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BASIC LEVEL

*First Responder Training Program*

CHEMICAL
BIOLOGICAL
RADIOLOGICAL
NUCLEAR

CBRN

# Pre-course Reading

Canada

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CHEMICAL BIOLOGICAL RADIOLOGICAL NUCLEAR CBRN First Responder Training Program

CBRN CHIMIQUE BIOLOGIQUE RADIOLOGIQUE NUCLÉAIRE Programme de formation des premiers intervenants

# Basic Level Pre-Course Reading

The CBRN First Responder Training Program was developed by an interdepartmental team of federal agencies led by the Canadian Emergency Management College, Public Safety and Emergency Preparedness Canada. Agencies participating in the development of this course were:

**Canadian Emergency Management College, Public Safety and Emergency Preparedness Canada**
www.psepc-sppcc.gc.ca

**Canadian Nuclear Safety Commission**
www.nuclearsafety.gc.ca

**Defence R&D Canada**
www.drdc-rddc.gc.ca

**Public Health Agency of Canada**
www.phac-aspc.gc.ca

**Royal Canadian Mounted Police**
www.rcmp-grc.gc.ca

# FOREWORD

The Basic Level of the CBRN First Responder Training Program has been divided into two parts. The first part is a pre-course reading which will provide participants with a common understanding of CBRN subject areas.

The second part is a one-day training session where the knowledge gained from the pre-course reading will be reviewed, enhanced and applied.

## How to Complete this Pre-Course Reading

It is important that participants take time to read through this self-study portion of the course to ensure optimal learning at the training session.

**Thinking questions** have been included throughout to allow reflection on content and to facilitate application of new information to local agency settings.

**Review questions** at the end of each chapter supplement learning by directing learner focus on key course content. Answers to these review questions are found at the end of the document.

A **Glossary** and list of **Acronyms** are included to familiarize readers with the terms used in this course and to help establish a common terminology.

## Preparation for the One-Day Training Session

In addition to completing this pre-course reading, participants are encouraged to carefully research their home organization. Participants must attend the training session with knowledge of their services' current response structures, communications systems, incident protocols, and they must be familiar with the protective equipment their organization provides for facing CBRN challenges.

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# ACRONYMS

CASCAD ..... Canadian Aqueous System for Chemical/Biological Agent Decontamination
CBRN ..... Chemical, Biological, Radiological and Nuclear
CSIS ..... Canadian Security Intelligence Service

DEOC ..... Division Emergency Operations Centre (RCMP, provincial)
DRDC ..... Defence Research Development Canada

ECBC ..... Edgewood Chemical Biological Center (United States Army)
EDTS ..... Explosives Disposal and Technology Section (RCMP)
EMO ..... Emergency Measures Office (provincial)
ERAP ..... Emergency Response Assistance Plan
ERT ..... Emergency Response Team

HVAC ..... Heating, Ventilation, and Air Conditioning

MCI ..... Mass Casualty Incident

NCTP ..... National Counter-Terrorism Plan
NESS ..... National Emergency Stockpile System
NFPA ..... National Fire Protection Association (US)
NIOSH……..National Institute of Occupational Safety and Health (US)
NOC ..... National Operations Centre (RCMP, HQ)

PIRA ..... Provisional Irish Republican Army
PPE ..... Personal Protective Equipment

RSDL ..... Reactive Skin Decontamination Lotion

WHMIS ..... Workplace Hazardous Materials Information System

# GLOSSARY

**Absorption** refers to the entry of a CBRN agent into the body through direct skin contact.

**Alpha (α) Radiation** is the least penetrating type of ionizing radiation. Alpha radiation cannot penetrate the outer layer of skin, so is not considered dangerous unless radioactive material enters the body. Something as thin as a single sheet of paper can completely stop alpha radiation.

**Ambulatory** refers to being able to walk.

**Antibiotic** is a substance that inhibits the growth of, or kills, micro-organisms.

**Asymptomatic** refers to not exhibiting any symptoms of contamination, injury, or illness.

**Atropine** is a compound used as an antidote for nerve agents.

**Bacteria** are single-celled organisms that multiply through cell division and can cause disease in humans, plants, or animals. Examples include anthrax, plague, and tularemia.

**Beta (β) Radiation** is a type of ionizing radiation that is more penetrating than alpha radiation and can damage skin tissue or the unprotected lens of the eye. However, beta radiation rarely penetrates far enough to pose a hazard to internal organs unless radioactive material enters the body. A thin protective layer such as a sheet of plywood can completely stop beta radiation.

**Biological agents** are living organisms, or materials derived from them, that cause disease in, or harm, humans, animals, or plants, or cause deterioration of material. Biological agents may be bacteria, viruses, or toxins, and may be used as liquid droplets, aerosols, or dry powders.

**Blister agents (also known as vesicants)** are chemical agents, which cause severe blistering and burns to eyes, skin, and tissues of the respiratory tract. Exposure is through liquid or vapour contact. Examples include mustard and lewisite.

**Blood agents** are chemical agents that interfere with the ability of blood to transport oxygen thus causing asphyxiation. These substances injure a person by interfering with cell respiration (the exchange of oxygen and carbon dioxide between blood and tissues). Common examples are hydrogen cyanide and cyanogen chloride.

**Body Substances Isolation (BSI)** is action taken (primarily with the use of gloves) to isolate all moist and potentially infectious body substances (blood, feces, urine, sputum, saliva, wound drainage, and other body fluids) from all patients, regardless of their presumed infection status.

**Casualty (victim)** is a person who has been injured (physically, psychologically, or by illness), contaminated, or killed as a result of the incident.

**CBRN material** is a general term, to be used when referring to all “CBRN agents”.

**CBRN weapon** is a weapon that depends on a CBRN material for its effect.

**Contagious** is defined as **an infection that is** capable of being transmitted from one person to another.

**Cutaneous** means pertaining to the skin.

**Culture** is a population of micro-organisms grown in a medium.

**Decontamination** is the physical or chemical process of preventing the spread of contaminants by making any person, object, or area safe by absorbing, destroying, neutralizing, making harmless, or removing the hazardous material.

**Dissemination device (also known as dispersal device)** is a means, mechanism, or tool contrived to spread or disperse a liquid, solid, or gaseous hazardous material.

**Doff** is a term used to describe the action associated with taking off Personal Protective Equipment.

**Don** is a term used to describe the action associated with putting on Personal Protective Equipment.

**Egress** is the designated exit route.

**Emergency Washdown** is a procedure for reducing effects of contaminants on victims by first arriving responders having to use limited resources on hand. This usually involves fire trucks applying large volume, low pressure water.

**Exposure** is the concentration or intensity of an agent multiplied by time.

**Gamma (γ) Radiation** is a type of ionizing radiation capable of penetrating all parts of the body. It can travel several metres in air, potentially affecting persons far from its source. It may be partially shielded by using large amounts of heavy materials such as lead, steel or concrete.

**Hazard (control) Zones**

- **Hot Zone** is the area where the contaminant concentration is deemed to be sufficient to cause death or injury to unprotected personnel or responders employing inappropriate PPE.
- **Warm Zone** is the area where decontamination of personnel and equipment occurs. The Warm Zone is critical as it contains control points that prevent the movement of contaminated casualties and equipment into the Cold Zone. The Warm Zone is also a staging area for equipment required in support of Hot Zone activities. The main decontamination facility is located at the egress point of the Warm Zone.
- **Cold Zone** is a designated clean area with controlled access where the scene command centre and other key administrative support areas are located.

**Host** is an animal or plant that harbours or nourishes another organism.

**Infectious agents** are biological agents capable of causing disease in a susceptible host.

**Ingestion** refers to the entry of a CBRN agent into the body by eating, drinking, or putting contaminated material into the mouth.

**Inhalation** refers to the entry of a CBRN agent into the body by breathing in vapours, gases, or particulate material.

**Injection** refers to the entry of a CBRN agent into the body by means of a needle or other break in the skin (bite, sting, etc.).

**Inner (safety) Perimeter** is an initial control zone designated by first-arriving responders (having Basic Level CBRN training) to protect those with limited Personal Protective Equipment from hazards. Subsequent responders with the Intermediate level of training will establish Cold, Warm and Hot Zones as required.

**Intervention Stage Tasks** are secondary, methodical and measured, positive or deliberate actions performed during the intervention stage of a CBRN incident by first responders with the Intermediate and Advanced levels of CBRN training. This is work unique to specialists/technicians and is carried out when wearing elevated levels of Personal Protective Equipment, while backed-up by systematic decontamination support, and with appropriate medications and antidotes at hand. Intervention actions include working in a contaminated environment to resolve the incident even when lives are not at imminent risk. Some examples are extended rescue operations in the Hot Zone, processing evidence in the Hot Zone, agent detection, neutralizing a dissemination device, and the decontamination of real property.

**Medical Officer of Health (MOH) (also known as Medical Health Officer)** is the director or head of a community health unit or department whose mandate includes: public health education/promotion, disease prevention and environmental health protection. The Chief Medical Officer of Health is a provincial position within the Ministry of Health.

**Mitigation** is action taken to reduce the overall effect of a hazard.

**Neutron Radiation** is a type of ionizing radiation capable of penetrating all parts of the body. It is normally associated with the operation of nuclear power plants and nuclear weapons. Neutrons can travel long distances, potentially affecting persons far from its source. It may be partially shielded by using materials such as wax, water or concrete.

**Organism** is any individual living thing, whether animal or plant.

**Outer (security) Perimeter** is the outer border surrounding a scene in which controlled access points are established to allow entry to accredited responders only and to monitor the exit of persons and equipment. This task is usually assigned to police.

**Parasite** is any organism that lives in or on another organism without providing benefit in return.

**Patient** is a casualty for whom medical intervention is viable.

**Radiation** in this training program refers to *ionizing* radiation. There are four main types of ionizing radiation: alpha, beta, gamma, and neutron. Radiation is invisible and cannot be detected without specialized equipment.

**RCMP National Operations Centre (NOC)** is located at RCMP Headquarters, Ottawa. The National Operations Centre is staffed continuously to support the Commissioner and senior executive of the RCMP. For the purposes of the NCTP, the NOC is the location of the Interdepartmental Policy Advisory Group, which provides the integration and co-ordination of the policy and operational response to a terrorist incident.

**Recognition Stage Tasks** comprise the assessment of the likelihood of a CBRN incident by recognizing and communicating signs and indicators. This can be accomplished by a member of the public or an emergency call centre operator before the initial arrival of first responders on-scene. This assessment can also be made by first responders attending a call that has not been identified already as a probable CBRN incident.

**Response Stage Tasks** are the initial and expedient actions performed by first responders, (having Basic level CBRN training) during the response stage and after arrival at a CBRN incident scene. These tasks include skills that are developed during regular training given by their emergency service orientation. Response tasks are those which can be undertaken with rudimentary protective equipment and are only supported by an Emergency Washdown capability. Calculated and limited risks are taken only for the purpose of saving lives. Some examples are rescue of ambulatory casualties, setting up perimeters, establishing Emergency Washdown, and establishing multi-agency communications.

**Routes of entry** are the pathways by which an agent or organism may enter the body through inhalation, ingestion, absorption, or injection.

**Routine Precautions** are actions taken by EMS and other health care providers to prevent the transmission of disease or contaminant from patient to care provider. The focus is on the prevention of skin puncture injuries and the use of traditional barriers such as gloves and gowns to prevent contact with body fluids of all patients, regardless of their presumed infection status. Routine precautions also include the use of masks and eye coverings to prevent mucous membrane exposures during certain procedures, and the use of individual ventilation devices when the need for resuscitation is predictable.

**Sharps** is a term used to describe all penetrating bio-hazards such as needles and syringes.

**Shielding** is material (lead, concrete, etc.) used to block or attenuate radiation for protection of equipment, materials, or people.

**Spores** are the reproductive elements of an organism (such as *Bacillus anthracis*) that can survive adverse conditions and live in a dormant state for several years.

**Symptoms** are signs or indications that bodily functions have been altered. Symptoms can aid in diagnosis.

**Toxicity** is a measure of the harmful effects produced by a given amount of toxin on a living organism. The relative toxicity of an agent can be expressed in milligrams (mg) of toxin per kilogram (kg) of body weight.

**Toxins** are potentially harmful substances of natural origin produced by an animal, plant, or microbe. They differ from chemical substances in that they are not manufactured. Toxins may include botulinum toxin, ricin, and mycotoxins.

**Triage (sorting)** is the process of identifying which patients require the most urgent rescue, decontamination, treatment, and transportation. Its intent is to treat the greatest number of patients for the greatest good.

**Vaccine** is a preparation of killed or weakened micro-organism products used to artificially induce immunity against a disease.

**Virus** is a microscopic organism that requires a living host to sustain its existence. Viruses cannot be controlled with antibiotics.

# 1. INTRODUCTION

After completing this chapter, participants will be able to:

- describe the purpose of the CBRN First Responder Training Program; and,
- describe the purpose of the Basic Level course.

## 1.1 CBRN First Responder Training Program

Welcome to the Chemical, Biological, Radiological, and Nuclear (CBRN) First Responder Training Program. The purpose of this program is to standardize the level of preparedness of first responders who may be in a position to respond to CBRN incidents. In so doing, it is hoped that the program will foster competent and confident responders.

This Basic Level Course will enhance responder ability to **recognize**, **survive**, and **respond** to, but not intervene in, a CBRN incident. It focuses on the needs of those who will be the first to arrive on scene or those who may otherwise be the first professionals presented with the results of a terrorist CBRN incident. This includes police, fire, emergency medical workers, emergency call centre operators and dispatchers, first aid providers, poison control, Public Health workers, pharmacists, hospital staff, environment inspectors, and quarantine officers. This list is neither exhaustive nor exclusive; many other groups may be involved in this basic line of response and defence. This multi-agency response may face overwhelming tasks, which will dictate that responders embrace duties beyond their normal roles.

**RECOGNIZE**
**SURVIVE**
**RESPOND**

Many professionals have specific roles to play, but are restricted to responding **within the limitations of the available protective equipment**. They must recognize as early as possible that an event has occurred, be prepared to provide services, and be ready to call in specialists. First responders must learn to restrict their attempts to aid victims in contexts where their actions will put them in direct jeopardy. Knowledge gained through this course will help responders to make informed decisions regarding these situations.

Responders already have the training, experience, and expertise enabling them to perform their daily responsibilities. They are skilled, dedicated, professionals. This CBRN First Responder Training Program provides information intended to supplement established skills and enable responders to deal with new challenges specific to a CBRN terrorist incident.

## 1.2 BASIC LEVEL COURSE OBJECTIVE

Successful participants will be able to recognize and respond to, but not intervene in, a potential CBRN incident while taking the necessary precautions and calling in the appropriate specialized resources.

# 2. CBRN RESPONSE OVERVIEW

After completing this chapter, participants will be able to:

- define what constitutes a CBRN terrorist incident;
- list reasons terrorists might consider using CBRN agents;
- list limitations and disadvantages for the terrorist use of CBRN agents;
- describe likely targets of a terrorist attack;
- describe some of the misconceptions regarding CBRN incidents;
- describe the CBRN response structure;
- describe, in general terms, incident stages; and,
- describe, in general terms, key response tasks.

The purpose of this chapter is to provide participants with a relevant recent history of terrorism. It includes a definition of terrorism, outlines the parameters of the use of terrorism as a weapon, and looks at potential targets. It begins to lay out two fundamental pieces of the theory of CBRN response: the CBRN Incident Stages and the Key Response Tasks.

