DEPARTMENT OF DEFENSE • OFFICE OF CIVIL DEFENSE

FALLOUT PROTECTION

WHAT TO KNOW AND DO ABOUT NUCLEAR ATTACK

DEPARTMENT OF DEFENSE • OFFICE OF CIVIL DEFENSE

H-6 DECEMBER 1961

CONCERNING THIS BOOKLET

One of the first tasks assigned to me by the President, after I assumed responsibility for the Federal Civil Defense Program last August, was to give the American people the facts they need to know about the dangers of a thermonuclear attack and what they can do to protect themselves. This booklet attempts to provide the facts.

The factual information in this booklet has been verified by independent scientific authority, and represents the best consensus of the scientific community that we can establish.

The booklet also describes the national civil defense program. This program necessarily rests on judgments about what are prudent precautions in the light of our knowledge of what might happen and our evaluation of scientific facts. Judgments may differ. It is my considered judgment that this is a reasonable and prudent program—and that it is the best program we can have, measured against the other priorities of our national life.

Robert S. McNamara

Secretary of Defense

WHAT YOU SHOULD KNOW AND WHAT YOU SHOULD DO

How to survive attack and live for your country's recovery

The purpose of this booklet is to help save lives if a nuclear attack should ever come to America. The foreign and defense policies of your Government make such an attack highly unlikely, and to keep it unlikely is their most important aim. It is for this reason that we have devoted so large an effort to creating and maintaining our deterrent forces. However, should a nuclear attack ever occur, certain preparations could mean the difference between life and death for you.

The need for preparation—for civil defense—is likely to be with us for a long time, and we must suppress the temptation to reach out hastily for short-term solutions. There is no panacea for protection from nuclear attack. In a major attack upon our country, millions of people would be killed. There appears to be no practical program that would avoid large-scale

loss of life. But an effective program of civil defense could save the lives of millions who would not otherwise survive. Fallout shelters and related preparations, for example, could greatly reduce the number of casualties.

President Kennedy, speaking on July 25, 1961, put it this way: "In the event of attack, the lives of those families which are not hit in the nuclear blast and fire can still be saved if they can be warned to take shelter and if that shelter is available. We owe that kind of insurance to our families and to our country."

The President was talking about shelter from radioactive fallout. The blast, heat, and fire of a nuclear explosion are appallingly destructive. But radioactive fallout could spread over thousands of square miles, covering a much greater area than the area endangered by fire and blast. Fallout would be a potential killer of millions of unprotected persons, but it also is a hazard that individuals and communities can prepare for through reasonable programs and actions. A fallout shelter program is one of these. This booklet contains information about a shelter program—what the Federal Government intends to do, and how State and local governments, and individual citizens can work together to bring it into being as a sound measure of national preparedness.

There is much we can do together, and perhaps the first step is to take a clear look at nuclear warfare and what it could mean to the world as we know it today.

There is no escaping the fact that nuclear conflict would leave a tragic world. The areas of blast and fire would be scenes of havoc, devastation, and death. For the part of the country outside the immediate range of the explosions, it would be a time of extraordinary hardship—both for the Nation and for the individual. The effects of fallout radiation would be present in areas not decontaminated. Transportation and communication would be disrupted. The Nation would be prey to strange rumors and fears. But if effective precautions have been taken in advance, it need not be a time of despair.

These are somber subjects, and they presuppose a catastrophe which can be made very unlikely by wise and positive policies, pursued with imagination and faith. Still, realistic preparation for what might happen is far more useful than blindness, whether from fear or ignorance. A sane and sober person can assume that, whatever comes to pass, he would draw on his reserve of courage and intelligence—and the unquenchable will to live—and begin to build again.

The experience would be terrible beyond imagination and description. But there is much that can be done to assure that it would not mean the end of the life of our Nation.

There are no total answers, no easy answers, no cheap answers to the question of protection from nuclear attack. But there *are* answers. Some of them are in this booklet.

WORDS TO KNOW

A-BOMB AND H-BOMB. Popular terms for what should correctly be called nuclear weapons. An atomic or A-bomb explodes through the fission (splitting) of atomic nuclei; a hydrogen or H-bomb is called a thermonuclear weapon because tremendous heat is needed to start the fusion process.

KILOTON. The power of nuclear weapons is measured in equivalents of the explosive energy of TNT. A one-kiloton weapon has the explosive equivalent of 1,000 tons of TNT.

MEGATON. The explosive equivalent of one million tons of TNT. In this booklet, a five megaton nuclear weapon exploded at or near ground level is assumed as a basis for describing explosive effects. There are much larger weapons which could do more damage, but the damage from larger weapons does not increase in direct ratio to the size of the weapons.

GROUND ZERO. The surface point at or above which a nuclear weapon detonates.

FIREBALL. The large, swiftly expanding sphere of hot gases, producing brilliant light and intense heat, that is the first man-

ifestation of a nuclear explosion. After about a minute, the fireball fades into the atmosphere.

BLAST (SHOCK) WAVE. The near-solid wall of air pressure produced by a nuclear explosion. Beginning at more than 2,000 miles per hour, its speed decreases rapidly with distance.

BLAST WIND. The wind gust which travels with the blast wave and may be of many times hurricane force.

ROENTGEN. A unit for measuring an amount of radiation exposure.

INITIAL (PROMPT) RADIATION. The burst of gamma rays and neutrons sent out from the explosion during the first minute after detonation. Initial radiation is most deadly within about two miles of ground zero.

FALLOUT. The radioactive debris of a nuclear explosion, which eventually falls to earth in particles. The amount of fallout is enormously greater if a weapon detonates on or near the surface than if it explodes high in the air. Large amounts of earth are drawn up by the fireball. High in the sky, radioactive elements are incorporated into the earth particles, which are scattered by winds and in time fall to the ground.

