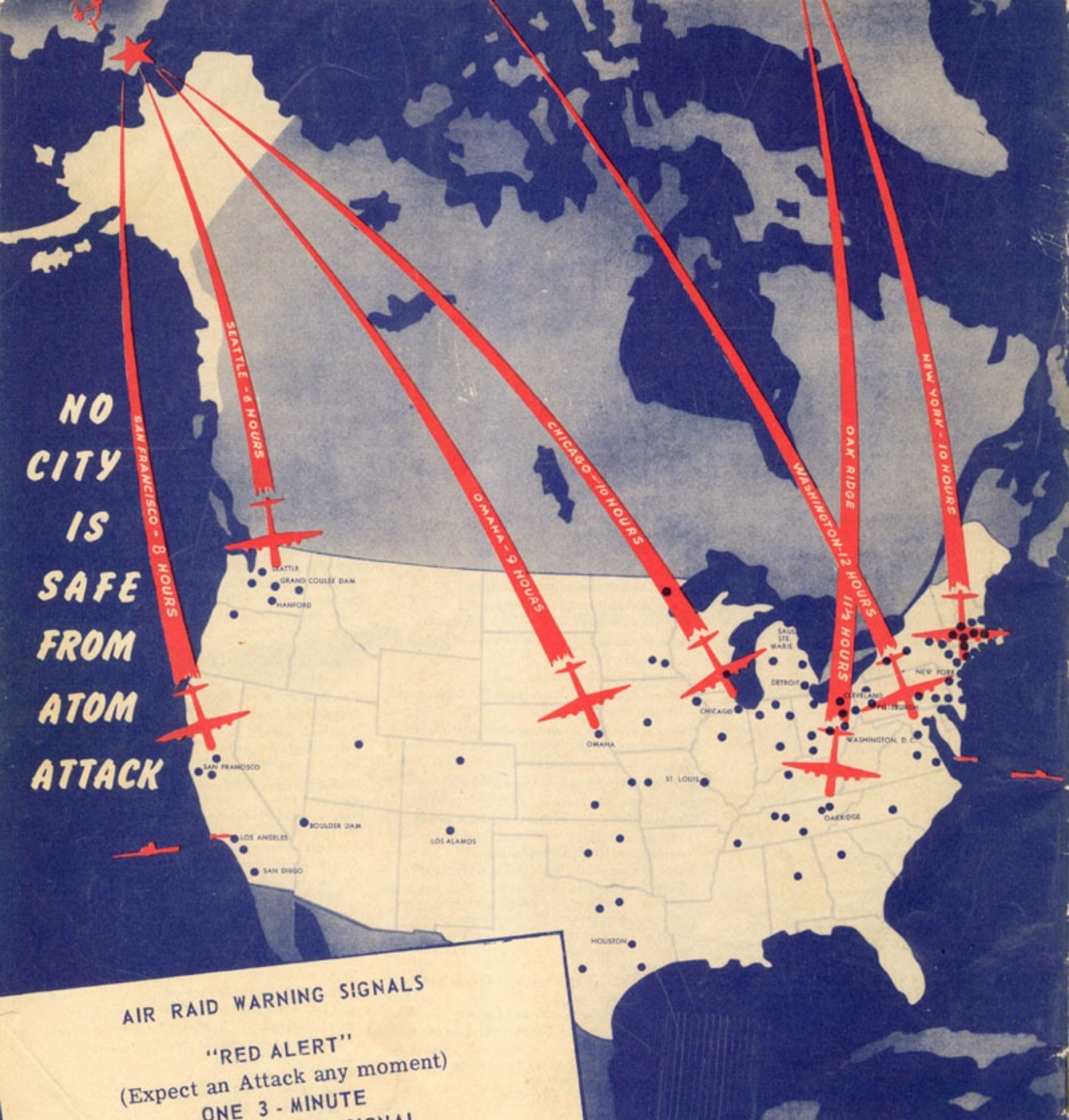


AIR RAID WARNING SIGNALS

"RED ALERT"
(Expect an Attack any moment)
ONE 3 - MINUTE
WARBLING SIREN SIGNAL

"ALL-CLEAR SIGNAL"
(Enemy aircraft no longer in area)
THREE 1 - MINUTE STEADY SIREN BLASTS
TWO MINUTES OF SILENCE BETWEEN

SOURCES OF MATERIAL — Damage from Atomic Explosion and Design of Protective Structures (Dept. of Defense and AEC) • A Study of Civil Defense (National Military Establishment) • Civil Defense Against Atomic Attack (Joint Committee on Atomic Energy) • The Effects of Atomic Weapons (Atomic Energy Commission) • Medical Aspects of Atomic Weapons (Dept. of Defense and AEC) • Control of Radiation Hazards in the Atomic Energy Program (AEC) • Civil Defense Status (Civilian Defense Office) • Self-Help and Mutual Aid in Civil Defense (NSRB) • Municipal Action in Civil Defense (NSRB) • State and Municipal Responsibilities in Civil Defense Planning (NSRB) • The City of Washington and an Atomic Bomb Attack (NSRB) • Address of William A. Gill, Ass't Dir. of Civilian Mobilization Office • Radiological Monitoring in Civil Defense (NSRB) • National Defense Transportation Journal • Bulletin of the Atomic Scientists • Must We Hide?, Dr. R. E. Lapp • United States Civil Defense.

PROTECTION ON THE HOME FRONT

THE AMERICAN RED CROSS AND CIVIL DEFENSE

Under a directive of the NSRB the American National Red Cross was given the responsibility for: coordinating a nation-wide blood program under the Civil Defense Plan; providing first aid training for all Civil Defense officials and volunteer workers; providing Home Nursing training; training Nurse's Aides; and training leaders and developing plans to assist Civilian Defense authorities in the provision of food, clothing and shelter during an emergency.

RED CROSS COURSES

The Seattle-King County Chapter of the American Red Cross in assisting Civil Defense preparedness, offers the following First Aid Courses.

Standard First Aid (including supplementary atomic information), an approximate 20 hour course for adults over 16 years.

Junior First Aid . . . . for Junior High and High School students under 16 (approximately 22,000 students had enrolled in the Junior and Standard first aid courses by June, 1951.

Advanced First Aid . . . . open to those who have completed the Standard Course.

First Aid Instructor . . . . open to those who have completed Standard and Advanced courses.

