404468

General Summary

First Shot on May 15

10:30 A.M.
temp 80° humidity 60%
Wind 18 m.p.h. from east
Waves on lagoon 3 feet height
20% cover of cumulus clouds at 3 to 5000

B-29 comes in at 30,000 ft, drops bomb 3.0 miles before reaching target, makes 100° turn with 3 mile radius of curvature. The bomb explodes 49 seconds later. The plane is than 10 miles away in total distance and plane is jolted as in heavy flak by between .15 and .20 psi. (.35 psi considered safe)

Blast

The explosion itself is very normal in most respects. As far as blast pressures are concerned one can scale from a 1 pound charge all distances multiplied by $W^{1/3}$ and all times multiplied by $W^{1/3}$. A normal blast damages structures by its impulse, the atom bomb blast damages by virtue of the peak pressure. Its duration is of the order of 0.5 to 1.0 seconds which is much longer than the natural period of oscillation of most structures. Because of this long duration, it is not safe to extrapolate physiological effects from normal blasts. We expect 20,000 tons TNT energy yield.

Shock over pressure (psi)	Horizontal Distance (yds)	Time (seconds)	Remarks
50	400	.4	Marginal Distance for killing people by blast, also for collapsing battleships and blowing in portholes.
10	900	1.25	Pressure still very high. Suction phase of shock well formed.
5	1350	2.4	Limit to A damage for reinforced concrete structures.
3	1900	3.5	Limit of A damage to weak structures, B to strong structures.
2	2500	5.5	Limit B damage to weak C for strong structures
.5	6800	19	Limit house windows would be blown
.082	35,000	90	Gentle breeze and thunderous rumble reaches spectators.

Visible Radiation (very strong in ultraviolet)
50 suns for .002 seconds at 10,000 yds
2 suns between .02 and 1 second
2/t (minutes) suns thereafter

Heating

Pine wood 400° at 1350 yards (charring)
100° at 2700 yards

Metal heats 1/30 as much as the pine and only melts in ball of fire.

If skin and tissue resemble pine wood, it will char at 1350 yards and produce physiological damage.

Gamma Radiation

In the initial burst lasting one minute at a distance R (yds):

$$\text{Roentgen units} = \frac{400{,}000}{(R/500)^2} \times 10^{-(R/500)}$$

This amounts to 1000 Roentgens at 1000 yards or 44 Roentgen at 1500 yards and drops rapidly thereafter.

The fission products produce $\frac{7.6 \times 10^{+23}}{t}$ $\frac{\text{MEV gammas}}{\text{hour}}$

where t is the time after the explosion in hours. This equation is valid after one minute. In the first shot about 0.2% of the fission products will be distributed to a radius of 1500 feet on the surface of water. The radioactivity at the center and 3 feet above the water will be

t(hours	Roentgen/hour
0.5	143
1	53
2	19
4	7

After the second shot 5% of fission are uniformly distributed in water in a cylinder of 1000' radius and 180' depth to give 3 feet above water surface

$$\text{Roentgen per hour} = 62/t(\text{hours})$$

The radioactive water moves at a velocity of 0.5 miles per hour towards the west and will therefore soon move out of the target area.

The activity in the center of cloud will be approximately

$$\text{Roentgen/hour} = 720/t(\text{hours})$$

assuming that the center of the cloud is at 40,000 ft and occupies 10 cubic miles after the first hour. The induced activity of the sea water is negligible (a few percent of activity of deposited fission products). The induced activity on any ship which remains afloat will be negligible.

Neutron Radiation

From experimental results at Trinity

$$\frac{\text{no. neutrons}}{\text{cm}^2} = 2.24 \times 10^{12} \times 10^{-(R(\text{meters})/840)^2}$$

R(meters)	$\frac{\text{no. neutrons}}{\text{cm}^2}$
100	2×10^{12}
600	1×10^{11}
1000	1×10^{9}
1500	1×10^{5}