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# Chemical/Biological/Radiological Incident Handbook (October 1998)

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## [Acknowledgments](#)

### [Introduction](#)

#### [Section A](#)

What Is the Difference Between a Chemical, a Biological, and a Radiological Event?

#### [Section B](#)

Personal Safety Considerations

#### [Section C](#)

Indicators of a Possible Chemical Incident

#### [Section D](#)

Indicators of a Possible Biological Incident

#### [Section E](#)

Indicators of a Possible Radiological Incident

#### [Section F](#)

Information To Be Reported

#### [Section G](#)

Glossary of Chemical Terms

#### [Section H](#)

Glossary of Biological Terms

#### [Section I](#)

Glossary of Radiological Terms

#### [Section J](#)

References

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## [Acknowledgments](#)

This handbook was first produced by the Chemical, Biological and Radiological (CBRN) Subcommittee in June 1995.

The subcommittee is one of seven subcommittees of the Interagency Intelligence Committee on Terrorism (IICT). Established and charged under DCI Directive 3/22, 24 October 1990, the IICT is comprised of representatives from 45 US Government agencies and organizations from the intelligence, law enforcement, regulatory, and defense communities. The IICT and its subcommittees provide an interagency forum for coordination and cooperation on a

This edition of the handbook earmarks the addition of information pertaining to radiological incidents. This update reflects the collective efforts of each agency represented on the CBRN Subcommittee to provide critical information on new and evolving trends necessary to understanding and dealing with changing counterterrorism issues. In particular, I wish to thank the Nuclear Regulatory Commission, the Defense Intelligence Agency, the Federal Emergency Management Agency, the Public Health Service and the Central Intelligence Agency for the major role they played in the update of this handbook.

Lastly, I want to recognize the CBRN Subcommittee's dedication in providing timely assessments and information to a myriad of organizations committed to counterterrorism. I hope that this handbook will play a useful role in these endeavors.

Richard L. Irvine  
Chairman, IICT

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## Introduction

This handbook is intended to supply information to first responders for use in making a preliminary assessment of a situation when a possible chemical, biological agent or radiological material is suspected. When evaluating and taking action against a possible chemical, biological, or radiological incident, your personal safety is of primary concern.

A concise list of observable indicators of the use and/or presence of CBR material is included to aid in the assessment.

Once a decision is made that the incident may involve CBR material, the checklist, found in Section F, should be completed and forwarded to the appropriate authority for coordinating the response to the incident.

A glossary of terms and a list of additional reference materials are included.

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## Section A

### **What Is the Difference Between a Chemical, Biological, or Radiological Event?**

Chemical, biological, and radiological material as well as industrial agents can be dispersed in the air we breath, the water we drink, or on surfaces we physically contact. Dispersion methods may be as simple as placing a container in a heavily used area, opening a container, using conventional (garden)/commercial spray devices, or as elaborate as detonating an improvised explosive device.

Chemical incidents are characterized by the rapid onset of medical symptoms (minutes to hours) and easily observed signatures (colored residue, dead foliage, pungent odor, and dead insect and animal life).

In the case of a biological incident, the onset of symptoms requires days to weeks and there typically will be no characteristic signatures. Because of the delayed onset of symptoms in a biological incident, the area affected may be greater due to the migration of infected individuals.

In the case of a radiological incident, the onset of symptoms requires days to weeks and there typically will be no characteristic signatures. Radiological materials are not recognizable by the senses, and are colorless and odorless.

Specialized equipment is required to determine the size of the effected area and if the level of radioactivity presents an immediate or long-term health hazard. Because of the delayed onset of symptoms in a radiological incident, the affected area may be greater due to the migration of contaminated individuals.

The following sections contain indicators of chemical/biological/radiological material release and key information to relay to responding organizations. In attempting to collect this information ***your personal safety is your primary concern.***

## **Section B**

### **Personal Safety Considerations**

When approaching a scene that may involve chemical, biological, or radiological materials the most critical consideration is the safety of oneself and other responders. Be cognizant that the presence and identification of hazardous agents may not be immediately verifiable, especially in the case of biological and radiological agents. The following actions/measures to be considered by first responders are applicable to either a chemical, biological, or radiological incident. The guidance is general in nature, not all encompassing, and its applicability should be evaluated on a case-by-case basis by the first responders.

