

CONFERENCE ON THE COLLECTION AND EVALUATION OF FALLOUT MATERIAL FOLLOWING NUCLEAR DETONATIONS

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1. A conference on the collection and evaluation of fallout material following nuclear detonations was held on August 5-6, 1952, at Los Alamos Scientific Laboratory. Those in attendance were:

- Leonard Baumash.....AEP-UCLA
- Kermit H. Larson.....AEP-UCLA
- Fred A. Bryan.....AEP-UCLA
- Robert J. Buettner.....AEP-UCLA
- Jon H. Olafson.....AEP-UCLA
- H. F. Schulte.....LASL
- Ed Hyatt.....LASL
- John H. Harley.....AEC-NYO
- Duncan A. Holaday.....USPHS, Salt Lake City
- Charles J. Spiegl.....AEP-University of Rochester
- Gordon M. Dunning.....AEC-Washington

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2. The purposes of this conference were:

- (1) To review and re-evaluate the objectives of such a fallout program.
- (2) To determine those procedures and equipment that appeared best to meet these objectives.
- (3) To reach agreements on collection and counting procedures that would provide data readily interpretable in common terms.

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ORGANIZATION & MANAGEMENT

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- (4) To provide an opportunity for free exchange of ideas of promising technical developments relevant to the programs.
- (5) To reach an agreement on organization, i.e., the relationship between the research and monitoring fallout groups and their place in the test organization.

3. It would not be appropriate to review all the discussions that occurred during the conference, but an attempt will be made to include the highlights, particularly those points where agreements were reached. If there are any omissions or corrections please so indicate in the near future.

4. It was recognized at the outset the need for determining a set of objectives toward which the fallout programs should be directed. The following outline of objectives represents a somewhat idealized concept. They probably can not all be attempted in the next operation, but at the present state of thinking they represent those that are believed valid and reasonable.

- I. Public Relations (The accumulation of data in a form usable in public relations covering the nature and significance of fallout.)
- II. Phenomenology of Fallout (The accumulation of all pertinent physical data that might contribute to a further understanding of the phenomenology of fallout.)

A. Airborne. The determinations of:

1. Concentrations
2. Particle size distribution
3. Specific activity (activity vs. particle size)
4. Characteristics
  - a. Decay curves
  - b. Chemical analysis
  - c. Microscopy
    1. Shape
    2. Surface appearance
    3. Plating

B. Settled. The determinations of:

1. Activity per unit area
2. Particles size vs. activity

C. Soil analyses. The determination of:

1. Soil composition at site of detonation

D. Micrometeorology. The determinations of wind velocity and direction, temperature and humidity at selected station.

III. Biological effects (To be cleared by Bio-Medical Screening Committee)

A. Collection and examination of animals within about a 80-mile radius.

1. Short term
2. Long term

5. The next order of business was the determination of procedures and equipment that would best meet these objectives. This included the selection of the best equipment that would probably be available for the next continental test operation and a discussion of equipment now being developed. It was the intent, therefore, to assure the presence of the best available equipment and also to encourage development and subsequent testing of prototypes during the test activities. The following is a synopsis of these discussions.

6. Objective I - Public Relations

The data collected under Objective II and III would suffice to meet Objective I (Public Relations).

7. Objective IIIA - Airborne (1) Concentrations

a. Automatic filter changers have advantages over a manually changing procedure; intermittent filter changers are more desirable than continuous tape. For the closer-in stations low volume samplers would probably be adequate. NYOO agreed to adapt their low volume battery operated sampler with such an automatic intermittent filter changer.

b. At more distant stations a high volume sampler will be necessary because of the relatively lower activity. These high volume samplers will require a greater power supply than batteries. A Homelite gasoline powered generator-motor is one of the better types available and will function reasonably well in the field if there is close maintenance.

c. UCLA agreed to work on the automatic intermittent filter changers for the high volume samplers.

d. The performance of the Electrolux leaves much to be desired. In connection with the automatic changer, UCLA may wish to develop a complete unit. One problem would be the relative cost, i.e., there are many Electrolux high volume samplers already available, but a better performing high volume unit may result in eventual savings in personnel costs.

e. Leslie Silverman of the Harvard School of Public Health has developed a new high volume sampler that may be very satisfactory for our purposes. It is estimated to cost \$250 which is high. Dunning will attempt to secure one of these for testing purposes.

f. UCLA is working on a new filter made of pyrafoam. They will investigate further to determine its characteristics with a viewpoint of possible adoption.

g. There were some discussions of eliminating the gasoline powered generator-motor unit for a directly driven pump but the status of presently known equipment did not justify any adoption at this time.

