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The Hydrogen Bomb

HER MAJESTY'S STATIONERY OFFICE

NINEPENCE NET

"The hydrogen bomb has made an outstanding incursion into the structure of our lives and thoughts"

SIR WINSTON CHURCHILL

IN 1956 a comprehensive pamphlet on nuclear weapons and their effects was prepared by the Home Office and Scottish Home Department and published by Her Majesty's Stationery Office. Not everyone has the time to read a full technical account of this kind, which is in any case intended chiefly for use in training the civil defence services. There has been a considerable demand for something shorter and this booklet has been prepared to meet that need.

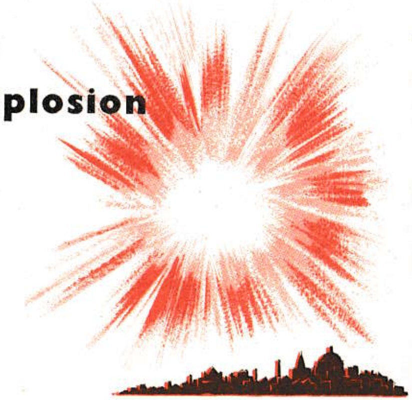
The object is to give, as briefly as possible, the facts about the hydrogen bomb. Knowledge of the effects of this weapon should be widespread. Terrible as these effects are, they can be exaggerated, and the information given in this booklet shows that much could be done to reduce them and to save lives.

This is not intended to serve as a comprehensive manual of instruction to the householder about the steps he could take to help himself and his family should war come : a much fuller booklet is being prepared for this purpose for issue should the need arise ; but reference is made to some of the precautions that could be taken.

The publication of this summary does not mean that the Government think war likely. As the 1957 White Paper on Defence made clear, the existence of nuclear weapons and of the means to use them is a safeguard against aggression and a deterrent to war. But everyone should know what these weapons could do, and have some idea of how their effects could be reduced.

If more information is required, reference should be made to Civil Defence Pamphlet No. 1 on Nuclear Weapons, published by Her Majesty's Stationery Office at 2s. 6d.

What a Nuclear Explosion is like . . .



A NUCLEAR BOMB is a device whose explosion results from the sudden release of the vast amount of energy locked up in the core of the atom. This energy is equivalent to the explosion of thousands or even millions of tons of high explosive.

The term " nuclear " includes both atomic and hydrogen bombs. These bombs vary in power just as high explosive bombs do. The atomic bomb dropped on Nagasaki, in Japan, at the end of the last war had a power of twenty thousand tons (or twenty kilotons) of high explosive. In a future war hydrogen bombs with a power of ten million tons (or ten megatons) of high explosive or more might be used. For the purposes of this booklet a ten-million-ton bomb has been assumed. We shall see that such an increase in the size of these terrible weapons does not bring a corresponding increase in their destructive power.

When a nuclear bomb explodes, its contents are transformed into a white-hot, radioactive ball of gas—the " fireball "—with a temperature as hot as the sun's interior. What happens afterwards depends on whether the bombs burst high in the air, or on or near the ground.

AN AIR BURST

If the bomb bursts in the air, there is a brilliant light, outshining the brightest sunlight and lasting some seconds. Radiant heat and harmful nuclear radiation are given out. These travel at the speed of light.

The tremendous pressure caused by the explosion travels more slowly, in the form of a blast wave. Moving at a speed somewhat greater than that of sound, this is accompanied for a short time by a powerful blast wind. Near the explosion the pressure may be fifty times the normal atmospheric pressure, but it drops rapidly as the blast wave surges outwards. The pressure and wind cause the damage to buildings.

The fireball grows in a few seconds to its full size, which may be as much as three to four miles across. Being much lighter than air, it soars upwards at over a hundred miles an hour, quickly losing its brilliance as it cools by expansion and mixing with the surrounding air. In a few minutes it has reached its full height of sixty to a hundred thousand feet and turned into the familiar mushroom-shaped cloud.

As it rises the fireball sucks in particles of dust and droplets of water from the surrounding air. Drawn up into the cloud, these mix with the products of the explosion and become radioactive. The mixture is mostly carried into the upper air where its radiation can do no harm. The cloud gradually thins out and drifts downwind. Its radioactive particles eventually fall to earth but, in the case of an air burst, they are so small and so widely dispersed that by the time they come down—days, months or even years later—almost all their radioactivity has been given off.

A GROUND BURST

If the burst is on or near the ground, the heat and blast effects are slightly reduced, but the danger from radioactive particles is much greater. The force of the explosion may result in a crater about a mile across and up to two hundred feet deep, from which hundreds of thousands of tons of earth, stones and other surface matter are ejected. All the matter in contact with the fireball becomes highly radioactive. As the fireball rises, it sucks up into the mushroom cloud most of this radioactive material together with dust and heavier particles which may become contaminated by contact with the radioactive material from the bomb itself. Some of the heavier particles spill out around the point of explosion, but the rest of the radioactive material sucked up with the mushroom is carried away by the winds of the upper air. It is still dangerously radioactive when it drifts back to earth. It is known as fall-out.