#### **Actions To Be Considered:**

1. *If outside, approach or evacuate upwind of the suspected area.*
2. *If outside, don available protective mask and clothing immediately. Cover all exposed skin surfaces and protect the respiratory system as much as possible. Overcoats, boots, gloves, hats, self-contained breathing systems, and organic vapor respirators will help provide protection.*
3. *If inside and the incident is inside, evacuate while minimizing passage through the contaminated area, keep windows and doors not used closed.*
4. *If inside, and the incident is outside, stay inside. Turn off air conditioning, seal windows and doors with plastic tape.*
5. *If radiological material is suspected, remember to minimize exposure by minimizing time around suspected site, maximizing distance from the site, and trying to place some shielding (e.g. buildings, vehicle, land feature such as a hill, etc.) between yourself and the site.*
6. *Deploy CBR detection equipment, if available.*
7. *When clear of the area or adequately protected, call specialized expertise if a CBR event is suspected.*
8. *Report information compiled under Section F to the appropriate authorities.*

#### **Decontamination Measures:**

1. *Once clear of the suspected contaminated area, remove all external apparel, such as clothes, shoes, gloves, hats, and leave them outside.*
2. *Proceed to a shower and thoroughly wash your body with soap and water. This needs to be accomplished within minutes. Simply flushing water over the body is not enough. You need to aggressively scrub your skin and irrigate your eyes with water. In the case of biologicals, this is often sufficient to avert contact infection. If available, for suspected biological and chemical contamination the contaminated areas should then be washed with a 0.5-percent sodium hypochlorite solution, allowing a contact time of 10 to 15 minutes. To make a*

0.5-percent sodium hypochlorite solution, take one part household bleach such as Clorox, and 10 parts water.

Do not let this solution contact your eyes.

- If a biological or chemical contamination is suspected, for decontamination of fabric clothing or equipment, use undiluted household bleach. A contact time of 30 minutes should be allowed before discarding or further use.

## Section C

### Indicators of a Possible Chemical Incident

Dead animals/birds/fish	Not just an occasional roadkill, but numerous animals (wild and domestic, small and large), birds and fish in the same area.
Lack of insect life	If normal insect activity (ground, air, and/or water) is missing, then check the ground/water surface/shore line for dead insects. If near water, check for dead fish/aquatic birds.
Physical Symptoms	Numerous individuals experiencing unexplained water-like blisters, wheals (like bee stings), pinpointed pupils, choking, respiratory ailments and/or rashes.
Mass casualties	Numerous individuals exhibiting unexplained serious health problems ranging from nausea to disorientation to difficulty in breathing to convulsions to death.
Definite pattern of casualties	Casualties distributed in a pattern that may be associated with possible agent dissemination methods.
Illness associated with confined geographic area	Lower attack rates for people working indoors versus outdoors, or outdoors versus indoors.
Unusual liquid droplets	Numerous surfaces exhibit oily droplets/film; numerous water surfaces have an oily film. (No recent rain.)
Areas that look different in appearance	Not just a patch of dead weeds, but trees, shrubs, bushes, food crops, and/or lawns that are dead, discolored, or withered. (No current drought.)
Unexplained odors	Smells may range from fruity to flowery to sharp/pungent to garlic/horseradish-like to bitter almonds/peach kernels to new mown hay. It is important to note that the particular odor is completely out of character with its surroundings.
Low-lying clouds	Low-lying cloud/fog-like condition that is not explained by its surroundings.
Unusual metal debris	Unexplained bomb/munitions-like material, especially if it contains a liquid.(No recent rain.)