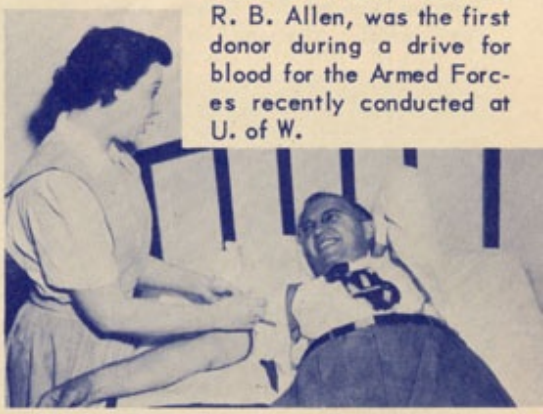
Those wishing to enroll in any of the above courses can do so by calling Red Cross at ELiot 2800.

BLOOD DONATIONS

The King County Central Blood Bank, Seattle, in cooperation with the American Red Cross, is furnishing blood and plasma to our armed forces. The American Red Cross locally is also preparing for the day when it may be called upon to supply wholesale quantities of blood and plasma to disaster victims should an emergency arise in this area. Blood donors are urgently needed to fill the monthly blood for the armed forces quota set for this area by the military. Any male resident (18 to 60) or female (21 to 60) in normal health may safely give blood. To make an appointment for a blood donation call Red Cross at ELiot 2800. The Blood Banks donor hours are Mon/ Thurs 1:00 to 8:00 p.m. and Tues/Wed/Fri/ Sat. 9:00 a.m. to 4:30 p.m.

(Left)

Preparatory to giving Red Cross first aid training to Junior and Senior High School students in King County, especially selected teachers were trained as Red Cross first aid instructors. Pictured is one of these instructor classes being given a demonstration of artificial respiration, under the watchful eye of Elmer Holstrom, Red Cross safety services director (left).



Univ. of Wash. Pres. Dr. R. B. Allen, was the first donor during a drive for blood for the Armed Forces recently conducted at U. of W.

SIX SURVIVAL SECRETS FOR ATOMIC ATTACKS

ALWAYS PUT FIRST THINGS FIRST AND

1. TRY TO GET SHIELDED

If you have time, get down in a basement or subway. Should you unexpectedly be caught out-of-doors, seek shelter alongside a building, or jump in any handy ditch or gutter.

2. DROP FLAT ON GROUND OR FLOOR

To keep from being tossed about and to lessen the chances of being struck by falling and flying objects, flatten out at the base of a wall, or at the bottom of a bank.

3. BURY YOUR FACE IN YOUR ARMS

When you drop flat, hide your eyes in the crook of your elbow. That will protect your face from flash burns, prevent temporary blindness and keep flying objects out of your eyes.

NEVER LOSE YOUR HEAD AND

4. DON'T RUSH OUTSIDE RIGHT AFTER A BOMBING

After an air burst, wait a few minutes then go help to fight fires. After other kinds of bursts wait at least 1 hour to give lingering radiation some chance to die down.

5. DON'T TAKE CHANCES WITH FOOD OR WATER IN OPEN CONTAINERS

To prevent radioactive poisoning or disease, select your food and water with care. When there is reason to believe they may be contaminated, stick to canned and bottled things if possible.

6. DON'T START RUMORS

In the confusion that follows a bombing, a single rumor might touch off a panic that could cost your life.

FIVE KEYS TO HOUSEHOLD SAFETY

1. STRIVE FOR "FIREPROOF HOUSEKEEPING"

Don't let trash pile up, and keep waste paper in covered containers. When an alert sounds, do all you can to eliminate sparks by shutting off the oil burner and covering all open flames.

2. KNOW YOUR OWN HOME

Know which is the safest part of your cellar, learn how to turn off your oil burner and what to do about utilities.

3. HAVE EMERGENCY EQUIPMENT AND SUPPLIES HANDY

Always have a good flashlight, a radio, first-aid equipment and a supply of canned goods in the house.

4. CLOSE ALL WINDOWS AND DOORS AND DRAW THE BLINDS

If you have time when an alert sounds, close the house up tight in order to keep out fire sparks and radioactive dusts and to lessen the chances of being cut by flying glass. Keep the house closed until all danger is past.

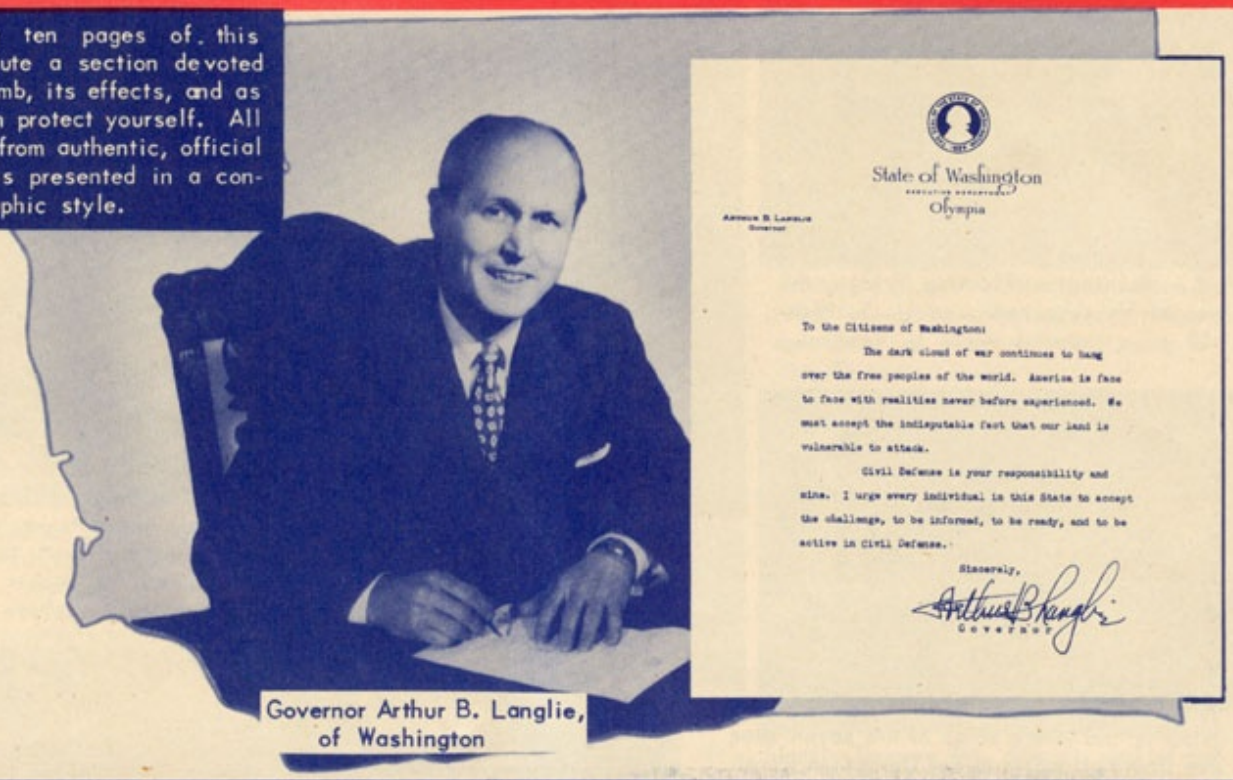
5. USE THE TELEPHONE ONLY FOR TRUE EMERGENCIES

Do not use the phone unless absolutely necessary. Leave the lines open for real emergency traffic.

