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Thomas E. Murray
Commissioner

December 11, 1951

Walter D. Claus, Chief, Biophysics Branch,
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CONSIDERATION OF THE GABRIEL REPORT

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SYMBOL: BMBP:WDC

Dr. John Bugher has asked me to prepare for you the following summary of the meeting of November 29 and 30 on the subject of the Gabriel Report. A copy of this has also been forwarded to Dr. Smyth.

An ad hoc committee was convened by Dr. Shields Warren on November 29-30, to evaluate the Gabriel Report and to give further consideration to the question of long-range and residual hazards which might be attendant upon the explosion of a large number of atomic bombs in warfare.

The Committee consisted of:

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- Dr. Lauriston S. Taylor, Chairman (U.S.N.B.S.)
- Dr. Nicholas Smith (author of Gabriel reports, and presently with Operations Research Office)
- Dr. Edward Teller (L.A.S.L. and U. Chicago Institute of Nuclear Studies)
- Dr. Joseph Kaplan (U.C.L.A. Geophysicist)
- Dr. Leo Marinelli (Radiologist and Health Physicist, Argonne)
- Col. Benjamin Holzman (U.S.A.F. Meteorologist)
- Dr. Sterling Hendricks (U.S.D.A. soil expert)
- Dr. William Urry (AFOAT - 1)
- Dr. Donald Reck (AFOAT - 1)
- Dr. Shields Warren (Div. Biol. & Med.)
- Staff members of Divs. Biol. & Med., Military Application and Reactor Development)
- Dr. Sverre Petterssen, Director of Scientific Services, Air Weather Service, attended briefly to discuss European weather and answer questions.

CLASSIFICATION CANCELLED BY AUTHORITY OF DOE/OC
Jose Diaz 4-17-81
REVIEWED BY DATE
Wilbur A Strauser 4-20-81
REVIEWED BY DATE
By: Dick Koogle 6-12-87
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M. L. KOLBAY, A.D.C. DATE: 11/7/94

The Committee considered the revised Gabriel Report of November 8, which had arrived at a number of the order of 10^5 nominal bombs which might be exploded before widespread radioactivity would become generally hazardous. This conclusion was based on the following assumptions, derived from the best available data.

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1. A fraction of 5×10^{-8} of each bomb would fall out per square mile. (Ranger data indicate this is conservatively large. Buster data are not yet compiled, but appear to be of the same order as Ranger data. Also it is known that bomb debris is contained in a ring about the earth some 30° wide. The area of the north temperate zone (43° wide) is 2×10^{8} square miles, so that fallout might be 5×10^{-9} per square mile, approximately the amount observed during Ranger).

2. Long-time hazard is primarily dependent upon ingestion of strontium-90, and 10^{-3} of the Sr fallout would be ingested by humans.

3. The mid-lethal ingestion dose is 10 micrograms.

4. An average of 200 people derive their feed from a square mile.

If about 55 grams of strontium is scattered per nominal bomb, the micrograms ingested per person would be

$$(55 \times 10^{+6} \times 5 \times 10^{-8} \times 10^{-3}) / 200 \cong 1.4 \times 10^{-5}$$

On the basis of something less than 10 micrograms being reasonably safe, approximately 10^{5} nominal bombs could be exploded.

The reviewing Committee agreed that under the safe meteorological conditions prevailing at Ranger and Buster, probably 10^{6} kilotons (including thermonuclear reactions) could safely be exploded in air and tower shots. On the other hand, the Military might not always detonate bombs under conditions chosen for minimal health hazards. Nevertheless, there might be situations where long-time poisoning of territory or of civilian populations would be undesirable.

Relatively short-range hazards (in both time and space) were seen to depend largely on rain-out of bomb debris, since the only observations of large fall-out in the U.S. were in areas of rain or snow. Hence considerable attention was given to questions of climatology, mixing of debris clouds with rain clouds, inclusion of debris in the thundershowers, scavenging of debris by rain-drops and by snow-flakes, and seeding of rain clouds.

Dr. Petterssen attempted to answer questions regarding frequency of rains in typical European areas, as for example the Leubeck area on the Baltic, the area of Weisbaden and of Budapest. Precipitation

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in central Germany is spotty in summer, more widespread in winter; the north has more general precipitation; the south has stronger high winds, milder and variable surface winds, and a relatively small amount of precipitation. Dr. Petterssen promised to submit a brief summary of weather in the three regions, gathered from reports now in existence.

It seems obvious that the weather would result in markedly different residual hazards from atomic bombs used in these three different areas.

Discussions indicated that precipitation gave increased emphasis to questions of external dosage.

1. Fallout contamination of the soil.

   Assuming that a bomb cloud was scoured through rainout in a wedge 200 Km x 30 Km, the average bomb fraction deposited would be approximately 10^{-4}/square mile (instead of the wide-spread average of 5×10^{-8}). Strontium contamination ceases to be the critical factor, except as the contaminated ground might be put out of agricultural use, and external radiation becomes the limiting short-distance effect.

2. External radiation.

   The average dose from a nominal bomb under the above conditions becomes about 1200 r over 10 - 12 hours, part of which, however, is beta radiation. The dose would probably be higher in some areas, less in others and would seem to be the critical factor. Inhalation is considered to be inconsequential in case of heavy rainout or snowout.

3. Inhalation hazard due to low-level bomb cloud.

   Should the bomb debris be held close to the ground in a wedge 200 Km x 30 Km and 40 meters high, the dose to the lung would be approximately the same as the external dose of about 1200 r. But if the cloud were to go to 6000 meters, the external dose would be about 3 r, and the inhalation dose to the lungs, roughly the same.

   (Note: These figures may be subject to some revision, upon more careful review of notes.)

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Thomas E. Murray [redacted]ember 11, 1951

4. Surface or sub-surface bursts (ground or water) would probably require analysis similar to intense rain-out.

The conclusion appears to be (although not specifically stated by the Committee) that when there are short-range effects such as would result from heavy precipitation at the time of, or immediately following bomb detonations, external radiation intensities are the limiting factors. Other effects such as inhalation or ingestion hazard, or soil contamination, are of secondary importance. The hazards are readily measured, and one nominal bomb under suitable conditions can place large areas in jeopardy. The number of bombs which can be detonated depends on weather conditions (if high local contamination is to be avoided), and the estimated number will depend upon the climatology of the region in which they are to be used.

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