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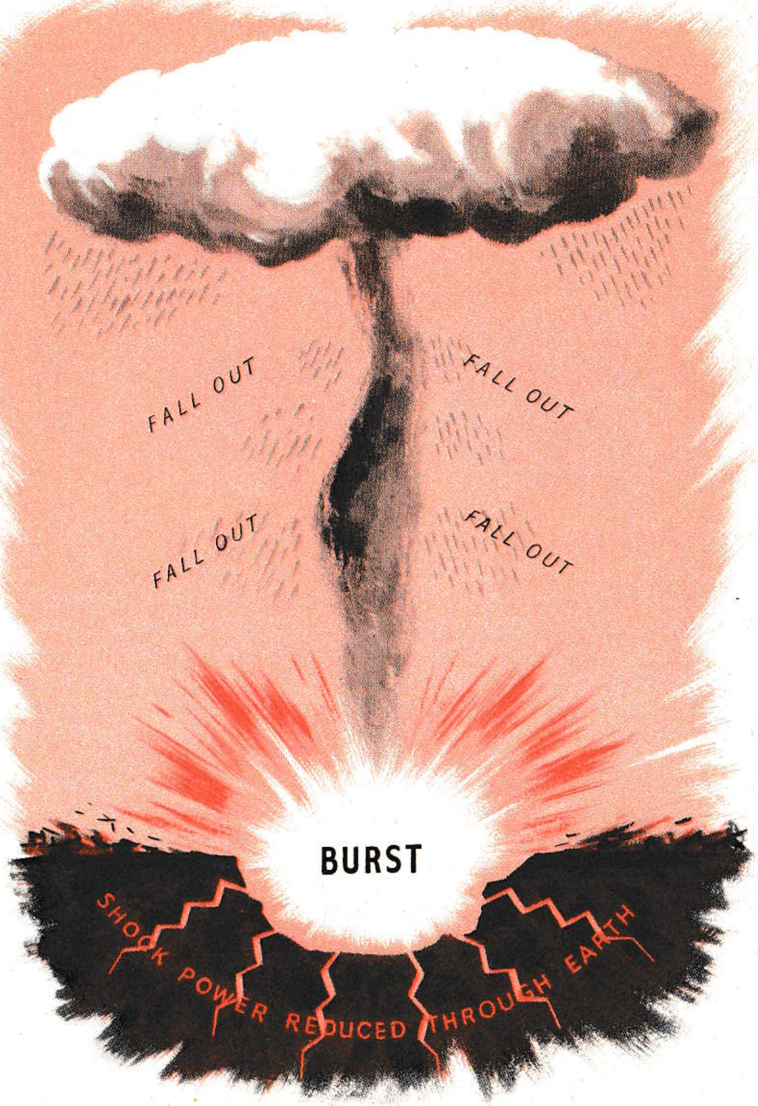


The danger from HEAT

THE fireball from a nuclear explosion gives out an immense quantity of heat. With an atomic bomb similar to the one used at Nagasaki, the " heat flash " lasts for only about one and a half seconds, and most of it is over in half a second. With the hydrogen bomb, heat is radiated for twenty seconds or more, most of it in the first ten seconds.

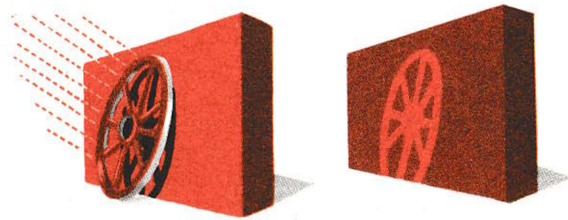
THE DANGER TO PEOPLE

What would happen to anyone in the open directly exposed to the heat? People have gained some inkling from nuclear tests. At one test, for example, the device exploded was rather more powerful than the bombs dropped in Japan. The day was clear, which favoured the radiation of heat, and the observers were six miles away. Even at this distance, their eyes would have been temporarily blinded, if not permanently injured, had they not worn very dark glasses. As the fireball rapidly expanded, they felt as if an oven door had been opened only a few feet away. If the distance had been only one or two miles, their skin would have been severely burnt. At half a mile, they would have been killed.

With a hydrogen bomb these distances would be increased, though not as much as might be expected. The " heat radiation " from a hydrogen bomb lasts longer. On a fine cloudless day, it might be felt as far as fifty miles away, but without injury to the skin. At sixteen miles, exposed skin might be injured;

at four, the burns would be fatal to anyone in the open. Mist or fog would reduce the range of the heat. They act as a barrier against heat rays, just as they do against the rays of the sun.