VICES IN SOME CIVIL DEFENSE CAPACITY

THE MIGHTY

The following ten pages of this Manual constitute a section devoted to the atom bomb, its effects, and as to how you can protect yourself. All information is from authentic, official sources, and is presented in a condensed but graphic style.



State of Washington
Olympia

To the Citizens of Washington:

The dark cloud of war continues to hang over the free peoples of the world. America is face to face with realities never before experienced. We must accept the indisputable fact that our land is vulnerable to attack.

Civil Defense is your responsibility and mine. I urge every individual in this State to accept the challenge, to be informed, to be ready, and to be active in Civil Defense.

Sincerely,

Governor

Governor Arthur B. Langlie, of Washington

A POTENTIAL MILITARY WEAPON

We are currently engaged in a conflict in which use of the atomic bomb is quite probable. It is highly important that you understand the effects of this weapon and how you can best protect yourself. We shall present in the following pages a simple digest of such facts from governmental and other authentic sources we feel to be of greatest value.

The atomic bomb is an extremely potent military weapon but not "absolute" in the sense that its possession alone guarantees victory. Thus far the United States has exploded several atom bombs and we have learned of the devastation that can be caused. In Hiroshima, 71,000 people were killed and 68,000 injured in a city of 245,000. About 75 A-bombs, according to Dr. R. E. Lapp, would probably have done as much damage to target areas in Germany as was done by all the strategic bombing during World War II. With all its tremendous heat and blast effects, accompanied by its unique radiation effects, it is still not unlimited in the amount of damage it can do. You need not worry, for example, about rumors to the effect that atomic explosions might contaminate the earth. It would take something like a million A-bombs to do the trick.

The atomic bomb is certainly to be feared and respected but there is no reason that it should cause panic. Now that the damage that it can cause, and the probable extent of such damage, is known, it has been possible to formulate certain simple rules that will go a long way towards insuring your safety and eliminate to a great degree the element of fear.

In any discussion of the atomic weapon it should be remembered that constant improvements in design and type, or useage, can be expected. A top military spokesman recently forecast the use of A-bombs as the next probable step in battlefield warfare and said that they can be used with deadly accuracy against troops, tanks and other military targets.

RADIOLOGICAL WARFARE — The use of radioactive gases, dusts or mists as a weapon, is a possibility and we should be prepared for it according to Prof. Ridenour of the University of Illinois, but because it is a mystery weapon its most important effect might be psychological since it probably couldn't be used to kill people. It probably would force them to abandon homes, towns and military installations, however.

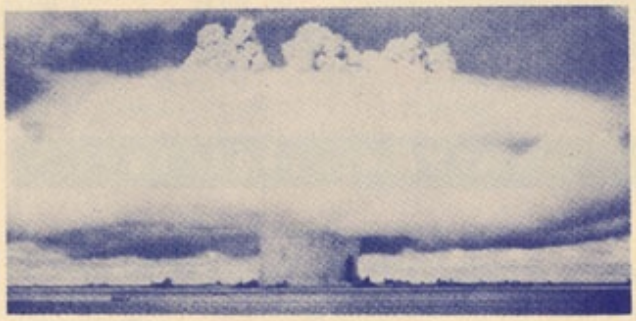
H-BOMB (Hydrogen Bomb) . . . It is no secret that research and experimentation on the development of the H-bomb is going on. It is not possible to predict when, or if, such a weapon will be produced. It is interesting to note however that according to the AEC a hydrogen bomb 1,000 times more powerful than the original A-bombs would be 10 times as destructive. It would cause severe destruction to over 30 to 40 square miles. According to a recent article in Science Digest, the H-bomb's most dangerous effect, from the viewpoint of the entire human race, would lie in the virulent radioactive dusts it might be used to produce. Such dusts, blown to the stratosphere would drift about the earth, gradually settling anywhere.

ATOMIC GUIDED MISSILES — or artillery shells, are certainly a future possibility, within perhaps two to five years, according to Army General J. Lawton Collins.

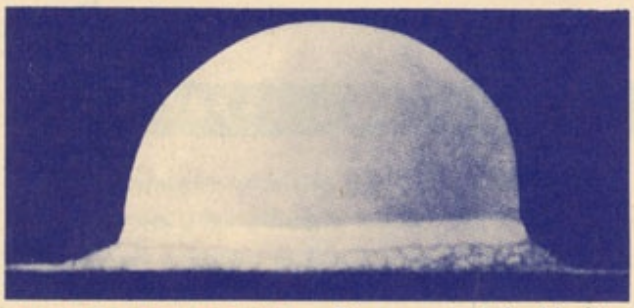
ATOM BOMB!

THE ATOMIC BOMB differs from other bombs in several important ways: (1) **ENERGY** released by an atomic bomb is roughly equivalent to that produced by the explosion of 20,000 tons of TNT bombs; (2) the explosion of the bomb produces highly penetrating, invisible **RADIATION** in the form of lethal gamma rays. In addition there is also; (3) intense **HEAT** (1,000,000° C. in center of fireball) and **LIGHT** (at 5.7 miles, the brilliance is 100 times that of the sun viewed at the earth's surface); and (4) **RADIOACTIVE RESIDUES** which remain after the explosion emitting harmful radiations.

