[redacted]

[redacted]

404708

[redacted]

MEETING OF JANGLE FEASIBILITY COMMITTEE

WASHINGTON, D. C.
JULY 13, 1951

487

PRESENT: Dr. A. Spilhaus, AFSWP
Col. Benjamin Holzman, USAF
Capt. H. L. Andrews, USPHS
Dr. H. Scoville, AFSWP
Dr. Louis Hempelman, University of Rochester
Dr. J. O. Hirschfelder, University of Wisconsin
Dr. John Magee, University of Notre Dame
Dr. Gaelen Felt, LASL
Dr. Jack C. Clark, LASL
Dr. S. Warren, Division of Biology & Medicine
Dr. L. W. Tuttle, Division of Biology & Medicine
Dr. J. C. Bugher, Division of Biology & Medicine
Mr. R. L. Butenhoff, Division of Biology & Medicine
Mr. H. C. Brown, Division of Biology & Medicine
Mr. L. Joe Deal, Division of Biology & Medicine
Lt. Col. W. R. Sturges, Division of Military Application
Col. George Schlatter, Division of Military Application
Mr. Merril Eisenbud, NYOO, USAEC

MINUTES ALSO DISTRIBUTED TO THE FOLLOWING:

Dr. Thomas Nolan, USGS, Department of Interior
Dr. Walker Bleakney, Princeton U.
Dr. Harold Hodge, Rochester AEC Project
Dr. G. Failla, Columbia U.
Dr. L. T. E. Thompson, Naval Ord. Test Station
Col. Richard Coiner, AEC
Mr. Carroll Tyler, SFOO
Dr. Norris Bradbury, LASL

[redacted]

The function of the Committee is to determine whether an underground burst of an A-Bomb that will rupture the surface to a substantial degree can be safely carried out within the continental limits of the United States, in the event that this is determined feasible, to recommend the site, and the meteorological, physical, or biological data to be obtained as a result of the burst.

At the meeting in Los Alamos, May 21 and 22, 1951, recommendations were made and criteria were established. At a subsequent gathering of certain of the Committee members, June 28 and 29, 1951, it was evident that some of the original criteria, and the recommendations should be reconsidered in light of additional data and studies developed by Dr. Gaelen Felt of the Los Alamos Scientific Laboratory (Appendix I). The purpose of the July 13 meeting was to reconsider the recommendations and criteria in terms of Dr. Felt's studies.

The actual firing will be at the Nevada Test Site, some 25 miles north of Frenchman's Flat.

The Committee agreed that the 1.25 KT deep underground weapon would be unnecessary from a strictly radiological safety viewpoint. Furthermore, that the order of firing should be, first the surface and second the scaled sub-surface.

The Committee reconsidered its criteria and they are as follows:

A. Geological

1. A basin at least partly enclosed by mountain ranges, in the expectation that the rise would tend to hold large particulate matter within the basin -- and additionally, to produce a deposit of finer particulate matter on the far sides of the ranges by descending air currents.

2. A low level of ground water. The large amount of fission products in the crater will not be adsorbed and held because of the absence of clay, and hence may tend to migrate to the ground water and show up in water supplies of grazing stock.

3. A soil predominatly silica. Preliminary studies should be made of soil chemistry and particle size distribution.

4. For the test itself, there is required a deep unconsolidated mass of soil with ~~a soil [illegible]~~ an absence of faulting in the area to be instrumented for ground shock.

B. Meteorological

1. Wind velocities in the lowest levels shall be persistent in direction with time to permit reliable predictions for at least 2 hours just prior to the test. Vertical wind shear in direction and velocity is desirable provided the trajectory of the entire cloud mass is confined to a sector which contains minimal population within a radius of 50 miles.

C. Radiological Safety

1. The external dose to non-participating inhabitants, of radiation from gamma rays, shall not exceed the accepted international permissible dose level of 300 mr/wk, which may be ~~averaged~~ integrated over a maximum of 10 weeks.

2. At a point of human habitation, the activity of radioactive particles in the atmosphere, averaged over a period of 24 hours, shall be limited to 100 microcuries per cubic meter of air (corresponding approximately to a ground level gamma intensity of 30 mr/hr).

3. The 24-hour average radioactivity per cubic meter of air, due to suspended particles having diameters in the range 0 micron to 5.0 microns, shall not exceed 1/100 of the above; nor is it desirable that any individual particle in this size range have an activity greater than 10^{-2} microcuries calculated 4 hours after the blast.

