Nuclear, Biological, and Chemical (NBC) Conditions

From the Air Force Survival Manual AFR 64-4

Nuclear (Atomic) Conditions

29-1. **Introduction** . The possibility of "induced conditions" has served to intensify the difficulties of basic and combat survival because of the serious problems posed by nuclear, biological, and chemical warfare. Though the prescribed survival procedures recommended in other parts of this regulation are still applicable, a number of additional problems are created by the hazards of induced conditions.

29-2. **Effects of Nuclear Weapons**. Nuclear weapons cause casualties and material damage through the effects of blast, thermal radiation, and nuclear radiation. The degree of hazard from each of these effects depends on the type of weapon, height of the burst, distance from the detonation, hardness of the target, and explosive yield of the weapon.

a. **Blast** . The blast wave is the cause of most of the destruction accompanying a nuclear blast. After a nuclear detonation, a high-pressure wave develops and moves outward from the fireball. The front of the wave travels rapidly away from the fireball as a moving wall of highly compressed air. An example of the speed of the blast wave is: At 4 seconds after the burst the blast wave has traveled about 4 miles and is still moving at 100 miles per hour. There are strong winds associated with the passage of the blast wave. These winds may have a peak velocity of several hundred miles an hour near ground zero. Ground zero is the point on the ground directly above or below the point of detonation. The overpressure, which is the pressure in excess of the normal atmospheric pressure, and the winds are major contributors to the casualty and damage-producing effects of the nuclear detonation. The overpressure can cause immediate death or injury to personnel and damage to material by its crushing effect. The high-speed winds propel objects, such as tree limbs or debris, at great speed and turn them into potentially lethal missiles. These winds can also physically throw personnel who are not protected, resulting in casualties. People both inside and outside of a structure may be injured as a result of blast damage to that structure; those inside by the collapse of the structure and by fire; and those outside by the flying objects carried by the winds (figure 29-2).

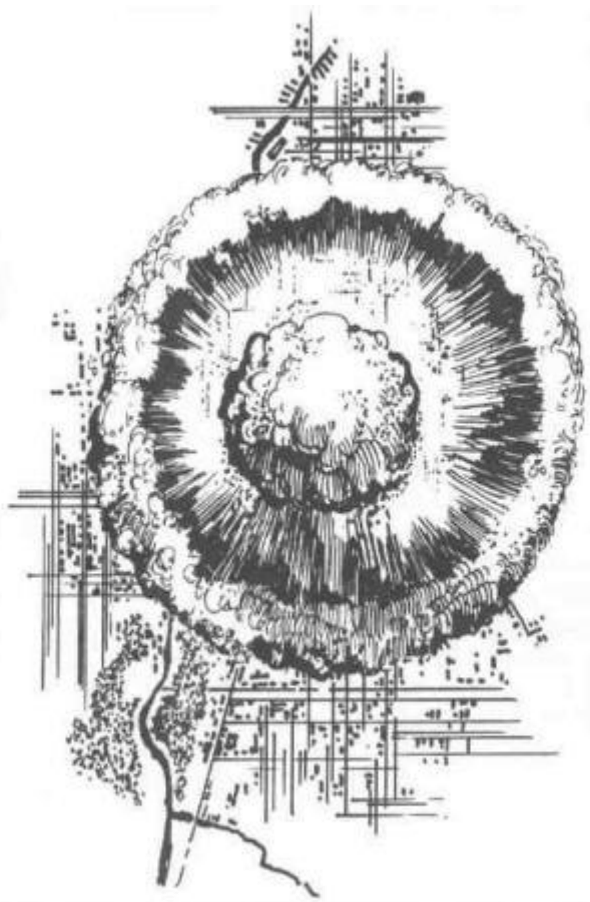

Figure 29-2. Blast.

b. **Thermal Radiation** :

(1) **Heat**. Within less than a millionth of a second of the detonation of a nuclear weapon, the extremely hot weapon residues radiate great amounts of energy. This leads to the formation of a hot and highly luminous, spherical mass of air and gaseous residue which is the fireball. The heat radiated from the fireball contributes to the overall damage caused by a nuclear burst by igniting combustibles and thus starting fires in buildings and forests. These fires may spread rapidly among the debris produced by the blast. In addition, this intense heat can burn exposed personnel at great distances from ground zero where the effects of blast and initial nuclear radiation become insignificant. The degree of injury from thermal radiation becomes more marked with the in- creasing size of the weapon. The degree of injury from thermal radiation is also affected by weather and terrain. During periods of limited visibility, the heat effect will be reduced significantly. Additionally, since thermal radiation is primarily a line-of-sight phenomena, terrain masking can help reduce its effects (figure 29-3).

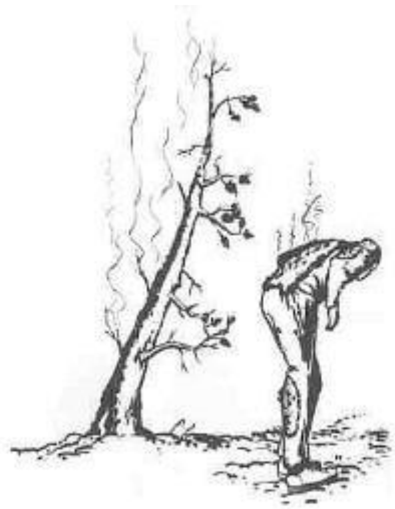

Figure 29-3. Thermal Radiation.