## 2.1 Terrorism in Perspective

### 2.1.1 What is CBRN Terrorism?

"Terrorism" is defined in Section 2(c) of the *Canadian Security Intelligence Security Act* as: "…activities within or relating to Canada directed toward or in support of the threat or use of acts of serious violence against persons or property for the purpose of achieving a political objective within Canada or a foreign state."[1]

Prior to the terrorist attacks first in Oklahoma City, and then on September 11, 2001, at the World Trade Centre in New York and the Pentagon in Washington, most North Americans believed terrorism was something that only happened in other parts of the world. Most people felt safe in the knowledge that terrorism was the domain of extremists and fanatics struggling for some political gain in distant countries. While terrorist events have been a part of our North American life for decades, most instances were relatively minor and were viewed as criminal acts that could be resolved with a police investigation and criminal proceedings.

[1] Security Offences Act and the National Counter Terrorism Plan, Government of Canada

The sarin gas attack in a Tokyo subway in 1995 was the first large CBRN terrorist incident. It shook the world with its huge impact on the lives and health of a large number of people.

While there have been a number of CBRN terrorist attacks worldwide which have targeted North American interests (primarily the United States), there have also been many within this continent committed by "home-grown" terrorist entities.

***1972*** *– Members of a U.S. fascist group called "Order of the Rising Sun" found in possession of 30–40 kilograms of typhoid bacteria cultures with which they planned to contaminate water supplies in Chicago, St. Louis, and other large Midwestern cities.*

***1984*** *– Members of an Oregon cult headed by Bhagwan Shree Rajneesh cultivated Salmonella bacteria (food poisoning) and used it to contaminate restaurant salad bars in an attempt to affect the outcome of a local election. Although 750 people became ill and 45 were hospitalized, there were no fatalities.*

***1995*** *– Two members of the Minnesota Patriots Council, a right-wing militia organization advocating a violent overthrow of the U.S. government, were convicted of conspiracy charges for planning to use ricin, a lethal biological toxin.*

***1995*** *– Thomas Lewis Lavy of Arkansas was charged with attempting to smuggle 130 grams of ricin across the border from Alaska into Canada in 1993 with intent to use the toxin as a weapon. Lavy hanged himself in his jail cell.*[2]

***1996*** *– A militant Canadian animal rights group called "The Justice Department" claimed to have sent 87 letters booby-trapped with razor blades infected with AIDS to companies "exploiting" fur animals.*[3]

***1995*** *– White supremacist and microbiologist Larry Wayne Harris was convicted for illegally obtaining three vials of bubonic plague cultures. He was suspected to be plotting an attack.*[4]

***1998*** *– Edmonton Police Service Explosive technicians destroyed four pipe bombs and three bottles of chemicals labelled "Potassium Cyanide" and "Procaine HCL". The pipe bombs and chemicals had been discovered in a locker at the Via train station.*[5]

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2 Schweitzer, G.E. and C.D. Schweitzer, *A Faceless Enemy*, Perseus Publishing, Cambridge, MA, 2002, p.121

3 RCMP (Royal Canadian Mounted Police), Canada Gazette,Vol. 63, No. 6, 2001, Ottawa, Ontario, Canada, p. 10

4 Schweitzer, G.E. and C.D. Schweitzer, *A Faceless Enemy*, Perseus Publishing, Cambridge, MA, 2002, p.121

5 Sgt. Jeff Anderson, Edmonton Police Service, personal communication, Edmonton, Alberta, January, 1998.

Among the numerous groups worldwide that have resorted to the use of CBRN weapons, their motivations for using them are as varied as the groups themselves. Many of the active groups in North America that have already resorted to violence and terrorism to advance their cause are no doubt capable of using CBRN materials.

There is every indication, both from statistical trends and intelligence, that use of terrorism will continue and likely increase. In recent years, attempts at the use of CBRN weapons have increased; more and more terrorist groups are viewing them as an acceptable form of terrorism.

### 2.1.2 Why Would Terrorists Use CBRN Agents?

Experts agree that there are a number of reasons to fear increased proliferation of CBRN weapons.

**One of the principal reasons is the increase in religiously motivated terrorists**. "*In 1968, none of the active terrorist groups were identified as being religiously motivated. By 1995, nearly half of the known active terrorist groups were religious in character or motivation".*[6] Rather than attempting to influence social or political change, in many cases the aim of the religiously motivated terrorist is the *"destruction of society and the elimination of large sections of the population".*[7] *"For the religious terrorist, violence is a sacramental act or divine duty, executed in direct response to some theological demand or imperative and justified by scripture".*[8]

**A second reason that terrorists would consider using CBRN weapons as an alternative is the lack of media attention given to traditional methods.** Many people have become immune to the traditional shootings and bombings that have been the weapons of terrorists for years. The old adage, "kill one, terrorize a thousand", is beginning to lose its validity. The ability of a CBRN terrorist attack to cause more fear and gain greater attention than a traditional attack may be seen as an advantage to the terrorist.

**Third, CBRN weapons are now more readily available to some terrorist groups as a result of the collapse of the Soviet Union, and the apparent willingness of "rogue states" to supply them.** The collapse of the Soviet Union resulted in their CBRN weapons programs falling into a state of decay, with many of the previously highly secured agents and weapons becoming available on the black market.

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6 Numbers of active, *identifiable* terrorist groups from 1968 to the present are derived from the RAND-St. Andrews Chronology of International Terrorist, and summarized in Lesser, I.O., B. Hoffman, J. Arguilla, D. Ronfeldt, and M. Zanini, *The New Terrorism*, RAND Publishing, Oxford University Press, NY, 1999.

7 Laqueur, W., *The New Terrorism*, Oxford University Press, 1999, p.81.

8 Lesser, I.O., B. Hoffman, J. Arguilla, D. Ronfeldt, and M. Zanini, *The New Terrorism*, RAND Publishing, Oxford University Press, NY, 1999, p. 20.

**Fourth, many marginalized "Nation States" also see terrorist organizations as an instrument to do their bidding in hostilities against their enemies.** Supplying CBRN weapons to terrorist groups is a way to attack their enemies without implicating themselves.

**Fifth, CBRN weapons are becoming easier to manufacture with a minimum amount of knowledge and equipment.** Rapid advances in biotechnology also forewarn of cheaper and easier CBRN weapons in the near future. These advances along with books, mail-order publications, and Internet accessibility to information allow amateurs the means and methods to practice without the requisite training, weaponry, and operational knowledge.

Other reasons CBRN agents may be advantageous to terrorists include:

- the difficulty in detecting them using traditional anti-terrorist sensor systems (conventional countermeasures);
- the time-lag (in many cases) for biological agents, between release of an agent and its perceived effects on humans, allowing the perpetrator(s) to escape;
- in at least some cases, the lack of an agent "signature," enabling an assassin, for example, to disguise the cause of death; and,
- their adaptability to small demonstration attacks as an indication of resolve and capability to be used in a much more devastating attack.[9]

### 2.1.3 Why Would Terrorists Not Choose CBRN Agents?

For the terrorist, one of the major disadvantages to using CBRN agents is their indiscriminate nature. Most traditional terrorist groups have clearly defined enemies that can be targeted relatively easily with traditional weapons. Not so with CBRN weapons, where friends as well as enemies are likely to suffer*. "Both breathe the same poisoned air, drink from the same contaminated reservoir".*[10]

These weapons also require the use of safety equipment (protective clothing, masks, etc.) as well as antidotes, possibly test animals, and lab facilities. Delivery systems must then be acquired and tested. The potential user of CBRN weapons must also consider toxicity, ease of acquisition, agent stability, immunity to detection, rapidity of effects, and communicability.

There may also be reluctance on the part of potential users to learn about new and relatively complicated weapons when high explosives and automatic weapons are readily available.

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9 CSIS (Canadian Security Intelligence Service) – Chemical and Biological Terrorism, "First Responders Briefing Pack", Ottawa, Ontario, Canada. 1997.

10 Laqueur, W. *The New Terrorism*, Oxford University Press, NY, 1999.

Other reasons terrorists might not pursue the use of CBRN weapons include:

- political counter productivity, given the likelihood of alienating supporters or potential supporters on moral grounds;
- fear of unprecedented governmental retribution that might follow; and,
- the lack of a perceived need for such indiscriminate, high-casualty attacks in furthering the goals of a group.[11]

### 2.1.4 What are Some Targets Terrorist Groups are Likely to Attack?

History has taught us that the likely targets of terrorists can be as varied as the motives of the terrorists. A high level of security often identifies the most desired targets. This, however, cannot always be used as a gauge of the likelihood of attack as evidenced by the bombings of the World Trade Centre in 1993 and the Alfred P. Murrah building in Oklahoma in 1995, or the hijacked airline attacks on the World Trade Centre and Pentagon in 2001. When the most likely targets are difficult to attack, terrorists, just like criminals, seek an easier target. For many years the Provisional Irish Republican Army (PIRA) attacked the commercial and financial districts of London because they were easy targets and brought attention to their cause. The recent attack in Bali, Indonesia is another example of an easy target being chosen with devastating results.

Some of the types of targets terrorist groups may attack include:

- Government buildings
- Transportation facilities (including mass transport)
- Political figures and leaders
- Military installations
- Nuclear facilities
- Churches, synagogues, mosques, and other facilities of religious significance
- Popular or symbolic landmarks
- Public utilities including power lines, pipelines, etc.
- Emergency services (including hospitals)
- Municipal, provincial, and federal infrastructure (roads, bridges, sewers, etc.)
- Financial institutions and related infrastructure (e.g., stock exchange)
- Agriculture
- Manufacturing
- Sports and entertainment facilities

[11] CSIS (Canadian Security Intelligence Service) – Chemical and Biological Terrorism, “First Responders Briefing Pack”, Ottawa, Ontario, Canada. 1997.

**Thinking Question**

**Identify potential terrorist targets in your community.**

### 2.1.5 What are Some Common Misconceptions Concerning CBRN Incidents?

**A CBRN terrorist attack is the easiest way to cause mass fatalities -** Historically, CBRN terrorist attacks have been a relatively ineffective way to cause mass fatalities. The Aum Shinrikyo cult in Japan was one of the most successful terrorist groups and their attacks resulted in a total of 12 deaths. The cult, which had tens of thousands of members, including scientists, biologists, and chemists, had an almost unlimited budget. During their years of active experimentation and planning, they attempted to use the Ebola virus, anthrax, and various gases. In spite of their expertise and financial backing, they fell short of their goal.

**It will never happen here -** In spite of the many failed past attempts, it would be foolish to believe that other individuals and groups will not continue to attempt to use CBRN weapons. It is easy to examine the newspapers and conclude, "It will never happen here". Before the bombing of the Alfred P. Murrah building in Oklahoma City, the residents of that city never believed it would happen to them. Before the *Salmonella* poisoning of hundreds of citizens of the town of Dalles, Oregon, they also thought, "It will never happen here". It **can** happen here, and it must be ensured that the response is effective, efficient, and professional.

**Nothing can be done -** When faced with the unknown, it is normal to feel that there is nothing that can be done. Course participants will learn there is much that can be done to prepare for a CBRN terrorist attack. Skilled response to an incident will have a profound effect on the outcome.

## 2.2 Overview of the CBRN Response Structure

Response to CBRN incidents will involve local first responders including police, fire, EMS, and hospitals. These agencies are accustomed to beginning their incident assessment upon receipt of the call. Rapid risk assessment is required to effectively deal with situations and minimize exposure to hazards. When faced with a more

complex scene such as a CBRN incident, responders must use existing resources in performing the tasks at hand, while minimizing the risks to themselves.

Good municipal emergency planning will identify the resources that are available locally and regionally, as well as those from the provincial and federal governments. Non-government organizations and industry may also contribute.

Senior levels of government and their services are ultimately responsible for consequence management. In most cases, the local police, fire services, EMS, Public Health, and hospitals will respond to a CBRN terrorist incident. Local hospitals and health care workers will bear immediate responsibility for treating casualties. First responders will have to rely initially on equipment and other resources available locally. It may take many hours before provincial and federal resources are mobilized and in a position to assist. Until then, local first responders must take mitigating actions on their own.

### 2.2.1 CBRN Incident Stages

CBRN scenes can be large, complex operations. The following stages may be used to understand the overall flow of operations:

1. The **Recognition Stage** involves discovery of an incident. An “in-house” emergency unit at the affected site may have resources to minimize the immediate impact on occupants. Activation of local emergency response initiates the response stage.
2. The **Response Stage** usually begins with emergency dispatch receiving the call. In some cases this phase may begin simply with first responders arriving on-scene. The focus of this Basic Level Course is to prepare responders to perform Key Response Tasks (See 2.3) initiated during this stage.
3. The **Intervention Stage** involves specialists and technicians who will conduct detection, identification, investigation, and intervention, as required. The Intermediate Level Course deals with tasks up to and including this stage. This Basic Level Course does not address the intervention stage in detail.
4. The **Recovery Stage** includes ongoing retrieval, monitoring, site remediation, and criminal investigations. The CBRN First Responder Training Program does not address this stage.

### 2.2.2 Preliminary Actions

Organizations occupying buildings or facilities which may be possible targets of CBRN terrorism should have in-house emergency plans. First responders who arrive at a scene may find that well-prepared organizations are taking sound preliminary actions because a CBRN incident is suspected.

Preliminary actions may include:

- evacuation and/or shelter in-place;
- notification of emergency services;
- Emergency Washdown;
- first aid assistance;
- suspicious packages and envelopes procedures; and,
- meeting first responders and providing information.

| **Thinking Question** |
| --- |
| **Does your jurisdiction have a program to encourage private and commercial organizations to have emergency plans? If not, who could be the lead of such a program?** |
| |

## 2.3 Key Response Tasks

Basic-level training deals with the tasks that a first responder can initiate during both the recognition and response stages. First responders are already familiar with many of these tasks. The focus of this course is to build upon existing skills and knowledge to better equip emergency teams to deal with a CBRN incident.

The Key Response Tasks are:

1) **Assessment**
2) **Personal Protection**
3) **Control of Situation**
4) **Casualty Management**
5) **Communication**
6) **Call for Additional Resources**

A summary of the Key Response Tasks follows. More detailed discussions of the first four Key Response Tasks are found in Chapters 3, 4, and 5. These Key Response Tasks are not necessarily listed in chronological order. Most of them begin when a potential CBRN incident is recognized and are ongoing throughout the incident.

### 2.3.1 Assessment

First responders must be able to recognize a potential CBRN incident. They must be on the lookout for any indicators of a CBRN incident and continually reassess the situation as it evolves.

Emergency call centre operators are often first to assess the situation. They must listen for, recognize, and ask about the indicators of a possible CBRN incident and then provide the pertinent information to those dispatched to the scene. CBRN Incident Reporting Guides that can be used for this purpose are provided in Annex B.

In other situations, a first responder may be approached by the public or be the first to recognize that a potential CBRN incident is occurring. In this case, assessment begins by gathering pertinent information and communicating it back to an emergency call centre. See Chapter 3 for more details.

**Thinking Question**

**Are the emergency call centre operators in your area trained to recognize a possible mass casualty, hazardous materials, or CBRN incident?**

### 2.3.2 Personal Protection

Without advance warning, even the best trained and best equipped responders can become casualties during their initial response. If it is determined that the site being approached is a possible CBRN incident site, protective measures must be immediately taken by first responders. Measures include:

- using available protective equipment consistent with the organization's protocols;
- not rushing in;
- remaining upwind and uphill from the incident; and,
- using agent avoidance techniques such as avoiding contact with potentially contaminated victims.

See Chapters 4 and 5 for more details.

### 2.3.3 Control of Situation

Taking control of the situation is a Key Response Task that will reduce the overall impact of a CBRN incident. This task includes:

- establishing inner (safety) and outer (security) perimeters;
- establishing safe gathering points for casualties and witnesses;
- establishing communications between all responder groups;
- using the “bullhorn” technique to direct contaminated casualties; and,
- conducting Emergency Washdown.