D. Radiological Test Data to be Obtained

1. Gross observations on the cloud:

   a. on the surface: follow the cloud in detail up to 50 miles, taking data on wind, height of cloud, diameter, dissipation, local variations due to wind currents, etc.

   b. in the air: follow the general contour of the cloud until level of twice background is reached. (Details will be worked out with AFOAT-1).

2. Measurement of external radiation at ground level during passage of the cloud, along trajectory of the cloud.

3. Ratio of beta to gamma activity at various points and times along the trajectory and at places of appreciable fall-out,

4. Detailed plot of fall-out, from rim of crater through areas showing approximately twice background intensity.

5. Gross observations on the crater, including size, lip formation, quantity of earth deposited nearby, amount of radioactivity retained in the crater, etc.

6. Requirements for off-site monitoring in relation to protection of personnel, including wells and ground water.

7. Sampling for concentration of oxides of nitrogen.

8. An evaluation of decontamination problems about the site, need for filling and covering the crater, etc.

9. Particle studies on the ground and in the air.

   a. Chemical constitution of the soil, and particle size distribution of the soil before the test.

   b. Particle size distribution of radioactive particles at various locations downwind for about 50 miles.

   c. Specific activity of the particles.

   d. Chemical composition and physical constitution -- how much "plating" occurs?

   e. Concentration in the air.

10. Analysis procedures should be previously developed to a point which will permit the above data to be adequately evaluated within a period of 7-10 days.

Note: Item 1. b. will be the responsibility of AFOAT-1.
Item 9 and 10 are to be primarily the responsibility of the Operations Group.

Other items will be the responsibility of the Division of Biology and Medicine until otherwise assigned.

Recommendations

It is the unanimous agreement of the Committee that a test involving the explosion of a 1.25 kiloton Uranium 235 bomb, under the conditions stated in the body of the report, can be carried out without undue hazard. The Committee recommends that the test be made.

The Committee recommends that the surface shot be carried out first followed by the scaled underground shot on schedule, unless some adverse occurrence becomes evident, in which case the Committee would review the evidence for further discussion.

These changes in criteria and recommendations are based largely on the consideration of the study and oral presentation of Dr. Gaelan Felt. A copy of the written study is attached as Appendix I.

Dr. Felt pointed out that it was the feeling of the Los Alamos Laboratory Test Group that the deep underground test was unnecessary from a radiological safety point of view. This opinion was based on their consideration of the Trinity data which most nearly approximate the surface burst. He has constructed a theoretical model, scaled to fit the Trinity data and the conclusions of this work indicate that the surface burst would probably be the safer, with the scaled underground being the second choice, and the deep underground the third. It was the feeling of the Committee that the selection in order of bursts should be made on the basis of considering the shot one knows most about; thus, the surface shot which most closely repeats Trinity should come first.

It was pointed out that the height of the cloud is one of the important factors to consider from the radiological safety point of view. The higher the cloud the better the chances are for dilution, dispersion of the radioactivity, and minimal concentration of radioactivity on the ground due to fall-out. There is evidence that the radioactivity is concentrated at the top of the cloud. The Ranger shots showed that the path of the low clouds will be greatly dependent on the terrain. The fall-out from the lower portion of the cloud will be more dependent on turbulence factors. The higher clouds are sheared and the radioactivity dispersed more quickly due to the higher wind velocities, with greater chance of predicting the stability of the higher winds.

There was considerable discussion regarding the level of radioactivity that outside populations should be allowed to take - a memo by Dr. Shipman, Appendix II, was read by Dr. Warren. Dr. Shipman points out that an exposure of 5 to 10r is not likely to harm anyone, and that this would be in line with the AEC emergency dose of 10r.

Since there are plans to use the Nevada Test Site on a recurring basis, it was felt that the AEC has no right to exceed established accepted safe maximum permissible doses for people outside the range, even if this means evacuation of some of the nearby populated areas. It was the feeling of the group that the public would better accept continued use of the test site if the AEC were honest and straight forward, by explaining the possibility of temporary evacuation, rather than take the risk of injuring any outside persons. The public has confidence in the safety of AEC operations, and nothing should be done to lessen this confidence. Since the only generally recognized safe maximum permissible dose is the 0.3r/per week, the Committee felt that any planned deviation from this would be unwise. However, it was felt that integrated over a 10-week period would neither harm anyone nor be inconsistent with the recognized safety standards and practices, but certainly would provide operational flexibility. It was noted that should an evacuation be necessary that FCDA might well take a major role in it, if able.