(2) **Light .** The fireball formed at the instant of a nuclear detonation is a source of extremely bright light. To an observer, 135 miles away from the explosion, the fireball of a 1-megaton weapon would appear to be many times more brilliant than the Sun at noon. The surface temperatures of the fireball, upon which the brightness depends, do not vary greatly with the size of the weapon. Consequently, the brightness of the fireball is roughly the same, regardless of the weapon yield. This light can cause injuries to personnel in the form of temporary or permanent blindness. Temporary blindness from a burst during daylight should be of very short duration and is not an important consideration for anyone other than aircrew members. At night, this loss of vision will last for longer periods because the eyes have been adapted to the dark. However, recovery should be complete within 15 minutes. The light flash can cause permanent injury to the eyes due to burns within the eye, but this is only likely to occur in personnel who happen to be looking directly at the fireball at the instant of explosion (figure 29-4).

Figure 29-4. Light.

c. **Nuclear Radiation** :

(1) Initial nuclear radiation is the radiation emitted in the first minute after detonation. For practical purposes, it consists primarily of neutrons and gamma rays. Both of these types of radiation, although different in character, can travel considerable distances through the air and can produce harmful effects in humans. Gamma rays are invisible rays similar to X rays. These penetrating rays interact with the human body and cause damage to tissues and the blood-forming cells. The effects of neutrons on the body resemble those of gamma rays. They are highly penetrating and are easily absorbed by human tissue. Neutron radiation can penetrate several inches of tissue. The neutron radiation produces extensive tissue damage within the body. The major problem in protecting against the effects of initial radiation is that a person may have received a lethal or incapacitating dose of radiation before taking any protective action (figure 29-5).

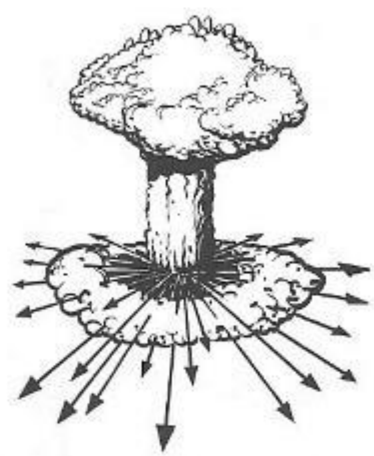

Figure 29-5. Nuclear Radiation.

(2) Residual nuclear radiation is that which lasts after the first minute and consists primarily of fallout and neutron-induced radiation.

(a) The primary hazard of residual radiation results from the creation of fallout. Fallout is produced when material from the Earth is drawn into the fireball, vaporized, combined with radioactive material, and condensed to particles which then fall back to the Earth. The larger particles fall back immediately in the vicinity of ground zero. The smaller particles are carried by the winds until they gradually settle on the Earth's surface. The contaminated areas created by fallout may be very small or may extend over many thousands of square miles. The dose rate may vary from an insignificant level to an extremely dangerous one for all personnel not taking protective measures.

(b) A secondary hazard which may arise is the neutron-induced radioactivity on the Earth's surface in the immediate vicinity of ground zero. The intensity and extent of the induced radiation field depend on the type of soil in the area around ground zero, the height of the burst, and the type and yield of the weapon. The only significant source of residual radiation from an airburst weapon is induced activity in the soil of a limited circular pattern directly beneath the point of burst (figure 29-6).

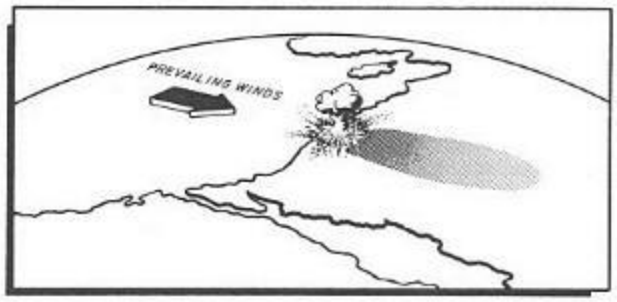

Figure 29-6. Residual Radiation.

29-3. **Types of Nuclear Bursts**. Nuclear bursts may be classified into three types according to the height of burst-airbursts, surface bursts, and subsurface bursts (figure 29-7).

a. **Airburst** . The detonation of a nuclear weapon at such a height that the fireball does not touch the surface of the Earth is called an airburst. Blast, thermal radiation, and initial radiation effects are increased in a low airburst. Fallout of radioactive material from an airburst is not of survival significance unless rain or snow falls through the radioactive cloud and brings the material to Earth. Neutrons from the detonation will cause induced radiation in the soil around ground zero. Except for very high airbursts, neutron-induced radiation in the area of ground zero will be of concern to survivors who are required to go into or across the area. Radiological monitoring will be required as units pass through such an area so that hazardous levels of radiation can be detected and avoided, if possible.

b. **Surface Burst** . The detonation of a nuclear weapon at such a height that the fireball touches the surface of the Earth or water is called a surface burst. Blast, thermal radiation, and initial nuclear radiation are not as widespread as from an airburst. Induced radiation is present but will be masked by residual radiation from fallout. The fallout produced by a surface burst is by far its most dangerous effect because the burst picks up a great deal more debris and radioactivates this debris; and, depending on the prevailing winds, the fallout covers thousands of square miles with high levels of radioactivity.