FALLOUT RADIATION. The radiation emitted by fallout particles. Each particle of fallout gives off radiation as though it were a miniature X-ray machine. This radiation consists chiefly of beta rays (dangerous only if fallout particles touch the skin or are swallowed or inhaled) and gamma rays. Gamma rays, like X-rays, are very penetrating, and create the need for protective shields (fallout shelters).

EARLY FALLOUT. The fallout that returns to earth during the first day. This booklet is mainly about early fallout. The radioactivity of such fallout decreases rather rapidly at first, and more slowly as time passes.

SOME BASIC FACTS

The probable effects of nuclear attack and the relative value of certain protective measures are complex subjects. There is no attempt here to discuss them in great detail, but to present information that might be helpful in understanding the overall problem.

Effects of a 5-megaton burst

A five-megaton nuclear burst at ground level would destroy most buildings two miles from the point of the explosion. Steel-frame buildings would be knocked sideways and great fires started.

The destruction five miles away would be less severe, but fires and early fallout could be a significant hazard.

At 10 miles, sturdy buildings would remain intact. At this distance fires probably would not be started by the fireball, but might be started by the blast wave which could rupture gas lines and short-circuit wires. Flying glass would present a major danger, as would early fallout.

At 50 miles from the bomb burst, all buildings would remain standing. The fading blast wave would take about five minutes to arrive, but would still shatter many windows. The greatest danger at this distance would be from early fallout which would begin arriving in some areas within three or four hours, depending upon weather conditions at the time.

Danger of fire storms

When nuclear or incendiary bombs strike a highly combustible city area, they can create a "fire storm"; the rising column of hot gases draws in surrounding cool air, producing inward-blowing winds that confine the fire storm to the blast damage area. Primary fires would be a much greater hazard than fire storms. For maximum fire damage, a nuclear weapon must be

detonated high in the air. This would eliminate most of the potential fallout hazard. The spread of fires from a nuclear attack would be limited in the same ways as are peacetime fires—by barriers such as open space, rivers, highways, by rainfall, and by varied distribution of burnable material.

Exposure to radiation

During the average lifetime, every human being receives about 10 roentgens of nuclear radiation from natural sources. In addition, people are exposed to small amounts of radiation in dental and chest X-rays and even from the luminous dials of wrist watches.

When large amounts of radiation are absorbed by the body in short periods of time, sickness and death may result. In general, the effects of radiation stay with people and accumulate over a period of time. Few people get sick who have been exposed to 100 roentgens or less. Exposure to more than 300 roentgens over a period of a few days will cause sickness in the form of nausea, and may cause death. And death is certain if a person receives an exposure of 1,000 roentgens over a period of a few days.

Young people might be injured more by nuclear radiation than older people. This is because young people are more apt to absorb radioactive elements into their bones and internal organs than are older people. Since young people are potential parents, they should be protected as much as possible following a nuclear attack to minimize the possible genetic effects on their descendants resulting from too much exposure to nuclear radiation.

Radiation sickness not contagious

Radiation sickness is neither contagious nor infectious. Fallout radiation cannot make anything radioactive. Food and water that have been exposed to fallout radiation are contaminated only to the extent that they contain fallout *particles.* Exposed food that may have particles on it can be made safe by washing, brushing, or peeling. Fallout particles can be removed from water supplies by sedimentation or filtering. Peo-

ple who have fallout particles on their bodies or clothing probably would not carry enough to endanger other people, but they should wash themselves for their own protection.

Long-term effects of radiation

Following a nuclear attack, most radioactive elements in fallout would decay rapidly, losing most of their power to harm. However, for some time thereafter the hazard could continue to restrict normal activities in some parts of the country. A few elements, such as strontium 90, cesium 137, and carbon 14, are long-lived and could harm humans in some ways, such as by being absorbed by food plants. However, the long-term damaging effects of such exposure are not yet known in great detail.

Radiation in the air

Following a nuclear attack the air would be contaminated by radioactive fallout only to the extent that it *contained fallout particles.* The most dangerous fallout particles—early fallout—would reach the earth in the first day after the detonation, but their mere passage through the air would not contaminate the air. Fallout particles in harmful amounts would not be present in basement family shelters. People in underground family shelters could keep fallout particles out of their shelters by having a simple hood over the air-intake pipe. Special filters are not needed for small shelters. However, group shelters that have high-velocity air-intake fans would have to have filters on the air-intake system to keep fallout particles out.

How early fallout looks

The most dangerous fallout—early fallout—would consist of radioactive particles that are relatively large and heavy—about the size of table salt or fine sand. The chances are you could see the *particles* although you could not detect the *radiation* from the particles without the use of a special instrument.

Special clothing offers little protection

Fallout radiation would pass through any type of protective clothing that would be practical to wear. Heavy and dense materials, such as earth and concrete, are needed to stop the highly penetrating fallout rays. Certain types of protective clothing could be useful—particularly for emergency workers—in keeping fallout *particles* off the body, but the wearer would not be protected from the *gamma radiation* given off by the particles. The worker would wear the clothing when in a fallout contaminated area, and then discard it or brush and wash it off thoroughly before entering a non-contaminated area.