See Chapter 5 for more details.

### 2.3.4 Casualty Management

First responders with Basic Level CBRN training can perform the following casualty management tasks as part of the Response Stage:

- initiate CBRN incident triage;
- ensure that potentially contaminated casualties have undergone Emergency Washdown (at a minimum) before treatment;
- provide immediate treatment to casualties on scene;
- ensure that casualties have been decontaminated before transport;
- transport casualties to medical facility for definitive care;
- collect the names of people involved for follow-up;
- advise and counsel victims;
- give out health-related information to health care providers and public; and,
- assess short and long-term health effects with appropriate response (e.g. order for evacuation, boil water advisory, etc.).

See Chapter 6 for more details.

### 2.3.5 Communication

Communication is critical for an effective response to all types of incidents. This is especially true of a CBRN incident where resources are likely to be stretched and many services and agencies are likely to be involved. Some of the important communications tasks are:

- relaying status reports (hazard changes, affected persons, estimated size of affected area, wind direction, etc.);
- maintaining communications between responder groups;
- updating emergency call centre operators and mobilizing additional expertise and resources;

- providing advice on approach to the incident site, estimating the number and condition of affected persons;
- ensuring that hospitals and public health officials are advised as soon as possible (as many as 80% of those exposed or potentially exposed may leave the scene and proceed to hospital before threat assessment or decontamination); and,
- dealing with the media.

### 2.3.6 Call for Additional Resources

**Specialists/Technicians –** Responders first on scene will request the assistance of specialists/technicians and, in turn, may be called upon to support them. It is, therefore, important that they understand the tasks that specialists/technicians will perform during the Intervention Stage.

Intermediate and Advanced levels of training build the expertise required to "intervene". These responders are trained to work in a potentially contaminated environment. Responsibilities include:

- establishing Hot, Warm, and Cold Zones;
- performing decontamination of casualties, responders, equipment, and area;
- identifying agents and site reconnaissance;
- performing triage in the Hot Zone;
- rescuing victims in the Hot Zone;
- neutralizing devices and mitigating CBRN agents;
- collecting and processing evidence in the Hot Zone;
- providing emergency medical care in the Warm Zone;
- decontaminating off-site casualties (e.g., at a medical facility)[12],
- decontaminating/gathering evidence from fatalities; and,
- providing advice to supervisors, commanders, and site managers.

**Other Resources -** Several other resources can be called in to contribute during the Response Stage. Some examples are:

- municipal emergency management services;
- public works;
- municipal transit operators (i.e., provide buses for shelter);
- commercial/industrial organizations;
- Red Cross/volunteers;
- coroner;
- provincial emergency measures organization; and,
- provincial CBRN response teams.

[12] Primarily casualties that have by-passed site emergency medical services.

**Federal Resources -** Federal assets will be provided in accordance with the provisions of the National Counter-Terrorism Plan. It is a requirement under the Plan to alert the Royal Canadian Mounted Police (RCMP) when a terrorist incident is suspected. The RCMP will take a lead role in the response. Some of the key resources that will be made available may include:

- Joint National CBRN Response Team (RCMP/DND)
- Emergency Response Assistance Plan personnel (Health Canada)
- Scientific Expertise (Defence R&D Canada, Health Canada, Canadian Nuclear Safety Commission)
- National Emergency Stockpile System (Public Health Agency of Canada)

## 2.4 Summary

Terrorism is a reality in society today. A CBRN terrorist attack can happen anywhere, and preparations can be made for this real possibility.

A CBRN incident can be loosely divided into four stages: Recognition, Response, Intervention, and Recovery. The focus of this Basic Level Course is on recognizing a potential CBRN incident (the Recognition Stage), and on actions performed during the Response Stage. These actions are summarized as the Key Response Tasks: Assessment; Personal Protection; Control of Situation; Casualty Management; Communication; and Call for Additional Resources.

## 2.5 Review Questions

**1. List six reasons that groups might use CBRN weapons.**

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**2. List four disadvantages of using CBRN weapons.**

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**3. List ten potential targets of CBRN weapons.**

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**4. Describe recommended actions under each Key Response Task during a CBRN incident.**

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**5. What steps could be taken before the arrival of specialized resources at the scene of a CBRN incident?**

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# 3. CBRN ASSESSMENT AND INCIDENT RECOGNITION

After completing this chapter, participants will be able to:

- describe the indicators of a possible CBRN incident;
- recognize unusual trends which may indicate a CBRN incident;
- describe signs and symptoms of chemical agent exposure and their onset;
- describe signs and symptoms of biological agent exposure and their onset;
- describe signs and symptoms of radiological exposure and their onset;
- recognize a potential CBRN agent dissemination device and how it may be used by terrorists;
- describe indicators that raise suspicion of a package; and,
- describe guidelines for dealing with a suspicious package incident.

The purpose of this chapter is to familiarize participants with the signs and indicators that might lead a responder to suspect a CBRN terrorist incident. Although it may be difficult to identify if the incident was accidental or intentional, it is important that responders recognize the potential threat and rethink some of the normal day-to-day operating procedures.

## 3.1 Indicators of a CBRN Incident

In December, 1984, mechanical failure caused an explosion at the Union Carbide chemical plant in Bhopal, India that resulted in the release of methyl isocyanate, a deadly gas, used in the manufacture of pesticides. The gas formed a cloud that killed 2500 people while another 50 000 – 100 000 became ill. Trees and plants in the area became yellow and brittle. This example clearly demonstrates that signs and symptoms, accompanied by an explosion, do not necessarily mean a terrorist incident has occurred. If this type of accident happened today, there is little doubt that terrorism would be suspected immediately. In some cases, there may be very subtle or even obscure evidence of terrorist involvement that might surface only weeks, months, or years later.

During September 9–21$^{st}$, 1984, in Dalles, Oregon, several hundred people fell ill with a form of food poisoning called *Salmonella typhimurium*. The cause of the food poisoning was attributed to bacteria in the salad bars of ten local restaurants. The fact that the *Salmonella* poisoning was a deliberate attack planned and executed by a nearby cult was only learned a year later, as the result of infighting among the cultists. This incident clearly demonstrates that a terrorist attack can also take on the appearance of a natural occurrence, and be overlooked.

For many first responders, this raises the question of how their response would differ. To ensure responder safety and the safety of others, suspicious incidents should be treated as intentional acts of terrorism until such time as they are determined otherwise. Responses to such incidents should be exactly the same, no matter what the cause.

### 3.1.1 Pre-Attack Indicators

The discovery of pre-attack indicators may lead to the early detection (or possibly even prevention) of a CBRN terrorist incident. Some indicators of the intent to use chemical, biological, or radiological material in an attack include:

- ideology advocating use of extreme violence, including attacks causing mass casualties;
- inclusion or attempts to acquire persons with a scientific and/or engineering background;
- treatment for unusual illnesses or symptoms; and,
- acquisition of lab equipment, precursor chemicals, Personal Protective Equipment, antibiotics, and/or vaccines[13]; and presence of animals or cages.

### 3.1.2 Indicators of a Chemical Attack

Indicators of a chemical attack will usually be the easiest to recognize because the chemical agents of interest to terrorists may have an immediate and noticeable effect on people and may be accompanied by distinctive chemical odours.

Some of these indicators include:

- a number of people displaying unusual behaviour, signs, and symptoms;
- abandoned devices or packages;
- unusual fogs, clouds, or mists (particularly indoors);
- unexplained pools of liquid;
- abnormal odours or strange smells;
- dead animals, birds or insects in the immediate area of concern;
- an explosive event; or,
- unexplainable illness (no evidence of source/lack of immediate logical cause).

### 3.1.3 Indicators of a Biological Attack

Biological agents may be odourless and invisible and it may be hours or days before effects are known. It is, therefore, difficult to determine if a biological terrorist attack has taken place. Community health care providers such as hospitals, medical clinics, and family physicians may be the first to notice and report trends involving abnormal rates of peculiar symptoms to Public Health officials.

[13] CSIS (Canadian Security Intelligence Service) – Chemical and Biological Terrorism, “First Responders Briefing Pack”, Ottawa, Ontario, Canada, 1997.

The only way to recognize a biological attack will be by careful evaluation of indicators such as:

- an unusual number of people displaying flu-like or other biological agent exposure symptoms;
- unseasonable illness, e.g., the prevalence of flu-like symptoms in mid-summer;
- unusual or unscheduled spraying;
- abandoned spraying devices; and/or,
- large numbers of people simultaneously exhibiting food poisoning symptoms such as vomiting and diarrhea.

### 3.1.4 Indicators of a Radiological Attack

Terrorists can expose people to radiation by deliberately planting a radioactive source in a public area. Dissemination of radioactive materials can be achieved in a number of ways including the detonation of a “dirty bomb”, the deliberate contamination of drinking water, or the use of a nuclear weapon. Terrorists could also sabotage nuclear facilities or radiological storage sites.

It is important to stress that radioactive materials can only be detected using radiation detection instrumentation. Only very high levels of exposure to radiation cause any short-term effects. As a result, it may be very difficult to recognize the terrorist use of radioactive material without intelligence indicators (such as specific threats). However, some indicators of very high levels of radiation exposure may include:

- localized burns with no obvious cause; and,
- significant numbers of people with symptoms such as nausea, vomiting, and abnormal blood counts that are not attributable to disease or do not have an obvious cause. (This may occur hours or even days after exposure.)

## 3.2 CBRN Materials: Signs and Symptoms

Any responder may be the first to arrive at a CBRN incident scene. It is critical that all services understand the CBRN signs and symptoms that may serve as early warning indicators for all first responders. Recognizing these early warning signs will help save lives and prevent first responders from becoming casualties.

### 3.2.1 Chemical Agents

A chemical threat may include chemical warfare agents that could have been recovered from old weapons or produced in clandestine laboratories. In some cases toxic industrial chemicals (TICs) can be used to achieve the aim of an attack. A *chemical warfare agent* is defined by the World Health Organization as, *…"a substance that is intended for use in military or non-military operations to kill, seriously injure or otherwise incapacitate people, or do harm or destroy their habitat or economy*." The World Health Organization has listed 17 chemical warfare agents that are grouped into five categories based on their properties, characteristics and the effects they cause:

1) **Nerve Agents – (Organophosphates)** The most toxic of the known chemical agents, nerve agents, are hazardous in both liquid and vapour states and can cause death within minutes of exposure.

**How they work:** Nerve agents disrupt the mechanism by which nerves communicate with the organs they stimulate, resulting in over-stimulation. Examples: Sarin (GB), Tabun (GA)

2) **Blood Agents -** Cyanide is commonly used in the production of hundreds of tonnes of chemical products each year. When employed in a chemical attack cyanide has the potential to produce high casualty counts. Cyanide can be disseminated in both solid and gaseous forms. Examples: hydrogen cyanide (HCN), cyanogens chloride (CK) or cyanide salts

**How they work:** Blood agents interfere with the body's use of oxygen and ultimately result in death by asphyxiation.

3) **Blister Agents ("Vesicants") -** Blister agents constitute both a vapour and a liquid threat to exposed skin and mucous membranes. Vesicants cause blisters (vesicules) to form on the affected areas of the skin or, if inhaled, serious injury to the respiratory tract. Examples: Mustard (H, HD), Lewisite (L)
**How they work:** On contact with exposed skin, mustard causes a delayed reaction to the affected region (4-24 hours). Lewisite will have immediate and painful effects.

4) **Choking Agents (Pulmonary Agents) -** Choking agents are used regularly in industrial applications. Examples: Phosgene (CG), Chlorine (CL)

**How they work:** Choking agents are chemicals that cause pulmonary edema. A person with this type of poisoning does not get enough oxygen and can die from asphyxiation.

5) **Riot Control Agents -** Riot control agents are chemicals that can temporarily impair the performance and normal function of affected individuals. These products are categorized as "non-lethal". Examples: chloroacetophenone (CS), pepper spray.

**How they work:** Depending on the agent, local irritation to affected areas may occur (eyes, nose and throat).

**3.2.1.1 Signs, Symptoms, and Onset** - Some chemical agents cause serious clinical effects in humans almost immediately, while others cause minor or no clinical effects within the first minutes to hours after contact. For example:

- Inhalation of vapours or skin contact with liquid nerve agents can cause loss of consciousness and death within minutes.
- Inhalation of blood-agent vapours can cause loss of consciousness and death within minutes.
- Exposure to some of the blister agents (i.e., Lewisite) result in immediate injury to exposed tissue, while apparent injuries from mustard may be delayed for 4-24 hours after exposure.
- A high concentration of choking agents will cause severe respiratory distress, while low concentrations may produce irritation to the eyes, nose and respiratory tract.
- Riot control agents produce almost immediate irritation and burning of the eyes, nose, and upper airway.

Only a small quantity of a chemical agent is required to affect a large number of casualties.

Table 1 shows the characteristics, effects, and initial onset timeframes for each of the five groups of chemicals.

**Table 1 Characteristics and Effects of Chemical Agents**

| Agent | Characteristics | Effects | Onset | Antidote |
|---|---|---|---|---|
| **Nerve**<br><br>**(Sarin)**<br>**(Tabun)** | • Colourless gas<br>• Colourless to pale yellow liquid | **SLUDGEM ***<br>• Pinpoint pupils<br>• Runny nose<br>• Shortness of breath<br>• Tearing<br>• Sweating<br>• Vomiting<br>• Salivating<br>• Urination<br>• Defecation<br>• Convulsions<br>• Cessation of respiration | • **Vapour:** seconds<br>• **Liquid:** minutes to hours | • Yes |
| **Blood**<br><br>**(Cyanide)** | • Colourless gas<br>• Salts<br>• Smells of bitter almonds | • Loss of consciousness<br>• Convulsions<br>• Temporary cessation of respiration | • Seconds | • Yes |
| **Blister**<br><br>**(Mustard)** | • Colourless to amber oily liquid<br>• Colourless gas<br>• Smell of garlic or geraniums | • Redness of the skin<br>• Blisters<br>• Irritation of eyes<br>• Cough, shortness of breath | • Hours | • No |
| **Choking**<br><br>**(Chlorine)** | • Colourless gas which may form white cloud | • Shortness of breath<br>• Coughing<br>• Irritation of eyes, nose, airways | • Hours | • No |
| **Riot Control (Tear Gas) (Pepper/ OC Spray)** | • Solid which is usually disseminated as a liquid spray | • Burning, stinging of eyes, nose, airways, skin | • Seconds | • No |

* SLUDGEM – The body tries to empty itself of all liquids when exposed to nerve agents. One way to remember the signs and symptoms of nerve agent exposure is to use the acronym "**SLUDGEM**":
**S-** Salivation, sweating; **L-** Lacrimation (tearing); **U-** Urination; **D-** Defecation; **G-** Gastric; **E-** Emesis; **M-** Miosis (pinpoint pupils). Pinpoint pupils are one of the most evident signs of nerve agent exposure.

### 3.2.2 Biological Agents

Biological agents pose a threat to national security because they:

- can result in high morbidity rates and have the potential for major public health impact;
- might cause public panic and social disruption; and,
- require special action for public health preparedness.

These agents can be further subdivided into viral agents, bacterial agents, and toxins.