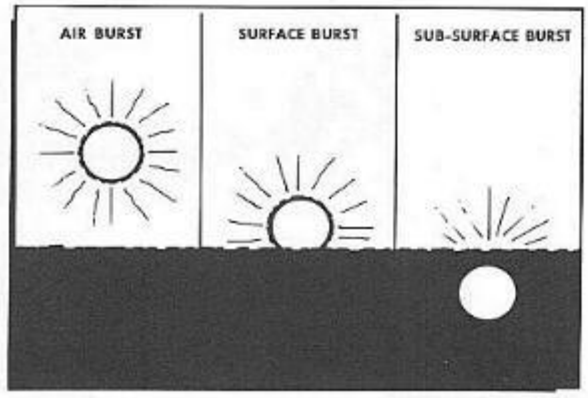

Figure 29-7. Types of Blasts.

c. **Subsurface Burst** . The detonation of a nuclear weapon so that the center of the fireball is beneath the surface of the Earth or water is called a subsurface burst. If a fireball of this type breaks through the surface, fallout will be produced. Thermal radiation will not be a significant hazard since it will be almost completely absorbed by the soil. Blast effects will also be significantly reduced. Shock waves passing through the ground or water will extend for a limited distance. The range of the initial nuclear radiation will be considerably less than from either of the other two types of bursts because this will also be absorbed to a great extent by the soil. However, extremely hazardous residual radiation will occur in and around any crater. If the fireball does break the surface, shock waves will pass through the ground and craters may result due to settling.

29-4. **Injuries** . The explosion of a nuclear bomb can cause three types of injures-blast, thermal radiation and nuclear radiation. Many survivors receive a combination of two or all three of the above injuries. For example, an unprotected person could be killed by a piece of debris, could be burned to death, or could be killed by initial nuclear radiation if the person is within a few thousand yards from the center of the blast.

a. **Blast Injuries** . Direct blast can cause damage to lungs, stomach, intestines, and eardrums, or can cause internal hemorrhaging. However, the direct blast is not considered a primary cause of injury because those close enough to suffer serious injury from the direct blast will probably die as a result of initial thermal radiation, or they will be crushed to death. The greatest number of blast injuries are received as an indirect result of the blast from falling buildings, flying objects, and shattered glass.

b. **Thermal Radiation Injuries**. Burns are classified in degrees according to the depth to which the tissues are injured. In first-degree burns, the skin is reddened as in sunburn. In second-degree burns, the skin is blistered as from contact with boiling water or hot metal. In third-degree burns, the skin is destroyed or charred and the injury extends through the outer skin to deeper tissues. The degree of burn received from thermal radiation depends upon weather conditions, distance from the explosion, and available protection. Many thermal casualties are compounded by nuclear radiation and indirect blast injury. This makes it difficult to attribute casualties to thermal radiation alone.

c. **Nuclear Radiation Injuries**. The injurious effects of nuclear radiation from a nuclear explosion represent a new threat which is completely absent in conventional explosions. This does not infer that this source of injury is the most important in a nuclear explosion. Rays from radioactive material are not as great a hazard as people fear. The amount of danger from fallout depends upon where and how the nuclear bomb explodes and how well the person is protected. The greatest danger from residual radiation (fallout) comes from exposure for a long period of time to radioactive particles which are nearby, or from dust settling on the body or clothing. Since fallout (like X rays) can destroy living tissue, particularly in the blood-forming system, the exposure of persons working in a radioactive or "hot" area must be controlled so as not to exceed a safe limit. Although a person can become seriously ill and even die from breathing radioactive dust, there is less danger from this than when the whole body is exposed to fallout. Remember, all types of radiation are dangerous (nuclear, thermal, X ray, or even that from an infrared lamp).

Nuclear, Biological, and Chemical (NBC) Conditions

From the Air Force Survival Manual AFR 64-4

Biological Conditions

30-1. Introduction. Biological agents are viruses and microorganisms, or their products, which are used to cause disease, injury, or death to people, animals, or plants (and, to a lesser extent, deterioration of material). Their use is an attempt to produce disease on a large scale. During war, these agents will probably be used primarily in a strategic role to attack rear area bases.

a. Most microorganisms are harmless to humans, animals, or plants, and a few are helpful. Yeast is used in bread, beer, and cheese production. Some microorganisms, however, do produce disease. Biological agents could consist of:

(1) Fungi - mold, mildew, athlete's foot; histoplasmosis; and other pathogenic fungi.

(2) Bacteria - plague, tularemia, anthrax.

(3) Rickettsiae - Rocky Mountain spotted fever, typhus.

(4) Viruses - yellow fever, smallpox.

(5) Biotoxins - mushroom, algae, and bacterial poisons.

b. Many biological agents are living, require moisture, food, and certain temperature limits for life and growth. They are killed by simple acts such as boiling water, adding purification tablets to water, cooking food, exposing them to sunlight, and (or) using germicides. Biological agents enter the body through the nose, mouth, or skin; however, most will not penetrate intact skin. By preventing their entry into the body, a survivor is safe from biological agents.

30-2. Detection. There is no simple method of detecting biological agents. A person cannot see, feel, or taste these agents in a biological attack whether spread through conventional means or sabotage. Additionally, a person cannot taste the toxins in food. The basic methods of disseminating the agents are through the generation of an aerosol, the use of disease-carrying vectors, and food and water.

a. Aerosols are particles composed of many organisms, or a single organism, which are dispersed into the air and transported by air currents. Effective transmission as an aerosol requires that biological agents reach the target area with an effective percentage remaining alive and capable of causing disease. The appearance of certain clues may warn a survivor of an aerosol biological attack. They are:

(1) Aircraft dropping objects or spraying. Both enemy aircraft or friendly aircraft could be engaged in neutralizing or destroying opposing forces.

(2) Breakable containers or new and unusual types of shells and bombs, particularly those which burst with little or no blast.

(3) Smokes and mists of unknown origin.