Gases-Toxic and/or Corrosive



Substances-Toxic (Non-Combustible)



Substances-Toxic (Combustible)

## Section D

### Indicators of a Possible Biological Incident

<p><b>Unusual numbers, of sick or dying people or animals</b></p>	<p>Any number of symptoms may occur. As a first responder, strong consideration should be given to calling local hospitals to see if additional casualties with similar symptoms have been observed. Casualties may occur hours to days to weeks after an incident has occurred. The time required before symptoms are observed is dependent on the agent used and the dose received. Additional symptoms likely to occur include unexplained gastrointestinal illnesses and upper respiratory problems similar to flu/colds.</p>
<p><b>Unscheduled and unusual spray being disseminated</b></p>	<p>Especially if outdoors during periods of darkness.</p>
<p><b>Abandoned spray devices</b></p>	<p>Devices will have no distinct odors.</p>



(Label Only)

Infectious Substances

## Section E

### Indicators of a Possible Radiological Incident

<p><b>Unusual numbers, of sick or dying people or animals</b></p>	<p>As a first responder, strong consideration should be given to calling local hospitals to see if additional casualties with similar symptoms have been observed. Casualties may occur hours to days or weeks after an incident has occurred. The time required before symptoms are observed is dependent on the radioactive material used and the dose received. Additional symptoms include skin reddening and, in severe cases, vomiting.</p>
<p><b>Unusual metal debris</b></p>	<p>Unexplained bomb/munitions-like material.</p>
<p><b>Radiation Symbols</b></p>	<p>Containers may display a radiation symbol.</p>
<p><b>Heat Emitting Material</b></p>	<p>Material that seems to emit heat without any sign of a external heating source.</p>
<p><b>Glowing material/particles</b></p>	<p>If the material is strongly radioactive, then it may emit a radioluminescence.</p>

### Placards Associated with Radiological Incidents



Radioactive Materials

## Section F

[The linked pages are not, nor were they intended to comprise, an online form. The form is provided, as it is in the printed handbook, as a worksheet people may use to record information regarding possible exposure to chemical, biological, or radiological materials. This information would help local authorities--medical, police, health, and others--who respond to the scene of a possible exposure to evaluate the situation. The three pages are provided as images for ease of printing; each is about 100K in size.]

[Page 1](#)

[Page 2](#)

[Page 3](#)

## Section G

### **Glossary of Chemical Terms**

acetylcholinesterase	An enzyme that hydrolyzes the neurotransmitter acetylcholine. The action of this enzyme is inhibited by nerve agents.
aerosol	Fine liquid or solid particles suspended in a gas; for example, fog or smoke.
atropine	A compound used as an antidote for nerve agents.
casualty (toxic) agents	Produce incapacitation, serious injury, or death. They can be used to incapacitate or kill victims. These agents are the choking, blister, nerve, and blood agents.
<i>Choking Agents</i>	<i>Substances that cause physical injury to the lungs. Exposure is through inhalation. In extreme cases, membranes swell and lungs become filled with liquid. Death results from lack of oxygen; hence, the victim is "choked"</i>
<i>Blister Agents</i>	<i>Substances that cause blistering of the skin. Exposure is through liquid or vapor contact with any exposed tissue (eyes, skin, lungs).</i>
<i>Nerve Agents</i>	<i>Substances that interfere with the central nervous system. Exposure is primarily through contact with the liquid (skin and eyes) and secondarily through inhalation of the vapor. Three distinct symptoms associated with nerve agents are: pin-point pupils, an extreme headache, and severe tightness in the chest.</i>
<i>Blood Agents</i>	<i>Substances that injure a person by interfering with cell respiration (the exchange of oxygen and carbon dioxide between blood and tissues).</i>
chemical agent	A chemical substance that is intended for use in military operations to kill, seriously injure, or incapacitate people through its physiological effects. Excluded from consideration are riot control agents, and smoke and flame materials. The agent may appear as a vapor, aerosol, or liquid; it can be either a casualty/toxic agent or an incapacitating agent.
cutaneous	Pertaining to the skin.
decontamination	The process of making any person, object, or area safe by absorbing, destroying, neutralizing, making harmless, or removing the hazardous material.



