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Seeing a Super-Bomb

It was a remarkably prescient document—the first technical description of a workable atomic bomb. The authors were Austrian-British physicist Otto R. Frisch and German-British physicist Rudolf E. Peierls, University of Birmingham. They conceived of this "super-bomb" five-and-a-half years before Hiroshima. They realized that "the most effective reply" to a foe's possession of such a weapon would be "a counter-threat with a similar bomb"—i.e., deterrence. The memo lent great impetus to US and British nuclear efforts and helped lead to the Manhattan Project.

"Frisch-Peierls Memorandum"

Otto R. Frisch and Rudolf E. Peierls
Memo given to the Committee for the Scientific Survey of Air Warfare
Birmingham, England
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Find the full text on the *Air Force Magazine's* website
www.airforcemag.com
"Keeper File"

The attached detailed report concerns the possibility of constructing a "super-bomb" which utilizes the energy stored in atomic nuclei as a source of energy. The energy liberated in the explosion of such a super-bomb is about the same as that produced by the explosion of 1,000 tons of dynamite. This energy is liberated in a small volume, in which it will, for an instant, produce a temperature comparable to that in the interior of the sun. The blast from such an explosion would destroy life in a wide area. The size of this area is difficult to estimate, but it will probably cover the center of a big city.

In addition, some part of the energy set free by the bomb goes to produce radioactive substances, and these will emit very powerful and dangerous radiations. The effects of these radiations is greatest immediately after the explosion, but it decays only gradually and even for days after the explosion any person entering the affected area will be killed.

Some of this radioactivity will be carried along with the wind and will spread the contamination; several miles downwind this may kill people. ...

Photo via Wikipedia

Otto Frisch (second from left) and Rudolf Peierls (third from left) flanked by British mathematician William Penney (l) and British physicist John Cockroft. All four worked on the Manhattan Project.

It is a property of these super-bombs that there exists a "critical size" of about one pound. A quantity of the separated uranium isotope that exceeds the critical amount is explosive; yet a quantity less than the critical amount is absolutely safe. The bomb would therefore be manufactured in two (or more) parts, each being less than the critical size, and in transport all danger of a premature explosion would be avoided if these parts were kept at a distance of a few inches from each other. The bomb would be provided with a mechanism that brings the two parts together when the bomb is intended to go off. Once the parts are joined to form a block which exceeds the critical amount, the effect of the penetrating radiation always present in the atmosphere will initiate the explosion within a second or so. ...

We do not feel competent to discuss the strategic value of such a bomb, but the following conclusions seem certain:

1. As a weapon, the super-bomb would be practically irresistible. There is no material or structure that could be expected to resist the force of the explosion. ...

2. Owing to the spread of radioactive substances with the wind, the bomb could probably not be used without killing large numbers of civilians. ...

3. ... Since all the theoretical data bearing on this problem are published, it is quite conceivable that Germany is, in fact, developing this weapon. ...

4. If one works on the assumption that Germany is, or will be, in the possession of this weapon, it must be realized that no shelters are available that would be effective and that could be used on a large scale. The most effective reply would be a counter-threat with a similar bomb. ...