Little hope in special medicines

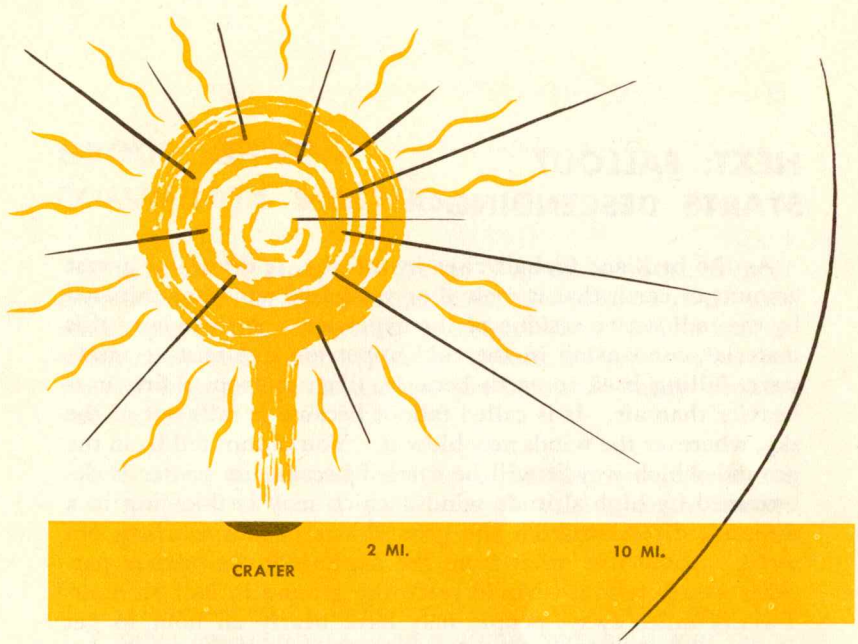
Although many experiments have been conducted, there is little likelihood that a pill or any other type of medicine will be developed that can protect people from the effects of fallout radiation, so that shielding from fallout becomes necessary.

Evacuation vs. shelter

Two conditions make pre-attack evacuation of less general value as a protective measure for nuclear attack than it appeared to be a few years ago: the danger of radioactive fallout to unsheltered evacuees, and the decrease in the probable attack-warning time if an enemy should attack with high-speed missiles. However, the problem of mass movement of people in the event of a nuclear attack is still a significant one because plans must be made to get people into shelters rather rapidly. Also, it may be necessary to move people out of severely damaged areas after an attack.

Probable reaction to disaster

Experience has shown that many human beings act cooperatively when disaster strikes, many feel helpless, a few panic. Disaster studies indicate that information, planning, and preparation clearly increase the extent of cooperative and constructive behavior following a disaster.

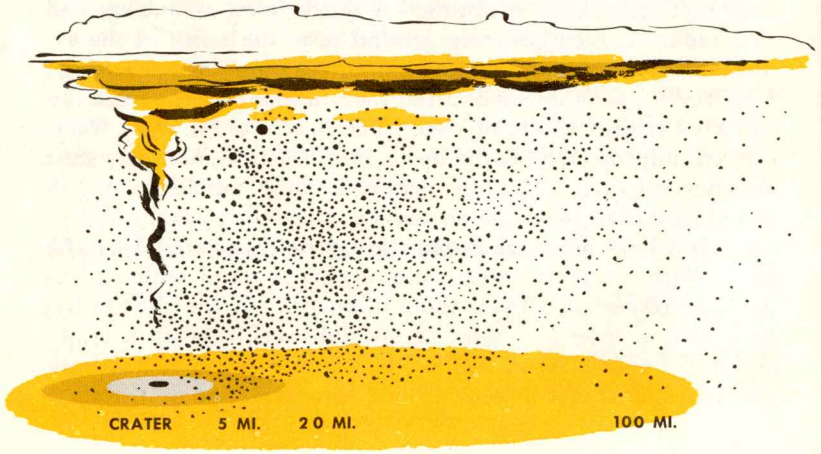


A NUCLEAR EXPLOSION: FIRST, THE BLAST

A five-megaton nuclear weapon explodes with a brilliant flash that lasts about a minute. A quick burst of nuclear and heat radiation emerges from ground zero, the point of the explosion. The spurt of nuclear radiation (*wavy lines extending from the fireball*) is called initial radiation or prompt radiation and kills within a mile or two. The heat rays (*straight lines*) can kill unprotected people up to 10 miles away and may start fires beyond that. The heat rays and initial radiation are followed by a blast wave which starts at more than 2,000 miles an hour, but loses much of its damaging force by about 10 miles out. With the blast wave comes a violent wind which picks up loose objects and bears them outward. In the illustration here, the weapon has burst at ground level, leaving a crater about half a mile across and 200 feet deep. Nearly everything within a radius of a mile of ground zero would be destroyed.

NEXT: FALLOUT STARTS DESCENDING

As the brilliant fireball rises in the sky, it draws up a vast amount of earth that is melted or vaporized and contaminated by the radioactive residue of the explosion. A little later this material, condensing in the cold upper air like rain or snow, starts falling back to earth because, like ash from a fire, it is heavier than air. It is called fallout because it falls out of the sky, wherever the winds may blow it. You cannot tell from the ground which way it will be carried because its scatter is determined by high-altitude winds, which may be blowing in a different direction from the ground-level winds you can observe. About five miles from the explosion, the heavier particles—early fallout—would reach the ground in half an hour. Twenty miles away, people may have nearly an hour to get ready. One hundred miles away the fallout may not start for four to six hours. All this early fallout, which carries the bulk of the radiation danger, descends in less than 24 hours. The less dangerous lighter particles—delayed fallout—might stay aloft for months.



GROUP ACTION: COMMUNITY SHELTERS

Experience in Europe in World War II and other human experiences under disaster conditions have pointed to distinct advantages of the community or neighborhood fallout shelter when compared with the family shelter. There are several reasons why group shelters are preferable in many circumstances:

1. A larger than family-size group probably would be better prepared to face a nuclear attack than a single family, particularly if some members should be away from home at the time of an attack.
2. There would be more opportunity to find first aid and other emergency skills in a group, and the risk of radiation exposure after an attack could be more widely shared.
3. Community shelters would provide shelter for persons away from their homes at the time of an attack.
4. Group shelters could serve as a focus for integrated community recovery activities in a post-attack period.
5. Group shelters could serve other community purposes, as well as offer protection from fallout following an attack.

