

# **Hazardous Materials And Mass Casualty Incidents**

**EMS Continuing Education  
Technician through Technician-Advanced Paramedic**

**Consistent with the  
National Occupational Competency Profiles  
as developed by  
Paramedic Association of Canada  
and  
“An Alternate Route to Maintenance of Licensure”  
as developed by Manitoba Health**

**Evaluated for content by:  
Shirley Dufresne, Marc Watt and David Lind**

**Developed by:  
Educational Subcommittee – Paramedic Association  
of Manitoba**

**Revised February 2007**

## **Disclaimer**

These documents were developed for improved accessibility to “An Alternative Route to Maintenance of Licensure” for all paramedics in Manitoba. Regional implementation of Alternate Route is at the discretion of the local EMS Director.

This is a supportive document to the National Occupational Competency Profiles and “An Alternative Route to Maintenance of Licensure.” It is not the intent that this package be used as a stand-alone teaching tool. It is understood that the user has prior learning in this subject area, and that this document is strictly for supplemental continuing medical education. To this end, the Paramedic Association of Manitoba assumes no responsibility for the completeness of information contained within this package.

It is neither the intent of this package to supercede local or provincial protocols, nor to assume responsibility for patient care issues pertaining to the information found herein. Always follow local or provincial guidelines in the care and treatment of any patient.

This package is to be used in conjunction with accepted models for education delivery and assessment, as outlined in “An Alternative Route to Maintenance of Licensure”.

This document was designed to encompass all licensed training levels in the province (Technician, Technician-Paramedic, Technician Advanced Paramedic). Paramedics are encouraged to read beyond their training levels. However, the written test will only be administered at the paramedic’s current level of practice.

All packages have been reviewed by the Paramedic Association of Manitoba’s Educational Subcommittee and physician(s) for medical content.

As the industry of EMS is as dynamic as individual patient care, the profession is constantly evolving to deliver enhanced patient care through education and standards. The Paramedic Association of Manitoba would like to thank those practitioners instrumental in the creation, distribution, and maintenance of these packages. Through your efforts, our patient care improves.

This document will be amended in as timely a manner as possible to reflect changes to the National Occupational Competency Profiles, provincial protocols/Emergency Treatment Guidelines, or the Cognitive Elements outlined in the Alternate Route document.

Any comments, suggestions, errors, omissions, or questions regarding this document may be referred to [info@paramedicsofmanitoba.ca](mailto:info@paramedicsofmanitoba.ca) , attention Director of Education and Standards.

Hazardous Materials and Multiple Casualty Incidents .....	4
What is a Hazardous Material? .....	4
Identifying Hazardous Materials .....	5
Recognizing Hazardous Materials in Transport.....	6
Shipping Documents .....	11
Resources .....	11
Recognizing Hazardous Materials in a Workplace – WHMIS .....	12
WHMIS Classification: .....	14
EMS Response to a Hazardous Materials Incident.....	16
Multiple Casualty Incidents .....	22
Triage .....	23
Triage Procedures.....	27
Critical Incident Stress Management .....	30
References .....	31

## **Conventions Used in this Manual**

The cognitive elements contained in this training module apply to all EMS licensure levels in Manitoba. Therefore no conventions have been used to differentiate between Technician, Technician-Paramedic, Technician Advanced Paramedic.

# **Hazardous Materials and Multiple Casualty Incidents**

## **Introduction**

Millions of tonnes of hazardous materials are made in Canada every year. To manage the risk to the public, our government has developed specific regulations. They address nearly every aspect of the manufacturing, distribution, transportation, and use of such materials. Unfortunately, hazardous materials may still be spilled or released as a result of equipment failure, vehicle collisions, environmental conditions, and human error. The result can be the loss of life and property.

Emergency management of major incidents often involves multiple casualties and several different response agencies working together in a coordinated effort. The scene must be secured, victims must be extricated or rescued, patients must be sorted and prioritized according to their needs for treatment and survival, and transport to local health care facilities must be coordinated. The incident command system has been developed to organize interagency functions and responsibilities in these situations.



*Hazardous materials incidents can occur in any community.*

The goal of this package is to review the following:

- Role of EMS professional at a hazardous material incident
- Identification of hazardous materials
- Methods of prevention and management of contamination
- Multiple casualty incidents
- The Incident Command System

## **What is a Hazardous Material?**

Hazardous Materials are also known in Canadian Legislation as Dangerous Goods. These two terms have become synonymous, in this module we will use the term Hazardous Materials.