TYPES OF EXPLOSIONS



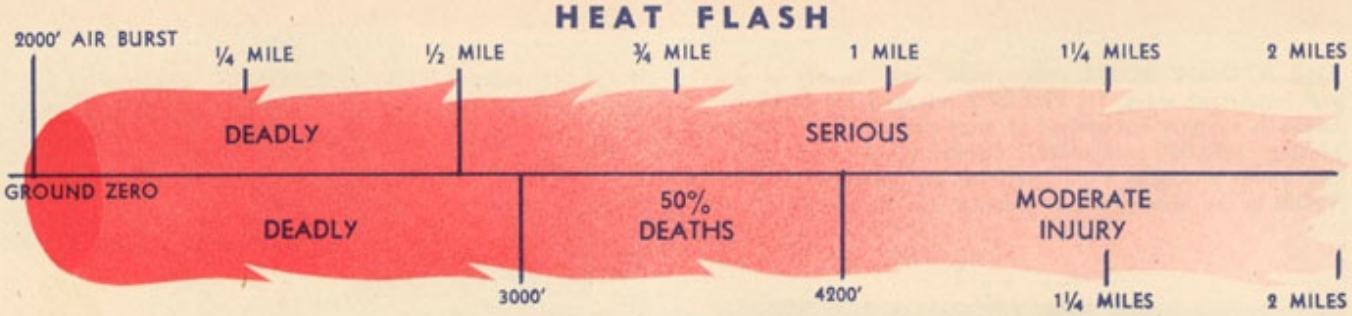
UNDERWATER BLAST — In test "Baker" off Bikini, a tremendous column of water was produced, which completely absorbed the initial flash of neutrons and gamma rays. When it began to fall back to the lagoon surface a critical base surge — a 200 to 300 foot wave of radioactive fission products — rolled over the ships in the harbor drenching them with highly contaminated radioactive products. Fall-out droplets were a further serious radioactive hazard many miles "downwind." In order to produce a critical base surge the water must be fairly deep. Fortunately little water of such depth exists in harbors or water adjacent to any of our larger cities. However the blast effect of an underwater explosion in even shallow water would cause considerable damage to any nearby docks or shore installations. . . . **AIR BURST OVER WATER** — In an air burst over water exposed structures, such as masts, spars, radar antennae, etc., within a radius of 3,000 to 3,500 feet may be expected to suffer very severe damage.



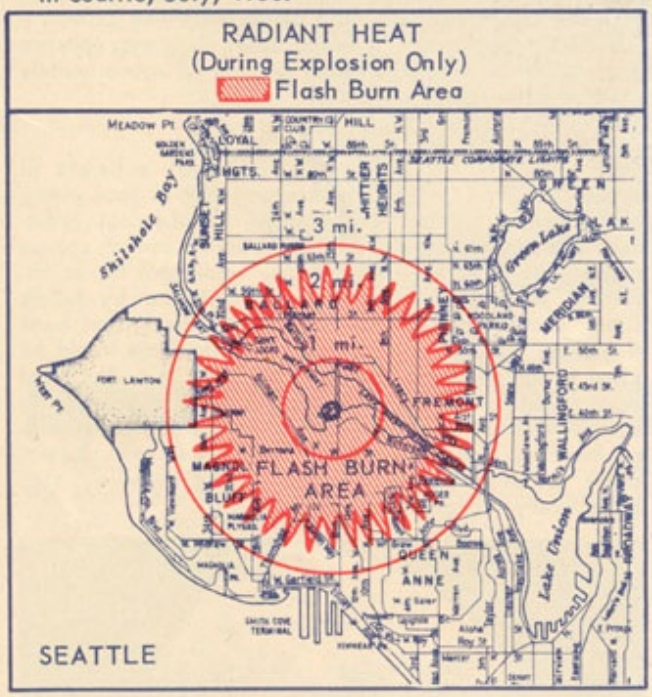
GROUND LEVEL BLAST — On account of the blocking and shielding effects of the huge skyscrapers a ground level or "basement" blast in say New York, or Chicago, would have a relatively small area of critical destruction. Very close buildings would probably collapse and those nearby would suffer loss of masonry and be materially weakened. Primary radiation would be materially checked by the shielding of the buildings but there would be a small area of intense residual radioactivity near explosion center. It would probably be 6 hours before it would be safe to walk across the area but to stay for any length of time would be out of the question without proper shielding. On account of falling debris, streets would likely be clogged and fire fighting would be rendered very difficult. . . . **SUB-GROUND LEVEL BLAST** — According to the AEC an atomic bomb could be made to burrow 50 feet or more into soft earth before exploding causing a "Grade D" earthquake. It would upset chimneys, collapse weak buildings, etc., to a radial distance of approximately 1350 to 3300 feet.

AIR BURST — An air burst of bomb at a height of about 2,000 feet, setting up thousand-mile-an-hour winds, very powerful suction and deadly, instantaneous radiation, appears to be the most destructive use of atomic energy. The heat wave in this case would not be as important as fires of secondary origin started by falling debris, shorting of electrical circuits, etc. The instant burst of gamma rays that would flash from the bomb would be lethal to anyone in the open up to 3,000 feet. The blast wave would be terrific, destroying almost everything within a half-mile radius of the explosion, and all but the strongest buildings would collapse to about one mile. Radioactive contamination of ground, building structures, etc., is practically negligible in an airburst.

DAMAGE EFFECTS OF AN



Hypothetical atom bombing problem as worked out in Seattle, July, 1950.



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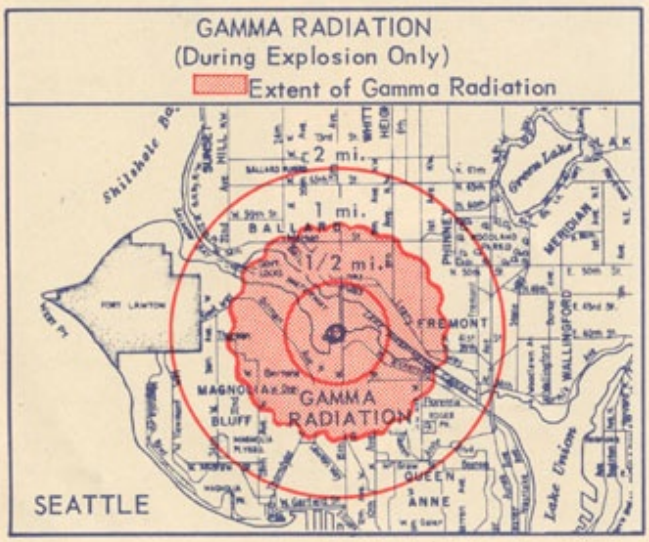


THERMAL EFFECTS

At the time of the explosion a terrific heat flash is generated. It goes out in straight lines from the explosion and lasts but a fraction of a second, but during that time it can burn unprotected skin at distances of 2½ miles and has been felt up to 5 miles. It has scorched telegraph poles at 2 miles. FIRE, set directly by the flash of radiant heat, or started by the ignition of gas from disrupted mains, or short circuits, can destroy huge areas. In Nagasaki, it was estimated that almost **immediately** after the detonation, fires were started in dwellings within a radius of 3,000 feet from ground zero. Debris-choked streets usually hamper or make fire fighting difficult. **If survivors will personally fight the small fires in their immediate area, huge conflagrations may never develop.**

RADIATION EFFECTS

GAMMA RAYS, pulses of electro-magnetic radiation, traveling with the velocity of visible light, are very penetrating. They are usually lethal to anyone in the open up to 3,000 or 4,000 feet from the bomb burst. They do most of their killing in the first second, or not at all. The second gamma ray hazard comes from the radioactive fission products left from the blast, or deposited from the cloud. Fission products from an air burst bomb must be regarded as something of a nuisance but a negligible factor in causing death. In the case of an underwater burst, however, residual radioactivity is much more extreme and may remain a hazard for a considerable time.