**1) Viral Agents -** Viruses are intracellular organisms that lack a system for their own metabolism, and are, therefore, dependent on host cells. Every virus requires its own special type of host. The host cells can be from humans, animals, plants, or bacteria. Viruses are much smaller than bacteria. Viral agents include:

- Smallpox (*Variola major*)
- Viral hemorrhagic fevers (VHF)

**2) Bacterial Agents -** Bacteria generally cause disease in humans and animals by one of two mechanisms: invading host tissues, and/or producing toxins. The diseases they produce often respond to specific therapy with antibiotics. Bacterial agents on the high-risk list include:

- Anthrax
- Plague
- Tularemia

**3) Toxins -** Toxins are deadly substances produced by living organisms (animals, plants, microbes). Exposed persons are not infectious. Toxic agents on the high-risk list include:

- Ricin
- Botulism Toxins

**3.2.2.1 Signs, Symptoms, and Onset -** The onset of symptoms depends on initial dosage and the host's resistance to the agent. Depending on the biological agent, the onset of symptoms may be delayed for a number of hours, days, or even weeks. Table 2 illustrates the effects and initial onset timeframes for each of the seven "high-risk" biological agents.

## Table 2 Effects and Onset of Biological Agents

| Agent | Effects | Onset |
|---|---|---|
| ***VIRAL*** | • **Initial -** fever, malaise, headache<br>• **2-3 days later -** rash inside mouth, on the face, forearms and palms, spreading to the trunk and legs. Eruptions develop at the same rate. | 7-17 days |
| **Smallpox** | | |
| **Viral Hemorrhagic Fevers (VHFs)** | • Fever, general malaise, chest/back pain, sore throat, cough, stomach pain, vomiting, diarrhea, rash, weakness, delirium<br>• Unexplained bruising or bleeding, possible bleeding from eyes, nose, or mouth | Anywhere from 2-21 days depending on the type of VHF. |
| ***BACTERIAL*** | **Inhalation**<br>• **Initial -** flu-like symptoms<br>• **2-4 days later -** abrupt onset respiratory failure, fever, shock, death<br>**Cutaneous:**<br>• **Initial -** sores or blisters on skin.<br>• **2-6 days later -** sores develop black centre<br>**Gastrointestinal: (upper & lower):**<br>• Upper: oral ulcers, swollen lymph glands<br>• Lower: vomiting, severe stomach pain, dehydration, bloody diarrhea, fever | 1 - 60 days<br>(2-60 days following inhalation; 1-7 days following ingestion or cutaneous exposure) |
| **Anthrax** | | |
| **Plague** | • **Initial (inhalational) -** flu-like symptoms<br>• **Progresses to –** fever, cough, shortness of breath, respiratory failure, death | 2-10 days (bubonic)<br>1-6 days (inhalational) |
| **Tularemia** | • **Initial (inhalational)** - abrupt onset of fever, chills, general muscle pain, headache, cough, chest pain<br>• **Ingestion –** tonsillitis, pharyngitis | 3-5 days (inhalational)<br>Sudden onset<br>1-14 days. May have no initial symptoms. |
| ***TOXIN*** | Many symptoms are manifested by cranial nerves such as:<br>• Blurred vision<br>• Dry mouth<br>• Difficulty swallowing<br>• Slurred speech<br>• Diarrhea<br>• Symmetric weakness going from head down<br>• Respiratory dysfunction | Inhalation:<br>Up to 72 hours post exposure.<br>Food borne:<br>12-36 hours post exposure (vomiting , diarrhea followed by CNS signs) |
| **Botulism** | | |
| **Ricin** | **Inhalation -** coughing, tightness in chest, difficulty breathing, muscle aches, severe inflammation of lungs & airway, cyanosis & death<br>**Ingestion -** nausea, vomiting, severe irritation of GI tract<br>• diarrhea, internal bleeding of stomach & intestines<br>• failure of liver, spleen & kidneys and death by collapse of circulatory vessels<br>**Injection -** death of muscles & lymph nodes near sight of injection and probably failure of major organs | Inhalation:<br>1-12 hours<br>2-5 days liver, CNS, kidney & adrenal glands. Patient may be asymptomatic during the preceding 1 to 5 days.<br>Ingested: 5 min–1 hour |

### 3.2.3 Radiological/Nuclear Agents (Materials)

Radiation can be divided into two general categories: ionizing and non-ionizing.

**Non-ionizing Radiation** is radiation such as Ultraviolet (UV) rays, microwaves, lasers, and electromagnetic fields (EMFs) from electric power lines. Although there are some health hazards associated with certain types and levels of non-ionizing radiation, the hazards are generally small.

**Ionizing Radiation** is radiation that may cause damage to the human body by interacting with cells. It is this type of radiation that is dealt with in this course and unless otherwise specified, references to "radiation" should be taken to mean ionizing radiation. There are four major types of ionizing radiation.

- **Alpha Particles** are large atomic particles. They have little external penetrating power, but can be harmful if alpha particle emitting radioactive material enters the respiratory tract, is swallowed or enters through an open wound. A typical alpha particle will travel no more than a few centimetres in air and can be stopped by the outer layer of skin or a sheet of paper.
- **Beta Particles** are small atomic particles (electrons) that are fast moving and have limited penetrating ability. They can be harmful if beta particles emitting radioactive material enters the respiratory tract, is swallowed or enters through an open wound. A typical beta particle can travel up to several metres in the air and is stopped by skin, thin layers of wood or plastic.
- **Gamma Radiation and X-Rays** are electromagnetic waves. Gamma radiation and X-Rays are capable of penetrating all parts of the body and can actually pass right through the body. These "waves" can travel several metres in air and may be shielded by using concrete, steel, lead, or other dense materials.
- **Neutrons** are particles that have been emitted from an atom's nucleus and are capable of penetrating all parts of the body. They are normally associated with the operation of nuclear power plants and nuclear weapons. Neutrons can travel long distances and may be shielded by using materials such as wax, water, or concrete.

Radiological or radioactive materials emit ionizing radiation. Ionizing radiation is energy in the form of electromagnetic waves (like x-rays) or sub-atomic particles. This type of radiation cannot be seen, heard, felt, smelled, or tasted.

Radiation is everywhere in the natural environment. It comes from the sun, outer space, soil and rocks, the air, and even from within the body. Everyone is exposed to this natural "background" radiation every day.

Radiation can also come from sources such as smoke detectors, x-ray machines, medical radioisotopes (used in both diagnosis and treatment), and industrial equipment. Radioactive materials are found in solid, liquid, gas and powder form. Although controlled, the use of radioactive materials is common. Nuclear materials are a type of radioactive material that can be used to fuel nuclear power plants or make nuclear weapons. Nuclear materials used to fuel power plants are different from those in nuclear weapons. Nuclear materials are very tightly controlled and very difficult to manufacture.

Terrorists could use radioactive or nuclear materials in a number of ways. For example:

### Planting Sources

If a very strong radioactive source were planted (i.e., hidden in an occupied area), health effects could be visible after a day or two. A weaker source may cause health effects that are not evident for longer periods (i.e., weeks or years).

### Dirty Bomb

The primary intent of a dirty bomb is to disseminate radioactive material thereby contaminating an area. Subsequent cleaning of an affected area can be very difficult. People exposed to the radiation can experience both short -and long-term effects.

### Nuclear Weapon

Immediate effects of a nuclear explosion are: blast, heat, and ionizing radiation. Delayed effects include fires and radioactive fallout.

**3.2.3.1 Signs, Symptoms and Onset -** Unlike some other agents, radiation cannot be detected by human senses. Exposure to very high doses of radiation can cause early or delayed reddening of the skin (radiation burns), but radiation exposure may go entirely undetected. Other effects can appear anywhere from minutes (or less) after a very severe radiation exposure to decades in the case of a low-level exposure. The only way to detect and measure radiation is by using radiation detection instruments.

The amount of radiation exposure depends both on the “strength” of the radiation field (the dose rate), and the amount of time spent in the radiation field. Higher doses (i.e., higher dose rates and/or longer exposure times) result in increasing probability and/or severity of effects.

Radiation can cause harm by damaging genetic material or cell structures within the human body. Alpha and most beta particles are only significant threats if they enter the body (through ingestion, inhalation, or internal contamination through wounds). Gamma rays, neutrons, and high-energy

betas, in comparison, can cause radiological damage from both inside and outside the body.

Early effects of exposure to ionizing radiation (Table 3) only appear after very high doses are received during a short period of time. For comparison to the doses listed, Canadians receive an annual dose of 2-4 millisieverts per year (mSv/y) from natural background sources.

**Table 3 Short-Term Effects of Ionizing Radiation**

| **Dose** (millisieverts) | **Probable Effect** |
|---|---|
| 0 – 1000 | no detectable injury |
| 1000 – 3000 | nausea, vomiting, possible fatality but unlikely for healthy individuals |
| 3000 – 6000 | injury and disability certain, death likely for 50% of people |
| 10,000 – and higher | fatal to all people |

Low doses of radiation over long periods of time are cumulative. Research on the effects of long-term exposure has indicated that it can result in an increased risk of cancer. Studies are ongoing to identify other possible long-term effects.

## 3.3 CBRN Dissemination Devices

As a first responder or someone who may be involved in the early stages of a CBRN incident, it is important to know the potential methods of dissemination. This knowledge may enable responders to recognize, avoid, and minimize the effects of an attack.

There are many methods of disseminating CBRN materials ranging from extremely basic to very sophisticated. Some of these methods have already been used with varying degrees of success. The poor performance of some improvised devices may result from lack of research and limited resources for testing effectiveness; however, even poor dissemination of a CBRN material can be successful in its intent to injure and terrorize.

Dissemination devices can be packaged in any shape or size. The outer container may have visible fans or nozzles. In assessing a scene, it is important that responders take all **indicators** into consideration such as the **location** and **design of a device**, as well as the **signs and symptoms** presented by victims.

Dissemination devices fall into four categories:

- **Mechanical Action**: frangible or soft containers of solid, liquid or gaseous product that may be propelled by hand or other means
- **Chemical Reaction**: the effects of mixing two or more materials to produce a hazardous substance
- **Pneumatic**: pressurized gasses used to empty or disrupt containers filled with solid, liquid or other gaseous products

- **Explosive**: explosive charges used to break or fracture containers filled with solid, liquid or gaseous products

### 3.3.1 Mechanical Action

Mechanical action disseminators use no external source for dissemination other than the action associated with the breaking of frangible or soft material containers. These disseminators may be bottles, bags, or other containers, either left unattended to disseminate on their own or be propelled by hand into the path of unsuspecting individuals. Mechanical action disseminators are most effective if placed in an area where there is air exchange and elevated ambient air temperatures (elevators, stairwells, etc.). This method of dissemination was used by the Aum Shinrikyo cult in Tokyo, Japan to disseminate sarin that killed twelve people.

### 3.3.2 Chemical Reaction

Chemical reaction dissemination requires the mixing of two or more products to create a more hazardous compound. An example of this type of reaction would be the mixing of potassium cyanide (KCN) and hydrogen chloride (HCl) to form hydrogen cyanide (HCN). Dissemination is achieved through mixing the products, resulting in the off-gassing of HCN.

### 3.3.3 Pneumatic

Pneumatic devices may use high pressure gasses to disseminate the solid, liquid or other gaseous agent products. These devices consist of an agent reservoir with separate or co-mixed pressurized gas to produce a very effective disseminator. The disseminator can be as simple as a garden sprayer or a container capable of withstanding moderate or high pressures.

### 3.3.4 Explosive

Explosive disseminators use high or low explosives or propellants to disseminate materials. When properly designed, these devices can be the most effective methods of dissemination; however, if improperly designed large amounts of the agent being disseminated will be destroyed by the explosive detonation. Note: the effects of radioactive materials are not diminished by an explosion.

## 3.4 Suspicious Package Guidelines

Responders should be aware that CBRN material can be delivered by mail. Criminals have fabricated explosive devices and sent them to their victims using various means. As a result of the events of September 11$^{th}$, 2001, and the subsequent anthrax letters, all organizations should regularly exercise enhanced protocols for mail handling that address chemical, biological, radiological, and explosives threats.

### 3.4.1 Indicators that Cause Suspicion

A package or envelope received by post or courier, or delivered in person may arouse suspicion because of “indicators” such as:

- **Looks Wrong**
  - too much postage
  - return address missing or foreign
  - address is incorrect
  - restrictive markings like “Personal, Confidential, Rush”, or “to be opened only by”
  - misspelled words
- **Feels Wrong**
  - too heavy for the size
  - presence of wiring or a granular substance inside
  - rigid, too bulky, or looks lopsided
- **Other Indicators**
  - item is dirty, stained or leaking
  - too much tape or string
  - strange odour or sound(s)
  - no deliveries expected

**Note:** Be prepared to detail observations for investigators.

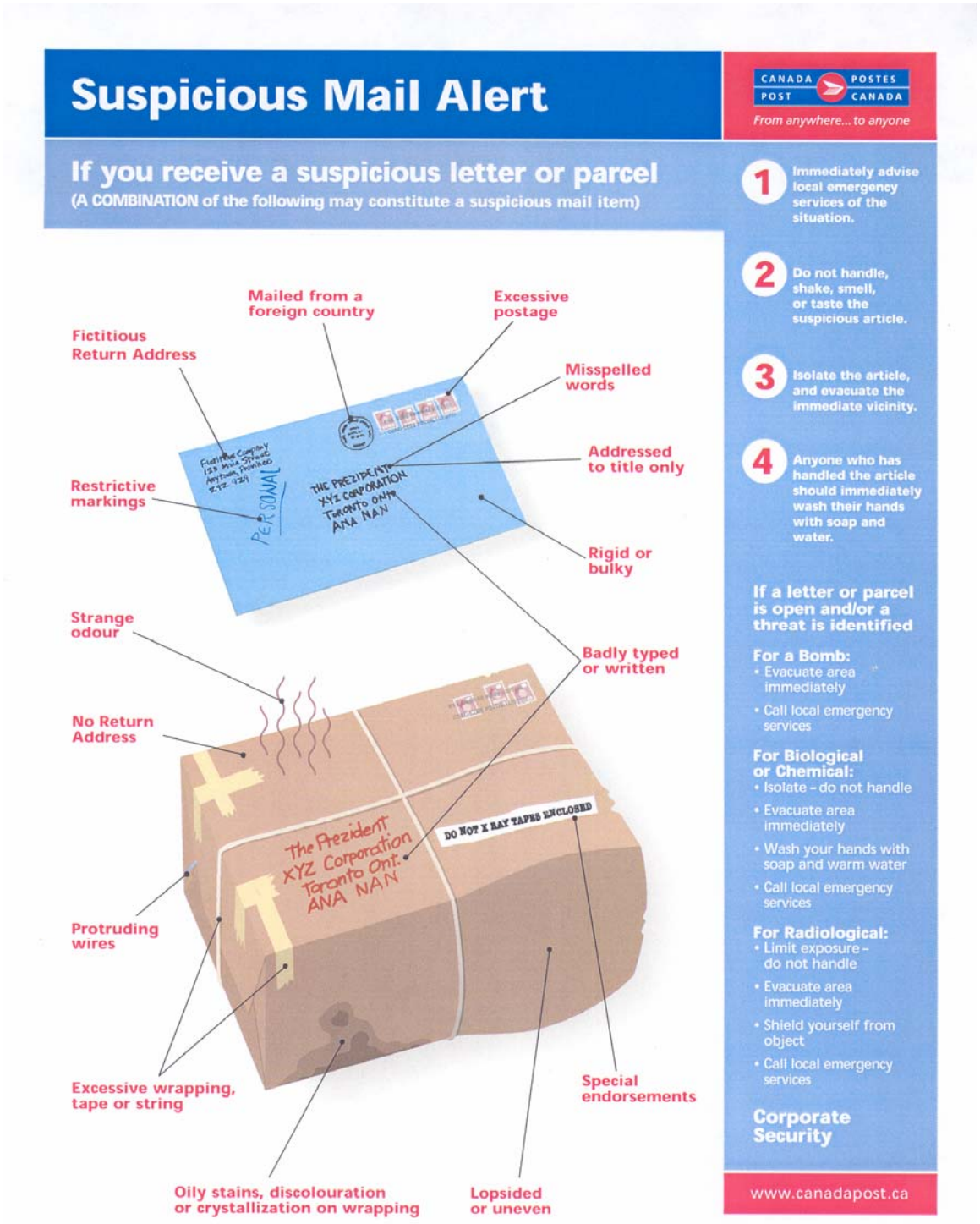


**Figure 1 Suspicious Letter and Package Indicators**

http://www.canadapost.ca/business/corporate/about/announcements/hazard2-e.asp

### 3.4.2 Suspicious Package Guidelines

The following guidelines are intended to offer basic elements of managing a suspicious package incident. Local agencies are encouraged to ensure that their own protocols contain the listed considerations.