Hazardous materials (hazmats) are those that in any quantity pose a threat or unreasonable risk to life, health, property or the environment, if not properly controlled. Hazmats include chemicals, wastes, and other dangerous products. The principal dangers they present are toxicity, flammability, and reactivity. Those commonly shipped or stored are as follows:

- Explosives

- Compressed gases
- Flammable solids and liquids
- Oxidizers
- Poisons
- Radioactive materials
- Corrosives
- Miscellaneous Hazardous Materials

Hazardous Materials can be the cause of an emergency anywhere and community preplanning can identify the specific sites that contain hazardous materials. For example, is there a farm, business, or industry in your community that might have something hazardous on the premises? Do you have a hospital in your area? Do they practice nuclear medicine? Do you have a photo shop in town? What chemicals do they use to develop a photo? What about a lawn and garden company? Do they stock fertilizers, insecticides, or other pesticides? Do your grocery stores refrigerate their stocks in freezers cooled by ammonia? Do rail lines or highways pass near your community? If they do it is likely that Hazardous Materials pass near by more often than we think about. What about the EMS call that sounds routine? Has someone committed suicide using a Hazardous Material? Where they overcome by the chemicals in a clandestine drug lab? Were they contaminated by handling a Hazardous Material and now require medical assistance.

### **Identifying Hazardous Materials**

**Informal methods of identification** should only be used as a temporary means to determine the presence of hazardous materials:

- Visually inspect the scene with binoculars before entering the site from an uphill and upwind direction.
- Obtain verbal reports from responsible individuals or bystanders
- Consider the incident location (probable location for presence of hazardous materials)
- Look for visual indicators (smoke, leakage, smells)
- What are the characteristics of the containers involved?
- Are there obvious signs and symptoms of victims' exposure?

A product should always be identified by **formal product identification** before any activity is undertaken that may pose a threat to the safety of emergency responders.

This can be accomplished by identifying safety markings found on or near the hazardous materials. Safety markings can be a symbol, sign, label, placard, number, word, or any combination of these things and will be discussed in detail later in this module.

Identifying hazardous materials in transport and in the workplace are somewhat different. Therefore each subject will be discussed separately.

## **Recognizing Hazardous Materials in Transport**

It is estimated that 5 – 15% of trucks on the road contain hazardous materials. Because emergency responses to vehicular crashes are common, the potential exists for exposure to hazardous materials. The Transportation of Dangerous Goods Act governs the movement, storage and handling of most hazardous products in transit. Its purpose is to protect the public from exposure in the case of accidental release. It also ensures the right information is available to emergency responders to provide the care and control of a site where there has been an accidental release of hazardous goods.

Transport Canada requires that ALL hazardous goods in transport are clearly identified with placards / labels, UN number or product identifier, shipping name and shipping documents.