8. Objective IIA - Airborne-Particle Size Distribution)

a. UCLA presented data that cast additional doubts on the validity of assumptions made for cascade impactor performance.

After considerable discussion it was agreed, however, that the cascade impactor would be used and the data obtained therefrom correlated with other data for determination of particle size distribution.

b. NYOO indicated their aerotic attachment did not perform too satisfactorily.

c. Of the several ideas that were introduced, one additional method seemed promising for this problem. This was the turbometric method in conjunction with an electrostatic precipitator of commercial type such as Westinghouse precipitron or the Trion Corporation of Pittsburgh (the electrostatic precipitator was originally discussed as a means of collecting sizable amounts of airborne material for chemical analysis. See below). UCLA agreed to investigate the possibility of this method.

9. Objective IIA-3 (Airborne-Specific Activity vs. Particle Size)

a. Until the performance of the cascade impactor is more clearly evaluated the relating of activity to particle size by this method is in doubt. However, this procedure will be continued and results correlated with other data.

b. The autoradiograph-microscope method appears to hold good promise but requires excessive manpower. This method would be followed at the discretion of the individual groups depending on availability of personnel, equipment and time.

10. Objective IIA-4 abc (Characteristics)

- a. Determination of decay curves, chemical analysis and microscopy will be followed at the discretion of the individual groups depending on the availability of personnel, equipment and time.
- b. UCLA agreed to investigate the desirability of utilizing about two of the commercially available electrostatic precipitators such as the Westinghouse precipitron or the Trion Corporation to obtain large samples of fallout material.

11. Objective IIB-1 (Settled-Activity Per Unit Area)

- a. Trays and sticky cellophane will be furnished by NYOO (financial arrangements to be made later). 8"x9" sticky cellophane will be folded after exposure to yield a 4"x9" sample for counting (see counting procedures below).
- b. Because of the low activity encountered, NYOO will continue to use the gum paper and dry ashing procedure.
- c. UCLA described a method of scooping known quantities of soil from a given area. By this method it will be possible to estimate the activity per unit area of surface as well as activity per gram of material. UCLA agreed to investigate further this procedure during the next continental test operation.
- d. Holaday described a device developed by NRDL using a rotating drum that might be equipped with sticky paper and thus used to measure settled fallout material at known intervals of time (see "Super-Stations" below). Holaday will investigate desirability and availability of this device.

e. The teams would be provided with survey meters and would record readings periodically. The purposes would be to establish isodose maps and to perhaps shed further light on the relationship between mr/hr vs. d/m of surface activity.

12. Objective II-B-2 (Particle Size vs. Activity)

a. Using the same method as noted in paragraph 11c, UCLA agreed to investigate further the relationship between activity and particle size.

13. Objective II-C (Soil Analyses)

a. Since soil composition might well effect significantly not only any induced activity or plating process, but also the fallout phenomena, it seemed advisable to make soil analysis at the site of the detonation. The extent of these studies is left to the discretion of UCLA.

14. Objective II-D (Micrometeorology)

a. To better understand weather variables and their effect on the phenomena of fallout, it seemed desirable to collect data on surface winds (velocity and direction) and temperature and humidity. Lt. Col. Clifford Spahn conferred with the group pointing out the extreme unpredictability of winds below 2,000 feet. He was not optimistic as to the usefulness of such data for prediction purposes and suggested that a large expenditure of funds would probably not be justified. Spahn further stated, however, that a minimum number of stations might prove quite valuable as a trial run in an attempt to correlate

fallout and weather conditions. Spahn suggested that the personnel at Dugway could provide very valuable information on the subject and recommended that the group confer with them. Holaday agreed to contact Dugway and request a meeting for October 20 and notify all interested parties.

b. The automatic weather stations (without recorders) would cost approximately \$1,000. LASL may be able to loan 2 sets. Additional sets might be purchased if it seems desirable, but it may be more feasible to obtain cheaper non-automatic sets and have readings taken periodically. Dunning agreed to contact the Weather Bureau at Washington for possible loan.

c. Topographical maps of the Nevada Test Site would be highly desirable for the fallout program as a whole and the micro-meteorology especially. Dunning agreed to try to locate such maps.