Dr. Clark pointed out that operationally it was not impossible to pre-warn people for an evacuation, but would involve some aspects of security.

Acting on a request from Dr. Tom White, it was the considered opinion of this Committee that radiological safety criteria established at ground level should hold also for aircraft passengers in military and commercial planes.

SECRET

UNIVERSITY OF CALIFORNIA
Los Alamos Scientific Laboratory
(Contract W-7405-Eng-36)
P.O. Box 1663
Los Alamos, New Mexico

In Reply
Refer To: DIR-638

7 July 1951

Dr. Shields Warren
Director, Division of Biology and Medicine
U. S. Atomic Energy Commission
1901 Constitution Avenue, NW
Washington 25, D. C.

Dear Dr. Warren:

As I indicated to you in my letter of June 22, 1951, I would keep you informed of any results obtained at Los Alamos bearing on the safety of Operation JANGLE. There is herewith enclosed an informal report by Dr. Gaelen Felt dealing with this problem and making some recommendations which are rather startlingly different from those which were being suggested earlier. Although I am not yet prepared to make any formal statement from the Los Alamos Scientific Laboratory on this matter (nor is it clear that I am supposed to do so), nevertheless I believe that you would be interested in Dr. Felt's approach.

We are endeavoring to study the small particle problem further, although this seems to present extreme difficulties. However, I am currently of the opinion that the major problem in safety is going to lie in this field rather than in any danger from external radiation dosage. We will, of course, continue to keep you informed of any progress we may make.

Yours truly,

NEB/hgc

/s/ N. E. Bradbury
Director

1A, 2A - Dr. Shields Warren w/encl.
3A - C. L. Tyler w/encl.
4A - A. C. Graves wo/encl.
5A - Dr. T. L. Shipman wo/encl.
6A - Reading File
7A - File

SECRET

SECRET

/APPENDIX I/

A. C. Graves, J-Division

June 28, 1951

Gaelen Felt, J- Division

JANGLE FALLOUT PROBLEMS

SD-9441

A. The JANGLE test program has raised, for the first time since Trinity, serious problems of radiological safety at moderate distances from the test site. A meeting was held on 25 June 1951 to discuss these problems and to arrive at decisions on the relative safety of the proposed shots and on the radiation levels to be expected. Those present were Shipman, White, Schulte, Harris, Brennan, Williams, and Heft from H-Division, and Ogle, Suydam and Felt from J-Division. The principal conclusions are given below:

1. The surface shot is considered the best shot with which to begin the program.

2. Under the worst conditions the integrated γ-dose at 50 miles would not exceed 10 roentgens from a single shot and for good conditions the estimated dose of about 3 roentgens is conservative on the side of safety by a factor of 3 to 5. The expected levels are acceptable to H-Division.

3. There is no predictable relation between radiation levels measured on the ground and the concentration of particles small enough to be retained in the lungs. Furthermore, the concentration of small particles in a region of space near the ground is completely uncertain and is virtually independent of the point of detonation, (underground or surface). It is felt, however, that on the average worse conditions will result from lower cloud heights than from higher.

4. Conditions necessary to produce β-ray burns will be accompanied by γ-ray levels higher than those tolerable to H-Division.

B. The conclusions listed above are based on arguments presented by various people at the meeting of 25 June. Rather than append the complete minutes, I will list below those points pertaining to the above subjects:

1. The data which best apply to the JANGLE problem are the Trinity data. The JANGLE shot which most nearly corresponds to Trinity is the surface burst. The theoretical model (see C below) developed to fit the Trinity data can therefore be trusted to predict results more closely for the surface shot than for the subsurface.

2. The model, matched to Trinity's 25-mile hot spot, predicts higher levels at greater distances than were actually recorded at those distances and may be considered conservative. Calculations for Greenhouse, though less convincing because of the lack of complete dose-rate contours and therefore of the exact numbers to be used, also give answers which are correct in order of magnitude, but are again conservative. (See Tables I and II.)

3. Surface winds are very difficult to predict over a period of hours. They are furthermore strongly affected by local terrain features. At greater altitudes, wind velocities and directions are steadier and more predictable.

4. The path of an active cloud can be predicted with some accuracy if the cloud reaches the higher altitudes. Experience from Ranger stems indicates that a low cloud will most likely follow the valleys. In that case the cloud would probably not disperse the 1 mile in 6 assumed in the calculations and would probably not follow a path based on local wind directions at the site except in a general sense. Mountain ridges and passes would not be effective in containing the small particles if the wind velocity were low. With higher winds the greater local turbulence would very likely increase local deposition, particularly on reverse slopes.

