

UNCLASSIFIED

INTER-OFFICE MEMORANDUM

DATE 1 September 1945

TO: G. Kistiakowsky

FROM: V. Weisskopf, P. Aebersold, L. H. Hempelmann, F. Reines

SUBJECT: CALCULATED BIOLOGICAL EFFECTS OF ATOMIC EXPLOSION IN HIROSHIMA AND NAGASAKI

The accompanying table indicates the blast pressures and radiation and heat intensities which have been calculated for the atomic explosion at Hiroshima and Nagasaki. The calculations indicate the following:

1) Blast effect (flying debris, falling buildings, violent displacement, etc.) may be lethal as far as Class A damage (1-1/2 mile radius) and possibly further. Freak survivals of individuals within this area certainly occur. According to the information obtained during the bombing of English cities, such survivals might even occur in the areas of greatest damage, i.e., within 1/2 mile of the point directly beneath the explosion.

2) The gamma radiation emitted within a few seconds after the explosion would probably be lethal for 800-900 meters since the lethal dose of this type of radiation is 500-900 roentgens. Freak survivors of the blast within this area would be killed by radiation. Death in these cases might be delayed for a period of weeks. The number of neutrons reaching the ground would probably cause no damage.

3) Severe thermal burns (third degree) of the exposed skin would probably occur almost for one mile. Clothing would afford considerable protection of the skin from the heat and light rays; even the lightest type of shelter would afford complete protection. Because of the short intense exposure, these burns would probably be even more serious than the most severe sunburns even though the spectrum of light from the explosion compares with that of sunlight.

4) Biological damage due to radiations from radioactive material deposited on the ground cannot be calculated since the latter is not known. It is likely to be insignificant but unusual meteorologic phenomena resulting in local precipitation or deposition of active material on falling dust particles cannot be excluded.

5) Other serious biological effects due to suffocation, (burning to death), etc., cannot be predicted.

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CALCULATIONS ON HIROSHIMA EXPLOSION

Radius in Meters on ground	Distance from bomb in meters	Roentgens actual	Blast (psi)	Heat & Light (like sunlight) cal/cm <sup>2</sup>	Depth of Skin Heated to 100° C. in mm.
0	550	35,000		100	7.5
590	800	2,500	27.0	39.5	3.0
840	1000	600	23.0	25.0	1.8
1000	1140	300	15.0	19.5	1.5
1400	1500	130	9.0	11.0	1.0
2400	2500	10	4.0	3.3	~0

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