G-series nerve agents	Chemical agents of moderate to high toxicity developed in the 1930s. Examples are tabun (GA), sarin (GB), soman (GD), and GF.
Incapacitating agents	Produce temporary physiological and/or mental effects via action on the central nervous system. Effects may persist for hours or days, but victims usually do not require medical treatment. However, such treatment speeds recovery.
<i>vomiting agents</i>	<i>Produce nausea and vomiting effects, can also cause coughing, sneezing, pain in the nose and throat, nasal discharge, and tears.</i>
<i>tear (riot control) agents</i>	<i>Produce irritating or disabling effects that rapidly disappear within minutes after exposure ceases.</i>
<i>central nervous system depressants</i>	<i>Compounds that have the predominant effect of depressing or blocking the activity of the central nervous system. The primary mental effects include the disruption of the ability to think, sedation, and lack of motivation.</i>
<i>central nervous system stimulants</i>	<i>Compounds that have the predominant effect of flooding the brain with too much information. The primary mental effect is loss of concentration, causing indecisiveness and the inability to act in a sustained, purposeful manner.</i>
industrial agents	Chemicals developed or manufactured for use in industrial operations or research by industry, government, or academia. These chemicals are not primarily manufactured for the specific purpose of producing human casualties or rendering equipment, facilities, or areas dangerous for use by man. Hydrogen cyanide, cyanogen chloride, phosgene, chloropicrin and many herbicides and pesticides are industrial chemicals that also can be chemical agents.
liquid agent	A chemical agent that appears to be an oily film or droplets. The color ranges from clear to brownish amber.
nonpersistent agent	An agent that upon release loses its ability to cause casualties after 10 to 15 minutes. It has a high evaporation rate and is lighter than air and will disperse rapidly. It is considered to be a short-term hazard. However, in small unventilated areas, the agent will be more persistent.
organophosphorous compound	A compound, containing the elements phosphorus and carbon, whose physiological effects include inhibition of acetylcholinesterase. Many pesticides (malathione and parathion) and virtually all nerve agents are organophosphorous compounds.
percutaneous agent	Able to be absorbed by the body through the skin.
persistent agent	An agent that upon release retains its casualty-producing effects for an extended period of time, usually anywhere from 30 minutes to several days. A persistent agent usually has a low evaporation rate and its vapor is heavier than air. Therefore, its vapor cloud tends to hug the ground. It is considered to be a long-term hazard. Although inhalation hazards are still a concern, extreme caution should be taken to avoid skin contact as well.
protection	Any means by which an individual protects his body. Measures include masks, self-contained breathing apparatuses, clothing, structures such as buildings, and vehicles.



V-series nerve agents	Chemical agents of moderate to high toxicity developed in the 1950s. They are generally persistent. Examples are VE, VG, VM, VS, and VX.
vapor agent	A gaseous form of a chemical agent. If heavier than air, the cloud will be close to the ground. If lighter than air, the cloud will rise and disperse more quickly.
volatility	A measure of how readily a substance will vaporize.

## Section H

### **Glossary of Biological Terms**

aerosol	Fine liquid or solid particles suspended in a gas; for example, fog or smoke.
antibiotic	A substance that inhibits the growth of or kills microorganisms.
antisera	The liquid part of blood containing antibodies, that react against disease causing agents such as those used in BW.
bacteria	Single-celled organisms that multiply by cell division and that can cause disease in humans, plants, or animals.
biochemicals	The chemicals that make up or are produced by living things.
biological warfare agents	Living organisms or the materials derived from them that cause disease in or harm to humans, animals, or plants, or cause deterioration of material. Biological agents may be used as liquid droplets, aerosols, or dry powders.
biological warfare	The intentional use of biological agents as weapons to kill or injure humans, animals, or plants, or to damage equipment.
bioregulators	Biochemicals that regulate bodily functions. Bioregulators that are produced by the body are termed "endogenous." Some of these same bioregulators can be chemically synthesized.
causative agent	The organism or toxin that is responsible for causing a specific disease or harmful effect.
contagious	Capable of being transmitted from one person to another.
culture	A population of micro-organisms grown in a medium.
decontamination	The process of making people, objects, or areas safe by absorbing, destroying, neutralizing, making harmless, or removing the hazardous material.
fungi	Any of a group of plants mainly characterized by the absence of chlorophyll, the green colored compound found in other plants. Fungi range from microscopic single-celled plants (such as molds and mildews) to large plants (such as mushrooms).
host	An animal or plant that harbors or nourishes another organism.
incapacitating agent	Agents that produce physical or psychological effects, or both, that may persist for hours or days after exposure, rendering victims incapable of performing normal physical and mental tasks.