Anything that keeps off the sun's heat will help to give protection against the heat of a nuclear bomb. At Hiroshima, for instance, a painted surface was scorched except where it was in the shadow of a wheel.



The protection given by clothing depends on the distance from the explosion. The chances of escaping serious burns are increased by wearing hat and gloves and slacks or trousers. At Hiroshima some Japanese women, who had on white cotton dresses with a darker pattern, suffered burns only beneath the pattern. The skin under the white material escaped. This was because white or light-coloured material reflects heat while dark material absorbs it. Colour apart, woollen clothes would be less likely to catch fire than cotton. If clothing did catch fire and there was no time to throw it off, the best way to put out the flames would be to roll over and over on the ground.

All this applies only to people caught in the path of the heat rays. Any solid substance would give full protection against this danger, and a few minutes' warning of the attack would give people time to take cover. Even if they had not heard a warning, people at a distance who took cover even a few seconds after the explosion of a hydrogen bomb would escape some of the heat.

THE DANGER TO BUILDINGS AND THEIR CONTENTS

Any inflammable material exposed to the heat radiated from the fireball may be ignited. Thus lace curtains in windows greatly increase the fire risk as they in their turn might set light to the contents of a room and in the end might cause a general fire in the building. It must be recognised that within three or four miles of a hydrogen bomb all buildings would be completely, or almost completely, destroyed by the blast. Around this central devastated area fires would break out in a number of damaged houses. At Nagasaki the belt of main fires reached a little over a mile from the atom bomb explosion. With a hydrogen bomb it might reach as far as ten miles, although this distance would be reduced on a dull, misty day. Still farther out, fires might be caused by the effects of blast. Gas mains would be burst, electric wires short-circuited and the contents of domestic fires scattered. Such fires might be expected anywhere up to twenty miles from the explosion.

Window panes should be whitewashed and anything inflammable removed from doorways and windows

Otherwise the heat flash will have its best chance to start fires

PRECAUTIONS IN BUILDINGS

Simple precautions can be taken against heat radiation, remembering that brick or stone will not catch fire, but the contents of a house might. The aim would be to prevent as much heat as possible from entering at all. One simple way would be to whitewash the windows. This would block some eighty per cent of the rays and, as they travel at the speed of light, most of the heat would be over and gone before the whitewashed windows could be broken by the slower-moving blast. Also, anything inflammable could be removed from windows and doorways. In built-up areas, the lower storeys would probably be shielded by other buildings. Here a householder would need to pay particular attention to the upper floors with a full view of the sky, and clear the rooms accordingly. If the heat were kept from causing fires by these simple precautions, one of the major hazards would be greatly reduced.

Equally simple measures could be taken to prevent fires caused by blast. Stoves could be shut down, coal and electric fires extinguished, and gas shut off at the main.

Many of the fires caused by a hydrogen bomb could be put out by the methods familiar in the last war : by beating or with a stirrup pump, or with a bucket of sand or water. If his house was not too badly damaged, a householder's first job after an explosion would be to look for such small fires and put them out. Speed would be all-important. Only when they had looked round and dealt with any fires would people take shelter from possible approaching fall-out.

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The danger from BLAST

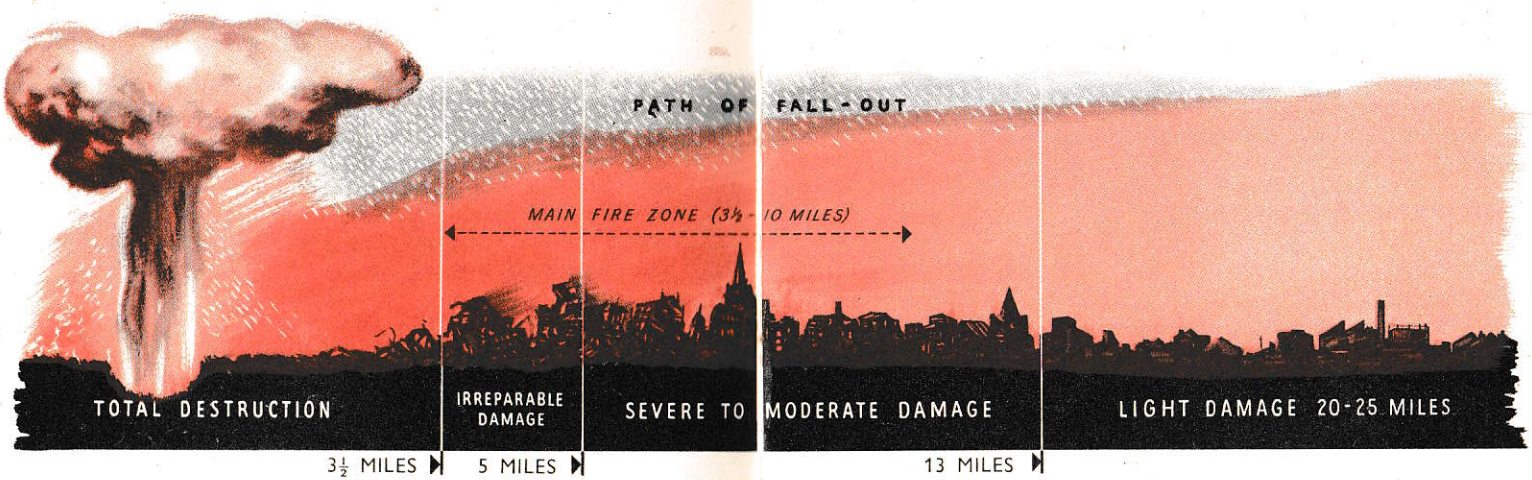
BLAST is familiar to many of us; it caused much of the destruction in Hitler's air-raids. As would be expected, the blast from a hydrogen bomb travels farther than that of a high explosive bomb. But it does not strike like a sudden blow; its action is drawn-out, more like a hurricane.