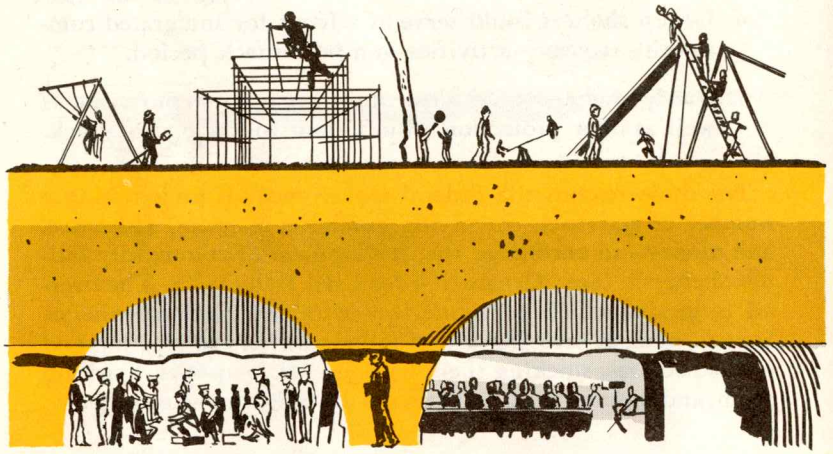
For these reasons the Federal Government is undertaking a number of activities—involving guidance, technical assistance, and money—to encourage the development of community fallout shelters. (See "Organizing for Civil Defense.") The overall program, which got underway with the National Shelter Survey, aims at securing group fallout shelters in existing and new structures, stocking them with essential supplies, marking them, and making them available to the public in an emergency.

A model public shelter and community center

As a model for its hundreds of communities, New York State expects to have a dual-purpose shelter, like the one below, on display at the Westchester County Airport by May of 1962.

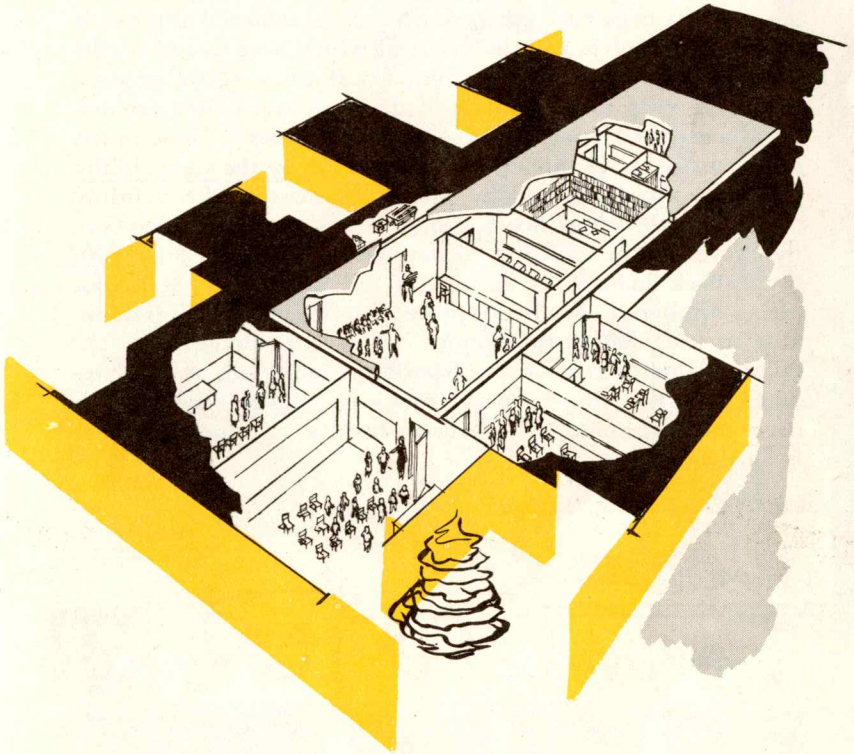
Many growing communities or neighborhoods are cramped for space in which small civic groups can hold their meetings. Gregarious teenagers often have no after-school hangout where they can relax with sodas and play the jukebox. This shelter can serve such purposes admirably; here a Scout meeting is going on in one section while adults attend an illustrated lecture in another. Requiring no surface space except for its entrances, the shelter can be built under a school playground or other civic property without interfering with present uses.

The shelter, built of corrugated metal arches buried under several feet of earth, can vary in size. New York's will have three arches, each 10 feet high, 20 feet wide, and 100 feet long. A steel surface door will lead to a corridor-tunnel providing entry to all arches. Arches can be reinforced with metal ribs for extra blast protection.