ATOM BOMB EXPLOSION

BLAST DAMAGE

GROUND ZERO — COMPLETE DESTRUCTION — ½ MILE — SEVERE DAMAGE — 1 MILE — MODERATE DAMAGE — 1⅝ MILES — PARTIAL DAMAGE — 2 MILES — LIGHT DAMAGE

BLAST DAMAGE CHART
(Air Burst) (AEC)

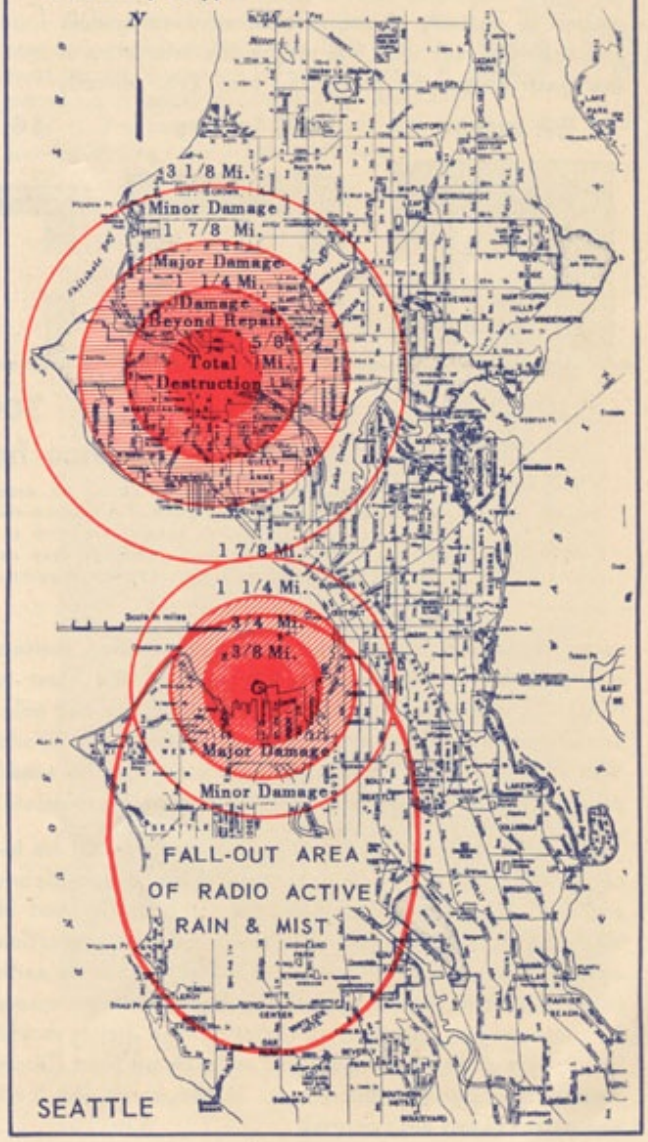
Feet	Damage . (Statistics relate to Japanese explosions.)
0	Ground Zero — or directly beneath the air burst.
1,500	Mass distortion of heavy steel frame buildings.
2,000	Limit of severe structural damage to earthquake resistant reinforced concrete buildings.
2,500	To this point virtually complete destruction of all buildings, other than reinforced concrete.
3,500	18-inch brick walls completely destroyed.
4,000	Roof tiles melted by heat.
4,500	Light concrete buildings collapsed.
5,000	12-inch brick walls severely cracked.
5,500	Electrical installations and trolley cars destroyed.
6,000	Severe damage to entire area. Severe structural damage to steel frame buildings.
6,600	Structural damage to multistory brick buildings.
8,000	Severe damage to homes, heavy damage to window frames and doors, foliage scorched.
8,300	Moderate damage to area.
9,000	Heavy plaster damage.
10,000	Blast damage to majority of homes. Severe fire damage. Flash ignition of combustible materials.
10,300	Partial damage to structures in area.
11,000	Flash charring of telegraph poles.
12,000	Light damage to window frames and doors, moderate plaster damage.
8 MILES	— Limit of light damage.

While giant skyscrapers with reinforced concrete structures and long periods of vibration should withstand the shock very well the masonry would be stripped off, girders twisted and people literally blown out of the top floors

BLAST DAMAGE AREA

Total Destruction — Major Damage
Damage Beyond Repair — Minor Damage

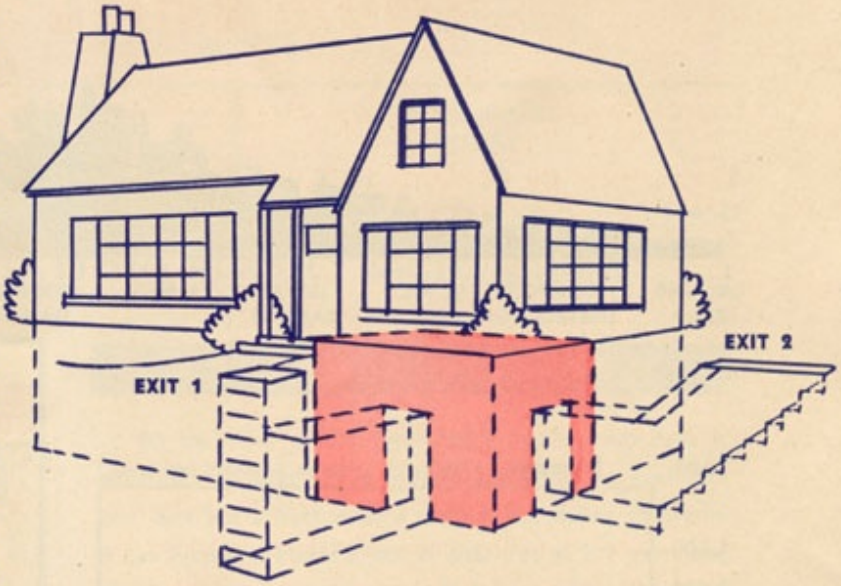
Hypothetical atom bombing problem as worked out in Seattle, July, 1950.