(4) Unusual substances on the ground or on vegetation. Sick, dead, or dying animals.

b. Vectors, such as mosquitoes and ticks which carry disease, can be delivered to the target area in containers by aircraft or missiles. The containers rupture on impact and release the vectors. Some vectors need a "host" or carrier that can transmit the disease organism through the skin; others may be inanimate objects, such as contaminated food and water. Because disease organisms can infect personnel, the use of a "protective" mask may not help protect against viruses. The vectors can produce disease throughout their entire life spans, regardless of how far or where they travel. Furthermore, they may pass the disease to successive generations. Therefore, survivors must be extremely cautious when skinning wild game by wearing gloves and other protective clothing as the game may host fleas which carry many diseases. (NOTE: Contact with animals should be avoided unless they are to be used as food (figure 30-1).)

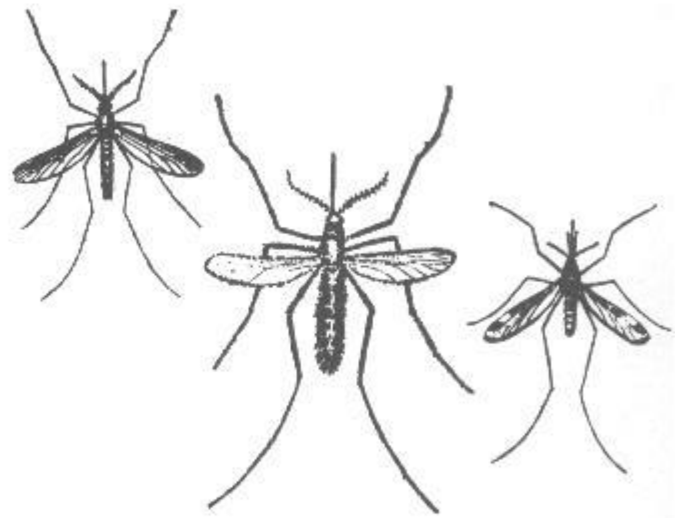

Figure 30-1. Vectors.

30-3. Climate. The various characteristics of aerosols and vectors will affect their utility in varying climates. While a survivor may encounter any form of biological agent once their use in combat occurs, the following factors may help a survivor assess the relative risk of various types of biological agents.

a. Aerosols are generally much more controllable in the area of application than are vector-borne agents. However, most aerosol agents deteriorate to some degree when exposed to direct sunlight. They are more suitable for use against small area targets.

b. Strong winds are necessary to ensure maximum area coverage of both aerosols and vectors. However, the density of coverage may be decreased by extremely high winds.

c. Vectors are less controllable than aerosols in the area of application following release. They are more suited for use against broad area targets. Although vectors tend to last longer in humid climates, many potential vectors (flies, fleas, mosquitoes, lice, etc.) will thrive in virtually any environmental area.

d. Generally, nighttime (1 hour before sunset 10 1 hour after sunrise) is the best period to dispense vectors. Vector movement and activity is usually greater during the cooler hours of darkness.

30-4. Terrain. Biological agent aerosols tend to follow the contour of rolling terrain and valleys very much like airborne particles, such as fog. Vegetation can slow the downwind travel of agents by removing some particles from the air. Due to a lack of sunlight, densely vegetated areas, such as a jungle (warm humid), allow some agents to thrive for extended periods of time. Because most of the biological agents are more hazardous when inhaled then when directly exposed to the skin, contamination of the ground following an attack is less dangerous to the survivor than exposure to an aerosol attack.

30-5. Protection. Defense against biological warfare is neither simple nor easy. The best defense against these agents is the natural resistance of the survivor's body, a high standard of personal cleanliness, careful attention to sanitation, good nutrition, up-to-date immunization status, proper use of drugs, and immediate self-aid to any break in the skin or a punctured wound. Germs must actually get inside the body to cause disease.

a. A protective mask, properly fitted and in good condition, will greatly reduce the danger of inhaling germs. If a mask is not available, a handkerchief or parachute material over the mouth and nose will suffice to provide protection. Since survivors cannot detect the presence of biological agents, they should wear the mask or some other protective equipment over the mouth and nose until they are rescued, if possible.

b. Cuts and sores, in addition to the nose and mouth, are open doors to germs trying to enter the body. Wounds must be kept clean and protected with a bandage. Any type of clothing will give some protection. Fasten the shirt or jacket collar, roll the sleeves down and button the cuffs, wrap the trouser legs or tuck them inside the boots, and tie down all other clothes to stop the entry of germs which may be in the air or on the ground. If the survivor has a uniform used for protection against chemical agents, it should be worn because it gives a greater degree of protection against germs than ordinary clothing.

c. Survivors should always be careful about eating and drinking during and after a biological attack. One of the easiest ways for germs to enter the body is through food and water.

30-6. Tips for a Survivor:

a. Keep the body and living quarters clean.

b. Don't neglect preventive medicine. Keep the shot record up to date.

c. Keep alert for signs of biological attack.

d. Keep the nose, mouth, and skin covered.

e. Protect food and water. Bottled or canned foods are safe if sealed. If in doubt, boil the food and water for 10 minutes.

f. Build a shelter, if possible. Shelter should be located and constructed to minimize vector and aerosol access to the survivor; for example, shelter enclosed-entrance 90 degrees to the prevailing wind.

g. If traveling, travel crosswind or upwind.

Nuclear, Biological, and Chemical (NBC) Conditions

From the Air Force Survival Manual AFR 64-4

Chemical Conditions

31-1. Introduction. Chemical agents may be solid particles, liquids, or gases which are toxic (poisonous) chemicals. These agents produce poisonous gas, fire, and smoke. The poisonous agents may produce casualties or irritating effects and render material or areas unusable. The body is attacked by chemical agents which produce specific damage depending on the type and concentration exposure of the agent used. Survivors must have thorough knowledge of how each of these agents affect: the body.