infectious agents	Biological agents capable of causing disease in a susceptible host.
infectivity	(1) The ability of an organism to spread. (2) The number of organisms required to cause an infection to secondary hosts. (3) The capability of an organism to spread out from the site of infection and cause disease in the host organism. Infectivity also can be viewed as the number of organisms required to cause an infection.
line-source delivery system	A delivery system in which the biological agent is dispersed from a moving ground or air vehicle in a line perpendicular to the direction of the prevailing wind. (See also "point-source delivery system.")
mycotoxin	A toxin produced by fungi.
microorganism	Any organism, such as bacteria, viruses, and some fungi, that can be seen only with a microscope.
nebulizer	A device for producing a fine spray or aerosol.
organism	Any individual living thing, whether animal or plant.
parasite	Any organism that lives in or on another organism without providing benefit in return.
pathogen	Any organism (usually living) capable of producing serious disease or death, such as bacteria, fungi, and viruses.
pathogenic agents	Biological agents capable of causing serious disease.
point-source delivery system	A delivery system in which the biological agent is dispersed from a stationary position. This delivery method results in coverage over a smaller area than with the line-source system. (See also "line-source delivery system.")
route of exposure (entry)	The path by which a person comes into contact with an agent or organism; for example, through breathing, digestion, or skin contact.
single-cell protein	Protein-rich material obtained from cultured algae, fungi, protein and bacteria, and often used as food or animal feed.
spore	A reproductive form some micro-organisms can take to become resistant to environmental conditions, such as extreme heat or cold, while in a "resting stage."
toxicity	A measure of the harmful effect produced by a given amount of a toxin on a living organism. The relative toxicity of an agent can be expressed in milligrams of toxin needed per kilogram of body weight to kill experimental animals.
toxins	Poisonous substances produced by living organisms.
vaccine	A preparation of killed or weakened microorganism products used to artificially induce immunity against a disease.
vector	An agent, such as an insect or rat, capable of transferring a pathogen from one organism to another.

**venom** A poison produced in the glands of some animals; for example, snakes, scorpions, or bees.

**virus** An infectious micro-organism that exists as a particle rather than as a complete cell. Particle sizes range from 20 to 400 nanometers (one-billionth of a meter). Viruses are not capable of reproducing outside of a host cell.

## Section I

### **Glossary of Radiological Terms**

- Acute radiation Syndrome** Consists of three levels of effects: Hematopoietic (blood cells, most sensitive); Gastrointestinal (GI cells, very sensitive); and Central Nervous System (brain/muscle cells, insensitive). The initial signs and symptoms are nausea, vomiting, fatigue, and loss of appetite. Below about 200 rems, these symptoms may be the only indication of radiation exposure.
- alpha particle ( $\alpha$ )** The alpha particle has a very short range in air and a very low ability to penetrate other materials, but it has a strong ability to ionize materials. Alpha particles are unable to penetrate even the thin layer of dead cells of human skin and consequently are not an external radiation hazard. Alpha-emitting nuclides inside the body as a result of inhalation or ingestion are a considerable internal radiation hazard.
- beta particles ( $\beta$ )** High-energy electrons emitted from the nucleus of an atom during radioactive decay. They normally can be stopped by the skin or a very thin sheet of metal.
- Cesium-137 (Cs-137)** A strong gamma ray source and can contaminate property, entailing extensive clean-up. It is commonly used in industrial measurement gauges and for irradiation of material. Half-life is 30.2 years.
- Cobalt-60 (Co-60)** A strong gamma ray source, and is extensively used as a radiotherapeutic for treating cancer, food and material irradiation, gamma radiography, and industrial measurement gauges. Half-life is 5.27 years.
- curie (Ci)** A unit of radioactive decay rate defined as  $3.7 \times 10^{10}$  disintegrations per second.
- decay** The process by which an unstable element is changed to another isotope or another element by the spontaneous emission of radiation from its nucleus. This process can be measured by using radiation detectors such as Geiger counters.
- decontamination** The process of making people, objects, or areas safe by absorbing, destroying, neutralizing, making harmless, or removing the hazardous material.
- dose** A general term for the amount of radiation absorbed over a period of time.