15. To study intensely fallout phenomena, about eight "Super-stations" are planned. The equipment and activities of these stations would probably consist of all or most of the following:

- (1) Automatic weather stations - wind velocity and direction, temperature and humidity.
- (2) Air samplers.
- (3) Fallout trays.
- (4) Cascade impactor.

- (5) Automatic background recorders.
  - (6) Film badges.
  - (7) NRDL (for measurement of settled fallout).
  - (8) Soil analysis.
16. The desirability of using film badges at every location where there is an air sampler was indicated but further discussion was withheld until after the photodosimetry meeting planned at Washington on August 18.
17. Buettner agreed to try to locate additional recorders from AEC supply.
18. Objective III (Biological Effects)
- a. UCLA suggested the determination of some biological effects of radioactive fallout. The program envisioned a short-term project in determining concentrations of radioactive material in certain organs of rabbits and rodents native to the test area and a long-term program of metabolism and bone deposition of radioactive materials. UCLA will describe their proposal in detail and submit it to the Bio-Medical Screening Committee.

COUNTING PROCEDURES

19. Three topics were introduced immediately: (1) extrapolation of data (2) the question of how low an energy beta should be measured and (3) calibration.

20. a. The problems suggested in extrapolation were the determination of the first appearance of airborne radioactive material (settled dust and airborne activity do not appear simultaneously and one can not be used to predict the time of arrival of the other) and the time to which data should be extrapolated. It was agreed that (1) the collection time per filter should be two hours (2) plans should call for at least one blank filter run before any airborne activity appeared and (3) if the airborne activity appeared between 0-2 hours after detonation, pertinent data would be used to make an intelligent estimate of time of arrival; if the airborne activity appeared after the first sampling period (after 2 hours) the data would be extrapolated to the midpoint of the sampling period.

b. There was a discussion of measuring the value of peak airborne concentration and its time of appearance. This did not appear to be a major problem with the group since the duration of exposure would be so relatively short. Some possible equipment that could be used to make these measurements were described, but it was felt that these should be continued on an experimental rather than operational basis.

21. The question of how low an energy beta should be measured reduced itself to the question of how low the counting equipment could measure. Data presented by NYOO suggested that 15 mg/cm<sup>2</sup> would reduce the beta counts by some 25% while data

from LASL suggested a somewhat higher figure. The critical point agreed upon was that estimates of absorption, counting efficiency and other factors should be made and accounted for and the counting rate reported. Thus, data from various organizations may be commonly interpreted.

22. Several calibration standards were discussed. LASL indicated data that suggested RaD, E standards were the most desirable of those tested. It was agreed by LASL, UCLA and NYOO to prepare such RaD, E standards and mutually exchange them for comparative purposes.
  
23. The question was introduced as to what if any interpretation could be made of gamma emission from the measured beta counts. LASL and NYOO mentioned data that suggested the  $\beta/\gamma$  ratio varies rather widely as a function of time. There was no conclusion drawn, but it was agreed to investigate further the  $\beta/\gamma$  ratio vs. time.
  
24. It was agreed that after exposure the sticky cellophane from the fallout trays would be folded once and counted in appropriate size gas flow counters. LASL agreed to make six such scalars at an approximate cost of \$1,000 each. LASL and UCLA will make financial arrangements.

ORGANIZATION

25. Dr. Thomas Shipman joined the group on the afternoon of August 9 to participate in a discussion of organization. Apparently there was a misunderstanding as to the role of the research and monitoring fallout groups in the test organization. After some deliberations, interested representatives from LASL, UCLA and Washington conferred with Drs. Alvin Graves and Gaelen Felt. It was finally agreed that the research program headed by Kermit Larson of UCLA would be under the newly formed Civil Effects Group (headed by Mr. Robert Corsbie) and would function only on selected shots. William Johnston of LASL would continue as program leader of the regular off-site monitoring which would function on every shot.