31-2. Chemical Groups. Chemical agents are divided into seven groups: nerve, blood, blister, choking, vomiting, incapacitating, and riot control. These agents can be dispersed by artillery shells, mortar shells, rockets, aircraft spraying, and bombs.

a. Nerve Agents. The nerve agents are among the deadliest of all chemical agents. They directly affect the nervous system and are highly toxic in both liquid and vapor forms. Examples of G-agents are tabun (GA), sarin (GB), and soman (GD). These nerve agents may be absorbed through any body surface. When dispersed as a vapor, they are absorbed through the respiratory tract or the eyes, but as liquid nerve agents, they can be absorbed through the skin. They are usually quick-acting casualty agents. Symptoms accompanying very small doses are headaches, dizziness, dimmed vision, and nausea. Large doses of nerve agents can interfere with breathing and may cause a tightness in the chest or convulsions, paralysis, and death. Symptoms of large doses of nerve agents are unpredictable, and circulatory collapse can occur without warning. The first effect of eye exposure to agents will probably be a dimming of vision caused by contraction of the eye pupils to pinpoint size. The pinpoint pupils will more noticeably affect vision in dim light. If the nerve agent contaminates the skin only, the pupils may remain normal or be only slightly reduced in size with other symptoms being first to appear. The injuries caused by nerve agents may range from mild disability to death depending on the dose received and the adequacy and speed of self-aid treatment. Nerve agents are odorless, unlike most chemical agents. A survivor must rely on observation of living things and detection devices to identify their presence.

b. Blood Agents (Cyanides). Blood agents produce their effects by interfering with some vital process within the body. The usual route of entry is inhalation. They prevent the body cells from using oxygen. Hydrocyanic acid (AC) and cyanogen Chloride (CK) are the important agents in the group. CK also acts as a choking agent (figure 31-2).

Figure 31-2. Symptoms.

(1) Symptoms associated with blood agent contamination vary. One type of blood agent causes a marked increase in the breathing rate; whereas, another type causes a slow breathing rate, a choking effect, and strong irritating effect. A slight exposure to still another type of blood agent causes headaches and uneasiness.

(2) Blood agents cause the skin to have a cherry-red color similar to that seen in carbon monoxide poisoning. This symptom, by itself, may help identify the blood agents' poisoning. The symptoms produced by blood agents also depend upon the concentration of the agent and the duration of exposure. If irreversible damage has not occurred, removal from the exposure to the agent may enhance recovery. Blood agents are used as quick-acting casualty agents. The speed in donning a protective mask is critical to survival in a blood agent attack.

c. Blister Agents (Vesicants). Blister agents were developed during World War I to circumvent the protective mask that had made chlorine gas obsolete. These agents are primarily designed to attack the body through the skin and eyes. They can also attack through the respiratory or digestive tracts and cause inflammation, blisters, and general destruction of tissue. Some examples of blister agents are mustard (HD), nitrogen mustards (HN), lewisite (L) and other arsenicals, mixtures of mustards and arsenicals, and phosgene oxime (CX). They are effective even in small quantities and produce delayed casualties.

(1) A drop of mustard-type agent the size of a pin-head can produce a blister the size of a quarter. Blister agents are more effective in hot weather than in cold weather. Vapors first affect the moist parts of the body (joints of arms and knees,

armpits, and crotch). People who are sweating are especially sensitive to the agents. Blister agents are quickly absorbed through the skin. Reddening of the affected area may appear any time up to about 12 hours after exposure depending on the degree of contamination and the weather conditions. Blisters may appear in a day or less following the reddening. Healing time varies from about 6 days to as much as 8 weeks in severe cases. Since the damage is done during the first few minutes of exposure, speed in administering self-aid is essential.

(2) Damage to the eyes may be worse than the effects on the skin. Even as a liquid, the agent may only mildly irritate the eyes at first or there may be no pain at all. In a few hours, however, the eyes hurt, become inflamed, and are sensitive to light. Tears and great pain follow, and permanent injury can result. Some blister agents cause immediate pain in the eyes.

(3) When inhaled, blister agents inflame the throat and windpipe and cause a harsh cough. Cases of serious exposure may result in pneumonia and death. Immediate detection of blister agents and prompt protection against entry into the eyes and lungs and on the skin is vital.

(4) Blister agents may be absorbed by any material (wood, concrete, clothing, metal, plastics, or rubber). Direct skin contact with these objects can cause blistering. Liquid blister agents will eventually penetrate gloves and other garments. Immediate decontamination after exposure is essential to prevent delayed absorption.

d. Choking Agents (Lung Irritants). These agents cause irritation and inflammation of bronchial tubes and lungs but do not harm the skin or digestive system. They are usually disseminated as gases and inhaled into the body. The best known of these agents is phosgene. During and immediately after exposure, symptoms include coughing, choking, and a feeling of tightness in the chest, nausea, and occasionally vomiting, headache, and crying. If large amounts enter the lungs, they will fill with liquid causing death from lack of oxygen. A properly operating and well-fitted mask protects against all choking agents.

e. Vomiting Agents. These agents produce strong pepper-like irritation in the upper respiratory tract. Other symptoms include irritation of the eyes and uncontrollable tearing. Symptoms of these agents include a very stuffy nose, severe headache, intense burning in the throat, and tightness and pain in the chest. These are followed by uncontrollable sneezing, coughing, nausea, vomiting, and a general feeling of bodily discomfort. These agents are dispersed as aerosols and produce their effects by inhalation or by direct action on the eyes. If survivors inhale a vomiting agent before donning their masks, they may become ill after the respirator is on. As long as a vomiting agent is present, however, mask-wear is essential. The mask should be pulled away from the chin during actual vomiting, but not removed. If the survivor has vomited in the mask, caution should be taken to avoid inhaling or ingesting the vomit. Vomiting agents are not considered a major threat because of the comparative case of protection against them and their lower toxicity unless used with other agents. Vomiting agents alone seldom produce death.

f. Incapacitating Agents. An incapacitating agent is any chemical which produces a temporary disabling condition which persists for hours to days after expo- sure to the agent has ceased (unlike that produced by riot control agents) and for which medical treatment, while not required, facilitates a more rapid recovery. (NOTE: Symptoms of riot control agents may not be distinguished from other lethal agents; therefore, the survivor must be prepared to provide treatment for lethal agents.) In actual usage, the term "incapacitating agent" has come to refer primarily to those agents which:

(1) Produce their effects mainly by altering or disrupting the higher regulatory activity of the central nervous system.