**1) Manage the Package**

- Note location, size, description, state of suspect package. Opened or unopened?
- DO NOT shake, empty, or open the item.
- Leave it where it is.

**2) Secure the Scene**

- Close doors and windows, turn off HVAC.
- Do not enter the immediate area.
- Do not use radios or cellular phones near the package.

**3) Manage Affected Persons**

- Consider Emergency Washdown
- Reassure by explaining what can be expected to occur within the response.
- Gather data – information from persons on-scene.
- Require potentially contaminated persons to remain in a separate room by themselves until advised by the appropriate authority.

**4) Request Additional Resources**

- Determine lead agency.
- Decontaminate scene/responder/equipment.
- Conduct sampling/identification.
- Mitigate.

**Thinking Question**

**Does your agency have suspicious package guidelines? If so, what are they?**

## 3.5 Summary

This chapter is intended to enhance the skills of first responders to identify CBRN incidents. It is through proper recognition and notification during the initial stages of a CBRN incident that the lives of both responders and the public will be saved.

The ability to recognize CBRN agent release can help save lives. The effects of some agents may be immediate, (i.e. nerve or riot control agents) and are easily and quickly identified. However, responders should also be aware that the effects of other products (biological and radiological) can be delayed by hours and, in some cases, days. Dissemination devices may not be readily identifiable as such, but if suspicion is aroused, notify the appropriate specialists and take the appropriate actions (Chapter 5).

Suspicious letters, mail and packages are often dealt with by first responders. Careful adherence to the basic procedures for suspicious package handling is essential and is a vital component of responder strategy. It is strongly recommended that agencies develop or review their policies and procedures relative to suspicious packages, and practice their emergency plans.

## 3.6 Review Questions

**1. You arrive on the scene and get reports from those who have come out of the building that people are experiencing the following symptoms. What might they have been exposed to?**

a) Nausea and vomiting _____

b) Sweating, shortness of breath, runny nose_____

c) Flu-like symptoms, some have gone into shock _____

d) Rash on feet and hands, fever, nausea_____

e) Stinging, burning eyes and skin_____

f) Convulsions, loss of consciousness_____

g) Slurred speech, dry mouth, blurred vision_____

h) Cough, shortness of breath_____

**2. The major difference between exposure to chemical agents and to biological agents is:**

a) Biological agents can cause death within minutes of exposure whereas chemical agents take days or weeks to show effects.
b) Chemical agents can cause death within minutes of exposure whereas with biological agents it is most often days or weeks.
c) A large amount of chemical agent is required to affect a large number of casualties, whereas only a small amount of biological agent is required.
d) None of the above.

**3. Ionizing radiation:**

a) Can naturally occur or be manufactured.
b) Is undetectable by human senses.
c) Can cause symptoms to appear anywhere from minutes to decades depending on the dose.
d) All of the above.

**4. Name some indicators that would lead you to be suspicious of a package.**

_____
_____
_____
_____
_____
_____

**5. What are the actions you should take immediately upon locating a suspicious package?**

_____
_____
_____
_____
_____
_____

# 4. PERSONAL PROTECTION

After completing this chapter, participants will be able to:

- describe how to avoid becoming contaminated;
- describe precautions for Secondary Contamination;
- describe the levels of responder Personal Protective Equipment, and when each level is appropriate;
- describe the need for Respiratory Protection; and,
- describe the risks of operating in Personal Protective Equipment worn at a CBRN incident.

This chapter will focus on enabling responders to protect themselves. A key protective strategy is to avoid exposure to contamination where possible. The responder must thoroughly understand both the capabilities and the limitations of the personal protective equipment that is available. These limitations must not be exceeded.

## 4.1 CBRN Agent Avoidance Techniques

The first step in personal protection is taking preventative action. An effective responder at an incident must minimize the likelihood of contact and exposure to the contaminant. During the sarin attack on the Tokyo subway, 15% of the responders became secondary casualties. Acts of heroism can add to the growing lists of casualties and eliminate valuable responder resources.

Avoiding contamination starts during the approach to the scene. The importance of recognizing the potential threat of a CBRN incident is discussed in Chapter 3. First responders **must** stop before entering the incident scene, approach uphill and upwind, reserve resources, and limit contact with casualties. These strategies will reduce the numbers of people exposed to contamination and are further discussed in Chapter 5.

Agent avoidance topics discussed in this Chapter are:

- Avoiding Secondary Contamination
- Levels of responder Personal Protective Equipment (PPE) (including their limitations)
- Risks of operating in PPE at a CBRN incident

## 4.2 Secondary (Cross) Contamination

The potential for “secondary” or “cross” contamination of responders by other responders or casualties who are contaminated will be of primary concern in any terrorist incident involving CBRN materials. Cross-contamination can occur by direct contact with contaminated clothes, skin, hair, or personal belongings such as handbags and briefcases. It can come from direct contact with visible liquids or solids, airborne

droplets, microscopic dust particles, or from contact with body fluids. Nerve agents induce the acute production of body fluids. Responders must be prepared to protect themselves from the transmission of all communicable diseases when this occurs. Universal precautions should be used when treating decontaminated victims.

## 4.3 Universal (or Routine) Precautions

Universal precautions are infection control guidelines designed to protect workers from exposure to disease spread by blood and body fluids. The Laboratory Centre for Disease Control (Health Canada) and the United States Centers for Disease Control and Prevention have developed the strategy of "Universal Precautions" to prevent contact with patient blood and body fluids. This strategy stresses that all patients should be assumed to be infectious for blood-borne diseases such as AIDS and hepatitis B.

Universal precautions include the use of gloves, mask, gown, and eye protection to prevent contact with blood, other body fluids, or other potentially infectious material. Proper containment of sharps is also required–needles can easily penetrate any PPE.

## 4.4 Responder PPE

There have traditionally been four levels of PPE available to emergency responders.

### 4.4.1 Level "A"

Level A protection is a fully encapsulating chemical-resistant suit with its own air supply system or "self-contained breathing apparatus" (SCBA). This protective equipment provides the highest known level of protection against liquids, vapours, gases, mists, and airborne particulate. In the case of emergencies involving CBRN materials, this ensemble may be employed for:

- entry into unknown environments; and,
- initial site reconnaissance.

### 4.4.2 Level "B"

Level B PPE consists of a chemical resistant suit that also includes SCBA. It does not, however, offer the optimal vapour protection found in Level A. Level B can either be a fully encapsulating suit or a non-fully encapsulating suit with a simple hood. It is worn when Level A

**Figure 2 Fully Encapsulating Suit with SCBA**

vapour protection is not required. Wrists, ankles, face-piece, hood, and waist are secured to prevent any entry of splashed liquid. Depending on the chemical to be handled, specific types of gloves and boots are to be donned. These may or may not be attached to the garment.

### 4.4.3 Level "C"

Level C PPE differs from Level B in the type of equipment needed for respiratory protection. The same type of hooded garment used for Level B protection can be worn for Level C. Level C protection allows the use of respiratory equipment other than SCBA. This equipment includes any of one of a number of air-purifying respirators. Emergency response crews use this level of protection only where oxygen levels are deemed sufficient and the specific respiratory hazard is known and is in measurable (quantifiable) amounts.

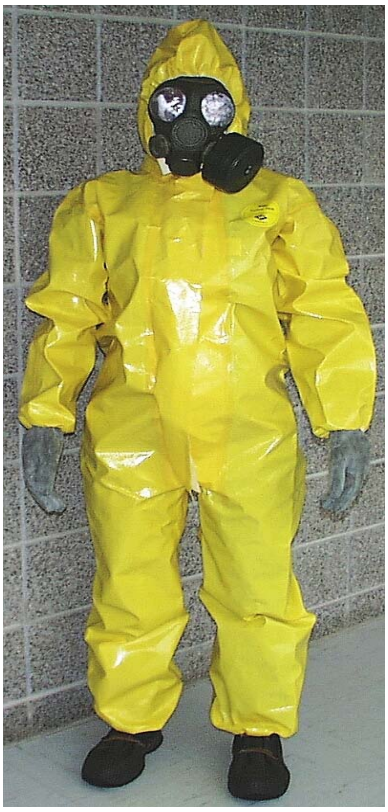

**Figure 3 Level "C" PPE with C4 Respirator and FR64 Canister**

Note: With the inclusion of SCBA, this protective equipment would be elevated to Level B PPE.

### 4.4.4 LEVEL "D"

Level D protection requires no respiratory protection and provides minimal skin protection. This type of clothing could consist of ordinary work clothes or uniforms.

Level D PPE is not considered chemical protection clothing; it is used in response to specific work related activities. Work conducted in Level D assumes that the atmosphere contains no known CBRN hazards, nor is there a potential for unexpected inhalation or contact with hazardous levels of CBRN agents.

***NOTE:*** *Level D PPE should not be worn in known CBRN environments.*

### 4.4.5 TURNOUT OR BUNKER GEAR

Turnout or bunker gear is not designed as chemical protective clothing, even with SCBA.

In viable rescue situations where CBRN PPE is not available, firefighter bunker gear with SCBA may be considered for use in short-term entry and egress of, and in clear view of well-ventilated, contaminated areas. The time spent in a suspected chemical agent environment using this PPE can be estimated by observing the activity of casualties at the scene. The supposition is that no movement may indicate a high mortality rate due to high agent concentration and contamination levels. Reciprocally, the presence of movement and/or consciousness may indicate lower agent contamination and concentration levels, thus moderating the level of risk to responders within the rescue window.

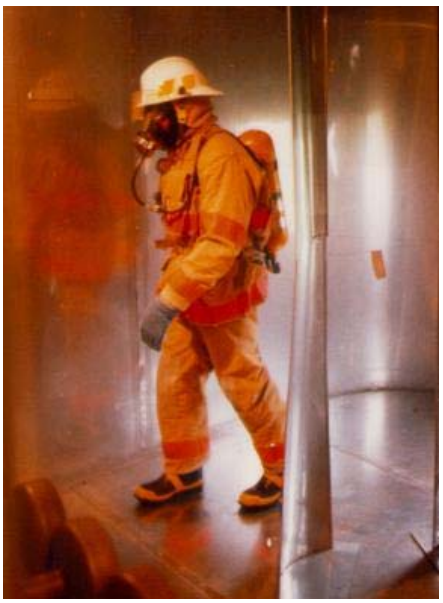

**Figure 4 Structural Fire-Fighting Turnout Gear with SCBA**

Rescue is dependent on a risk vs. benefit judgment call and should only be considered for the purposes of saving lives where better protection is not available.

Please consult the following web site for additional information: http://www.ecbc.army.mil/hld/cwirp/ffpe_scba_rescue_ops_download.htm

This strategy of choosing optimal protection in an unknown environment is the ***All Hazards Approach***. As more information is gathered regarding the hazards present, PPE

can be adjusted accordingly. Responders opting for Level B protection must consider its limitations with respect to vapour protection. Although not recommended for extended CBRN responses, Level B may provide protection for shorter periods.

## 4.5 CBRN PPE

Two types of PPE designed specifically for use in CBRN environments are the Canadian Forces (CF) Protective Ensemble and the two-piece suit generally used by NATO groups. They are designed to provide adequate protection to responders who must exert themselves over a long period of time. When oxygen levels are adequate and an analysis of the contaminant has been conducted, responders may dress in CBRN PPE. This PPE must include a CBRN-approved negative pressure face piece respirator and canister, rubber boots, and gloves.

### 4.5.1 Canadian Forces Nuclear, Biological, Chemical Warfare (CF-NBCW) Protective Ensemble [Available only to CF Personnel]

The CF-NBCW (one-piece) is a multi-layered protective system containing a layer of activated carbon impregnated into foam. The carbon-layered foam is covered by an outer shell of **liquid repellent** fabric. The suit is used when the concentration(s) and type(s) of airborne substance(s) is (are) known and the criteria for using air purifying respirators are met (C4 respirator and C7 canister).

**Figure 5 Canadian Forces, Nuclear, Biological, Chemical Warfare (CF NBCW) Protective Ensemble**

## 4.5.2 Equipment generally used by NATO Groups

The two-piece suit, generally used by NATO groups, consists of pants and a hooded jacket. This protective equipment differs from the CF-NBCW in that it adsorbs liquids into the suit using a wicking action. The suit is used when the concentration(s) and type(s) of airborne substance(s) is (are) known and the criteria for using air purifying respirators are met (respirator with approved CBRN canister). The oxygen content of the atmosphere must be normal.

Other improvised protective measures such as wearing TyvekTM coveralls over bunker gear may afford additional protection. Depending on the agent used, bunker gear supplemented by taping and TyvekTM coveralls may allow responders to complete immediate action procedures such as establishing perimeters and evacuating immediate hazard areas until technicians/specialists arrive with enhanced protective equipment.

**Figure 6 Two-piece CBRN Personal Protective Equipment with C4 Respirator and FR64 NIOSH-Approved Canister**

Determining the right PPE to use, especially respiratory protective equipment, is a critical task and is part of the initial scene evaluation and risk assessment. The choice made will determine the success or failure of the rescue and the continued effectiveness of responder crews. Personnel without PPE or without the correct PPE must stay outside cordoned off areas.

**Thinking Question**

**What level of protection does your current standard PPE offer you?**

## 4.6 Respiratory Protection

Respiratory Protection is critical for first responders. Many CBRN materials are undetectable to the human senses and can affect people most acutely through inhalation. Many different respiratory systems exist, ranging from the maximal protection offered by SCBA, to minimal protection offered in paper filtered dust masks. Responders must be trained in the use of their respiratory equipment and must remain diligent to use it only within its limitations. Respirators and filters should be specifically tested and approved for CBRN agents.

As discussed earlier in this chapter, responders must use an ***All Hazards Approach*** when considering PPE. As applied to respiratory protection, it must be assumed that dangerous levels of CBRN materials exist, at least until appropriate and comprehensive agent detection can be conducted. Only specialized responders equipped with Level A suits, complete with SCBA, have adequate protection to work in unknown environments. Responders with less than this level of protection should use the protection equipment they have and remain at a safe distance. Chapter 5 will outline how perimeters and hazard zones are established. Generally, respiratory protection requirements are linked to these zones.

The respiratory protection provided by gas masks and filter systems can be adequate but this depends on analysis of the contamination and proper use of equipment in accordance with established zones.

## 4.7 Risks of Operating in PPE at CBRN Incidents

PPE does not provide protection without a cost. Wearing protective clothing can be very taxing on responders. It is important to understand that the response to a CBRN incident can extend over a long period of time. Some protective equipment is designed to address traditional emergencies that are most often handled over a short time period.

Consideration must always be given to supporting responders wearing protective equipment. For example, there must be adequate work breaks and a supply of drinking water. Responders should call for replacements and remove themselves from possible contamination before exhaustion sets in.

There have been occasions when responders have been taxed by their protective equipment to the point that they have removed it and put themselves in jeopardy. This can be a fatal mistake when CBRN materials are present.