5. Trapping of fission fragments in the crater is very largely offset by the increase in neutron induced activity. There is, therefore, little to choose between one shot and another so far as total activity in the cloud is concerned.

6. The trajectories of particles small enough to be retained in the lungs are not predictable under actual conditions. Natural air turbulence will keep such particles suspended indefinitely until they are rained out or reach the earth by some other special mechanism. At ground level, in the absence of rainout, the concentration of such particles will be dilute. Still, it is better that these particles come from a higher altitude than a lower, since the numbers of such particles at ground level and at moderate distances will depend very little on the initial cloud height while the activity contained in those from a low cloud will be greater. The problem of small particles is, incidentally, little more significant for the JANGLE shots than for any other shots already fired or to be fired in the future. For all practical purposes, the time of descent of these particles to ground level is fortuitous and beyond the range of prediction.

A. C. Graves June 28, 1951

7. Our lack of knowledge of the effects of retention of a given number of active particles in the lungs does not permit a dividing line to be set up between a harmful and a harmless concentration. We are sure only that a zero concentration is harmless, and a zero concentration cannot be guaranteed. In view of paragraph 6 above, one may expect appreciable concentrations of small particles at any place and at any time beyond some minimum following a shot.

8. Our knowledge of the effects of external γ- and β-dosage is considerably more precise than is that of the effects of inhalation or ingestion. Damage from both γ- and β-radiation may be expected from exposure to the products of a nuclear explosion. The radiations will be quantitatively related and the more serious will be the γ-radiation. The severe β-burns noted on cattle near Trinity are a strong indication that these same cattle were subject to γ-doses of the same order as the emergency tolerance and possibly higher. For the present, the γ-dose is the best criterion for judging the degree of radiological hazard. In the case of sporadic exposure of the kind contemplated, in contrast with the repeated regular exposure suffered by workers in radiological fields, the allowable dose can, from the safety point of view, very well be raised to 5 or 10 roentgens (publicity considerations disregarded).

C. The theoretical model used to predict radiation levels as a function of distance for various conditions of particle size, cloud height, and wind velocity is based on the following assumptions:

1. The wind is constant in velocity and direction from the surface to the top of the cloud.

2. Directional and velocity wind shears are implied in the assumption that the cloud spreads horizontally 1 mile in 6.

3. Stoke's Law governs the rate of fall of all particles of interest.

4. The activity in the cloud at the time it begins to move away from the site is more concentrated at the top than at the surface. At any height the activity is initially proportional to $h^{7/2}$.

5. The fraction of the total activity carried by particles of diameter between D and D + dD is given by

$$dA = Kx^2 e^{-x^2} dx$$

where $$x = \frac{D}{a}$$

and "a" is a parameter representing a mean particle size, and "K" is a normalizing constant.

6. The yield is 1 KT and the total activity at the end of 1 hour is 300 megacuries. A deposition of 1 megacurie/mi^2 is equivalent to 4 r/hr.

A few remarks should be made in amplification and support of these assumptions. The assumption of constant wind velocity is better suited to work in the U. S. than to work at Eniwetok. Also, for the JANGLE shots, the clouds are not expected to rise to the great heights at which pronounced wind shears are found. The assumption of a spreading of the cloud corresponds to the observation that clouds do spread, but no detailed mechanism has been included in the calculations. Stoke's Law is used in the absence of anything better and in the knowledge gained from Eniwetok that it gives results not too far out of line with the facts. Similarly from experiments, all of which were above ground, it is clear that the higher parts of the cloud are more active than the lower (this fact may not hold for subsurface bursts). The choice of the 7/2 power law increase with height is, of course, arbitrary, and was made in order to obtain a hot spot like that found at Trinity. The odd half integral power was chosen to simplify the integrations. Stoke's Law relating the height from which a particle of given diameter must come in order to reach the earth at a given time indicates

$$h = KD^2.$$

In the integration of height and particle size which determines the activity at a given distance, one thereby obtains an odd power of x in the integral

$$\int_0^{x_0} x^{(2n+1)} e^{-x^2} dx$$

and can obtain the answer without reduction of the integral to a sum of terms plus an integral of the form