(2) Last for hours or days rather than the very short duration of riot control agents.

(3) Do not seriously endanger life (except when large doses are received) and produce no permanent injury.

g. Riot Control (RC) Agents (Irritant Agents). RC agents are the least poisonous of the seven groups of chemical agents. They act primarily on the eyes, causing intense pain and tearing. Higher concentrations irritate the upper respiratory tract and the skin and sometimes cause nausea and vomiting. These agents may be dispersed as smoke or in solutions as droplet aerosols. Al- though they are used primarily in training and in riot control, some agents may be used in combat. When an unmasked person comes in contact with riot control agents, the effects are felt almost immediately. The effects begin in 20 to 60 seconds, depending upon agent concentration. Duration of effects lasts 5 to 10 minutes after removal to fresh air. There is usually no permanent damage to the eyes. For a short time (minutes), a person may be unable to see. If the mask is used before RC agents enter the eyes, increased protection is afforded.

31-3. Detection:

a. General Indications. Detection of a chemical agent requires the recognition of evidence gathered by direct or indirect means. Therefore, every survivor must be alert and able to detect any clues indicating chemical warfare is being used. General symptoms of chemical 1 agents are tears, difficult breathing, choking, itching, coughing, and dizziness. In the presence of agents that are very hard to detect without the use of detection devices, survivors must watch their fellow aircrew members constantly for symptoms. Additionally, a survivor's surroundings may provide valuable clues to the presence of chemical agents; for example, dead animals, sick people, or people displaying abnormal behavior.

b. Smell. Survivors cannot rely on the nose as a fool proof means of detecting chemical agents. Although some agents do have a characteristic odor, many others have little or no odor at all. An agent may smell quite differently to different individuals. A mixture of agents will have a different smell than any one agent by itself.

c. Sight. Since chemical agents are in one of three physical states - solid, liquid, or vapors - the sense of sight may help detect their presence. Most chemical agents in the solid or liquid state have some color. In the vapor state, some chemical agents can be seen as mist or thin fog immediately after bomb or shell bursts. Nerve agents are either a colorless liquid or a colorless vapor. Although survivors can't see nerve agents, their eyes may help by detecting the methods used to dispense the agents. Mustard gas, unless purified, is dark brown in its liquid state. As a liquid, it is easy to detect and would appear as oily, dark patches on leaves and buildings. However, liquid mustard changes slowly to a colorless gas. As a gas, it is still very toxic, but now the eyes will not be an effective aid to detection (figure 31-5).

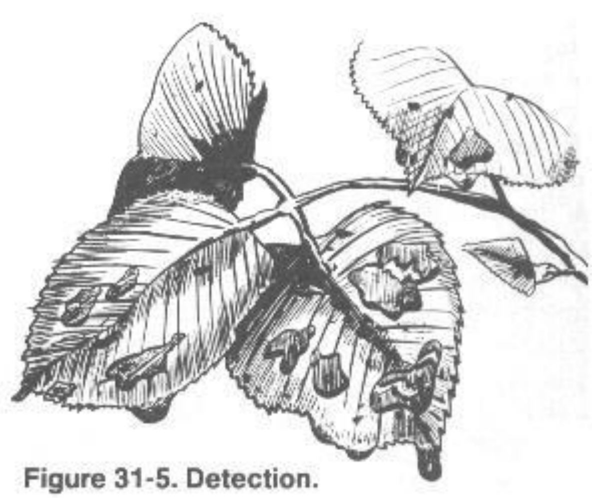

Figure 31-5. Detection.

d. Hearing. If survivors know the methods being used by the enemy to spread chemical agents, they can detect the sounds of the enemy's chemical munitions. For example, a bomb filled with an agent would probably cause only a muffled explosion; however, aircrew members untrained in ordnance may have difficulty in making this distinction.

e. Feel and Taste. Irritation in the nose or eyes or on the skin is an urgent warning to protect the body from chemical agents. Additionally, a strange taste in food, water, or cigarettes may serve as a warning they have been contaminated.

31-4. Protection:

a. Protective Actions. Survivors should use the following steps, listed in the order of importance, to protect themselves from chemical attack:

(1) Use protective equipment.

(2) Give quick and correct self-aid when contaminated.

(3) Avoid the areas where chemical agents exist.

(4) Decontaminate equipment and the body as soon as possible.

b. Equipment. Survivors' masks are as vital to them as life jackets are to sailors or as parachutes are to fliers. If properly adjusted, they protect the face, eyes, and lungs from chemical agents. Survivors are responsible for proper care of the mask and should inspect the masks frequently to ensure they are free from damage and in good condition. Aircrew members located in areas of potential contamination are issued protective clothing.

c. Self-Aid. Survivors must apply self-aid skillfully and promptly after exposure. Not only is it important for them to know what to do, but they must also know what not to do. It is evident from previous information in this chapter that each type of chemical agent produces certain conditions which require special treatment. However, there are certain essentials of self-aid which, if applied soon enough, give some relief and may prevent serious injury.