Respiratory protection often inhibits clear communication but it must not be removed to talk when contamination may be present.

## 4.8 Summary

Personal protection measures should begin as early as possible in the response. Preventative actions can be taken to avoid being exposed to contamination even when protective equipment is not available. Make optimum use of the equipment that is available.

There are many forms of personal protection equipment and respiratory protection. Responders must understand the limitations of each and refrain from exceeding the level of protection that the equipment offers. Perimeters and hazard zones help define protection equipment requirements.

## 4.9 REVIEW QUESTIONS

**1. Is it possible for fire-fighters in bunker gear to engage in rescue operations during a CBRN incident? Explain.**

_____
_____
_____
_____
_____
_____

**2. What actions can you take to practice agent avoidance techniques?**

_____
_____
_____
_____
_____
_____

# 5. CONTROL THE SITUATION

After completing this chapter, participants will be able to:

- describe how to safely perform scene size-up;
- describe Inner (safety) and Outer (security) perimeters and Cold, Warm, and Hot Zones;
- describe how to help/control contaminated victims;
- describe how to establish and execute Emergency Washdown procedures; and,
- describe the Decontamination process.

This chapter describes tasks associated with the evaluation of a potential CBRN scene. It then addresses factors critical to establishing an orderly response.

## 5.1 Safe Scene Size-Up

Responders are accustomed to evaluating a scene upon arrival at an incident. They are trained to observe, quantify the job requirements, and protect themselves and others from threats. When it is known that the incident involves a CBRN agent, essential information must be collected. A reporting guide for emergency call centres is found in Annex B.

When conducting the size-up, it is most important not to rush in as responders often do. Stop and proceed carefully. Commit minimum resources and minimize their exposure. Identify an escape route in case the situation suddenly deteriorates. Pay particular attention to casualties (how many, type and severity of symptoms). Warn other responders. Beware of secondary devices and the possible presence of a perpetrator. Wear PPE. In the absence of PPE, use time, distance and natural shielding, to limit exposure.

**Approach the Scene from an Uphill/ Upwind Direction.**

- **Why uphill?** Toxic materials will flow away from you. Elevation protects from pockets of toxic vapours and gases that are heavier than air.
- **Why upwind?** The agent should be blown away from responders if potential sources of contamination are upwind. Consider the points discussed regarding weather.

It will help to have a clear understanding of the factors that contribute to spreading contamination. Consider the following:

**Weather is a major factor** – wind speed and direction, air stability, temperature, precipitation, and cloud cover are among the factors which determine where and how contamination travels and how long it will remain a hazard.

- **Wind speeds** under 8 kph tend to disperse a cloud evenly, creating a circular or oval hazard area around the release site. At wind speeds above 8 kph, the cloud

usually forms a pear-shaped plume as it travels downwind. High wind speeds will break up the cloud and disperse it more rapidly.

- **Air stability** is another critical factor. During hot, sunny days, the ground-level air tends to rise, taking the toxic cloud with it. These unstable conditions usually limit the downwind distance over which the cloud will travel. During evenings and overcast days, the ground air tends to stay low and so will the cloud.
- **High ambient air temperature** tends to volatilize a chemical agent more readily, increasing the amount of vapour hazard near non protected persons.
- **Low ambient air temperature** tends to decrease the volatility of chemical agents. Some agents such as RD mustard will freeze at 14 º C.
- **Precipitation**, particularly mist or heavy rain, will knock down agent vapours and aerosols.
- **Cloud cover and sunlight** together have several effects on a toxic cloud. During the day, clear skies and light cloud cover normally result in unstable conditions. Increased cloud cover results in more stable conditions. At night, overall conditions tend to be more stable, regardless of cloud cover.

**Terrain is another important factor**. The presence of buildings and features such as hills, valleys, and trees, can have a considerable effect on the wind direction and the degree of air turbulence. In a city with tall buildings, the wind can move in different directions within a few blocks. Such prominent features may also break up a vapour cloud.

**Type and quantity of the agent are also factors**. Some agents evaporate relatively quickly and create a dense, short-lived vapour hazard. Other agents evaporate very slowly and could create a low-density cloud of long duration.

**Dissemination methods also affect cloud formation**. Vapour from a liquid puddle will form a less dense cloud than one from a pressurized spraying device. The use of an explosive to disperse the agent will instantly create a vapour cloud. The characteristics of the vapour cloud depend on the type and amount of agent, and the skill of the terrorist in the construction of an explosive device.

## 5.2 Perimeters and Hazard Zones

Inner (safety) and Outer (security) perimeters should be quickly established by those first on scene. It is critical to correctly cordon off the area. This is a primary safety measure that will contribute to effectively controlling the situation.

Normally the Emergency Response Guidebook provides stand-off distances when commercial Dangerous Goods are involved. In a terrorist incident, there will rarely be Dangerous Goods symbols or placards to assist in applying these guidelines. In lieu of this information, a “worst-case scenario” approach should be adopted. If the source of contamination is enclosed, then the minimum distance for the inner (safety) perimeter

should be 100 metres. If the source of the contamination is outside, a distance of 900 metres from the source of contamination is a required minimum. This distance should be stretched in the downwind direction according to the strength of the wind and extended beyond the reach of visible drifting contamination (smoke, fog, or a plume). These worst case scenario distances can be adjusted as the identity and the quantity of the agent are established.

A second boundary called the Outer (security) Perimeter should be established at a greater distance to restrict public access and provide a secure working area for all responders.

Specialists and technicians will establish more formal **hazard zones**. They will divide contaminated scenes into three areas designated the “HOT–WARM–COLD” zones. These areas are drawn out at increasing distances from the source of contamination. Tools like portable meteorology stations and agent detection instruments will assist in establishing these more precise boundaries. The zones are important to safety. They help define protective equipment requirements and identify where tasks, such as handling casualties and performing decontamination, will take place. These zones must be flexible and respond to changes in weather patterns or changes at the source of the hazard. The Hazard Zones **may** be similar to the perimeters that were laid out originally.

- The **HOT** Zone is the area where the contaminant concentration is deemed to be sufficient to cause death or injury to unprotected personnel or responders employing inappropriate PPE. The pre-decontamination area is located at the designated exit area of the Hot Zone.
- The **WARM** Zone is the area where decontamination of personnel and equipment occurs. The Warm Zone is critical as it contains control points that prevent the movement of contaminated casualties and equipment into the Cold Zone. The Warm Zone is also a staging area for equipment required in support of Hot Zone activities. The main decontamination facility is located at the egress point of the Warm Zone.
- The **COLD** zone is a designated clean area with controlled access where the command centre and other key administrative (e.g., decontaminated casualty control) and logistical (e.g., transport) support areas are located.

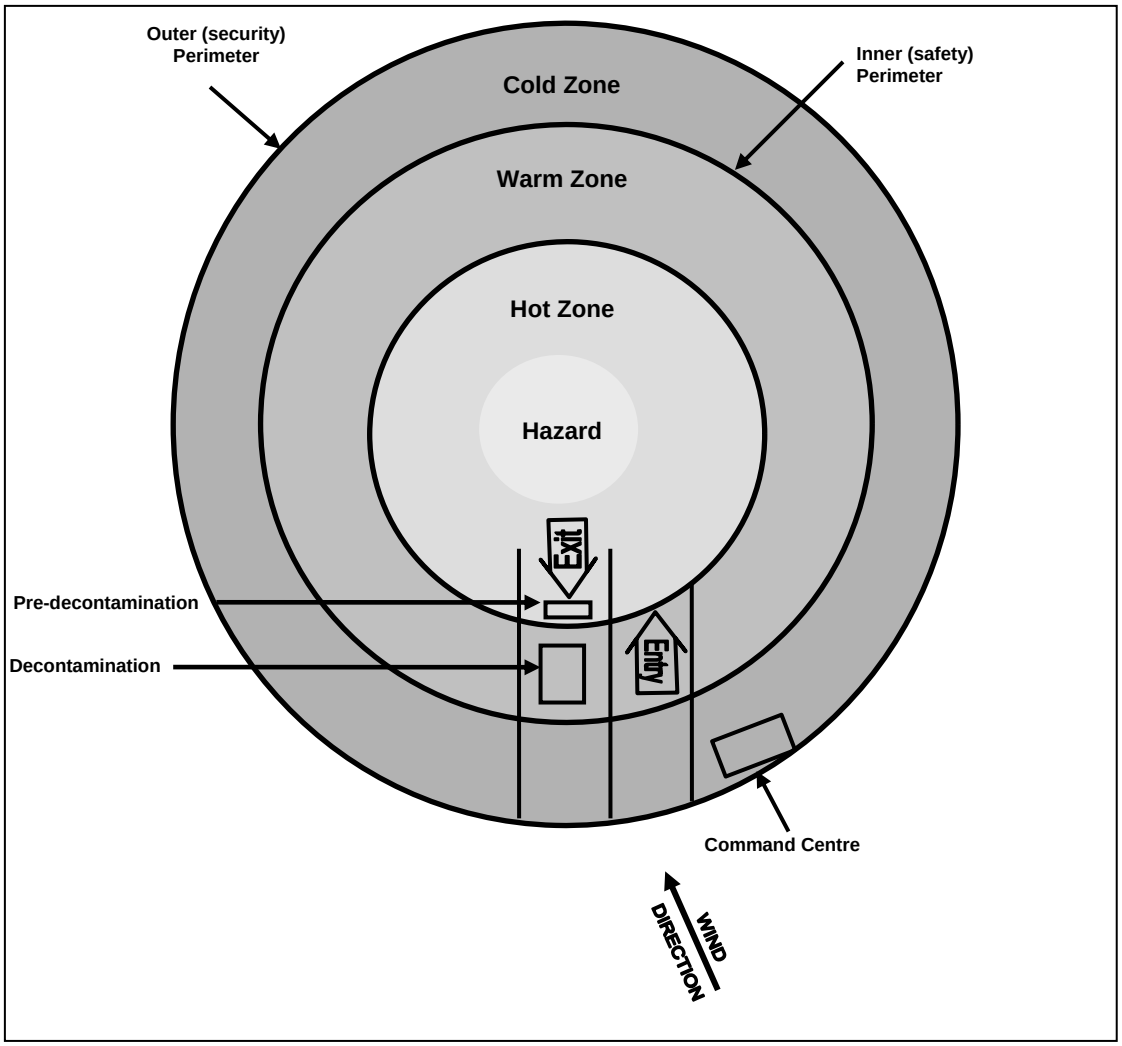


**Figure 7 Hazard Zones**

# 5.3 Control of Contaminated Casualties

## 5.3.1 Do Not Touch Potentially Contaminated Persons Without Wearing Proper PPE

**Bullhorn marshalling** is a technique that can be used to communicate with potential casualties using a portable amplification device or vehicle public address system. Responders who do not have access to voice amplifying equipment should:

- keep a distance of approximately 5 metres between themselves and ambulatory casualties;
- tell casualties not to come closer;
- remain upwind while facing the casualties;

- speak in a loud, firm voice; and
- direct casualties as appropriate to the proper safe gathering point, such as the entrance of the Emergency Washdown, or to the Decontamination process.

### 5.3.2 Establish Safe Gathering Points

In the early stages, it is important to try and minimize cross contamination. Try to separate the potential casualties who were closest to the release site and show signs of contamination from those who were the furthest from the site of release and show no signs of contamination.

**Figure 8 A Safe Gathering Point**

**Ensure that hospitals have been notified.** It is predicted that as many as 80% of affected persons will leave the scene and present themselves at the hospitals. If hospitals have enough notice they may be able to prepare to receive potentially contaminated patients.

### 5.3.3 Emergency Washdown (EW)

Emergency Washdown is a procedure first responders use to reduce the effects of contaminants on victims. When first arriving responders are presented with exposed casualties, deliberate and expedient action may be required. The intent of Emergency Washdown is to deal with these casualties using the resources on hand until additional resources arrive and the Decontamination process is set up. The immediate implementation of an Emergency Washdown in cases where exposed casualties are displaying severe signs and symptoms of contamination will be critical in saving lives.

Emergency Washdown can be water sprayed from fog nozzles over victims from one or more fire trucks. A high volume of water at a low pressure is required (See Figure 9).

**Figure 9 Spraying Water from Fog Nozzles for Emergency Washdown**

In order to most efficiently activate the Emergency Washdown process, responders should follow these guidelines and **direct casualties to**:

**1. Exit to the holding area -** use scene tape, rope, vehicles, pylons, etc. to create a physical corridor which ushers people toward the entrance of the Emergency Washdown set-up.

**2. Remove clothing carefully to prevent contamination from clothing to skin -** care must be taken to limit the spread of contamination when removing and handling clothing and footwear. Casualties can be directed to assist each other. (Note - testing with simulated chemical agents shows that the removal of clothing can remove most of the contaminants up to 80%.)

**3. Avoid blotting or scraping** - this may in fact drive certain types of agents into the skin.

**4. Place removed clothing and personal items in double plastic bags if practical and/or feasible** - in order to both limit the spread of contamination and to preserve evidence, these items should be collected and controlled.

**5. Walk through the water spray with arms and legs apart and head back -** this helps to clean more quickly.

**6. Wash from the top down -** if soap and water are available, casualties should be instructed to lather thoroughly and follow with rinsing. (Note: soap and water may NOT destroy CBRN agents but rather remove and dilute them.)

**7. Avoid swallowing water and avoid getting anything but the direct spray into the face.**

**8. Be careful not to wipe face with dirty hands.**

**9. Proceed under direction to a safe holding area to await decontamination.**

**10. Remain in temporary shelters (from weather, bystanders, media, etc.) that should be provided for casualties**

**11. Makeshift shelters can be made using tarps/tents/buses/buildings**

**What Personal Protective Equipment is required to safely operate the Emergency Washdown?**

When implementing Emergency Washdown, PPE limitations must be considered. At a minimum, full firefighter bunker gear with SCBA should be utilized. However, as described in Chapter 4**, *Personal Protection,*** firefighter bunker gear with SCBA provides only limited protection and work time. Therefore, the use of Level C protection with a CBRN approved respirator is an alternative after consultation with CBRN trained HAZMAT personnel.

**Responders without these levels of protection should not conduct EW and should stay uphill and upwind.**

**Where would an Emergency Washdown be set-up?**

- Upwind and Uphill of the release site (Hot Zone)
- Just inside the Inner Perimeter – consider the wind direction and the upgrade. Establish an entry point/corridor from the inner perimeter and an exit point/corridor from the EW to the holding area
- The safe holding area would be located upwind and uphill of the EW

**After Emergency Washdown, can casualties be treated and transported to the hospital?**

Until casualties have been decontaminated, their treatment and transport should be avoided except for life saving purposes. A casualty **cannot** be considered "clean" after Emergency Washdown if the washdown is not followed by a thorough decontamination process. The decision to transport patients presents a risk-versus-benefit judgement call. Emergency Washdown is not a substitute for thorough decontamination, but decontamination can be conducted without Emergency Washdown. Where mass casualties occur, Emergency Washdown may be left operational as a component of the decontamination process.

EW can be established with standard fire-fighting equipment and a water supply. Its immediate implementation is critical to saving lives.

### 5.3.4 Decontamination

It is important for responders at the Basic level to understand decontamination because it is an essential component in resolving a CBRN terrorist incident. decontamination is a Key Response Task implemented to “control the hazard”. It has a preventative value and contributes significantly to the successful mitigation of the consequences of a CBRN terrorist incident when conducted properly. While decontamination is usually conducted by responders with Intermediate level training (a core skill of the HAZMAT component of the response), other responders may be required to assist in the process. At a minimum, all on-scene responders should recognize the decontamination set-up and understand its role.

