between 150 and 1000 roentgens. The final result of the meeting was a tentative adoption of a committee report as follows:

Report of Committee (Robert Newell, Chairman).

		Effect of Acute Doses of Radiation
1.	10,000 roentgens	Results in convulsions or death immediately or soon after exposure.
2.	1,000 roentgens	Incapacitates 100 per cent in 1 to 3 hr. All ultimately die.
3.	500 roentgens	Incapacitates 100 per cent for first 24 hr. <50 per cent will hold up to job for 2 weeks at greatly reduced efficiency. >75 per cent (probably >90 per cent) will die inside of 6 weeks.
4.	200 roentgens	10 per cent ineffective for $\sim$1 week, 50 per cent nauseated for 24 hr.
5.	300 roentgens	The permissible dose in 5 years.

H. M. Parker and I were asked by L. Hemplemann and Col. Cooney to study the radiation exposure cases at Los Alamos, in order to set more definitely the accident exposures, since this is probably the best high level radiation exposure data we have on man. Such information would be vital in case of an atomic war.

December 6 at Berkley, California

I visited N. B. Garden of the Health Physics Division (called Health Chemistry). I was very favorably impressed with the progress he has made in instrument development and new hood design. By the use of glove boxes and proper chemical techniques they are able to work with medium levels of "hot" material without laboratory contamination. They use glass wool filters in all their hoods. All "hot" units such as filters and hoods can be removed quickly as a unit from the laboratory for decontamination. Their method of operation is to have each new chemical experiment discussed and planned in detail before the experiment begins. The experiments are done in glove boxes (similar to dry boxes) but before opening the source holder in the glove box, one makes certain that all the chemicals, glassware, manipulators, etc., are contained in and properly arranged in the glove box so that no "hot" chemicals are brought out into the laboratory under any conditions. After the completion of the experiment, the glove box is bodily removed from the

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hood and taken to another area for decontamination. My impression of this was that it is very good and I would like to have it tried at ORNL. However, I would like to have had some survey meters along with me so I could check the laboratories for contamination. I believe their method would be improved if they made frequent radiation surveys of the laboratories.

December 6 at San Francisco

H. M. Parker, L. S. Taylor, E. Williams, and I had a meeting on units and to resolve our different points of view on this subject. Dr. Parker wanted a unit expressed in ergs/cc of tissue; Dr. Failla wanted the old rep; I wanted a unit based on the measured ionization in an air cavity in the medium. After a long discussion we finally agreed as follows:

1. To retain the roentgen as a unit of quantity for X and gamma radiation where it is applicable.

2. To recommend a new fundamental unit, ergs/gm of medium.

3. To recommend a new practical unit which is a multiple of the fundamental unit and is defined as that amount of ionizing radiation that delivers a dose of 93 ergs/gm of tissue to a point in tissue.

This latter unit is suggested primarily as a convenience to radiologists. It is equal in magnitude to the unit I had suggested earlier, but it is defined as the energy absorbed in tissue rather than that in air. In order to find it one must convert an ionization measurement in a cavity chamber to this new unit by the use of certain parameters (relative mass stopping power, ion pairs per electron volt, etc.). To obtain the biological damage one must obtain in addition the specific ionization and the time factor.

December 7 at Hunter's Point

I visited the Naval Radiological Defense Laboratory under the direction of W. H. Sullivan. I met with the directors of the laboratory and gave a discussion on some Health Physics problems. Dr. Sullivan showed me over his various laboratories and gave a review of the many parts of their program. He has a number of interesting projects under way in physics, chemistry, biology, and health physics. I was impressed especially by the particle studies by Drs. Frank Holden and Frank Owen. They are getting some interesting results on decontamination and on the effects of radiation in reducing the available energy of animals for doing useful work. They are using some alpha counters that have practically zero background. Perhaps we could use some of these in our urine analysis work at ORNL.

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December 7 at San Francisco

We (Taylor, Parker, Williams, and I) had another meeting on radiation units and drew up a proposed reply to the British proposal on units presented to us by Dr. Mayneord.

December 8 at San Francisco

I met with the Committee on Units of the Radiological Society of North America. The proposal (of Taylor, Failla, Parker, Williams, and Morgan) was presented and agreed upon after a drawn out discussion.

December 8 at San Francisco

There was a meeting of the Executive Committee of the Radiation Protection Committee of the National Bureau of Standards, and of the subcommittee chairmen. Those present were L. S. Taylor, H. M. Parker, E. Williams, H. B. Williams, R. S. Stone, and K. Z. Morgan. Plans were made to get out a revised booklet of the Committee on Radiation Protection by January 15, 1949. I am to furnish data on the general level of maximum permissible concentration of radioactive material in air and in water before the end of this year and Dr. Charles H. Perry and I will get out a report for the permissible levels of some of the radioisotopes during the year 1949. Failla will get out his report on maximum permissible external exposures early next year. The new maximum permissible exposure level to X and gamma radiation will probably be 0.3 r per week for total body exposure, 0.5 r per week to just the skin (inside the horny layer) and probably about 1.0 r per week just to the hands.

A list of names was suggested for a new Committee on Waste Disposal.

December 11 at Richland, Washington

I visited with H. M. Parker and other members of the Hanford Works Health Physics Division. Most of the reports I read and discussions I had were of a classified nature so I will list only as follows:

1. The particle problem has been of major importance and has lead to difficult decisions. Particles have been found at great distances (hundreds of miles). Many of the particles are insoluble in water. The sand filters seem to be working satisfactorily.

2. Factors of 10^5 selective absorption of radioisotopes in fish have been found.

3. There were no important new instrument developments. They have a new portable poppy that is promising. They have an improved method of beta monitoring for the waste water.

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4. They have interesting three dimensional graphs giving the flow of fission products and plutonium from their holding tanks that are buried in the ground.

5. They have obtained information from all the Hanford Works' personnel recently regarding employee-employer relations which has been very useful. I think we should make a similar investigation at ORNL.

6. There is an elaborate building program under way at Hanford.

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