Built-in shelter in new structures

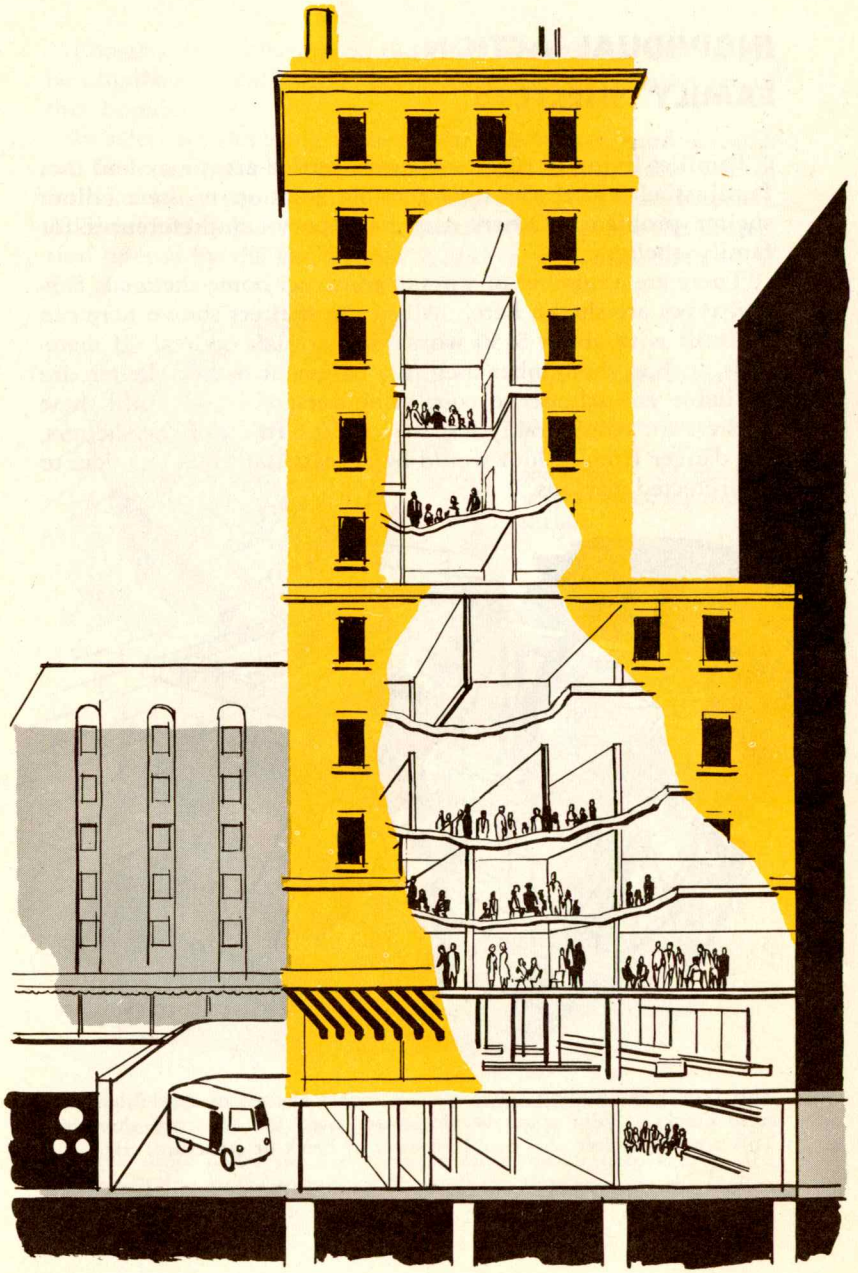
Added safety against fallout radiation can be built into a new structure without great extra cost. Sometimes the necessary protection can be assured by using the "safety core" design principle illustrated in the school building below. Even though it has no basement, the school house provides a shelter that is also useful for other purposes. The thick-walled central core with concrete-slab roof contains "activity rooms," divided and reinforced by the walls of a library and rest rooms. Projecting baffle walls shield the windows of surrounding classrooms.



A city building provides fallout protection

After a nuclear attack, a tall apartment or office building 10 miles or more from the explosion could be one of the safest refuges. In this drawing the people have taken shelter from radioactive fallout in an office building.

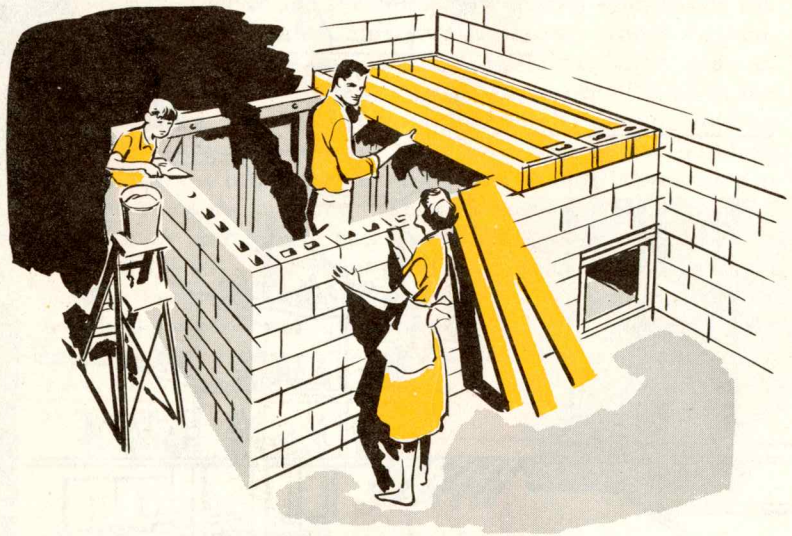
Because the gamma rays given off by fallout penetrate much like X-rays, the people taking shelter in the building shown on the opposite page have put as much mass of material as possible between themselves and the particles which have settled on the roof, ground, and other horizontal surfaces. Above ground, they have gone to the middle of the building; below ground, they have found shielding in a basement corner. Those in the main basement are shielded from radiation by the surrounding earth, by partitions, and by the whole mass of the building above. On the upper floors, people have shielded themselves in the "core" of the building. They have avoided the floor with the setback and terrace because of radiation from the fallout piling up there. (For better protection on any floor, it is advisable to keep below the window-sill level.) Because the tall building shields lower floors from some radiation, people have taken shelter in more rooms on that side. But no one has taken cover on the ground and top floors because the shielding there is inadequate.



INDIVIDUAL ACTION:
FAMILY SHELTERS

Families living in rural or sparsely settled areas may find that family shelters are the only feasible solution to their fallout shelter problem. Others may have personal preferences for family shelters.

There are a number of ways to construct home shelters. Several types are shown here. All of the shelters shown here can be built with about $150 worth of materials or less. If materials, such as the lumber used in a basement lean-to shelter, are available at little or no cost, some persons could build these shelters for considerably less than $150. In all of the shelters, the danger from fallout would be at least 100 times less than to unprotected persons.



This family is building a basement compact shelter of sand-filled concrete blocks. Solid concrete blocks are used for the roof shielding. This type of shelter also could be built of brick or structural tile.

Construction drawings on these and other family shelters can be obtained by following the instructions on the last page of this booklet.

In selecting shielding material for any shelter, sand or earth can be substituted for concrete or brick, but for each inch of solid masonry you need an inch and a half of sand or earth. Adding shielding material to a shelter will improve the protection offered by the shelter, but it also may increase the cost of the shelter.

This sand-filled lean-to basement shelter will accommodate three persons. The house itself gives partial shielding. Sandbags are used to block the end of the shelter.