### **Placards / Labels**

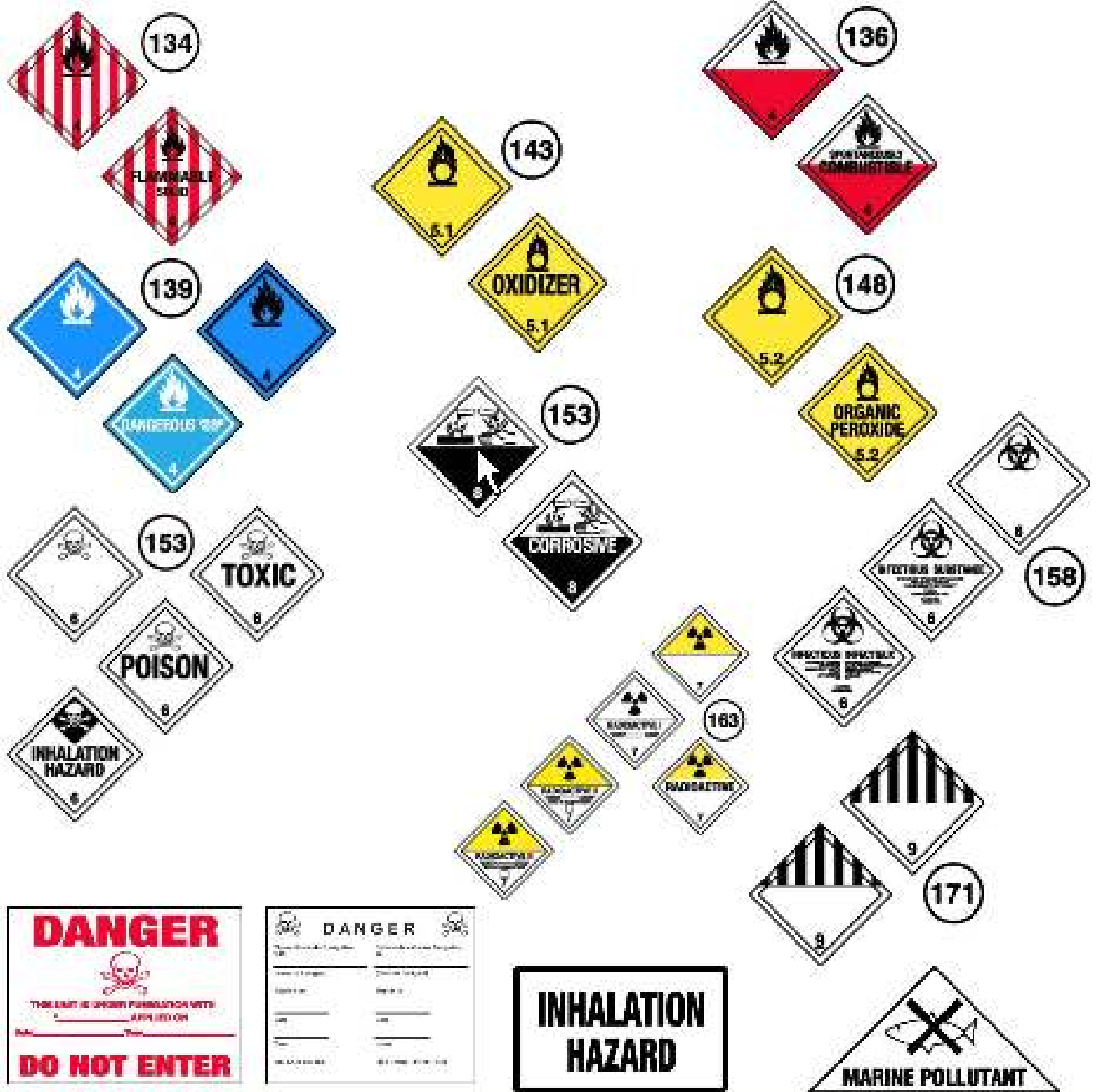
Transportation vehicles carrying a hazardous material that is a regulated commodity must by law, use placards with the class numbers visible. Not all placards require an identification number or (UN number). Placards including identification numbers must be placed on both ends and both sides of all cargo tanks, portable tanks and rail cars. **TDG** (Transportation of Dangerous Goods - Canada) or **DOT** (Department of Transportation – U.S.) labels and placards are *diamond shaped* and are usually identical (except in size) and communicate using colour, class and symbol.

Small packages do not have placards, but 100mm x 100mm labels. Under TDG regulations, these are not required on 4 sides of a small package. Small packages require a label on any one side of the package, on the shoulder (in the case of a cylinder), or on two opposite sides of the package for radioactive materials. Identification numbers on small packages are not found on the label, but beside it on the package surface

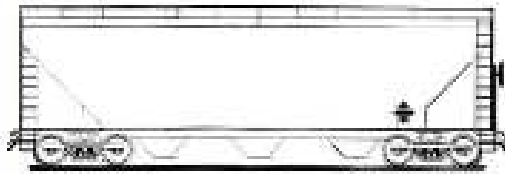
Labels and Placards identify the class of the hazardous material in the transport vehicle. If the vehicle contains a mixed load, a DANGER placard may be used instead of a placard for each product. It is important to note that the absence of a placard does not mean that hazardous materials are not in the load. For example a chemical shipped in a smaller amount may not require a placard. It is a good practice to assume a hazardous material is present until the shipping documents can be consulted for detailed information about the load.