$$\int_0^{x_0} e^{-x^2} dx$$

The choice of a particle size distribution function is likewise arbitrary and is justified on several grounds. A Gaussian distribution is perhaps more logical but is equally arbitrary, implies some particles of negative diameter, and introduces an additional parameter, the standard deviation. The fact that the function chosen predicts that there will be more particles of 1-Å size than of 1-μ size is offset by the assumption that the activity carried by a particle is proportional to its area. The resulting curve of activity (rather than number of particles) as a function of particle diameter seems sensible enough. (One might point out that the effect of making the activity proportional to the area rather than the volume of a particle is largely washed out by the high power of the particle diameter introduced by the height function mentioned in the preceding paragraph). Normalization of the activity function shows that one-half of the total activity is concentrated in particles of diameter less than 1.1 a, where "a" is a mean particle size.

The form in which the calculated results are presented consists of a family of curves in which the parameter is h_0/a^2, the maximum cloud height divided by the square of the mean particle diameter. The abscissae are reciprocals of the times at which the fall-out begins, wind velocity divided by distance to the point under consideration, while the ordinates are given by the distance squared multiplied into the integrated dose. Since fission fragments alone are considered in the calculations and the $t^{-1.2}$ decay law is assumed, one may find the initial dose rate by dividing the total dose obtained from the curves by 5t where "t" is the time at which the fall-out began. Some typical results are given in the tables below:

Table I

Radiation rates at Trinity for a fit at the 25-mile hot spot. (Predicted mean particle size a = 75 μ)		
Distance (Miles)	Roentgens/hour	
	Measured	Predicted
120	0.1	0.5
180	0.01	0.09

Table II

Greenhouse Item (Based on a = 40μ calculated from Dog fall-out on Parry)			
Time of Fall-out (hours)	Effective Distance (Miles)	Roentgens/hour	
		Measured	Predicted
5	100	0.05	0.26
10	200	0.07	0.23

Table III

Cloud Height (Miles)	Distance (Miles) 5	10	20	35	50	100
Estimated total dose in roentgens from JANGLE shots. Wind velocity = 10 mph*, mean particle size = 75 microns (Trinity)						
½	920	100	9	1.3	0.4	0.03
1	1200	240	30	4.6	1.4	0.1
3	145	160	63	15	5.2	0.6

* - Dose beyond 40 miles will increase with wind velocity for all three cloud heights.

Table IV

Cloud Height (Miles)	Distance (Miles) 5	10	20	35	50	100
Estimated total dose in roentgens for JANGLE. Wind velocity = 10 Mph*, mean particle size = 20 microns.						
½	145	160	63	15	5.2	0.6
1	18	60	48	18	7	0.9
3	0.5	2	8	10	7	1.7

* - At 50 miles, level decreases for increasing wind velocities if cloud height is 3 miles.

The estimated doses in Tables III and IV will bear further comment. Our interests from the safety viewpoint center on the region from 35 to 100 miles. Tables III shows a marked increase of dose with cloud height and is apparently in contradiction with the statement that the surface burst is the best. It is felt, nevertheless, that the deposition from a low cloud may well be higher than indicated because of the confinement of the cloud to the valleys. It is mainly our uncertainties about the path of a low cloud, the extent of neutron activation, and the true particle size distribution which leads to the conclusion that the surface shot is the best one to start with.

Table IV indicates the effect of particle size. The levels are generally raised at the distances of interest -- 20 microns is about the worst size -- but it is apparent that the predictions are beginning to favor the higher cloud height. If the mean particle size is 12.5 microns, all levels fall and the dose from the 1/2-mile cloud height, though down to 3r, is a factor 10 greater than the dose from the 1-mile cloud. In the case of 12.5- particles, the doses are considerably greater for all cloud heights if the wind velocity is reduced from 10 to 5 mph.

GAELEN L. FELT
J-Division Office

GLF:lh

Distribution:
Cpy 1B thru 5B - Felt

Appendix

The attached curves are those from which the numbers in the tables were computed. For any given case one first determines which of the family of curves to use from the relation

$$\frac{h_o}{a^2} = 2^n \times 10^{-4}$$

where "h_o" is the cloud height in miles and "a" is the mean particle diameter in microns. If one then chooses a wind velocity "V" in mph and a distance "D" in miles from zero one can determine the integrated dose "I" in roentgens from the curve labeled by the parameter "n".

The following points are immediately evident from the curve:

(1) For fixed "V" and "D" a unique value of "n" gives the heaviest dose at D. Thus for a fixed mean particle diameter "a" the dose will be decreased both by higher and lower cloud heights. Physically the higher cloud leads to greater dilution and the lower leads to greater deposition, near the crater.