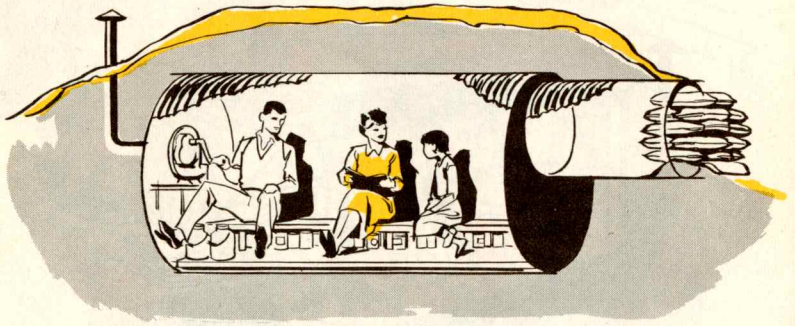
This backyard plywood shelter can be built partially above ground and mounded over with earth, or be built totally below ground level.

A gravel drain under the shelter and a ditch outside help keep it dry. The family blocks the entrance with sandbags after entering the shelter.

A number of firms have entered the home shelter field. As in any new commercial activity there are abuses. Advertising claims may be misleading; designs and products may be inadequate. Your State and Federal governments will do what they properly can to minimize these abuses, but the most effective discouragement to those taking advantage of the rising interest in home shelters is your caution and shrewdness. You will have the cooperation of the Better Business Bureau, your local Civil Defense director, and of your local, State, and Federal government officials concerned with such matters.

Trade associations that are interested in the shelter construction business have offered their cooperation in making home shelter plans available to the public and in working with others to maintain a high level of business practice. Several of these are listed on the last page of this booklet.

In the event of a nuclear attack, be prepared to live in a shelter as long as two weeks, coming out for short trips only if necessary. Fallout would be most dangerous in the first two days after an attack, and even if you were inside a shelter you probably would have absorbed some radiation. Your freedom of action would depend on your radiation exposure during the critical period after the fallout descends. So, never expose yourself unnecessarily to radiation.



This prefab backyard shelter for four can be bought for under $150. The price includes the corrugated steel-pipe unit (4-foot diameter), entry and air vent pipes.

This four-person basement-corner shelter is made of curved asbestos-cement sheets which are covered with sandbags. Materials cost about $125.

LAST-MINUTE IMPROVISED MEASURES

In the nuclear age, nobody can guarantee you so many minutes, hours, or days of warning time. An enemy ultimatum might set a deadline; enemy bombers could be tracked while hours away; but enemy missiles could arrived unannounced. However, even the briefest warning you might get by radio or sirens would give you the precious, live-saving time to act.

The two public warning signals are:

A 3- to 5-minute STEADY TONE, meaning, turn on your radio for directions from local authorities.

A 3-minute WARBLING TONE or SHORT BLASTS, meaning take cover immediately.

There are at least two situations that could increase the severity of the danger you would face: A plan of action but no time to put it into effect, or time to act but no plan of action—no shelter, for example.

A plan but no time

Your first warning of nuclear attack could be the flash of an explosion. Don't look at it. Quick action during the next few seconds could save your life.

If you are inside, dive under or behind the nearest desk, table, sofa or other piece of sturdy furniture. Try to get in a shadow;

If you have no basement, you can improvise a shelter by digging a trench next to the house, and making a lean-to structure with house doors. Pile the dirt from the trench and other heavy objects on top of the doors and at the sides for as much radiation shielding as possible.

it will help shade you from the heat. Lie curled on your side with your hands over the back of your neck, knees tucked against your chest. Stay away from windows, or turn your back to them—they admit heat rays and also may shatter.

If you are outside, run into a building and assume the same curled-up position. If possible, face a corner.

If you cannot get into a building, seek the lowest, most protected spot, such as a ditch, gutter or depression in a lawn. Lie in the curled position. Face away from loose or breakable objects.

If you are far enough away from the explosion you may feel no effect at all. But stay put for five minutes to be sure. By then the blast effects will have passed or lost their force. You will have at least half an hour to find fallout protection.

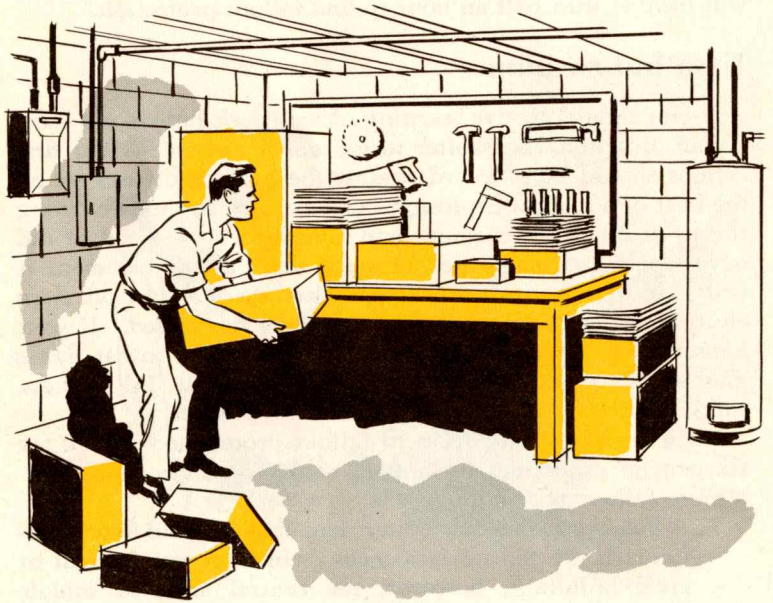
Time but no plan

If you should receive warning of an attack but do not have a plan of action—no shelter to go to, for example—your first actions should be to guard against the hazards of fires set by the heat of a nuclear explosion. Get rid of such quick burning things as oily rags, curtains, and lampshades. Get rid of old newspapers and magazines, or stack them in the basement if you plan to improvise a fallout shelter there. Shut off main electric and gas lines until the fire danger has passed. If your house has venetian blinds, lower and shut them to bar flying glass and screen out some of the blast's fierce heat. Fill buckets, sinks, a bathtub, and other containers with water.