<b>dosimeter</b>	A portable instrument for measuring and registering the total accumulated dose to ionizing radiation.
<b>gamma rays (<math>\gamma</math>)</b>	High-energy photons emitted from the nucleus of atoms; similar to x rays. They can penetrate deeply into body tissue and many materials. Cobalt-60 and Cesium-137 are both strong $\gamma$ -emitters. Shielding against gamma radiation requires thick layers of dense materials, such as lead. Gamma rays are potentially lethal to humans.
<b>half-life</b>	The amount of time needed for half of the atoms of a radioactive material to decay.
<b>Highly enriched uranium (HEU)</b>	Uranium that is enriched to above 20% Uranium-235 (U-235). Weapons-grade HEU is enriched to above 90% in U-235.
<b>Ionize</b>	To split off one or more electrons from an atom, thus leaving it with a positive electric charge. The electrons usually attach to one of the atoms or molecules, giving them a negative charge.
<b>Iridium-192</b>	A gamma-ray emitting radioisotope used for gamma- radiography. The half-life is 73, 83 days.
<b>isotope</b>	A specific element always has the same number of protons in the nucleus. That same element may, however, appear in forms that have different numbers of neutrons in the nucleus. These different forms are referred to as "isotopes" of the element. For example, deuterium (2H) and tritium (3H) are isotopes of ordinary hydrogen (H).
<b>lethal dose (50/30)</b>	The dose of radiation expected to cause death within 30 days to 50% of those exposed without medical treatment. The generally accepted range from 400-500 rem received over a short period of time.
<b>nuclear reactor</b>	A device in which a controlled, self-sustaining nuclear chain reaction can be maintained with the use of cooling to remove generated heat.
<b>Plutonium-239 (Pu-239)</b>	A metallic element used for nuclear weapons. The half-life is 24,110 years.
<b>Rad</b>	A unit of absorbed dose of radiation defined as deposition of 100 ergs of energy per gram of tissue. It amounts to approximately one ionization per cubic micron.
<b>radiation</b>	High energy alpha or beta particles or gamma rays that are emitted by an atom as the substance undergoes radioactive decay.
<b>radiation sickness</b>	Symptoms resulting from excessive exposure to radiation of the body.
<b>radioactive waste</b>	Disposable, radioactive materials resulting from nuclear operations. Wastes are generally classified into two categories, high-level and low-level waste.

<b>Radiological Dispersal Device (RDD)</b>	A device (weapon or equipment), other than a nuclear explosive device, designed to disseminate radioactive material in order to cause destruction, damage, or injury by means of the radiation produced by the decay of such material.
<b>radioluminescence</b>	The luminescence produced by particles emitted during radioactive decay.
<b>rem</b>	A <b>Roentgen Man Equivalent</b> is a unit of absorbed dose that takes into account the relative effectiveness of radiation that harms human health.
<b>shielding</b>	Materials (lead, concrete, etc.) used to block or attenuate radiation for protection of equipment, materials, or people.
<b>Special Nuclear Material (SNM)</b>	Plutonium and uranium enriched in the isotope Uranium-233 or Uranium 235.
<b>Uranium 235 (U-235)</b>	Naturally occurring uranium U-235 is found at 0.72% enrichment. U-235 is used as a reactor fuel or for weapons; however, weapons typically use U-235 enriched to 90%. The half-life is $7.04 \times 10^8$ years.
<b>X-Ray</b>	An invisible, highly penetrating electromagnetic radiation of much shorter wavelength (higher frequency) than visible light. Very similar to gamma-rays.

## Section J

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[\[Return to Top\]](#) [\[Publications Page\]](#) [\[CIA Homepage\]](#)