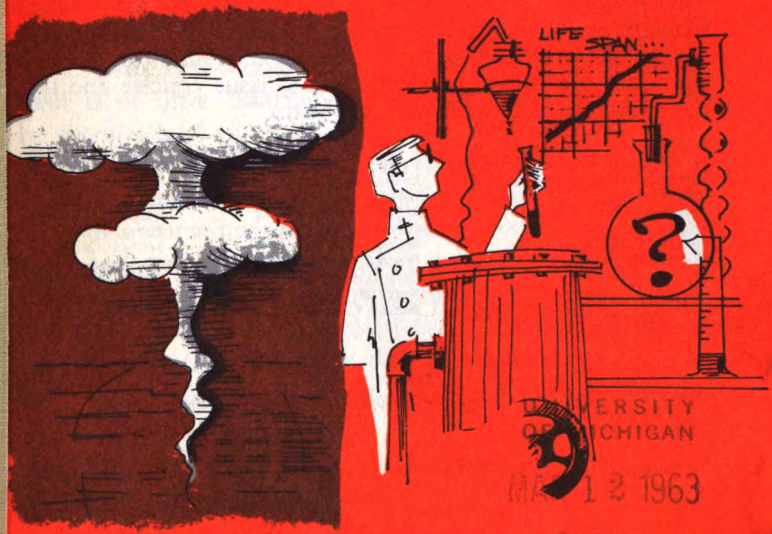
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TESTING AND TAMING OF NUCLEAR WEAPONS

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BY DAVID R. INGLIS

The author of this timely pamphlet is Senior Physicist of the Argonne National Laboratory, chairman of the Federation of American Scientists, and a former editor of the Bulletin of Atomic Scientists. . . . *Illustrations are by Bill Dove of Visual Services, Inc.*

Everyone knows that nuclear energy has brought a revolution in the life of man. It is a dual challenge, a threat and a promise. The threat is of utter destruction by the nuclear weapons of war. The promise is of an abundant life for all of mankind based on nuclear power and nuclear aids to medicine and other sciences. The promise will be fulfilled only if we live long enough, somehow evading the threat of destruction.

It would be more pleasant to dwell on the promising side, to hope that by emphasis on "atoms for peace" we could somehow push the threat into the background. That approach is a little like sweeping the dirt under the rug. It is the purpose of this pamphlet to look instead at the more serious aspect of the atomic age, at the threat and to see whether there is something we can do to ameliorate it.

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air descends. The radioactive material may spend a month or more in the troposphere getting mixed up with the weather before it starts to come down in rain. Most of it falls in the north-temperate zone, including the northern half of the United States.

The nice thing about this arrangement is that practically none of this worldwide fallout comes down very soon, and there is time for the very intense and short-lived part of the radioactivity to die. The long-lived radioactive elements of the bomb debris are the ones which cause concern. The most important of these are known as Strontium 90, and Cesium 137. It takes about thirty years for these materials to lose half of their radioactivity.

present and future fallout

The increase of radioactivity from fallout in the past few years is shown by measurements of the Strontium 90 in the soil near New York City. The measurements are in a unit called millicuries per square mile, and the increase is interesting. At the end

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dead within two miles of a bomb would be lucky compared with those farther away whose skin might peel off from flesh burns, or who might be incinerated in the firestorm. There would be little or no chance for care of the wounded, for they would be legion and in most places the healthy people who were further from the bombs would have to hide in holes and cellars to avoid the radiation from "local" fallout, extending in a wide swath hundreds of miles downwind from each big bomb burst. When they would emerge weeks later, they would face the problem of controlling the panic of desperate mobs fighting for the remaining food supplies, and of raising food fit to eat from contaminated soil.

That it would be terrible beyond imagination there is no doubt, but it is impossible to say just how bad it would be, how many would survive the direct effects of the initial attack, how many would survive the ensuing panic and turmoil and disease, how many might resume an orderly and productive existence, and to what extent some remnants of civilization might survive. We have no experience with human behavior under such extreme circumstances of terror and universal bereavement.

