PUBLIC SAFETY

Nuclear Testing Resumed

➤ THE RESUMPTION of Russian nuclear testing poses another problem besides the threat of war: the dangers of radioactive fallout.

The threatened testing of a 100 megaton nuclear bomb—5,000 times more powerful than the Hiroshima bomb—could dump more than five tons of intensely radioactive debris into the earth's atmosphere. Most of the radioactive particles would be swept by winds to all corners of the earth.

The earth's atmosphere is still recovering from the extensive nuclear testing concluded in late 1958, which marked the beginning of the informal moratorium. The following spring the largest amount of radioactive fallout rained down from the sky.

Although the United States has also announced plans to resume nuclear testing, the tests will be conducted underground where radiation contamination is at a minimum. The most powerful United States bomb is somewhere in the range of 20 megatons.

The Russian atomic bombs exploded this fall will produce a large fallout in the spring. The amount of radioactive pollution depends upon the size of the bomb, the height of the explosion and weather conditions.

Heavier radioactive particles created in the explosion fall near the Russian test site. The lighter particles are carried by winds in an easterly direction over most parts of the Northern Hemisphere. They can then be deposited by rains within a few days. Large explosions hurl radioactive particles up into the stratosphere where they remain for months or years before falling back to the earth.

The highest levels of fallout occur in the Northern Hemisphere between 40 and 50 degrees latitude. In the United States, the area is roughly north of a line passing through Philadelphia and north of Kansas City and San Francisco.

Fallout includes many particles, such as strontium-90, that lose their radioactivity very slowly. The particles are washed by rains into the soil, eventually reaching the foods humans eat.

Sufficient amounts of radiation can damage or kill human cells. Many scientists are worried about the radiation's effect on future generations because of its damage to the body's reproductive cells.

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Aim for Neutron Bomb

➤ A NEUTRON BOMB, which has been widely discussed but so far as known does not exist, may be developed through resumed nuclear testing by Russia or the United States.

It would be thermonuclear hydrogen-fusion in character, but without the fallout of the H-bomb. The unsolved trick is how to set it off without aid of a fission bomb which is the necessary trigger of an H-bomb, causing the release of strontium-90 and other radioactivity.

If such a fusion bomb of small size could be made, it is suggested that it could be exploded high above a military or other target, producing a limited blast with little contamination, but a burst of high-voltage neutrons killing to human and other life, leaving buildings relatively intact and not poisoning the countryside. This would be very useful in military operations.

This principle of the neutron bomb is no secret. The progress made by scientists on both sides of the Iron Curtain is not known.

Some of the methods of starting a controlled thermonuclear reaction that could be used for the peaceful production of nuclear power might be applied to a neutron bomb. Experts of various nations gathered at Salzburg, Austria, Sept. 4-9, to discuss controlled nuclear fission research. The electromagnetic methods of walling in extremely hot electrified mixtures of light hydrogen, called plasma, possibly could be used to create concentration of heat and set off the explosion.

Some discussion has visualized neutron bombs being used in space to produce a blast of the all-pervading particles that could destroy a missile by heating it intensely and melting it.

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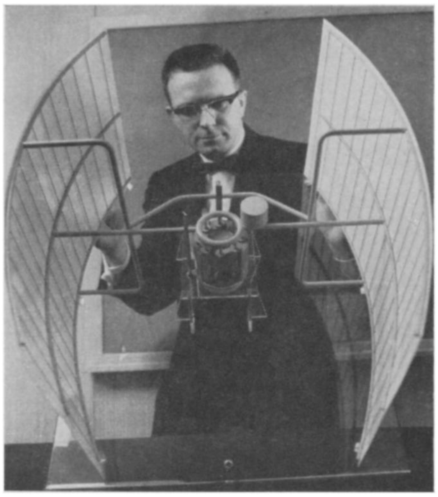

NUCLEAR POWER SYSTEM—A nuclear thermoelectric system that could power instruments gathering scientific data on the moon has been developed by the aerospace electrical department of Westinghouse, Lima, Ohio. Niles F. Schuh shows a model of the system using spontaneous decay of a radioisotope to produce heat which is converted into electricity. The curved shields are waste heat radiators.

Taming H-Bomb Nearer

➤ DUE TO NEW THEORIES that were presented to the Salzburg, Austria, conference on taming H-bomb power for useful work, the long-sought breakthrough may be closer than hitherto imagined.

United States and Soviet laboratories studies showed that there is a chance of controlling the oscillations in the plasma or ionized gas that is held in a magnetic field so that it can cause the fusion of light element atoms and give off energy non-explosively. At the 1958 Geneva conference it was felt that thermonuclear harnessing might not be possible, and that the plasma would be destroyed before it is heated to the 400 million degrees or more required to ignite the controlled fusion reaction.

The new theory showing these apprehensions are largely unfounded was presented by William E. Drummond of General Atomics Fusion Laboratory, San Diego, Calif. Russian scientists reported a similar conclusion.

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Small Atom Bomb

➤ THE PERFECTING of a small atom bomb that could be used like conventional heavy artillery will probably be a first objective of the underground atomic testing to be undertaken by the United States.

If there has been theoretical progress toward setting off an H-bomb without exploding a fission bomb as an igniter, creating the so-called neutron bomb, this may also be tried.

Because the explosions would be underground, there would be opportunity to try out atomic explosions for chemical processing deep in the earth and for the release of oil from oil sands as has been proposed from time to time.