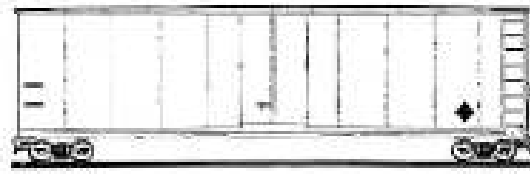
**TABLE OF PLACARDS AND INITIAL RESPONSE GUIDE TO USE ON-SCENE**  
 USE THIS TABLE ONLY IF MATERIALS CANNOT BE SPECIFICALLY IDENTIFIED BY  
 USING THE SHIPPING DOCUMENT, NUMBERED PLACARD, OR ORANGE PANEL NUMBER



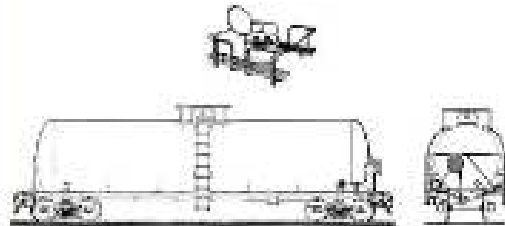
## RAIL CAR IDENTIFICATION CHART\*



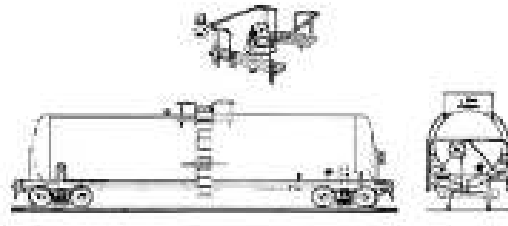
Hopper Car  
Dry Bulk (140)



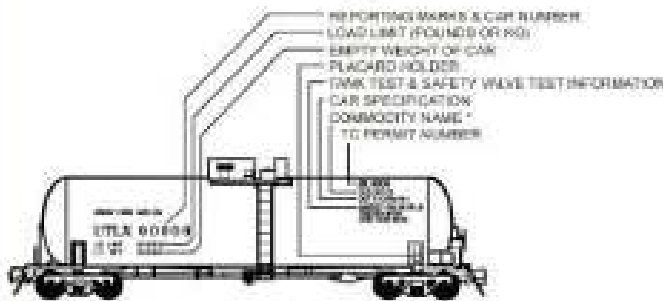
Box Car  
Mixed Cargo (111)



Pressure Tank Car  
Compressed Liquefied Gases (117)



Low pressure tank car  
Liquids (131)