Studies have been made of what might happen if we *assume* an attack of a certain intensity, but it would be a mistake to consider the result a prediction of what will happen. There was in

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***Solution*— A good test ban agreement backed by inspection.**

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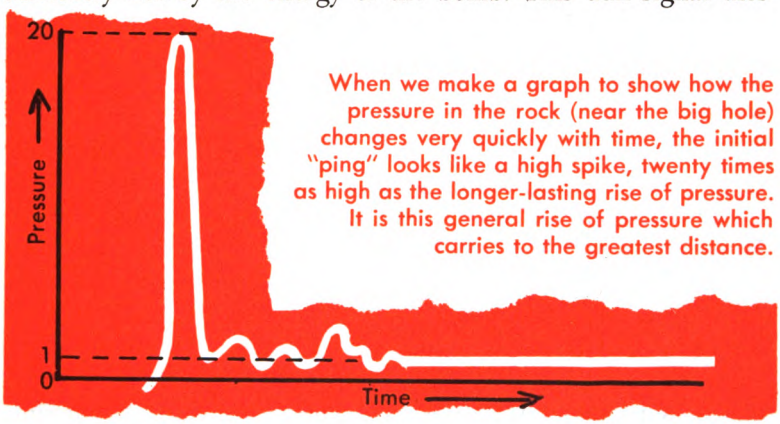
***Solution*—Control of production of nuclear materials and methods of delivery.**

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the extent of believing that another nation might go to some trouble to hide tests, we must be reasonable in judging how much effort they might decide to expend.

muffling tests in big holes

The method of hiding tests so far discussed which seems the least implausible involves preparing a very large round cavity deep underground and detonating the bomb at its center. The air space around the bomb muffles the shock transmitted to the surrounding rock. Two very different kinds of vibrations go out into the rock, along with various intermediate varieties. The first is a sharp "ping" made when the shock wave in the air meets the rock. It remains quite strong for two or three hundred miles, but becomes rapidly weaker at greater distances. The second is a dull "thud", a slow outward shift of the rock to make room for the expansion of the cavity when the air in it is made extremely hot by the energy of the bomb. This dull signal dies

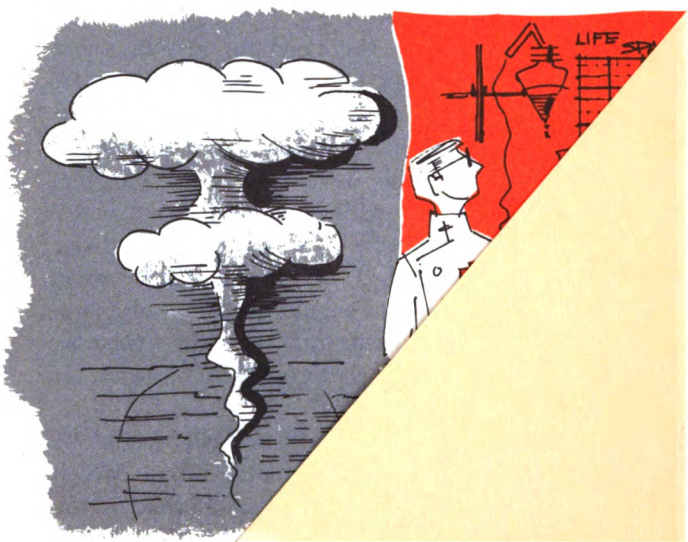


When we make a graph to show how the pressure in the rock (near the big hole) changes very quickly with time, the initial "ping" looks like a high spike, twenty times as high as the longer-lasting rise of pressure. It is this general rise of pressure which carries to the greatest distance.

off more gradually at greater distances, and in most cases it can be observed thousands of miles away. Because it travels so far, it has been considered to be the most useful basis for monitoring, and the control system which has been discussed at Geneva depends entirely on this low-frequency signal. Seismologists have

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temptation to seek the advantage of an overwhelming surprise attack. If we could fully appreciate the uncertainties of the situation, we would probably insist that our government pursue more seriously the possibility of such a step of disarmament. We would surely cease to tolerate our decade-long failure to establish a vigorous agency with adequate laboratory and development facilities dedicated solely to devising and assessing possible paths to a more stable peace through various degrees of arms control.



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