Then turn your attention to fallout protection. There are six general guidelines to keep in mind for improvising last-minute fallout protection:

1. A basement is usually better than aboveground floors, particularly in private residences. (In large commercial or civic buildings, however, the central areas of middle floors could offer good protection.)
2. A corner of a basement that is below ground level is better than the center of the basement.
3. On aboveground floors, improvise shelter away from outside walls.

4. When improvising shelter, keep it small. Concentrate the shielding mass immediately around and above you to conserve construction time.
5. Stay away from windows and outside doorways. They are weak points in your fallout shield. Also, windows could be shattered many miles beyond the severe blast damage area of a nuclear explosion.
6. If caught in the open, try to get to some substantial structure, such as a large commercial or civic building, a tunnel, or cave. If none of these is readily available, look for a culvert, underpass or ditch—anything that will get you below ground level—and improvise a shelter.



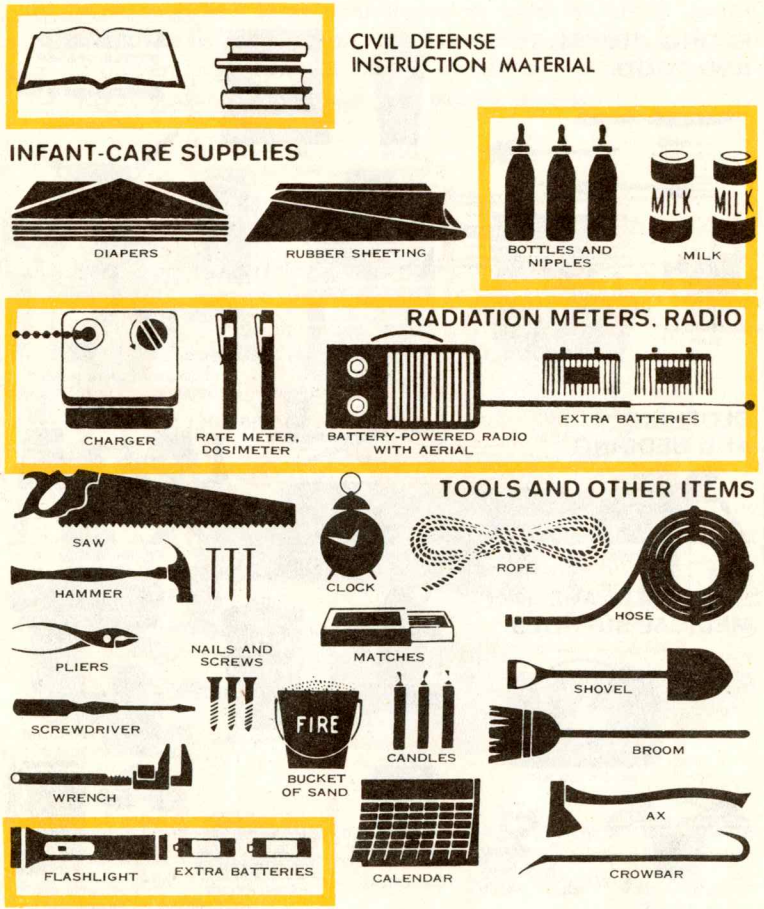
This man is improvising a fallout shelter in a basement corner by stacking heavy material on and at the open sides of a sturdy table. Piling dirt and other heavy material in the basement window wells will improve his margin of protection.

SHELTER SUPPLIES

Not every item on this chart is vital to life. (The most essential ones are outlined in color.) But even though you might be able to leave your shelter briefly after a day or two, you should prepare to be *completely* self-sustaining for at least two weeks.

The one essential is water; most people can live no more than four days without it. The minimum for a shelter is one quart of fluid per person per day; if space is available near the shelter, a gallon of water a day per person would provide for your comfort, including washing.

Some items, such as tools, should be kept handy but need not be inside the shelter itself.



EMERGENCY HOUSEKEEPING

Following is a checklist of preparations for, and best ways of, living in close confinement for the two days to two weeks when a shelter may have to be your home. Also included is a resume of the first aid information you may need.

Water

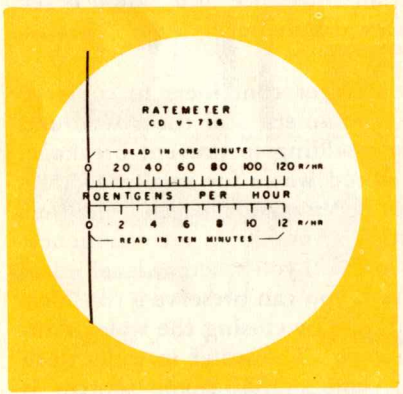
It is more vital than food. Humans can live on a quart of water or other fluid a day, but an allowance of a gallon is far more comfortable, especially in a warm shelter.

Store water in five-gallon or larger containers to conserve space. If you use small glass containers, seal them well and pack them with newspapers or wadding to prevent breakage. Some may want to test their stored water for smell and taste every three months, but it is not necessary for health. Odorous as it might become, it will still be usable in an emergency. Announcements on your radio may tell you whether local water supplies are safe. If they are not, you can preserve a considerable safe water supply in your house by closing the water shut-off valve leading in from the street. The water in toilet flush tanks, pipes, hot water tanks, and similar home sources is drinkable.

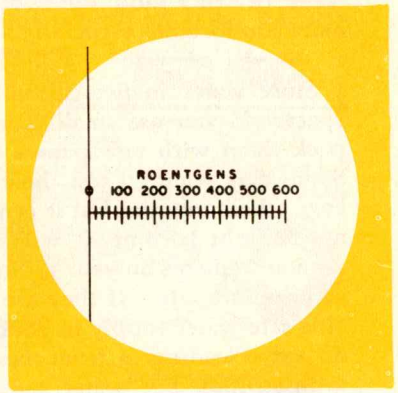
Unless authorities have pronounced it safe, try to avoid using water from outside the house or open sources (lakes, reservoirs) after the attack without purifying it. Germs or radioactive material, or both, may get into water. Cloudy or unclear water

should first be strained through a paper towel or several thicknesses of clean cloth, or else be allowed to settle in a deep container and then siphoned off. After that, it may be freed of germs with water purification tablets, obtainable at drug and sporting goods stores, or by boiling vigorously for a few minutes, or by adding 20 drops of iodine to a gallon of clear water or 40 drops to a gallon of cloudy water. Then let it stand for 30 minutes. Liquid household bleaches of the sodium hypochlorite type can also be used. The label usually gives instructions.