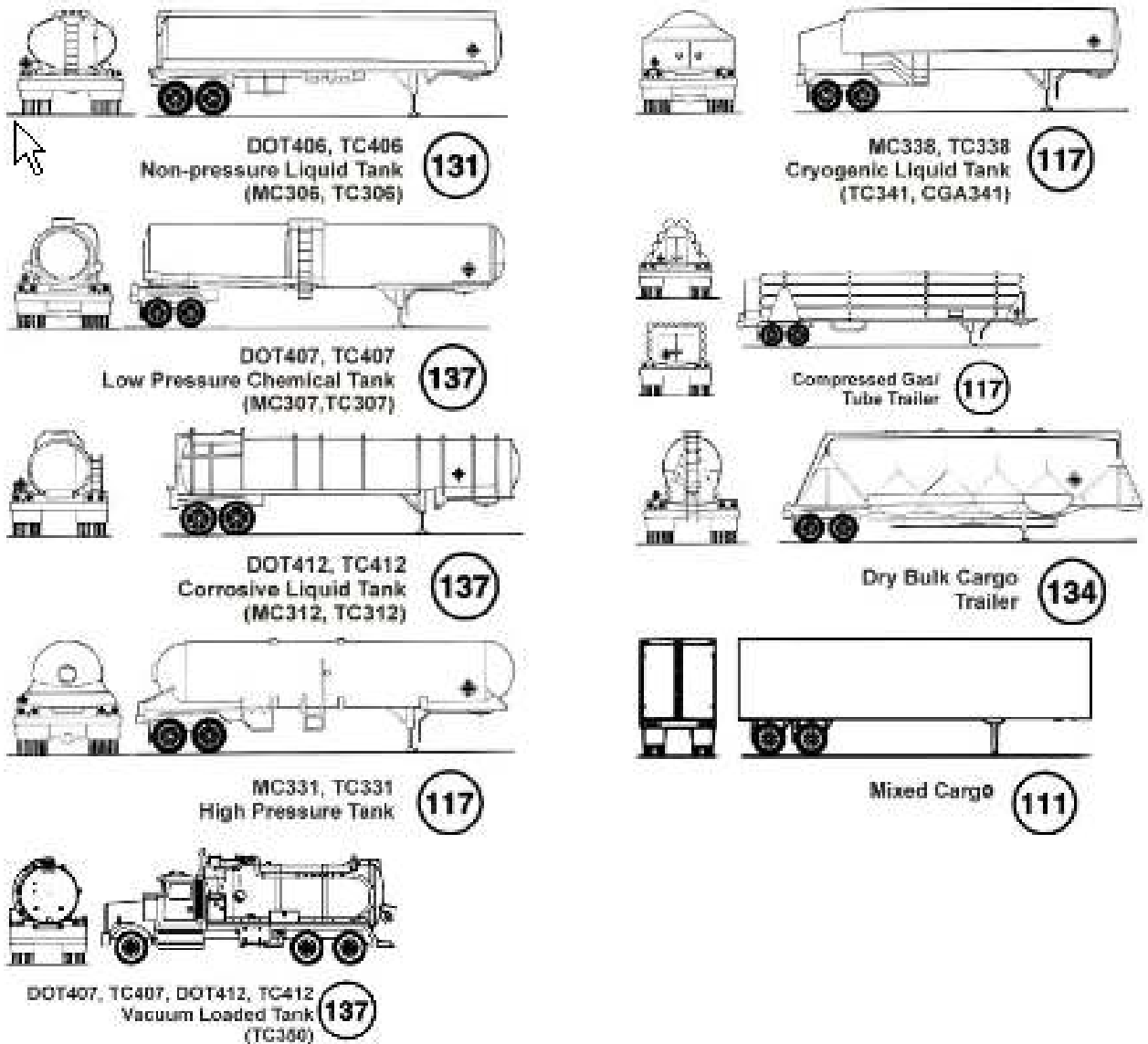
**CAUTION:** Emergency response personnel must be aware that rail tank cars vary widely in construction, fittings and purpose. Tank cars could transport products that may be solids, liquids or gases. The products may be under pressure. It is essential that products be identified by consulting shipping documents or train consist or contacting dispatch centers before emergency response is initiated.

The information stenciled on the sides or ends of tank cars, as illustrated above, may be used to identify the product utilizing:

- the commodity name shown; or
- the other information shown, especially reporting marks and car number which, when supplied to a dispatch center, will facilitate the identification of the product.

\* **The recommended guides should be considered as last resort if product cannot be identified by an other means.**

## ROAD TRAILER IDENTIFICATION CHART \*



**CAUTION:** This chart depicts only the most general shapes of road trailers. Emergency response personnel must be aware that there are many variations of road trailers, not illustrated above, that are used for shipping chemical products. The suggested guides are for the most hazardous products that may be transported in these trailer types.

**\* The recommended guides should be considered as last resort if product cannot be identified by another means.**

## Shipping Documents

Under the Transportation of Dangerous Goods Act in Canada, all hazardous goods must be accompanied by shipping documents. Shipping documents can be useful for clarifying what is labeled “dangerous” on placards or mixed loads. These documents contain vital information when responding to a hazardous materials incident. Use this information to initiate protective actions for your own safety and that of the public. The shipping document contains the proper shipping name, the hazard class or division of material, ID number, and where appropriate, the Packing group. It may also contain information on infectious substances, gross quantity, where technical information can be obtained and phone numbers to activate the ERAP (Emergency Response Assistance Plan). *Shipping documents are to be located in the cab of the transport vehicle, usually in the pocket of the driver’s door, over the visor, or on the seat beside the driver. Rail shipping papers are in the possession of a member of the train crew, usually the lead locomotive.* When in storage in the course of transportation (trailer, railcar etc stored in a compound), shipping documents must be in a waterproof container placed on the means of transport if in an unsupervised area. Documents should be found with the person in charge of the area if it is supervised.