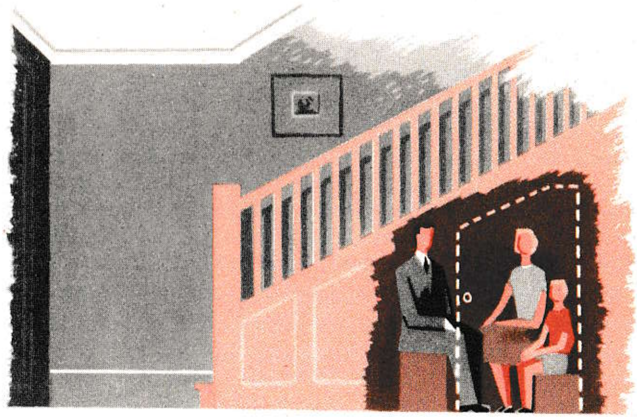
THE EFFECT ON BUILDINGS

An atomic bomb of the type dropped on Nagasaki, if burst a thousand feet above ground, would level all buildings within half a mile. Buildings between half and three-quarters of a mile away would be damaged beyond repair; those up to two miles away would suffer severe to moderate damage; light damage would extend as far as three miles.

The damage from a hydrogen bomb would extend for distances seven or eight times as great. A bomb bursting at ground level is expected to produce a saucer-shaped crater about a mile wide and up to two hundred feet deep, with debris from the crater scattered in a ring about two miles across. The remains of any buildings in this area would be buried by the debris. A ground-burst bomb, however, would not cause damage over such a wide area as one burst high in the air.

With an air burst the damage above ground would extend farther. The blast wave enters through the windows or doors of most buildings and builds up pressure inside. The roof is forced upwards and the walls outwards. Where the blast cannot get in so easily the position is reversed and the building tends to be crushed inwards. Buildings which survive these effects may still be pushed over sideways by the continuing blast wind.





The stairs would give some protection against falling debris

Best at resisting pressure are heavily framed steel and reinforced concrete buildings or those with rounded streamlined surfaces. In Nagasaki, for instance, most of the tall factory chimneys survived.

THE DANGER TO PEOPLE

At Hiroshima and Nagasaki very few injuries, such as perforated ear-drums, were caused directly by the blast itself. The real danger is that people would be struck by falling masonry, flying debris or fragments of glass, or might themselves be thrown against some object.

The warning system, however, is designed to enable people to get under cover. A slit trench, especially if covered with a

few feet of earth, or a cellar or basement would give good protection. If there were no cellar or basement it would be safest under the stairs, or under a table or bed which would give some protection should the roof or ceiling collapse ; and if there were no time to reach such places before the flash is seen, the best place indoors would be close to an inside wall, avoiding windows or anywhere in the possible path of flying glass.

People caught unprotected in the open could at least try to shelter from the rubble and flying debris, if only in doorways or behind walls or even trees. Failing this, they could fall flat on the ground, with the head and face covered, if possible close to the wall of a substantial building, or in a nearby ditch or gutter.

A slit trench with earth covering protects against blast and radiation

The danger from RADIOACTIVITY

GENERAL

THE white-hot fireball in a nuclear bomb explosion is intensely radioactive. With an atomic bomb like that used at Nagasaki, the direct radiation extends beyond the complete destruction by blast. This direct radiation caused the many cases of radiation sickness and the resulting deaths at Hiroshima and Nagasaki. With the hydrogen bomb, however, the direct radiation does not extend as far as the total destruction by blast. Anyone outside the area of total destruction would not be affected by direct radiation.

Fall-out would set another problem. As we saw previously, fall-out is the dust and debris sucked high into the sky which gradually comes down again, covering the landscape with a thin film of dust. From contact with the fireball, this dust is highly radioactive and after reaching the ground it continues to give off various forms of harmful radiation. Fall-out might be very hard to see. No doubt it would show up on a polished table left outside, but not on cultivated ground and probably not on roads, pavements or roofs. Instruments would be needed to detect it or to tell it from ordinary dust, since its harmful effects would not be immediately apparent.