Radiation in itself does not affect water. It is only if the radioactive particles themselves get into water that the water becomes dangerous. There are effective ways to decontaminate water containing radioactive particles. The particles can be removed by the simple filtering process with paper or cloth that



Enlarged view of a ratemeter scale. This particular model must be exposed to radiation for certain specific times to measure the dose rate (intensity) of radiation.



Enlarged view of a dosimeter scale. The instrument is used to measure the total amount of radiation to which a person has been exposed.

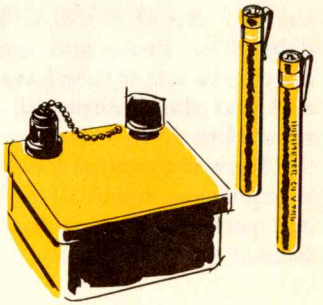
was described earlier, or by running the water through one of the devices that are sold to soften water for home use. Perhaps an easier way would be to mix a handful of clay soil with each gallon of water and allow it to settle out over a period of a day.

Radiation meters

Because gamma rays, like X-rays, are not detected by any of the five senses, each shelter should have some simple instruments to detect and measure them. Instruments developed specifically for home use can be ordered through department stores and other retail outlets. Having these instruments does not automatically provide you with simple solutions to problems of radiation exposure since the relations between dose rate, total dose, time, radioactive decay, etc., must be learned. Instructions will be available, however, on how to interpret the instrument readings. If these are studied and understood in advance, the instruments can be of great value in intelligently planning your action in a fallout situation.

A ratemeter will tell what the intensity of the radiation is. It is similar to a speedometer in a car except that it measures roentgens per hour rather than miles per hour. Thus, from a ratemeter reading made just outside the shelter, you can get an indication of whether it is safe to leave the shelter for a brief period. The dosimeter will show you the total amount of radiation to which you have been exposed during an emergency period. It is similar to a mileage indicator in a car but it measures total roentgens rather than miles. Carefully study the instructions provided with these instruments by the manufacturer.

At right is a kit of radiation instruments developed specifically for home use—a ratemeter, dosimeter, and charger. Other models are being developed.



Food

Wherever you live—in the country, city apartment, or suburban house—you should keep a two-week supply of food on hand. Large community shelters in existing buildings are going to be stocked by the Federal Government with emergency foods. But for the present, and especially for apartment residents who may have to take quick refuge in the central core or basement of their building, a good plan is to keep handy a box or basket with rations and water.

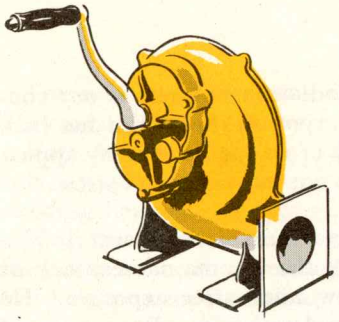
In planning a two-week supply of food for whatever shelter you will use, bear these things in mind:

Ten thousand calories will be adequate for an adult during an inactive two-week shelter stay. Select familiar foods (they are more heartening and acceptable during times of stress) and food that will last for months without refrigeration and can be served without cooking. Suggestions: canned meat, fish, poultry, beans, peas and fruits; cereals and tinned baked goods; cheese spreads, peanut butter and jellies with crackers; evaporated or dried milk.

Pick cans and packages of a size suitable to your family's needs for one meal; this prevents spoilage and offers you greater daily variety. Keep all foods in their original containers. Those that do not come in cans should be wrapped and tape-sealed in polyethylene sheets. Write the date of purchase on cans or packages, and use oldest purchases first.

After a nuclear attack, food stored indoors should be safe to eat. That is especially true of food in freezers and refrigerators, which should, of course, be kept closed as much as possible. Eat the perishable foods first, especially if electricity and gas are cut off. Bread is still edible even when moldy; sour milk is drinkable. Fruits and vegetables with "rotten" spots cut out are safe to eat; if they have been exposed to fallout, wipe, wash and peel them, disposing of wash-water and peelings outside the shelter.

Throw out canned foods if bubbles appear in the juices, even though they smell all right. In an emergency, most canned and packaged animal foods can be eaten by humans without harm.



A hand-operated air blower, like this one at the left, would provide ample ventilation for any underground family shelter. Other models are being developed.

Ventilation

Fresh air is more vital than food and water. A basement home shelter will get its air via door cracks and other crevices through which fallout particles are unlikely to drift. But well-sealed community shelters and home underground ones will need ventilation systems because even at rest a person should have at least three cubic feet of air a minute.

In many home underground shelters a three-inch intake pipe is installed to suck in fresh air by means of a hand-operated blower that is cranked periodically, and an exhaust pipe is set up to vent stale air. The air-intake pipe should extend at least a foot above the ground, and have a weather cap over it to keep out fallout particles.

Community shelters should have an air filter to remove particles that may get into the ventilation system. Since this filter may collect radioactive material, the people in the shelter should be shielded from it. No blower is necessary for the outlet or exhaust pipe because of the pressure created within the shelter by the intake blower. In smaller shelters the outlet pipe may be unnecessary because air would leave through cracks around the door. Blowers are available at hardware stores.

Radiation sickness

The principal ailment unique to nuclear warfare is radiation sickness. Its severity depends on the amount of radiation to which a person is exposed and on the length of the exposure time. That is because the body can take a certain amount of radiation damage and repair it without serious permanent injury. It is only when one gets too much too fast that sickness