(1) Since there are definite time limits after which self-aid becomes useless, immediate self-aid or personal decontamination is all-important if survivors are exposed to liquid nerve or blister agents. Since they may not know whether the contamination is by liquid nerve agent or liquid blister agent, the following procedures are recommended:

(a) Don the mask and clear it.

(b) Contact with thickened (persistent) nerve or mustard agents requires the use of decontamination kit, or if not available, tear away the contaminated area of clothing and rinse immediately with water.

(c) Rinse contaminated areas with water (removes nerve agents).

(d) If effects of nerve agents become apparent, then and only then, use an antidote, realizing the antidote provides protection only from nerve agent (GA, GB, GD). It is also incapacitating and is not effective against V agents.

(2) Use the self-aid procedure given in the following paragraphs for specific agents if the agent has been identified.

(a) Nerve Agents. The protective mask and hood, if available, must be donned immediately at the first sign of a nerve agent in the air. Stop breathing until the mask is on and the face piece cleared and checked. The mask should be worn constantly until the absence of the nerve agent in the air is indicated or the individual moves into a clean area (where there are live animals, etc.) If, after masking, the survivor has an unexplained runny nose, tightness of the chest, dimness of vision, or breathing difficulty, the use of the antidote should be considered. (Use of the antidote is moderately to severely incapacitating. The survivor should consider the severity of symptoms, availability of the buddy care system and requirements for rescue before injecting the antidote.) Exposure to high concentrations of a nerve agent may bring on uncoordination, mental confusion, and collapse so rapidly that the survivor cannot perform self-aid. If this happens, a fellow aircrew member must administer first aid. Severe nerve agent exposure may rapidly cause unconsciousness, muscular paralysis, and breathing stoppage. Any remaining survivors should keep their masks on and move out of the area as soon as possible. The following precautions should be used when applying self-aid for nerve agents:

-1. Antidote should not be used until certain it is needed. Pinpointing of the eye pupils or blurred vision, tightness in the chest, and difficulty in breathing are signs it is needed. If certain nerve agents are inhaled, the antidote counteracts them and makes the survivor feel better.

-2. If survivors have inhaled a very large dose of nerve agent vapor, they may need more than one injection of the antidote to relieve their symptoms. If the symptoms are steadily becoming worse and the first injection does not relieve them, or if their mouth does not become dry, it may be necessary to use an extra dose. Inject the second dosage in a different muscle. (NOTE: Do not use your own combo pen to inject a victim; use theirs. Additionally, if you find a deceased aircrew member, remove the combo pens from the deceased and take them with you.)

-3. If the difficulty in breathing is not relieved by the second injection, one more dose may be administered. Dryness of the mouth is a good sign. It means they have had enough antidote to overcome the dangerous effects of the nerve agent.

-4. If a drop or splash of liquid nerve agent gets into the eye, instant action is necessary to avoid serious effects. The eye should be irrigated immediately with water by tilting the head back, looking straight upward. Slowly pour water into the contaminated eye. Hold the eye open with the finger if necessary. Pour the water slowly so that irrigation will last at least 30 seconds. Survivors must irrigate in spite of the danger of breathing nerve agent vapor. Don the mask quickly after completing the irrigation. The pupil of the contaminated eye should be observed during the next minute, in a mirror if one is available or by someone nearby. If the pupil rapidly gets smaller, inject antidote intramuscularly al once. If the pupil does not get smaller, antidote is not needed.

-5. If liquid nerve agent gets on the skin or clothing, it should be removed. The liquid should be blotted off the skin with a handkerchief, a piece of cloth torn from the outer clothing, or personal decontaminating kits. Pinch-blotting the liquid won't spread the contamination. Contaminated clothing must be quickly removed and the skin washed with soap and water. In an emergency, the contaminated portion of the clothing can be cut away and the contaminated skin area flushed with water. The muscles under the contaminated area should be observed for any signs of twitching. If none develops in the next half hour and the survivor has no tightness in the chest, the decontamination was successful. If twitching of the muscles under the area of contaminated skin does develop, the antidote should be administered at once.

-6. Food and water which may be contaminated with nerve agents must be avoided. If a survivor has swallowed contaminated food or water and all of these symptoms occur - nausea, pains in the stomach, increased flow of saliva, and a tightness in the chest - the antidote must be administered.

(b) Blood Agents. If during any chemical attack, a sudden stimulation of breathing or an odor like bitter almonds is noticed, the survivor must don the mask as quickly as possible. Speed is absolutely essential; this agent acts so rapidly that within a few seconds its effects will make it impossible for survivors to don the mask by themselves. The breath should be held until the mask is on the face, if at all possible. This may be very difficult since the agent strongly stimulates respiration.

(c) Blister Agents. The protective mask, hood, and clothing must be worn when liquid or vaporized blister agents are known to be present. There are two groups of blister agents, one called mustards and the other called arsenicals. Self-aid against mustards and arsenicals is the same. A liquid mustard in the eye will not hurt immediately. A liquid arsenicals in the eye will sting and hurt severely.

- 1. To remove a liquid blister agent from the eye, the eye is irrigated using the same procedure as for removing nerve agents. Speed in decontaminating the eye is absolutely essential. The self-aid procedure is very effective for mustard within the first few seconds after exposure but is of little value after 2 minutes.

-2. Generally, for any liquid blister agent on the skin, the survivor should:

-a. Pinch-blot to prevent the liquid from spreading, using cloth or any other absorbent material at hand. The used cloth or absorbent material should then be discarded.

-b. Scrub the skin with soap and water and rinse thoroughly with clean water. When scrubbing, special attention must be paid to areas not covered by clothing (neck and ears).