(2) For fixed "h_o" and "a", two regions of wind velocity "V" exist such that the dose at "D" is below the maximum possible at that distance. For example, if, at $D = 50$ miles and $n = 4$, one wants the integrated dose to be less than 5 roentgens, the condition will be met by

$$V \geq 18 \text{ mph}$$

or

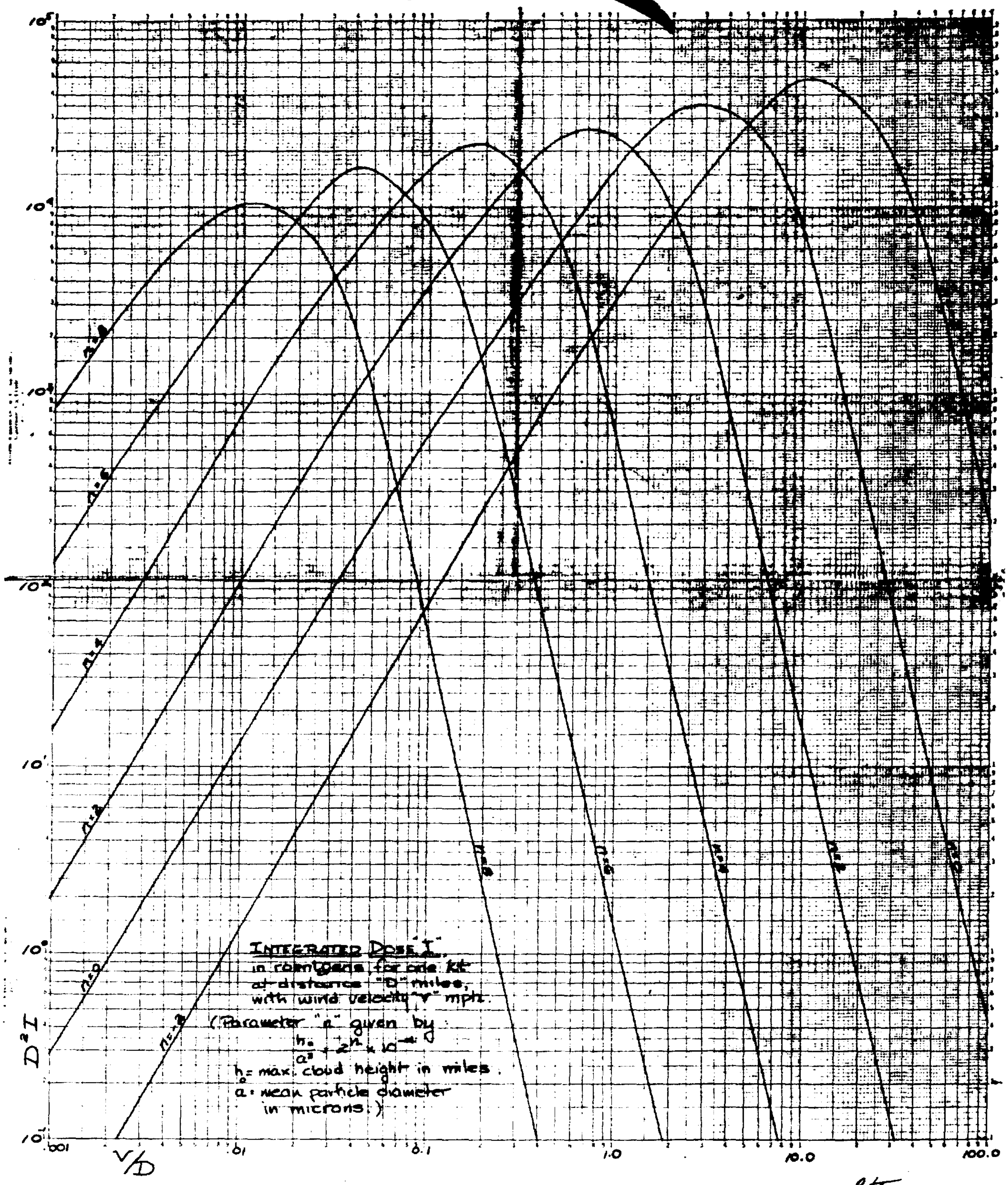
$$V \leq 3.4 \text{ mph}$$

The condition $n = 4$ corresponds to a cloud height of 2 miles and a mean particle size of about 35 microns.

