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By WJ NARA, Date 3/10/89

30 July 1945

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MEMORANDUM TO THE CHIEF OF STAFF

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1. The following additional conclusions have been drawn from the test in New Mexico with respect to the probable effects of the combat bomb which will be exploded about 1800 feet in the air:

a. Measured from the point on the ground directly below the explosion the blast should be lethal to at least 1000 feet. Between 2500 and 3500 feet, blast effects should be extremely serious to personnel. Heat and flame should be fatal to about 1500 to 2000 feet.

b. At 10 miles for a few thousandths of a second the light will be as bright as a thousand suns; at the end of a second, as bright as one or possibly two suns. The effect on anyone about a half mile away who looks directly at the explosion would probably be permanent sight impairment; at one mile, temporary blindness; and up to and even beyond ten miles, temporary sight impairment. To persons who are completely unshielded, gamma rays may be lethal to 3500 feet and neutrons to about 2000 feet.

c. No damaging effects are anticipated on the ground from radioactive materials. These effects at New Mexico resulted from the low altitude from which the bomb was set off.

d. Practically all structures in an area of one or two square miles should be completely demolished and a total area of six to seven square miles should be so devastated that the bulk of the buildings would have to have major repairs to make them habitable.

e. At New Mexico tanks could have gone through the immediate explosion area at normal speeds within thirty minutes after the blast. With the explosion at the expected 1800 feet, we think we could move troops through the area immediately preferably by motor but on foot if desired. The units should be preceded by scouts with simple instruments. The nearest exposed personnel should not be nearer to the blast than six miles plus the necessary allowance for bombing inaccuracy and they would require a high order of discipline and special but simple instructions. As an extra

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Memo to Secretary of War

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precaution, extra special dark glasses might be issued to all commanders of units as large as a platoon. If dropped on the enemy lines, the expected effect on the enemy would be to wipe out his resistance over an area 2000 feet in diameter; to paralyze it over an area a mile in diameter; and to impede it seriously over an area five miles in diameter. Troops which were in deep cave shelters at distances of over a mile should not be seriously affected. Men in slit trenches within 800 feet should be killed by the blast.

2. The energy of the test explosion has been broken down as follows:

Total theoretical energy contained in the bomb at 100% efficiency was 21,000 to 24,000 tons. Of this amount, 21,000 to 24,000 tons were converted into actual energy made up of:

- Blast -- 10,500 tons minimum, 13,500 maximum
- Light -- 2500 tons
- Waste Heat -- 8000 tons, about 4000 of which went into the air and 4000 into the ground. If the explosion had been at the combat altitude of 1800 feet, most of the 4000 that went into the ground would have been converted into blast, making the total blast from 14,000 to 17,000 tons.

3. There is a definite possibility, as we increase our rate of production at the Hanford Engineer Works, with the type of weapon tested that the blast will be smaller due to detonation in advance of the optimum time. But in any event, the explosion should be on the order of thousands of tons. The difficulty arises from an undesirable isotope which is created in greater quantity as the production rate increases.

4. The final components of the first gun type bomb have arrived at Tinian, those of the first implosion type should leave San Francisco by airplane early on 30 July. I see no reason to change our previous readiness predictions on the first three bombs. In September, we should have three or four bombs. One of these will be made from 235 material and will have a smaller effectiveness, about two-thirds that of the test type, but by November, we should be able to bring this up to full power. There should be either four or three bombs in October, one of the lesser size. In November there should be at least five bombs and the rate will rise to seven in December and increase decidedly in early 1946. By some time in November, we should have the effectiveness of the 235 implosion type bomb equal to that of the tested plutonium implosion type.

5. By mid-October we could increase the number of bombs slightly by changing our design now to one using both materials in the same bomb. I

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have not made this change because of the ever present possibilities of difficulties in new designs. We could, if it were wise, change our plans and develop the combination bomb. But if this is to be done, it would entail an initial ten-day production setback which would be caught up in about a month's time; unless the decision to change were made before 1 August, in which case it would probably not entail any delay. From what I know of the world situation, it would seem wiser not to make this change until the effects of the present bomb are determined.

L. R. GROVES
Major General, U.S.A.

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