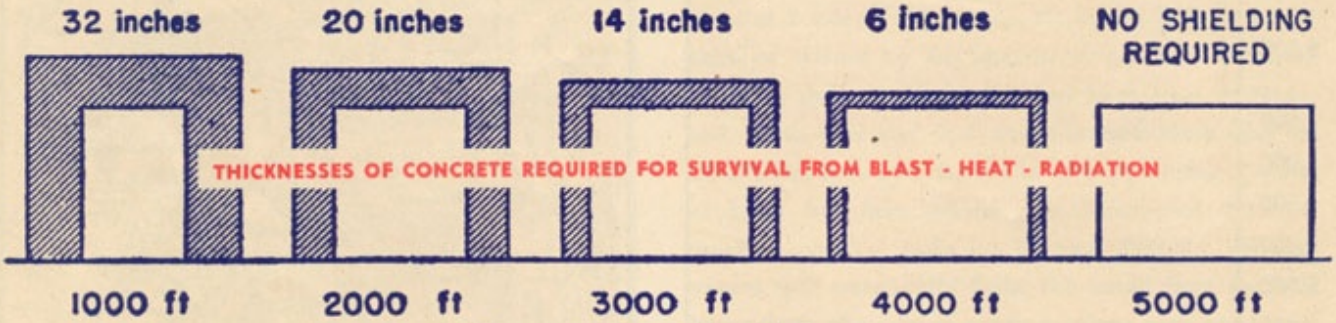
ADVANCE PRECAUTIONS

YOUR BOMB SHELTER

Best protection from an atomic explosion is the properly constructed shelter. This can be built in the open or as a specially reinforced room in your basement as in the diagram to the right. The room can be made any size you wish but should have no windows, since glass transmits the deadly gamma rays. Some means of getting out, preferably two exits, should be provided.



The most flimsy structure will give you complete protection against heat flash, but protection against the deadly gamma rays and neutrons is a main consideration. Lead is the most effective shielding device, but since lead is expensive and not practical, your next best bet is a shelter of reinforced concrete or perhaps reinforced concrete with a thick layer of earth over the top. If built outside, completely underground or partially above ground, solid earth walls and ceiling 6 feet thick will reduce the intensities of the gamma rays to practically zero even directly under the bomb burst. Some crude, semi-buried shelters only 900 feet from ground zero withstood the blast in Nagasaki, and none were damaged beyond one-half mile. Semi-buried shelters of the type used in Europe in World War II for protection against conventional bombs would provide worthwhile protection against atomic explosions.



The shelters shown as diagrams above are, according to the book MUST WE HIDE, by Dr. R. E. Lapp, effective at the distances given. For neutron shielding a modified concrete made by adding a considerable proportion of an iron (oxide) ore, such as limonite, or magnetite, to the cement is effective. Small pieces of iron, such as steel punchings, may also be incorporated. Concrete should be kept painted to seal its pores, reducing the penetration of gamma rays.

Outside shelters, buried or semi-buried, should be located well clear of buildings to avoid hazards from debris and fire. Outside shelters designed for a static load of 500 pounds per square foot should provide protection against blast at one-half mile from ground zero if an earth cover of at least 2 feet is provided. This cover is necessary for protection against ionizing radiation. The shelter should be capable of being closed up so as to be air tight. Doors should close tightly against seals in the frame. At least two means of exit are essential.

Concrete or hard-packed-earth building materials do not become dangerously radioactive when bombarded by gamma rays.

In your atomic shelter, whether inside or outside, adequate drainage and ventilation should be provided. Basements of homes, especially if they extend beyond the main structure of the house, offer reasonable protection against blast damage, provided they are not too near the center of the explosion and have outside escape hatches to be used in case the house collapses or catches fire.

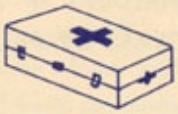
If you give them an idea of what you need, your local construction company will help in working out the details for an effective shelter. Some of them already have specifications.

MAY SAVE YOUR LIFE

EQUIPMENT AND SUPPLIES FOR YOUR BOMB SHELTER

Your bomb shelter should be equipped with certain necessary items that may be extremely valuable when it comes time to emerge into the bomb-blasted outer world.

FLASHLIGHT OR BATTERY-OPERATED LIGHTING FACILITIES— will be found valuable since all light circuits may be put out of commission at the time of the burst.



FIRST-AID KIT— will be found essential for rendering aid to injured or to members of your own family or group.

PORTABLE RADIO— to keep you in contact with emergency broadcasts concerning the disaster. (Battery operated)

FOOD AND WATER— A few cans of staple food and water in a tightly sealed jar may be most useful. Properly covered or canned foods should undergo little or no contamination. Contaminated water, when distilled, is perfectly safe for drinking purposes. The radioactive material remains behind in the residual scale and brine. MERE BOILING OF WATER CONTAMINATED WITH RADIOACTIVITY IS OF NO VALUE.

BLANKETS — may be needed for warmth or shock protection.

FIRE EXTINGUISHER— A small hand fire extinguisher will permit you to put out any small fires in your immediate vicinity. This may prevent these fires from spreading into a general conflagration and will be a godsend to the firefighting groups which will have their hands full trying to cope with major fires.

TOOLS— of a simple nature, such as a shovel, saw, hammer, hand ax, crow bar, pliers, knife, etc., may be necessary to remove debris from exit of your own shelter or in doing rescue work.

GAS MASK— An ordinary gas mask is adequate protection against swallowing or breathing sub-microscopic radioactive particles. If a mask is not available a surgical type of gauze face covering would help. In case of a high air burst, this probably would not be necessary, as very little radioactive residue is present.

GLOVES— Rubber gloves will serve to cover any small overlooked skin wounds that might permit entry of the radio-active particles into the blood stream. Heavy work (cotton or leather) gloves to slip over the rubber gloves might be helpful in the event of attempting to move heavy timbers or working in debris.

HEAD COVERING— Some sort of tight-fitting cap, preferably of the type used by surgeons, covering the hair as completely as possible, should be worn.

COVERALLS— (preferably of a light color and loose fitting to tuck into your boots or overshoes) will provide an effective and practical working outfit that can later be discarded along with your other clothes when you have left the radioactive area.

BOOTS OR OVERSHOES— will prevent radioactive particles adhering to your shoes and at the same time will be most helpful in working in flooded areas. If overshoes or boots are not handy, you can wrap your shoes with cloth which can be discarded later along with any radioactive particles.

(Above) An advance monitor entering an area of high radioactive contamination. (The average individual would not require such elaborate protective devices.)

WHAT TO DO IF BOMB FALLS WITHOUT WARNING

Your first indication of an atomic bomb burst will be an awesome glare in the sky hundreds of times brighter than the sun. DON'T LOOK AT THIS GLARE. YOU WILL EXPOSE YOUR FACE AND BODY TO FLASH BURNS AND DEADLY RADIATION.

1. **IF YOU ARE IN THE OPEN,** DROP TO THE GROUND INSTANTLY, BACK TO THE LIGHT, AND TRY TO SHADE YOUR BARE FACE, NECK, ARMS AND HANDS. THIS WILL NOT PROTECT YOU FROM GAMMA RAYS BUT WILL PROTECT YOU FROM BURNS which can hurt you far beyond the limits of radiation effects. (See photo No. 1)

KEEP YOURSELF DOWN FOR AT LEAST 10 SECONDS. THE IMMEDIATE DANGER IS THEN OVER AND YOU CAN GET UP AND LOOK AROUND AND DECIDE WHAT TO DO NEXT — IF YOU ARE ABLE.