Distribution:

Cpy 1A thru 6A - Felt (w/1 att. each)
Cpy 7A - J-Division
Cpy 8A - J-Sequence
Cpy 9A - Mail & Records

~~SECRET~~



10^5
10^4
10^3
10^2
10^1
10^0
10^{-1}
D^2I
.001
.01
0.1
1.0
10.0
100.0
V/D
n=8
n=6
n=4
n=2
n=0
n=-2
INTEGRATED DOSE "I"
in roentgens for one kt
at distance "D" miles,
with wind velocity "V" mph.
(Parameter "n" given by
$\frac{h_0}{a^2} = 2^n \times 10^{-4}$
h_0 = max. cloud height in miles.
a = mean particle diameter
in microns.)

SECRET

APPENDIX II

John C. Clark, J-Division July 11, 1951

T. L. Shipman, M.D., Health Division Leader

SPECIAL RAD SAFE PROBLEMS - OPERATION BUNGLE

H-59

In view of your forthcoming trip to Washington, there are a few matters which I would like to send along with you, either for your own information or for discussion in Washington.

1. L. R. D.

In accordance with the conference in your office on 11 July, it can be stated that neither you as its Director nor the Rad Safe officers have specific interest in cloud tracking activities beyond a maximum radius of 600 miles. It is our feeling that beyond this distance any cloud will be sufficiently dispersed so that aircraft, commercial, private or military, can fly through it with impunity. I further feel that at these distances there can be no significant fall-out which could possibly produce a health hazard of any sort. We feel, therefore, that cloud tracking activities beyond this distance should be contracted for by the AEC. By previous memo and discussion with Walter Claus of the Division of Biology and Medicine, I have stated that we do not feel able to administer and supervise dust collecting, air sampling or ground monitoring programs beyond a 200-mile area, and that such work, if it is to be done, should be administered by someone in or appointed by the Division of Biology and Medicine. The information gained from such programs is of some academic interest to us, and copies of reports of such activities should certainly be sent here. The information gained, however, may be of specific interest and importance to the AEC and the Division of Biology and Medicine in providing data for the photographic industry and also in defending any claims or suits for damage resulting from the operations. If the Division of B & M has not started anything in this direction, they should perhaps be needled gently.

2. Evacuation

It is my feeling that developing detailed plans for possible evacuation of civilian population and the carrying out of such plans is not a responsibility of the Rad Safe organization. I feel that it is our responsibility to determine in advance under what conditions evacuation should be accomplished and to state when such conditions have been attained. It should be an additional responsibility to point out which of alternate evacuation routes might be preferable. The magnitude of the operation is already placing enough of a work load on all Rad Safe personnel so that I do not feel it possible to assign specific people to this work. There is also the fact

SECRET

RESTRICTED DATA
This document contains restricted data as defined in the Atomic Energy Act of 1946.

that should we approach a situation where the question of evacuation might come up for active consideration, all of our available people will be busy monitoring, etc. It will certainly not be the time to have these people wondering about how to get children, pets, etc. into vehicles. I do feel, however, that some organization should carry out specific planning for possible evacuation of civilian groups in the surrounding area. It is absolutely essential that this be done in such a way as to avoid frightening people unnecessarily. We do not wish to wear out our welcome or otherwise jeopardize the cordial public relations currently existing. Technically speaking, this is the sort of thing which should be the responsibility of the Civil Defense organization on a State level, although I doubt if any such organization actually exists.

3. Permissible Exposure

For both Operation Ranger and Operation Greenhouse we used a permissible exposure of 3.0 r for the operation. If it is agreeable with Dr. Warren, we propose that this same level be used again. Experience in the two recent tests has shown this to be realistic and workable. We do not consider it a calculated risk; neither does it appear to be unduly restrictive.

In this connection I might point out that certain workers at Greenhouse actually got more exposure from fall-out than from operational activities. This situation was totally unexpected, and was more or less handled by studiously looking the other way. In other words, workers were not credited with fall-out exposure in determining the extent of their activities, although it meant that a number of people came home with quite significant total exposures. In the cases of Los Alamos personnel this has been entered in their exposure records. I do not feel that we can afford to adopt a similar policy again. (This does not imply criticism of the decisions made at Greenhouse).

I feel that using the 3.0 r permissible exposure for the operation does not seriously violate the spirit of the AEC directive on this matter. Actually we are giving ourselves a little leeway to permit the concurrent beta exposure which is not measured.