DECAY OF RADIATION

All radioactive material gives out less radiation as time passes. This is known as the " decay " of radioactivity. The rate of decay follows known laws and cannot be speeded up or slowed

down. After a couple of days fall-out would be one hundred times less dangerous than it was at first. But even then it might still be dangerously radioactive.

GAMMA RAYS

The most dangerous of the rays are " gamma rays ", injurious to all forms of life. The damage they do depends on the total dose absorbed by the body. This in turn depends on the intensity of the radiation and time of exposure to it. The emission of gamma rays might be compared with the radiation of ordinary heat. As a red-hot poker loses heat within minutes, so radioactive particles lose the greater part of their radioactivity within a few days. Just as a person can touch a hot surface for a very short time without injury, so can he withstand a high degree of radiation for a few moments.

ALPHA AND BETA RAYS

The two other forms of radiation—" alpha rays " and " beta rays "—are a lesser risk. Alpha rays travel only a few inches; they are dangerous if material emitting them is eaten or otherwise absorbed by the body. Beta rays travel a few yards. Clothing gives protection against them, but not against gamma rays.

RADIATION SICKNESS

Since life began, living creatures have been exposed to radiation from natural sources. We are subjected all the time to cosmic radiation from the sky ; we have all breathed and eaten tiny quantities of radioactive material ; our bodies have always contained small amounts of radioactive elements. We get a tiny dose of radioactivity when our chests are X-rayed. Some granite in common use is radioactive and so is the luminous dial of a wrist-watch. There is, however, a limit to the amount of radiation the human body can absorb without harm. If this limit were exceeded, as might easily happen with exposure to

fall-out, the overdose would start to destroy living tissue and interfere with the formation of new blood. The result is serious illness and, with heavier doses, death.

Persons affected feel nothing at the time. Symptoms do not show themselves until later—how soon depending on the strength of the dose. If it were heavy, the first symptoms—nausea and shock—would come within a few hours. These would be followed, in the first day or two, by vomiting, diarrhoea and fever, with tiredness and depression, but little pain. In less serious cases symptoms appear only after several days, or even two or three weeks. Other symptoms are loss of appetite, loss of hair (which grows again as the patient recovers), internal bleeding and bleeding of the mouth and gums.

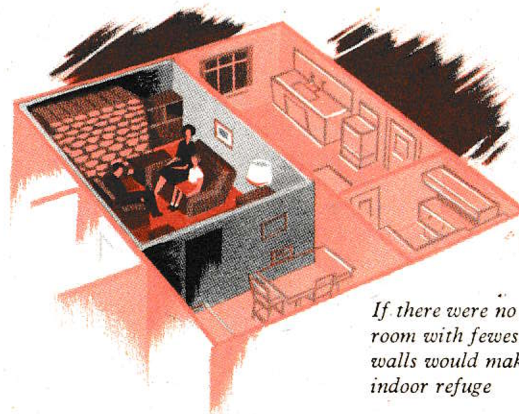
People with radiation sickness have less than normal resistance to infection. Careful first-aid would therefore have to be given to even the simplest cuts or wounds. The mouth, throat and nose would need keeping scrupulously clean. If possible, people affected would have to be kept warm and allowed complete physical and mental rest.

PROTECTION FROM FALL-OUT

The only useful protection from nuclear radiation is some kind of shielding of heavy material between oneself and the source of radiation—that is, the radioactive dust or fall-out. The three factors which count in gaining protection are the distance from the radioactive dust; the weight of material in between; and the time for which one remains protected while the radioactivity decays.

A slit trench with overhead cover of two or three feet of earth would give very good protection from fall-out, as well as protection against blast, but the occupants would have to remain in the trench for forty-eight hours or more while the radioactivity surrounding them decayed.

A prepared refuge room inside a house could be made to give good protection against fall-out (although not so good as a covered slit trench) and it would also be much less uncomfortable for a period of two days or more. A cellar or basement would be by far the best place for a refuge room; next best would be the room with the fewest outside walls and the smallest windows. The windows would need to be blocked with solid material, to the thickness of the surrounding walls at least. It would help if the walls themselves were thickened, not necessarily to their full height, with sandbags, boxes filled with earth, or heavy furniture. The occupants of the refuge room would have to remain in it until told that it was safe to come out—perhaps for a period of days—and the room would have to be prepared and equipped accordingly.



If there were no cellar, the room with fewest outside walls would make the best indoor refuge

In some places it might be practicable to make good use of both an outdoor slit trench and an indoor refuge room, using the first for protection against blast, and the second, if the house survived the blast, for subsequent protection against fall-out.