2. **IF YOU ARE IN THE STREET,** DUCK BEHIND A TREE OR INTO A CORNER OR A DOORWAY IF IT IS ONE LEAP OR SO AWAY. BEND OVER, BACK TO THE LIGHT, SO AS NOT TO EXPOSE UNPROTECTED PARTS OF THE BODY — BUT IF SHELTER IS SEVERAL STEPS AWAY, DO NOT TRY TO MAKE IT. FALL TO THE GROUND AS IF YOU WERE IN THE OPEN AND THEN WAIT 10 SECONDS.

THEN PRESS YOURSELF TIGHTLY AGAINST A BUILDING IF YOU CAN, TO AVOID SHATTERED GLASS OR FALLING BRICKS. (See photo No. 2)

3. **IF YOU'RE AT HOME OR IN THE OFFICE,** DROP TO THE FLOOR, BACK TO A WINDOW, OR CRAWL BEHIND A DESK OR TABLE. THERE IS A LITTLE TIME LAG BETWEEN THE GLARE AND THE BLAST WAVE, SO FOR A FULL MINUTE STAY AWAY FROM THE WINDOWS AND THE DANGER OF FLYING GLASS. SAFEST PLACE INSIDE A BUILDING IS AGAINST AN INTERIOR PARTITION WHICH **MAY** BE STRONG ENOUGH TO RESIST COLLAPSE.
(See photos No. 3 and 3A)

AVOID PANIC — BE CALM . . . MASS HYSTERIA

WHAT TO DO IF YOU HAVE ADVANCE WARNING

AIR RAID WARNING SIGNALS

"RED ALERT"	"ALL-CLEAR SIGNAL"
(Expect an Attack any moment)	(Enemy aircraft no longer in area)
ONE 3 - MINUTE	THREE 1 - MINUTE STEADY SIREN BLASTS
WARBLING SIREN SIGNAL	TWO MINUTES OF SILENCE BETWEEN

1. Move at once to designated shelters or disperse as directed. In the event special shelters have not been prepared, go to the nearest subway or deep basement.

2. If no adequate shelter is nearby, you can still protect yourself against flying debris and some of the heat effect. Get away from frame buildings and trees. Lie down, preferably in a ditch, behind a wall, in a ravine. Protect your eyes from the flash by covering your eyes with your arm. If not, you may be temporarily blinded. Remain under shelter for a few minutes after the blast, to be sure all flying debris has landed.

3. If able, try and help any injured people near you. Administer first aid when possible. Put out any small fires in your vicinity. Each home should have a fire extinguisher available, as chances are that city water pressure will be gone.

4. When you have done what you can in your immediate vicinity, report to the place designated by civil defense authorities, as you will be needed to help in rescue work, evacuation of wounded, general fire fighting, and other emergency jobs. If no place to report has been designated, see if you can aid any of the emergency crews who will be in operation.

5. After the initial rescue work is done, check with a radiological defense man as to the safety of the area.

6. Take a shower and scrub thoroughly three or four times to remove any radioactive materials that may have gotten on you, using sodium bisulphite or potassium permanganate if badly contaminated, and if advised by competent authorities to do so.

7. Change your clothes, discarding the clothes you wore in the affected areas, especially shoes. **Bury them! Do not burn them!**

8. When feasible, check with a radiological defense adviser and a doctor to make sure you are well and safe.

9. Do not spread rumors. Enough confusion will exist without adding to it.

CAN SERIOUSLY HAMPER ORGANIZED DEFENSE

PERSONAL INJURY EFFEC

INJURIES FROM ATOMIC EXPLOSION

I. Those caused by the blast pressure or shock wave directly.
II. Those caused when buildings are wrecked.
III. Those caused from radiant heat.
IV. Those caused by burns, either in the wreckage or otherwise.
V. Those caused by nuclear radiation.
VI. Those caused through residual contamination.

BLAST INJURIES

Direct blast injury may occur whenever the greatly increased air pressure comes into contact with body surfaces, causing multiple hemorrhages, particularly of the intestinal tract, the stomach, the lungs, the ears, and the sinuses about the nose. Direct blast is not a significant primary cause of death. Most blast injuries are the result of missiles, such as broken glass, falling bricks, etc.

The shock wave from the blast sweeps outward rapidly from ground zero and, in the case of Japan, took up to 10 seconds to travel 2 miles.

In the water, the dangerous level for pressure is about 500 pounds per square inch. In an underwater atomic explosion, any person immersed in the water probably would be killed or seriously injured up to 2,000 yards from the zero point.

Since practically all brick and light masonry buildings with weight-bearing walls in the blast area will be wrecked, wooden buildings flattened, and the doors and other partitions of blast-resistant steel-reinforced concrete buildings blown out, people in or near these buildings will be killed or injured by collapse of structures, and by missile effects of debris.

GENERAL

There are no particular problems involved in the treatment of individual injuries received as a result of an atomic attack. Standard treatment procedures can be used in treating mechanical injuries (cuts, lacerations, broken bones, concussions, etc.), burns, shock and radiation effects. Problems of a more serious nature are involved in the necessity of treating thousands of individual cases almost at once, in the immediate need for mountains of medical supplies and prompt evacuation of seriously injured to hospitals outside of the disaster area. There is nothing mysterious about radiation, as man is subject to a constant bombardment of cosmic rays. He accumulates minute amounts of radium in his body through life, and X-rays are used extensively in the treatment of certain illnesses. The only difference in atomic radiation is in the types of rays and the intensity.

FLAME BURNS

A conflagration may be expected to follow any atomic bomb blast. Fire damage light in underwater bursts.

Burns suffered from flames, in such cases, differ in no way from those encountered in any ordinary intense fires unless radiation injury has also been suffered. In Japan, there were many cases where excessive scar tissue (keloids) formed, and many of the survivors have contraction deformities not specifically related to exposure to the atomic bomb, but rather to slow healing, improper care, and infection. Burns suffered in non-atomic bomb raids resulted in comparable amounts of scar tissue, a tendency in Japanese as a race.

It would be unrealistic to prepare for fewer than 40,000 to 50,000 severely burned persons from a single atomic explosion. Fortunately, severe symptoms from radiation in those not killed outright do not ordinarily come on until several days after the acute exposure, so that those suffering from burns and mechanical injuries will actually constitute the chief immediate medical problem and make their heaviest demands on emergency facilities at a time when those suffering solely from acute radiation will require very little attention.

FLASH BURNS

The flash burns caused by an atomic explosion may be first degree, merely reddening the skin; second degree, causing blisters; or third degree, damaging all layers of the skin.