The purpose of the decontamination process is to remove or neutralize contaminants from casualties, responders, equipment, and evidence. It is a planned, systematic, thorough, technical, and staged process for maximum removal of contamination. The process also includes precautionary measures intended to limit cross-contamination. The term “clean” is used to indicate that something, which may have been contaminated, has been passed through this process.

Decontamination requires the training, skill, and equipment associated with Intermediate level training. It includes a requirement for agent detection, the selection of decontaminating solutions based on agent identification, and alternative levels of PPE. This labour intensive process requires time to set up and staff to sustain over a long-term operation. It is a comprehensive step-by-step process and thus is limited by the rate at which it can be conducted. Consequently, there is limited capacity for dealing with volumes of people. This process, however, must not be rushed to the point that the efficiency of agent elimination is compromised.

### 5.3.5 Key Components of the Decontamination Process

**Equipment requirements** – the Decontamination process requires high levels of personal protection, detection equipment, shelters, specific decontaminants, and shower systems.

**Location** – this process is always established within the Warm Zone. There is a clear entry point from the direction of the Hot Zone and a clear exit point toward the Cold Zone. Early decontamination measures are often implemented at the exit point from the Hot Zone to reduce the spread of contamination as soon as possible.

**The decontamination process** is designed to reduce the threat posed by contamination in a graduated manner. This becomes increasingly complex when casualties require decontamination and are unconscious or otherwise non-ambulatory.

**Pre-decontamination** is the initial phase of a decontamination process where "cross-contamination" controls are established at the egress point of the Hot Zone. It controls the spread of raw, visible, or gross contamination as early as possible. Pre-decontamination aids significantly in the prevention of "cross-contamination". It involves standing in a footbath (shuffle pit) filled with decontamination solution (household bleach) and removing supplementary footwear and gloving (if worn). The contaminated footwear and gloves are deposited in waste containers. Individuals may then continue through the footbath en-route to the main decontamination process. Equipment may be bathed in decontaminating solution at this point.

Elimination of liquid or solid contamination includes chemical agent and radiation monitoring, visual inspection, application of decontamination solutions, and a systematic, directed, undressing of casualties.

Elimination of vapour threats includes maintaining respiratory protection until thorough decontamination has been completed.

Finally, respiratory protection can be removed, and decontaminated casualties can dress in temporary clothing. Data on the decontaminated casualties are then recorded.

**A Decontamination Line** involves more elaborate decontamination procedures and will vary depending on type and extent of contamination, number of affected persons, and available resources**.** It is a deliberate and controlled process but is flexible and includes variations of the preceding stages. For example, it could be as simple as a two-person setup, or involve many persons.

**A Decontamination Facility,** a component of the Decontamination Line, is a shelter such as a tent, trailer, bus, or a building such as a school or office.

## 5.4 Summary

Control of the situation is a Key Response Task. It includes performing a safe scene size-up, establishing safety and security perimeters, and the control of potentially contaminated casualties.

The purpose of the Inner (safety) Perimeter is to keep responders and others from entering a potentially dangerous area. The Outer (security) Perimeter is established to restrict public access and provide a secure working area for all responders.

Potentially contaminated casualties present a hazard to everyone, and should not be touched by responders not wearing proper PPE. Control of the situation can be more efficiently managed when safe gathering points are established for the safety of victims, responders, and others. Emergency Washdown should be performed to try to remove

contamination from victims before specialized responders and equipment can arrive to perform Decontamination procedures.

## 5.5 Review Questions

**1. Explain why an Emergency Washdown process should be implemented.**

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_____
_____
_____
_____

**2. Why is it important to understand the Decontamination process?**

_____
_____
_____
_____
_____
_____

# 6. CASUALTY MANAGEMENT

After completing this chapter, participants will be able to:

- explain triage procedures for contaminated patients and procedures for patient transport;
- explain effective self-aid and directed first-aid for exposure to CBRN materials;
- describe the medical support for responders;
- describe the potential impact of the public's reactions to a CBRN incident, on emergency services;
- describe the potential impact of a CBRN incident on emergency responders; and
- describe ways of managing stress before, during, and after a CBRN incident response.

The importance of a planned multi-agency response underlies a discussion in this chapter of the issues governing triage, first-aid, and medical treatment for large numbers of casualties of a CBRN incident. The equally serious challenge of providing needed support for responders in a highly stressful environment is also discussed.

## 6.1 Triage

CBRN incidents require additional skills and protocols to deal with the complexity of the event. An understanding of triage and first aid is a requirement for all agencies. In the event of a mass casualty incident, personnel from all agencies will need to assist with casualty management. Agency cross-training fosters, not only a better understanding of others' roles, but also the ability to respond more safely and effectively.

During a CBRN incident, responders must not contaminate themselves while attempting to treat exposed or contaminated casualties. One of the main themes of this training program reinforces the idea that first responders with Basic level CBRN training will not intervene in a CBRN incident due to safety concerns. However, EMS will be triaging, treating, and transporting casualties after the CBRN agent has been identified and after their safety has been assured through decontamination procedures and/or donning personal protective equipment.

EMS and other medical staff must have a thorough knowledge of triage and treatment priorities specific to a CBRN incident. Police and fire services should be prepared to adopt a supportive role to assist EMS as required.

### 6.1.1 Mass Casualty Triage

In mass casualty situations the goal is to "**treat the greatest number for the greatest good."** The material presented in this chapter is meant to expand on existing Mass Casualty Incident (MCI) protocols.

| Thinking Question |
| --- |
| **Describe your local triage model (the system you will be using in your jurisdiction).** |
| |

### 6.1.2 Triage Procedures Involving (Potentially) Contaminated Casualties

Triage usually begins when first responders arrive on-scene and it is evident that there are casualties. However, if contamination is suspected**, Initial Triage** should take place in the Hot Zone by specialty teams, who are equipped with PPE.

An unprotected rescuer can begin treatment of a patient only when the appropriate decontamination measures have been undertaken; therefore, patient care may have to be delayed until the patient reaches the Cold Zone. ***Do not treat contaminated casualties without proper PPE.***

### 6.1.3 Procedures for Transporting Patients from CBRN Sites

- Ideally, transport only decontaminated patients. If a contaminated patient is transported anywhere, the threat of spreading the contamination to other people, areas, and facilities may outweigh the benefits to the patient. The transport of patients who have undergone only Emergency Washdown is a risk-versus-benefit call.
- Avoid transporting people with no symptoms to the hospital. In many jurisdictions, Public Health will be responsible for the disposition of these people.
- Consider using public transit buses or school buses for shelter and transport, especially for minor injury (green-tagged) casualties. This will preserve ambulances for the more serious casualties. Paramedics assigned to the bus can provide ongoing assessment and care.

## 6.2 First Aid

### 6.2.1 Directed First Aid

Directed first aid or “Bullhorn First Aid” as it is sometimes called, becomes necessary when casualties who are (potentially) contaminated cannot be approached or touched because they will pose a risk to responder safety. As well, crowd control and coaching will be necessary to prevent contaminated casualties from leaving the scene. In these situations, casualties may be directed to administer self-aid.

### 6.2.2 Self-Aid and First Aid/Treatment for Chemical Agents

The effects caused by the deliberate release of chemical agents on humans vary according to the type and amount of chemical, the vulnerability of those exposed, etc. Both supportive treatment and antidotes should be considered, although few specific antidotes to chemical agents are available. The following are triage and treatment issues to consider when a chemical agent is involved.

| | |
|---|---|
| trauma/impact/burns | hypothermia |
| aggravated natural illness | hyperthermia /dehydration |
| antidote reactions | stress reactions |

The treatment in the field will vary for each jurisdiction depending on types of supplies in the ambulances as well as personnel qualified to give pharmacological treatment.

**Thinking Question**

**Describe the resources and supplies available in your area (i.e., Advanced Care Paramedics versus Basic Care Paramedics).**

Table 4 illustrates self-aid procedures for first responders and non-critical casualties, first aid/treatment, and provides additional information about each of the five groups of chemical agents.

***Note:*** *Emergency Medical Services should have a thorough knowledge of the charted agents in this chapter. Police and Fire personnel should have an awareness level of these agents.*

**Table 4 Self-Aid Procedures and Treatment for Chemical Agents**

| Agent | Self-Aid | Medical Treatment/First Aid | Additional Information |
|---|---|---|---|
| **Nerve** | • Wash skin exposed to the agent with soap and water | • Decontamination<br>• Resuscitation<br>• Atropine*<br>• Pralidoxine*<br>• Obidoxine*<br>• Diazepam (Anticonvulsant)<br>• Reactive Skin Decontamination Lotion (RSDL)<br>*may be used as auto injectors | • Speed is vital in treating casualties<br>• Atropine must be given as soon as possible |
| **Blood** | | • Amyl nitrite<br>• Sodium nitrite<br>• Sodium thiosulphate | • Speed in treatment is critical<br>• In severe cases death occurs quickly |
| **Blister** | • Remove agent from eyes<br>• Immediately wash with soap and water | • Immediate decontamination<br>• Use antibiotics and local anaesthetics<br>• Treat skin blisters for thermal burns<br>• Oxygen<br>• Ventilation<br>• Morphine<br>• Use a steroid inhaler and/or Salbutamol (Ventolin) | • Treatment must be immediate<br>• Secondary respiratory and skin infections<br>• Inflammation of the cornea of the eye (keratitis) |
| **Choking or Pulmonary** | | • Ventilation<br>• Oxygen<br>• Ventolin inhaler<br>• Lasix<br>• IV therapy<br>• Strict rest and warmth | • Initial symptoms may be delayed |
| **Riot-control** | • Rinse eyes with water<br>• Wash with soap and water | • Removal from environment<br>• Rinse eyes with water<br>• Oxygen<br>• Ventolin inhaler | |

### 6.2.3 First Aid and Medical Treatment for Biological Agents

Recognition of a biological attack is not immediate because the onset of symptoms is delayed. Laboratory confirmation and diagnosis also requires time. Consequently, there are no definitive "First Aid" measures that would be instituted over and above generally accepted patient care methods. Table 5 provides incubation periods, contagiousness factors, and patient treatment for the seven "high-risk" biological agents.

**Table 5 Incubation, Contagiousness and Treatment for Biological Agents**

| Agent | Contagiousness | Incubation Period | Treatment Information |
|---|---|---|---|
| **Anthrax** | Anthrax is not contagious | 1 – 60 days | Antibiotic therapy<br>- Ciprofloxacin<br>- Doxycycline<br>Vaccine<br>- Limited availability in Canada (not for general public) |
| **Plague** | Pneumonic: contagious<br><br>Bubonic: transmitted from rodents to humans through infected fleas | 1 – 10 days bubonic<br>1– 6 days inhalational | Antibiotic therapy<br>- Streptomycin: drug of choice<br>- Gentamicin, Doxycycline, Ciprofloxacin<br>Prophylaxis<br>- Vaccine for bubonic plague<br>- Doxycycline<br>Vaccine<br>- No licensed vaccine in Canada |
| **Small Pox** | Contagious from rash onset until all scabs are cleared | Average 12 days<br>(range 7 – 17 days) | Vaccine<br>- Will be available for the general public in the event of an emergency<br>- Vaccination within 4 days of exposure offers protection |
| **Tularemia** | Tularemia is not contagious | 1–14 days, usually 3-5 days (inhalational)<br>Route and dose-dependent | Antibiotic therapy<br>- Doxycycline - Gentamycin<br>- Ciprofloxacin - Streptomycin |
| **Viral Hemorrhagic Fevers (VHFs)** | Most are contagious throughout the duration of the illness | 2 – 21 days depending on the individual organism/disease | • Vaccine – For yellow fever only<br>• Antiviral – Ribavirin - for some VHFs<br>• Prophylaxis – None |
| **Botulism** | Botulism is not contagious | 2 hours to 8 days; route and dose dependent<br><br>12 – 72 hours foodborne | Antibiotic therapy<br>- Not effective against Botulism but can be used to treat secondary infections + antitoxin<br>Prophylaxis<br>- Antitoxin must be administered within 48 hours<br>Vaccine<br>- Not for the general public |
| **Ricin** | Ricin is not contagious | Inhaled: 1 – 12 hours<br><br>Ingested: 5 min – 1 h | • Antibiotic - None<br>• Prophylaxis - None<br>• No vaccine |

### 6.2.4 First Aid and Medical Treatment for Radiation

The initial first aid that is given to casualties in radiation accidents is for associated injuries and medical conditions, NOT for the effects of radiation. This is because the medical effects of radiation are almost always delayed. The most important initial medical interventions for radiation exposure are decontamination, stabilization, and monitoring. Casualties involved in a radiological incident should be moved away from any potentially contaminated areas, *except if the movement may cause serious injury.*

- Decontamination is required to reduce the total exposure, possibly preventing any clinical symptoms and reducing long-term risk. Sometimes decontamination (for internal contamination) must be done in the hospital.
- Treatment is the same for radiation burns as for other burns.

### 6.2.5 Medical Support for Responders

One of the paramedic's roles may be to provide medical support to responders at the scene. Medical personnel should establish the baseline vital signs of each individual responder (e.g., blood pressure and pulse rate) at a medical monitoring station in the cold zone, before individuals don protective clothing. Vitals should also be evaluated after decontamination and doffing of the suit. HAZMAT teams sometimes include paramedics to provide this monitoring and medical support role. For this reason, it is important that responders *know the capacity and structure of the medical resources available in their communities.*

Components of pre-entry and post-entry assessment of responders include:

- vital signs
- body weight
- general health

Trained EMS personnel must understand how the following factors influence heat stress:

- hydration
- physical fitness
- environmental factors
- level of PPE
- duration of entry

The assessments must be documented and the data obtained must be interpreted and analyzed by authorized medical personnel, with action taken to remove the responder from further duty and threat as required.

| Thinking Question |
| --- |
| **What are the medical monitoring protocols for first responders practiced by Emergency Medical Services in your community?** |
| |

# 6.3 Psychosocial Response

## 6.3.1 Potential Impact of the Public's Reaction on Emergency Services

The first casualties of a terrorist attack will likely result from direct exposure to the CBRN agent and/or from trauma-related injuries. The impact on those potentially exposed or not exposed, however, may be almost as traumatic because of the uncertainty and anxiety associated with a CBRN incident. Both exposed and non-exposed individuals may exhibit similar symptoms. Experience with past events indicates that there may be 4 to 20 psychological casualties for every physical casualty in a mass casualty situation. For example, of the 5510 people who sought medical treatment in the 1995 Tokyo sarin gas attack:

- 12 died,
- 17 were critically injured,
- 1370 had mild to moderate injuries, and
- 4000 + had no or minimal injuries.

Immediately after learning of a CBRN attack, the whole community will be affected. People trying to get away from the disaster area could cause traffic jams and accidents. Medical facilities could easily become overwhelmed with physical and psychological casualties. Stress, fear, worry, and grief will add to existing medical and psychological problems in the community. Increased stress on the response system can be caused by the reactions to the incident rather than by the incident itself. Two distinct health care challenges must be addressed when training for a CBRN terrorist attack: managing the deaths and injuries caused directly by the attack and dealing with the fears, health concerns, and psychosocial reactions that will arise.

### 6.3.2 Potential Impact of a CBRN Incident on Emergency Responders

Many emergency responders have experienced personal, psychological or emotional trauma during their career. Mass casualty incidents generate stress on responders because there are never enough resources to provide optimal care. Difficult choices are made in a chaotic, possibly hazardous pre-hospital environment, information is scarce and the death rate may be high. Responders work knowing they will face post-incident scrutiny by administration, colleagues, families, coroners, lawyers, media, and the public.