A quite badly damaged house could give substantial protection against fall-out, and it would be essential to stay put in a damaged area—either in some remaining part of your own house or in a nearby building with less damage—until the danger from fall-out had been assessed and a warden, or other civil defence worker, had advised you to move elsewhere. It would, of course, be necessary to put out small fires.

DETECTION OF FALL-OUT

It would be vital to know where to expect fall-out and what its intensity would be. This would depend on weather conditions; the direction and speed of wind—not only near the earth, but as high as 80,000 feet or more—and the presence or absence of snow or rain.

Surveying a contaminated area

The cloud of radioactive particles would drift downward from the explosion, over an area whose length and width would depend on the speed and direction of the winds and the power of the bomb itself. (When the United States held a hydrogen bomb test in the Pacific in 1954, fall-out began on some islands 170 miles downwind eight hours after the explosion and continued for several hours.) If there were a hydrogen bomb attack on Britain some areas many miles from the scene of the disaster would be affected by fall-out. So everyone, townsman or countryman, must understand the nature of the danger and the precautions that can be taken against it. Fall-out is a grim new menace, but it could be met and dealt with if the precautions suggested here were taken.

WARNING MEASURES

Special arrangements are being made for the Royal Observer Corps (whose primary duty is to report the movement of enemy

aircraft) to measure the local intensity of fall-out. The reports would help to determine the area affected and the degree of contamination in each part of the area. They would also provide information from which the movement of fall-out could be forecast and warnings given to threatened areas. A public warning system is being planned, and steps are being taken to select suitable signals to give warnings both of air-raids and of fall-out.

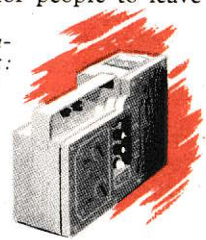
The danger from radioactivity is all the greater because it cannot be seen, smelled, heard or tasted. It can be detected and measured only by instruments. Wardens and other civil defence workers are being trained in their use so that they can give guidance as necessary. It would be essential to follow their instructions.

LIFE IN A FALL-OUT AREA

Before fall-out from an explosion reached an area, every effort would have been made to warn people so that they could go to cover. Warning notices would have been put on roads to stop anybody unwittingly entering an area affected by fall-out. When fall-out arrived, most people in the area would have to stay in refuge or shelter for at least two days. They could not leave cover until their warden told them it was safe, and told them what they should do when they came out.

The authorities would be measuring and recording the intensity of fall-out in different areas. In those where the contamination was slight it might be safe for people to leave

Left: Contamination Meter. Right: Radiac Survey Meter



cover and move about freely less than two days after the explosion. But in most affected areas people would have to stay in shelter for two days or more, and, when they finally emerged, to follow simple rules about the time they could safely spend in the open. These rules would depend upon how dangerous the radiation was in their area and might have to be observed for several months. This is because people in a fall-out area would be building up a cumulative dose of radiation all the time. They would get much more radiation in the open than if they stayed indoors. Disregard of a warden's advice might have serious, or even fatal, consequences.

In certain areas radioactivity would be so intense that people could avoid sickness and death only by leaving as soon as the fall-out had decayed enough to allow movement. No one could be allowed back into such areas for a long time.

DECONTAMINATION

We have already seen that the rate at which radioactivity decays cannot be altered. Nor can radioactivity be destroyed by burning or with chemicals. There are only two ways to reduce the danger. The first is to keep under cover. The second is to remove the radioactive dust or other contaminated material and leave it where the radioactivity can decay harmlessly. It would be unsafe to try to get rid of the fall-out soon after it had settled; its radioactivity would still be dangerously high. We have already seen that people should remain under cover until the authorities advised them to emerge. It might then be worth while sweeping or washing the fall-out from a paved or concrete path around the house. It might also be possible to remove it from roof and gutters.

Radioactive dust, like ordinary dust, would settle on, and cling to, the hair, skin and outer clothes of anyone caught in the open. Outer clothing would have to be removed as soon as possible, with care not to shake off the dust. A light spray of

water would help to keep it down. People would need to put any contaminated clothing well out of the way, although most could be kept for washing later—with plenty of soap powder. Heavily contaminated clothing might have to be buried. Burning, as we have already seen, would not destroy the radioactivity which must either be left to decay naturally or removed to where it can do no harm.

Radioactive dust on the body could be washed off with soap and water, particular attention being given to the nails and hair. If the waste water could not flow freely down the drains, it would have to be poured into a hole in the ground and covered with earth. If a washing machine were used for clothes, some of the radioactive particles might stay inside the machine. A bucket or tub would be better. If a vacuum cleaner were used, radioactive material would collect in the bag and the whole machine would have to be put where the radiation could do no harm. When the bag was emptied its contents would have to be buried; even then the bag would probably contain some radioactive material.