-3. Survivors must decontaminate or remove any clothing which is contaminated with liquid blister agent. Small areas on the clothing can be decontaminated by using soap and water. The contaminated parts of the clothing can also be cut out, thus making the clothing safe to wear.

-4. When mustard vapor is detected, a survivor must put on the mask and leave it on until clear of the area. There is no decontamination procedure of any value when a mustard vapor agent is used. The damage is done as soon as the mustard vapor strikes the eyes, although the full extent of the injury may not appear for several hours.

(d) Choking Agents. The protective mask should be donned immediately upon detection of any choking agents in the air by odor (like cut green corn or grass), irritation of the eyes, or change in the taste of a cigarette (smoking may become tasteless or offensive in taste). Survivors should hold their breath while masking. If an agent has been inhaled, normal survival duties should be continued unless there is difficulty in breathing, nausea and vomiting, or more than the usual shortness of breath from exertion. If any of the above symptoms occur, survivors should rest.

(e) Incapacitating Agents. The mask should be donned immediately. Complete cleaning of the skin with soap and water should be done at the earliest opportunity. The eyes should be flushed with clear water only. Survivors should shake or brush clothing, and when conditions permit, change clothing and thoroughly wash the contaminated clothing.

(f) Vomiting Agents. The protective mask must be worn in spite of coughing, sneezing, salivation, and nausea. The mask can be lifted from the face briefly if necessary to permit vomiting or to drain saliva from the face piece. Carrying on duties as vigorously as possible will help to lessen and to shorten the symptoms. Survival duties can usually be performed despite the effects of vomiting agents.

(g) Riot Control Agents. After the protective mask has been donned and cleared, the eyes should be kept open as much as possible. When vision clears, activities can continue. The eyes should not be rubbed. If drops or particles have entered the eyes, the eyes can be flushed with water. Chest discomfort can usually be relieved merely by talking.

31-5. Avoiding Chemical Agents. If survivors are hit by a chemical attack, they may have to remain in a contaminated area. After an attack, they should not expose themselves to other enemy weapons and must seek areas which are less contaminated. If the attack is on a very small scale, they might seek an upwind area. Depending on the area and weather conditions, crosswind movement may be best. Chemical agent attacks may cover too large an area to permit area avoidance. Selecting routes on high ground may be advisable because gas is usually heavier than air and tends to settle in low places. Cellars, trenches, gullies, and valleys are examples of places to avoid when possible. Woods, tall grass, and bushes tend to hold chemical agent vapors. (NOTE: Survivors have a better chance to avoid chemicals if they are familiar with the attack areas and if they know their personal location.)

31-6. Decontamination of Chemical Agents. Decontamination is removing, neutralizing, or destroying the agents. The purpose of personal decontamination is to remove agents from the body or personal equipment before serious injury occurs. An example of decontamination by removal is pinch-blotting the chemical agent from the skin. Neutralization makes the agent harmless. The contaminated cloth could also be buried. Common sense and quick thinking play a big role in personal decontamination. Survivors may have to rely on what- ever they have at hand to remove chemical agents from the skin, eyes, or equipment. If liquid nerve or blister agents touch any part of the body, they must be removed as quickly as possible. If survivors are caught without soap and water, then anything which can dilute or remove the agents will have to be used; it may be mud, dirt, or urine. A crude remover may remove only two-thirds of the agent, but it is far better than leaving the agent in full concentration. It must be remembered that nerve and blister agents penetrate very rapidly. (NOTE: Use a scraping action to avoid pressing the agent into the skin.)

a. Soap is excellent for removing chemical agents. Cold water, while not as good as warm water, does dilute or weaken chemical agents. Hot, soapy water removes agents quickly. If the operational situation permits, a bath or a shower should be taken. The mask should be left on until after survivors have washed their hair and thoroughly scrubbed themselves while avoiding wetting the canister or check pads. Exposed areas and hairy regions of the body should be given extra attention.

b. When clothes have been exposed only to chemical agent vapors, airing usually decontaminates them (with the exception of mustard vapors which will absorb into the garment and requires washing for removal). If chemical agent droplets or liquid splashes are present, survivors will need detergent or soap and water. Wool clothes are best washed in soapy, lukewarm water. Cot- ton clothes can be boiled.

c. Boots or shoes can be scrubbed with soap and water and rinsed at least twice. If the survivors' choice is wearing contaminated clothes and shoes or nothing, decontamination of the material must be done the best way possible. Almost any effort will help the survival situation.

31-7. Tips for a Survivor:

a. Keep the body and living area clean.

b. Keep the nose, mouth, and skin covered.

c. If a protective mask is needed, but unavailable, improvise. The charcoal cloth from the CD suit or undergarment makes a moderately effective mask for short-term agent exposure. The use of the aircrew helmet, visor, and charcoal mask may provide a higher level of protection for the eyes and respiratory system.

d. Build a shelter or rest area in a clearing away from vegetation. Decontaminate the ground by removing the top soil. Keep the entrance closed and 90 degrees to the prevailing wind.

e. Do not use wood or vegetation from a contaminated area for a fire.

f. Look at the area around a water source and check for foreign odors (garlic, mustard, geranium, bitter almond), oily spots on the surface or nearby, and the presence of dead fish and animals. If they are present, do not use the water.

g. Keep food and water protected. Bottled or canned foods and water are safe if sealed, and the cans are decontaminated before opening.

h. If possible, obtain water from a closed source, precipitation (if there is no evidence of agent vapor in the air), and from a slow-moving stream after it has been filtered.

i. Do not use plants for food or water in a contaminated area.

j. Do not use sick animals as a food source. When skinning animals in a contaminated area, use protective clothing (gloves).

k. If traveling, travel crosswind or upwind.