During a CBRN incident, responders must face unfamiliar challenges in situations where they have no experience. Unfamiliar and unknown factors will create fear. Pressure to quickly resolve the situation and to deal with the fact that mass casualties were produced intentionally adds to the psychological challenge.

Emergency responders with discipline, training, and equipment will lead an effective community response. Stop, think, and take a deep breath before plunging in. **"The first vital signs to control are your own."**

### 6.3.3 Measures to take Before a CBRN Incident

- Training and participating in response exercises are two of the best means of reducing the stress associated with responding to CBRN incidents.
- Knowledge of CBRN agents (nature and effects) and standard response procedures will increase the responders' sense of competence, confidence, and control.
- Proficiency of the equipment and the team will reduce anxiety.
- Explaining preparation and safety measures to family members will reduce their anxiety.

### 6.3.4 Actions for Responders During a CBRN Response

- Know that there is medical and rescue support available if something happens.
- Try to control reactions by breathing slowly and regularly. Concentrate on breathing normally.
- Focus on the immediate task, while keeping alert for other danger.
- If the task or exposure is prolonged, take breaks (away from the immediate scene if possible) and rotate tasks.
- If response is prolonged, eat well and drink plenty of water.
- Watch for signs of stress and task saturation in fellow responders. A buddy system allows first responders to keep an eye on each other and note signs of stress and/or contamination.

Post traumatic stress is a well-known phenomenon. Expect physical and emotional instability not only in emergency responders but perhaps throughout the whole target community. Physical ailments, work absenteeism, domestic violence, and divorce rates often rise within the next year. Responders, those exposed and the public will experience less stress if community planning has resulted in a competent emergency agency response and a flow of clear, directive, timely, useful information. Still, there will be some who need psychological support.

## 6.4 Summary

First responders with Basic level training will face serious challenges when dealing with CBRN casualties who require decontamination, triage, and first aid. These challenges include specific operational guidelines that are unique to CBRN incidents. A committed effort to cross-agency training in this area will ensure an effective team response.

Effective response to a terrorist incident involving CBRN agents requires psychological preparation and skill in dealing with extremely stressed people. It is by nature, a very chaotic situation involving critical challenges at intellectual, physical and emotional levels. Shock may be experienced because of an inability to assimilate everything at once. Feelings of helplessness can be compounded by not being able to “intervene” as is the norm. This chapter has outlined the potential impact of the public response on emergency services and has suggested ways to cope during a CBRN attack.

A terrorist attack could affect thousands of people both physically and psychologically over a long period of time. This course will provide responders with information on CBRN materials to help contend with these effects.

## 6.5 Review Questions

**1. The main objective of mass casualty triage is to:**

a) provide optimal care for all
b) treat those that are most seriously injured first
c) treat the greatest number for the greatest good
d) transport as many victims as possible away from the incident site

**2. “Bull-horn first aid” is:**

a) only used when treating casualties suffering from the effects of radiation
b) used when you cannot go near or safely touch casualties
c) used to direct victims to the nearest hospitals
d) used for crowd control

**3. The most important point to remember when transporting patients is:**

a) transport decontaminated patients if necessary
b) transport the most critically injured first
c) transport the casualties to hospitals as quickly as possible
d) ideally transport only decontaminated patients

**4. How can you help yourself during a CBRN incident?**

a) work with a buddy
b) focus on the immediate task
c) take a break
d) both a and c
e) all of the above

**5. History shows that for every physical casualty in a mass casualty incident there may be _____ psychological victims**

a) twice as many
b) zero
c) 4 to 20 times as many
d) an equal amount of
e) none of the above

**6. Which of the following can help reduce the psychological impact of a CBRN incident on first responders?**

a) increased knowledge though increased training
b) participation in response exercises
c) knowing that medical and rescue support are available
d) all of the above
e) none of the above

**7. CBRN mass casualty incidents generate stress on responders because:**

a) information is often scarce
b) the death rate may be very high
c) the lack of resources to provide optimal care
d) the incident was deliberate
e) all of the above

# 7. SUMMARY

The Basic Level Pre-Course Reading focuses on the following critical messages:

- Resist the natural inclination to rush into a scene where signs of CBRN terrorism exist. Early recognition of some of these indicators should trigger a change in traditional response patterns. Err on the side of safety and caution, and treat the situation as a "worst-case scenario". A thorough risk assessment is always required.
- Do not exceed the capability of the safety equipment available nor put first responders at unreasonable risk.

The completion of this pre-course reading will prepare first responders to actively participate in the Basic level training one-day classroom course where key pre-course content will be further explored. Instruction will be supported by participant discussion, learning activities and practical training scenarios.

Candidates from central emergency service disciplines (such as dispatchers, fire, police and EMS) will participate in this course. Since CBRN incidents require that all responders work together in fulfilling their responsibilities, the one-day course is built on the concept of working as a team. This course will give service groups an opportunity to discuss some of the challenges of tackling a CBRN situation together.

It is essential that participants prepare themselves for the course by completing the pre-course reading. Throughout the pre-course reading there are thinking questions that prompt research on local organizations' CBRN-related protocols and equipment. In order to create an interesting and constructive dialogue between responder services, each participant must clearly understand the roles and responsibilities of responders as well as local protocols for a CBRN incident.

# ANNEX A: ANSWERS TO REVIEW QUESTIONS

## Chapter 2 – CBRN Response Overview

### 1. List six reasons that groups might use CBRN weapons

- Number of religiously motivated terrorists has increased
- Mass media attention can be achieved
- CBRN weapons are more readily available
- Marginalized Nations can supply CBRN weapons to terrorist without implicating themselves
- CBRN weapons are becoming easier to manufacture
- There is a time lag between release of the agent and its perceived effects on humans
- *See Section 2.1.2 for more information*

### 2. List four disadvantages of using CBRN weapons

- Friends as well as enemies may become victims
- The manufacturing of these agents requires equipment, labs, test facilities and test animals
- Terrorists are reluctant to stray from the traditional uses of terrorism, automatic weapons and explosives
- Terrorists fear possible unprecedented government retribution that might follow
- *See Section 2.1.3 for more information*

### 3. List ten potential targets of CBRN weapons

- Government buildings
- Transportation facilities (including mass transport)
- Political figures and leaders
- Military installations
- Nuclear facilities
- Churches, synagogues, mosques, and other facilities of religious significance
- Popular or symbolic landmarks
- Public utilities including power lines, pipelines, etc
- Emergency services (including hospitals)
- Municipal, provincial, and federal infrastructure (roads, bridges, sewers, etc)
- Financial institutions and related infrastructure (eg, stock exchange)
- Agriculture
- Manufacturing

- Sports and entertainment facilities
- *See Section 214 for more information*

**4. Describe recommended actions under each Key Response Task during a CBRN incident.**

Key Response Tasks are listed in Section 2.3. Overall responsibility for specific actions will vary depending on service group.

**5. What steps could be taken before the arrival of specialized resources at the scene of a CBRN incident?**

Preliminary actions, assessment, self protection, control of situation, casualty management, communication, request for additional resources. *See Sections 2.2 and 2.3 for more information*

# Chapter 3 - CBRN Assessment and Incident Recognition

**1. You arrive on scene and get reports from those who have come out of the building that people are experiencing the following symptoms. What might they have been exposed to?**

a. **Nausea and vomiting**: possibly almost any biological agent, a nerve agent or very high radiation exposure
b. **Sweating, shortness of breath, runny nose**: could be almost any CBRN agent
c. **Flu-like symptoms, some have gone into shock**: almost any biological agent
d. **Rash on feet and hands, fever, nausea**: possibly smallpox
e. **Stinging, burning eyes and skin**: possibly blister or riot agent
f. **Convulsions, loss of consciousness**: possibly nerve or blood agent, or very high radiation exposure
g. **Slurred speech, dry mouth, blurred vision**: possibly botulism
h. **Cough, shortness of breath**: could be almost any CBRN agent

Remember that not all victims will show all symptoms, and some symptoms may be due to stress, not exposure to a CBRN agent. It will be very difficult to tell what type of agent (or combination of agents) is responsible when you arrive first on-scene.

**2. The major difference between exposure to chemical agents and to biological agents is:**

a) Biological agents can cause death within minutes of exposure whereas chemical agents can take days or weeks.

***b) Chemical agents can cause death within minutes of exposure whereas with biological agents it is often days or weeks.***

c) A large amount of chemical agent is required to affect a large number of casualties, whereas only a small amount of biological agent is required.

d) None of the above.

**3. Ionizing radiation:**

a) Can be naturally occurring or manufactured

b) Is undetectable by human senses

c) Can cause symptoms to appear anywhere from minutes to decades

***d) All of the above***

**4. Name some of the indicators that would lead you to be suspicious of a package.**

Looks wrong, feels wrong, other indicators. *See Section 3.4.1 for more information.*

**5. What are the actions you should take immediately upon locating a suspicious package?**

Manage the package, secure the scene, manage affected persons, and request additional resources. *See Section 3.4.2 for more information.*

# Chapter 4 - Personal Protection

**1. Is it possible for fire-fighters in bunker gear to engage in rescue operations during a CBRN incident? Explain.**

These types of risk versus benefit decisions are dependent upon the particular circumstances of each CBRN incident. It is important to note that the information pertaining to the ECBC IRP *Risk Assessment* is presented **ONLY** to provide technical and operational guidance for those who choose to perform quick, initial rescue in the absence of higher levels of PPE. This information is, in no way, intended to serve as a recommended standard. *See Sections 4.4.5 and 4.5 for more information.*

Note: In the absence of any information about the nature of the threat, Level A PPE offers the best protection.

**2. What actions can you take to practice agent avoidance techniques?**

Avoid contact and exposure to the contaminant. Do not touch exposed or potentially exposed people without wearing correct PPE. Evaluate risk at the scene and employ the correct equipment.*(See Section 4.1 for more information.)*

# Chapter 5 - Control the Situation

**1. Explain why an Emergency Washdown process should be implemented.**

The intent of Emergency Washdown is to deal with potentially contaminated casualties using the resources on hand until additional resources arrive to set up the Decontamination process. The immediate implementation of an Emergency Washdown in cases where exposed casualties are displaying severe signs and symptoms of contamination will be critical in saving lives.

**2. Why is it important to understand the Decontamination process?**

First responders with Basic level CBRN training may be assisting with decontamination procedures. Proper decontamination can limit the impact of a CBRN incident and ultimately save lives.

# Chapter 6 - Casualty Management

**1. The main objective of mass casualty triage is to:**

a) Provide optimal care for all
b) Treat those that are most seriously injured first
***c) Treat the greatest number for the greatest good***
d) To transport as may victims as possible away from the incident site

**2. "Bull-horn first aid" is:**

a) Only used when treating patients suffering from the effects of radiation
***b) Used when you cannot go near or safely touch casualties***
c) Used to direct victims to the nearest hospitals
d) Used for crowd control

**3. The most important thing to remember when transporting patients is:**

a) Transport decontaminated patients if necessary
b) Transport the most critically injured first
c) Transport the casualties to hospitals as quickly as possible
***d) Ideally transport only decontaminated patients***

**4. How can you help yourself during a CBRN incident?**

a) Work with a buddy
b) Focus on the immediate task
c) Take a break
d) Both a and c
***e) All of the above***

**5. History shows that for every physical casualty in a mass casualty incident there may be _____ psychological victims.**

a) Twice as many
b) Zero
***c) 4 to 20 times as many***
d) An equal amount of
e) None of the above

**6. Which of the following can help reduce the psychological impact of a CBRN incident on first responders?**

a) Increased knowledge through increased training
b) Participation in response exercises
c) Knowing that medical and rescue support are available
***d) All of the above***
e) None of the above

**7. CBRN mass casualty incidents generate stress on responders because:**

a) Information is often scarce
b) The death rate may be very high
c) The lack of resources to provide optimal care
d) The incident was deliberate
***e) All of the above***

# ANNEX B: CBRN Incident Reporting Guides

## REPORTING GUIDE FOR A THREAT RECIPIENT

**WHEN A THREAT IS RECEIVED:**

- □ Listen
- □ Be calm and courteous
- □ Do not interrupt the caller
- □ Get as much information as possible
- □ Start call trace action, if available, and let the person in charge know while the caller is on the line

TELEPHONE TRACE NUMBER:

**RECORDED DATA:**

| Date: | Time: □ AM □ PM | Duration of Call: |
|---|---|---|

**EXACT WORDING OF CALL OR MESSAGE:**

**QUESTIONS TO ASK:**

| |
|---|
| What time will the toxic agent be released? |
| Where is it? |
| What does it look like? |
| Where are you calling from? |
| Why did you place the device? |
| What is your name? |
| What is the name of your organization? |

**PERSON WHO MADE THREAT:**

| |
|---|
| Name: |
| Address (Street Address, City, Province): |
| Phone Number: |

**IDENTIFYING CHARACTERISTICS:**

| | | | |
|---|---|---|---|
| Sex: | □ Male | □ Female | Other: |
| Accent: | □ English | □ French | Other: |
| Voice: | □ Loud | □ Soft | Other: |
| Speech: | □ Fast | □ Slow | Other: |
| Diction: | □ Good □ Lisp | □ Nasal | Other: |
| Manner: | □ Emotional □ Vulgar | □ Calm | Other: |

| |
|---|
| Background Noises: |
| □ Was voice familiar? (specify): |
| □ Was caller familiar with area (specify): |

**HOW WAS THREAT RECEIVED?**

□ Telephone □ Internet □ Letter □ Package
□ In Person □ Personal Observation

**RECIPIENT'S PARTICULARS:**

| | |
|---|---|
| Name: | Telephone: |
| Address: | Supervisor: |

# CBRN INCIDENT REPORTING GUIDE FOR EMERGENCY CALL CENTRES

## DATE AND TIME OF INCIDENT:

Date: | Time: □ AM □ PM

## INCIDENT LOCATION:

Street Address:

City: | Province:

## DESCRIBE LOCATION:

## ESTIMATED TIME SPENT IN AREA:

## DISTANCE FROM POINT OF IMPACT OR ACCIDENT:

## REASON FOR REPORT:

□ Dead/dying/sick birds, insects, or animals
□ Unusual drops of liquid
□ Dead, discoloured vegetation
□ Unusual death
□ Other:
□ Unusual illness
□ Unusual odours
□ Vapour cloud

## TERRAIN DESCRIPTION:

□ Flat □ Desert □ Sparse trees □ Shore
□ Hills □ Mountains □ Urban □ Thick bush
□ River □ Suburban
□ Other:

## WEATHER:

□ Clear □ Rainy □ Snowy □ Dust
□ Cloudy □ Foggy □ Misty □ Mild
□ Windy
□ Other:

## TEMPERATURE:

□ Hot □ Warm □ Cool □ Cold

## ODOUR:

□ None □ Sweet □ Irritating □ Garlic/Horseradish
□ Changing □ Pepper □ Forest □ Almond/Peach
□ Fruity □ Flower □ Rotten eggs □ Fresh mown hay
□ Other:

## VISIBLE SIGNS:

□ Smoke □ Mist □ Colour: _____ □ None
□ Other:

## UNEXPLAINED SYMPTOMS:

□ None □ Tightness in chest □ Stinging of skin
□ Dizziness □ Blurred vision □ Reddening of skin
□ Runny nose □ Fever □ Welts/blisters
□ Choking □ Difficulty breathing □ Nausea/vomiting
□ Cough □ Diarrhea □ Headaches
□ Other:

## ESTIMATED NUMBER OF CASUALTIES:

## LOCATION OF CASUALTIES:

□ Still in contaminated site □ Have left the scene
□ Contained in safe location
□ Other:

## EXPLOSION:

□ None □ Air □ Ground □ Structure
□ Underground
□ Other:

## DESCRIBE DEVICE OR CONTAINER:

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