FOOD AND WATER

In general it would not be safe to eat food on which fall-out might have settled. Food kept in sealed packages, closed containers or closed cupboards would, however, be safe. Vegetables or fruit such as potatoes or apples could be eaten if they were thoroughly washed before peeling. People would have to make certain that contamination did not reach the food while it was being prepared, perhaps from contaminated cooking utensils, from containers contaminated on the outside or even from unscrubbed tables.

A word of warning about water supplies: previous paragraphs have mentioned the use of water for various purposes, but very little might be available. Piped supplies might be disrupted by physical damage, and, until they were restored, water would have to be carted in tanks on lorries. Because of the radiation danger carting would not be immediately possible where fall-out was heavy. It would be essential to have a reserve supply by keeping the bath and other containers filled and, if possible, covered.

FARMERS

Farmers, like everyone else, would have to shelter if they were in a contaminated area and so, if possible, would their livestock. Once it was safe to leave cover it would be safe to get on with most farming operations, although care would have to be taken with dusty jobs.

In a heavily contaminated area many livestock would receive a fatal dose of radiation, but, in many cases, their flesh would be edible if they were slaughtered before they died from the effects of radiation.

The growth of crops would be little affected. If they had been contaminated with fall-out they would be dangerous to eat, but some crops—a cabbage, for example—might be made safe by thorough washing after the outer leaves had been removed.

If cattle grazed on contaminated pasture it would be dangerous to drink their milk. If they had no access to contaminated pasture but had clean water and were fed on clean stored food, such as hay or silage, their milk would be safe.

The Ministry of Agriculture, Fisheries and Food are preparing detailed advice for farmers on the precautions they could take.

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CIVIL DEFENCE

against Nuclear Weapons

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In trying to picture what would happen in a nuclear war many of us would attempt to pick out the likely targets. In the process most of us who live in towns would put our own town high on the list—because it is a big town ; because it is industrialised ; because it is a port or near an aerodrome ; or simply because it was bombed in the last war. In fact one could never be sure what principles would guide an enemy in selecting his targets. One thing, however, seems clear : in a world war there would be so many possible targets, in other countries besides our own, that an enemy would have to make a most careful selection. Many desirable targets might not be attacked at all, and it would be wrong to assume that targets attacked would necessarily be hit. None the less, the picture of a nuclear bomb attack is grim. Not only would death and destruction be on a greater scale than ever before but also there would be no easy return to normal for the survivors. It would mean a long struggle to keep life going and the bulk of the country's resources would be concentrated on relief and rescue in the worst stricken areas.

THE PROBLEM

The course of a war in which nuclear weapons were used would depend very largely on the action of our own and our allies' defence forces. This action is outside the scope of this booklet. More than ever before, however, the morale and activities of civilians in all the countries involved would be a most important, if not a decisive, factor. The problems to be considered here are, therefore, how can lives best be saved, how can casualties and sickness best be minimised, how can life best be kept going. These are civil defence problems. Some of the methods of tackling them, and the organised forces available, are discussed below.

EVACUATION

The more widely people were dispersed, the fewer the casualties which would be caused by blast and heat. The Government have already stated that they are considering proposals for moving, from the most crowded areas, " priority classes " comprising mothers, young children and adolescents, and the aged-infirm. Such a movement would be much bigger than anything attempted in the last war, and many problems would obviously arise in organising such a large transfer of people and at the same time ensuring that the economic life of the nation was not brought to a stop if war did not come after all. The whole matter is being examined with representatives of the many authorities concerned.

WARNING AND MONITORING SYSTEM

It is the object of the national warning system to provide timely warning of attack. Sirens have been installed in all towns and in large villages. The Royal Observer Corps would

monitor fall-out so as to provide the national warning organisation with the data on which to base public warnings of fall-out. Warning would be issued in the fall-out area wherever the amount of contamination was likely to be dangerous.

SHELTER

It must be remembered that a large hydrogen bomb exploded on or near the ground might produce a crater of a mile or so in width, and that the remains of any buildings in an area two miles across might be buried by the debris from the crater. Protection within a few miles of such an explosion is impracticable, but over very large areas at a greater distance from the explosion many lives could nevertheless be saved by making full use of the best available cover, particularly against fall-out, the effects of which extend far more widely than the effects of blast. Many houses and other buildings have accommodation which could readily be adapted to give protection against fall-out.

CONTROL IN FALL-OUT AREAS

We have seen that arrangements are being made for the Royal Observer Corps to measure fall-out over the whole country and that its posts would provide information on which warning of approaching fall-out could be given to the public. Arrangements are also being made to tell people in areas actually contaminated by fall-out what to do. If these people followed the rules radiation sickness would be kept to a minimum.

THE HOUSEHOLD

In contaminated areas many people would have to remain under cover for two days or more. It follows that they would need adequate stocks of food and water. Indeed, the household would have to be organised as the basic unit of survival. We have also seen that the protection which an ordinary house provides against the various hazards can be improved. But, above all, every household would have to know what to expect; any form of panic through ignorance of what to do would greatly increase the number of casualties.