There has already been expressed by some of the military groups the feeling that they may not necessarily be bound by the same permissible exposure levels as will be used for other workers; they would like to feel that they can go ahead and get higher exposures if they wish. Certainly I on my own responsibility cannot permit this; and as this operation is being staged fundamentally by the AEC, I feel that there should be a specific directive covering this matter from Dr. Warren personally. We can think of a few rare individual cases where leniency might be permitted, such as the pilot of a jet plane collecting air samples.

SECRET

4. Sequence of Detonations

At the meeting of Dr. Warren's committee which was held here in May, it was decided that Operation Jangle would open with the deep underground shot. This particular shot was added to the plan of the operation purely as a method to determine the safety of the succeeding shots. It was the major premise of this committee that such a shot would be the safest of the three, in that the radioactive cloud would be contained by surrounding mountains. After considering this matter carefully, we feel that this is a false assumption and that in all probability the deep underground shot could be the most dangerous of the lot. Basing my personal opinion on the calculations made by Gaelen Felt and on various conversations and discussions with Jerry Suydam, Bill Ogle, members of H-1, and others, I am satisfied that the deep underground shot would probably be the most dangerous of the three, and that it could under proper conditions deposit dangerous amounts of activity in populated areas.

I realize perfectly well that such an opinion cannot be proven beyond doubt by any calculations done so far, but I feel strongly that firing the deep underground shot represents a possible risk to surrounding population and livestock; and that should things go wrong, it could jeopardize the entire future of the Nevada Test Site. Personally I would be willing to accept this risk if I felt that the detonation were essential from a scientific or military point of view. It is my understanding, however, that while the D. O. D. and others have accepted the inclusion cheerfully, this particular detonation was tossed in purely as a radiologic safeguard. For this reason, therefore, it is my personal recommendation that the deep underground shot be eliminated from Operation Jangle, and that the surface detonation be fired first.

/Original signed by Thomas L. Shipman, M.D./

T. L. Shipman, M.D.
Health Division Leader

TLS/es

Distribution: John C. Clark - cy 1A
T. N. White - cy 2A
H-Div. File - cy 3A

P.S. I should not forget to add the opinion which is generally held here, and to which I subscribe, that the exposures permissible for the general population beyond the 40 mile radius, which were proposed by Dr. Failla and incorporated in Dr. Warren's report of the meeting here, simply are not realistic. It would cause me personally very little concern if some of these people should by chance receive as much as 5 or 10 r total dose. I would not anticipate exposure of this magnitude, but if conditions were right, a dose of 2 or 3 r might not be surprising. I would consider evacuation if the estimated total dose seemed to be somewhere between 25 and 50 r, provided we could be certain that such evacuation would not serve to increase the exposure rather than decrease it.

SECRET

SECRET

DISTRIBUTION:

copy 1 Dr. A. Spilhaus, AFSWP
2 Col. Benjamin Holzman, USAF
3 Capt. H. L. Andrews, USPHS
4 Dr. H. Scoville, AFSWP
5 Dr. Louis Hempelman, University of Rochester
6 Dr. J. O. Hirschfelder, University of Wisconsin
7 Dr. John Magee, University of Notre Dame
8 Dr. Gaelen Felt, LASL
9 Dr. Jack C. Clark, LASL
10 Dr. S. Warren, Division of Biology & Medicine
11 Dr. L. W. Tuttle, Division of Biology & Medicine
12 Dr. J. C. Bugher, Division of Biology & Medicine
13 Mr. R. L. Dutenhoff, Division of Biology & Medicine
14 Mr. H. C. Brown, Division of Biology & Medicine
15 Mr. L. Joe Deal, Division of Biology & Medicine
16 Lt. Col. W. R. Sturges, Division of Military Application
17 Col. George Schlatter, Division of Military Application
18 Mr. Merril Eisenbud, NYOO, USAEC
19 Dr. Thomas Nolan, USGS, Department of Interior
20 Dr. Walker Bleakney, Princeton U.
21 Dr. Harold Hodge, Rochester AEC Project
22 Dr. G. Failla, Columbia U.
23 Dr. L. T. E. Thompson, Naval Ord. Test Station
24 Col. Richard Coiner, AEC
25 Mr. Carroll Tyler, SFOO
26 Dr. Norris Bradbury, LASL
27 -- 35 -- Div. of Biology & Medicine, AEC, Washington, D.C.

SECRET