Severe burns are caused both by the radiant heat from the explosion of the atomic bomb (flash burns) and from the fires that break out in the wreckage (flame burns). The effects of visible light probably are not significant. Even those who look directly at the burst apparently suffer only temporary dazzling and loss of vision.

Atomic bomb flash burns are distinctly different from those caused by other types of explosions, since they are due to radiant heat rather than to hot gases, as in the case of shell bursts or gasoline explosions. Shadow effects are prominent. An ear, for example, might be badly burned, yet the skin behind the ear be unharmed.

As compared with flame burns, flash burns show a much smaller depth of penetration of the skin. This is due to the fact that the thermal radiation flash lasts only approximately 3 seconds. Within the depths to which the thermal radiations penetrate, the tissues appear to be completely destroyed; in a radius of 3600 feet from ground zero blackening indicates that actual charring has occurred.

Direct injury from radiant heat occurs at the explosion of the bomb; Japanese people in the open suffered third-degree burns up to 1,500 yards and second-degree burns up to 2,500 yards. The effect was instantaneous.

Even loose clothing afforded some protection against atomic flash burns, and color also had a protective effect. White clothing tended to reflect the radiant heat, darker clothing to absorb heat. Burns sometimes were cross-hatched where light clothing was marked with dark lines. Tight clothing was less protection, and burns were inflicted at elbows and where straps crossed the shoulders, for example, while other places where clothing was loose were protected or less severely burned.

As far as burning caused by thermal radiation is concerned, the essential points are protection from direct exposure for human beings and the avoidance of easily combustible materials, especially near windows.

TS OF AN ATOMIC BLAST

RADIATION INJURIES

Because of the concentration of ionizing radiation nearly everyone not protected by earth, steel, or thick concrete within a radius of approximately 3000 ft. would probably die. The most serious cases would succumb within a few hours to 4 or 5 days after exposure. A second group would develop susceptibility to infection due to destruction of their white blood cells and would die from 4 days to 6 weeks after exposure. Another group would incur multiple hemorrhages and die within 2 to 3 weeks from this cause.

THEIR TREATMENT

Many people believe that very little can be done in treatment of radiation casualties. This is true of a lethal dose; but many borderline cases can be saved by:

a. Good medical care.

b. Whole blood transfusions. It has been estimated that, for a catastrophe such as at Hiroshima, approximately 250,000 pints of blood would be needed, 80,000 per week for the first 3 weeks.

c. Control of infection by antibiotics such as penicillin and aureomycin.

d. Intravenous feeding to supply necessary sugars, proteins and vitamins.

e. Control of the bleeding tendency by use of drugs.

Whole blood would be required in great quantities, primarily to treat the casualties suffering from mechanical injuries and burns, secondarily to treat victims of ionizing radiation.

GENERAL

There is little about the effects of either old or new weapons which is new to the health professions. The atomic bomb produces burns, lacerations, amputations, crushing injuries, and blast injuries which all surgeons are accustomed to treating. Radiation sickness is a new type of wartime injury, but it is not a new disease and its symptoms are recognized by physicians, particularly radiologists.

When the dose is 400 r or less, many lives can be saved with proper treatment. Immediate hospitalization, so as to insure complete rest, and avoidance of chills and fatigue, is the first step. Whole blood transfusions should be given as required, until the bone marrow has had time to regenerate blood cells. Adequate nourishment should be provided by intravenous feeding to supply necessary sugars, proteins, vitamins, etc. Infection may be controlled by the use of penicillin and other antibiotics.

Findings in Japan show that people exposed to heavy radiation suffer various injuries, sicknesses, and malfunctions which together are called the **acute radiation syndrome.** Physicians find that the severity of the symptoms is related importantly to two factors: The amount of radiation absorbed in a single dose, and the proportion of the body exposed.

No unusual ill effects directly attributable to ionizing radiation have occurred among Japanese survivors. Whether or not such after-effects will occur among these survivors will have to be answered in the future. After-effects from radiation exposure that cannot be fully assessed for many years are effects on heredity and effects on fertility. From investigations, it is found that the likelihood of parents having deformed children after suffering sublethal amounts of ionizing radiation is very slight.

With adequate warning which is heeded and adequate shelters which are occupied, the casualties can be greatly reduced. Furthermore, doctors with ample medical supplies, hospital facilities, and blood banks can save many of those injured by blast or burns.

GAMMA RAYS

Gamma rays are very similar to powerful X-rays and constitute the greatest radiological danger in an atomic blast. They penetrate deeply into the body and ionize the carbon, nitrogen, hydrogen, and oxygen atoms, disrupting the complex body combinations of these elements, changing the proteins, enzymes and other substances that make up our cells and bodies. As a result, the cells are injured or killed; if enough cells are damaged or killed, the person becomes seriously ill or dies.

One may receive radiation producing far more serious tissue damage than a severe burn without any sensation and no damage will be apparent for several days.

In the case of such a high air blast as in Japan, some 15 to 20 per cent of the deaths probably will be caused solely by nuclear radiation. The remaining 80 to 85 per cent will be caused primarily by injuries suffered in the collapse of buildings and by burns, although many of these may also suffer severe radiation exposure.

A dose of 400 r (roentgens) of radiation received over the whole body in the course of a few minutes represents the median lethal dose which would be fatal to about 50 per cent of human beings. At the minimum distance of 2100 feet from the explosion, protection from a lethal dose would require something like 20 inches of concrete, 3 inches of lead, or 40 inches of packed earth.

CONTAMINATION

The chief external radiation hazard in a contaminated area will come from gamma rays thrown off by fission products or by materials made radioactive by neutrons or gamma rays during the explosion. Filter masks, clothing tight at the wrists, ankles, and neck, and tight-wristed gloves will afford protection against Alpha and Beta particle contamination. Material heavily contaminated with Beta-emitting material should not, however, be handled, even with gloved hands, since it can cause severe burns. Tongs or equivalent instruments should be used. Clothing should be discarded at the edge of the contaminated area to avoid spreading radioactive contamination. Thorough soap-and-water bathing would be a valuable precaution.

Gamma radiation from contamination will not approach the power of direct bomb radiation, but it still can be severe. The best protection against contamination that gives off gamma radiation is to use instruments to detect its presence and to avoid any areas of dangerous concentration.

At a bomb burst, contaminated particles of the size which will most readily pass from the small airpockets of the lung into the blood stream ascend rapidly into the atmosphere. The chances of inhaling a dangerous amount of these small particles is small unless explosion occurs during rain or heavy overcast. A combat-type gas mask will filter out 99.999 per cent of all such particles.

Any wound suffered in a contaminated area should be cared for in the same manner as any similar injury in an uncontaminated area. Clean such a wound with soap and water or potassium permanganate, cut out the damaged tissue, and cover the wound. Amputation is not indicated.