The Project Gnome which will explode a 10-kiloton device in a dry salt deposit near Carlsbad, N. M., to produce power will probably also be undertaken. Water will be pumped into the explosion zone deep in the earth and steam drawn off to run generators.

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Fallout Hits in Four Days

➤ RADIOACTIVE fallout from Soviet nuclear tests can be expected in United States mainland water supplies within four to seven days after the test. It hits the Aleutian Islands first, then Alaska.

Fallout from previous Soviet tests has reached the U. S. usually within four to five days.

Dr. George Anton of the Atomic Energy Commission's fallout studies branch said that strontium-90 would not show up in the milk supply for a few weeks. It takes that long for this fallout product to settle on the plants, be eaten by a cow and get into the milk.

Shorter-lived decay products from the fallout can be detected sooner than the strontium-90, he said, partly because the methods used to detect them are simpler.

The prevailing winds carrying the radioactive fallout at the time of the first test on Sept. 1 had a pattern heading eastward from the Lake Baikal region, then dipping southward into Manchuria. From there they headed northeastward toward the Japanese island of Hokkaido.

After heading toward the open ocean, the winds, picking up speed, went toward southern Kamchatka, then westward to the Aleutian island chain.

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PHYSICS

H-Bomb Research "Bottle"

➤ THE MASSACHUSETTS Institute of Technology has reported that a new kind of magnetic bottle will be built in its laboratories. Proposed by a graduate student, it may show how a major obstacle to the development of thermonuclear power plants can be removed.

Thermonuclear reactions, such as occur in the H-bomb, explain the tremendous energy of the sun and stars, but thus far have not been controllable on earth. Both in this country and abroad, magnetic containers of various shapes are being studied. But the better a container is, the harder it is to put the necessary fuel inside of it.

The desired reactions occur between isotopes of hydrogen at extremely high temperatures. Physicists call such a fuel a plasma. In a doctoral thesis written at MIT, Air Force Capt. R. C. Wingerson has proposed the use of a corkscrew-shaped magnetic field to overcome the difficulty and trap plasma in a magnetic container long enough for atomic nuclei to fuse and release energy.

Experimental apparatus embodying Capt. Wingerson's idea will be built by James S. Tulenko, another MIT graduate student, under the supervision of David J. Rose, professor of nuclear engineering. Prof. Rose believes Capt. Wingerson has found a solution to a problem with which nuclear engineers have grappled for the last decade.

One of the various types of bottles which they have studied consists of a long pipe, the walls of which are a magnetic field created by an electrical coil around it. The ends of this pipe are open but "mirror" magnetic fields are set up there to serve as stoppers. The Russian physicist, K. D. Sinel'nikov, proposed two years ago that an undulating field be used to fill and trap plasma in such a bottle. The Wingerson corkscrew effects should be more effective.

By making a magnetic field spiral like a drill, Capt. Wingerson's computations show, a beam of particles shot into the tube along its axis with a certain energy can be wound up or unwound. In other words, some of their longitudinal energy can be transformed into perpendicular energy. The mirrors then can be more effective, and more particles retained in the tube for sufficient time.

In effect, the device that will be built at MIT will be similar to a lobster trap. It should be easy for a particle to get into the thing, but difficult for it to escape because of the trap's geometrical configuration. The walls of this trap are to be complex magnetic fields created by an axial coil and mirrors, and the entrance will be determined by the corkscrew fields.

The experimental trap that Mr. Tulenko is designing will be eight feet long and will be used to hold electrons. The ionic charged particles needed for a thermonuclear reaction to occur are relatively heavy, and would necessitate a structure between 50 and 100 feet long. But Mr. Tulenko's device will be a scale model of a larger device.

Large-scale experimental machines of many types already have been built. MIT scientists have maintained, however, that the first step should be to acquire more fundamental knowledge of the nature of plasmas, their instabilities, and their behavior in magnetic fields.

Additional preliminary research inspired by Capt. Wingerson's discovery already is under way in the Atomic Energy Commission's Los Alamos Scientific Laboratory. It was described at an international conference on plasma physics and controlled nuclear fusion research in Salzburg, Austria.

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PUBLIC SAFETY

Local Fallout Worst

➤ IT IS LOCAL fallout that we should worry most about—rather than the worldwide variety circling the earth.

This is the belief of Dr. Willard F. Libby, professor of chemistry at the University of California, Los Angeles, a former member of the U. S. Atomic Energy Commission and 1960 Nobel Prize winner in Chemistry.

He divides fallout from nuclear explosions into three main types—local, tropospheric and stratospheric.

The intense local fallout comes down quickly and in heavy doses, generally over an area 200 to 300 miles downwind from the bomb-burst. As much as 80% of the total fallout may come down within the first few hours after an explosion.

In past nuclear tests, local fallout has been carefully controlled, but in a nuclear war it could represent the greatest danger to the civilian population. The danger can be largely countered by a nation-wide shelter program, Dr. Libby believes. Radioactive particles which are too fine to be caught in the local fallout start circulating around the earth on one of two levels depending on the power of the bomb and the height of its mushroom cloud.

As a rough rule, the fine particles from an atom bomb explosion are carried in the troposphere, the lower part of the atmosphere, in a fairly narrow earth-circling band of air, and come down inside a month.

Fine particles from the more powerful H-bomb explosions, with mushroom clouds pushing above 40,000 feet, are picked up by air masses of the stratosphere.

These particles circle the entire earth for about five years, losing most of their radioactivity, before coming down through gradual mixing with the lower tropospheric air.

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