THE VICTIMS OF ATTACK

After a hydrogen bomb explosion vast numbers of people would be in dire need of help. In the immediate vicinity of the bomb crater there would be few survivors. Farther out, however, there would be people trapped in damaged buildings. Others would be injured and needing urgent first-aid. Others, though uninjured, would be shocked and dazed. There would be a great number of homeless who would have to be looked after and fed. Where would these people find help? Help might come from a friendly neighbour if he, himself, were not in trouble. But much more would be needed and it could only be effective when properly organised.

THE CIVIL DEFENCE SERVICES

The Civil Defence Corps and its partner, the Industrial Civil Defence Service, are specially organised for this purpose. The Corps provides the Wardens. It has special sections trained to deal with control, signals, reconnaissance, rescue, ambulance and first-aid duties, emergency feeding and welfare generally. The welfare section is closely associated with the Women's Voluntary Services who encourage as many of their members as

possible to join the Corps, and give every assistance to local authorities with its organisation and training. But would all the members of the civil defence services be properly trained and would they be available in adequate numbers? Certainly not today. These are voluntary organisations; there are too few volunteers and not all of them are yet trained.

THE POLICE

Besides the civil defence services, many peace-time services would be able to give trained and effective help. The police, for example, as guardians of the public, would have a vital task. In this they would have the aid of the special constabulary. They would have to carry out their main peace-time duties of preserving law and order in conditions of great difficulty. Even more than in peace time, the public would look to them for help and advice.

FIRE SERVICE

In war, the fire brigades maintained by local authorities would be brought under central control and formed into a National Fire Service. This would be greatly expanded by the mobilisation of several thousand R.A.F. reservists, trained in fire fighting. But as these numbers would still not be enough, the Auxiliary Fire Service is needed to fill the gap. At present there are not enough volunteers in the A.F.S. It needs large numbers of men to be trained in peace for fire fighting and women for communications work and similar duties.

HOSPITALS AND NURSING

The peace-time hospital service would be expanded to deal with as many civilian sick and war casualties as possible. Hospitals would be evacuated from our larger cities to the reception areas. The capacity of the existing hospitals in those areas would be increased and new hospitals established in buildings reserved for the purpose.

The ambulance services would also be expanded very considerably by requisitioning suitable vehicles and installing stretcher fitments.

The National Hospital Service Reserve was formed to train men and women who would be needed in the hospital first-aid service in war. Membership is open to men and women without nursing experience and to trained nurses no longer regularly engaged in nursing. The former are first trained in first-aid and home nursing and opportunities for further training in hospital are provided. The British Red Cross Society, the St. John Ambulance Brigade, in England and Wales, and the St. Andrew's Association in Scotland, are responsible for enrolling auxiliary members and teaching first-aid and home nursing. Auxiliaries wear the uniform of the voluntary organisation through which they are enrolled.

After a hydrogen bomb attack there would be far more injured people than even the expanded hospital service could cope with. Many might not be able to reach hospital. These cases, and the less seriously injured, would have to be looked after in their own or other people's homes where their lives would depend on the care and knowledge of those who were tending them. Countless lives could be saved if, and only if, a large section of the population had acquired in peace time an elementary knowledge of first-aid and home nursing such as the voluntary organisations provide.

THE ARMED FORCES

Besides the civilian services there would be another important source of help : the Armed Forces. First there would be the Mobile Defence Corps which is organised into fully mobile battalions and especially trained and equipped in rescue and ambulance duties. But all the Armed Forces in the United Kingdom who were not required actively to engage the enemy would have the responsibility of assisting civil defence. Because of the planning and training now in progress they would be able to undertake a wide variety of tasks.

THE NEED FOR CIVIL DEFENCE VOLUNTEERS

The numbers available in the fighting services would, nevertheless, be so small compared with the size of the task that their availability to help in no way lessens the need for civilian forces. The local volunteer would be first in the stricken area and his local knowledge would be needed by any reinforcements coming from farther afield.

CONCLUSION

It is certain that if a nuclear attack were to come, the aid of every man and woman would be needed—service men and civilians alike. Everyone would have to help himself and his neighbour as far as he could. But improvisation would not be enough. The survival of individuals and of groups would depend on plans made beforehand ; adequate help for the victims of attack could come only from people trained and organised in advance.

The picture this booklet has painted of a nuclear attack is grim indeed ; but it is not hopeless. Much could be done. An efficient Civil Defence organisation, linked with a public that knows the facts, could save millions of lives. The best defence against chaos and confusion would be a resolute spirit of self-reliance, based not on groundless optimism, but on knowledge of the facts. That knowledge is none the less valuable because, as all hope, it may never be used.

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