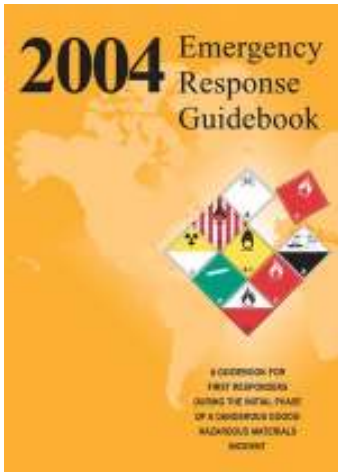
EMERGENCY CONTACT 1-000-000-0000		EXAMPLE OF EMERGENCY RESPONSE TELEPHONE NUMBER	
NO. & TYPE OF PACKAGES	DESCRIPTION OF ARTICLES	HAZARD CLASS OR DIVISION NO.	QUANTITY
1 TANK TRUCK	ISOPROPANOL	3 UN1219 II	3,000 LITERS
	SHIPPING NAME	ID NUMBER	PACKING GROUP

Figure1. Example of a shipping document.

## Resources

**Emergency Response Guidebook (ERG):** Every ambulance should have a copy of the ERG and a pair of binoculars. It is primarily a guide to aid first responders in quickly identifying the specific or generic hazards of the material(s) involved in the incident, and protecting themselves and the general public during the initial response phase of the incident.

Responders should become familiar with the ERG Guidebook before using it during an emergency. The guidebook contains colour coded contents:



1. Yellow – bordered pages: The numerical index. An index list of dangerous goods in numerical order of ID number.
2. Blue – bordered pages: The alphabetical index. An index list of dangerous goods in alphabetical order of material name.
3. Orange – bordered pages: The most important section of the book where all safety recommendations are provided. Each guide contains 3 main sections of information pertaining to potential hazards, public safety and emergency response actions, including first aid.
4. Green – bordered pages: Contains a table which lists by ID number, TIH (toxicity by inhalation) materials and provides two different types of recommended safe distances which are “initial isolation distances” and “protective action distances”. It also includes the Table of Water-Reactive materials which produce toxic gases.
5. White – pages: Provide explanations and additional information.
6. Table of Placards – Provides a guide page number when only a general placard or hazard is known.

**CANUTEC (Canadian Transport Emergency Centre):** provides 24hr emergency advisory and regulatory information service that assists emergency responders in the event of a dangerous goods accident. 0-613-996-6666 (collect) or \*666 via cellular.

## **Recognizing Hazardous Materials in a Workplace – WHMIS**

The Workplace Hazardous Materials Information System (WHMIS) regulates the storage, handling and information of hazardous materials in the workplace. All controlled products must have a supplier or workplace label which contains the product name, risks and reference to the **Material Safety Data Sheet (MSDS)**. **These products may not require a WHMIS label due to quantity exemptions.**

**MSDS (Material Safety Data Sheets)** – are supplied by the manufacturer and contain important information on health hazards, safe handling, and emergency management. These can be invaluable in an emergency as they contain much more detailed information than you would find in the ERG. For example, look at Section 3 of the Monitor MSDS located at the back of this module. Under Hazards Identification, it will tell you what signs and symptoms an accidental exposure may manifest. *“First symptoms of poison (inhalation) may be nausea, increased salivation, blurred vision, constricted pupils...if poisoning severe, low blood pressure, cardiac irregularities, loss of reflexes..”*

Under Workplace Safety and Health Regulations, MSDS must be available on site for each and every hazardous material. A minimum of 9 subjects of information must be contained on the label, but you may see more:

1. Product information
2. Hazardous ingredients
3. Physical data
4. Fire or explosion data
5. Reactivity data
6. Health hazard data
7. Preventative measures (PPE, spills, disposal, storage)
8. First aid measures
9. Preparation information



Figure 2.

## **WHMIS Classification:**

There are 6 classes of controlled products and 8 hazard symbols. These symbols are ALWAYS in a circle on the label, while TDG symbols and placards are in a diamond shape.

### **Hazard Symbols**

The WHMIS system groups hazardous materials into six classes or categories based on the type of hazard which they represent. These materials are also called controlled products. Each category has its own hazard symbol and it is important that the worker be able to recognize these.

#### **Class A - COMPRESSED GAS**



A compressed gas is a material which is a gas at normal room temperature (20° C) and pressure but is packaged as a pressured gas, dissolved gas or gas liquefied by compression or refrigeration.

The hazard from these materials, aside from their chemical nature, arises from sudden loss of integrity of the container. A compressed gas cylinder is usually quite heavy and when ruptured can become a projectile with the potential to cause significant damage.

*Acetylene and oxygen are examples of compressed gases.*

#### **Class B - FLAMMABLE AND COMBUSTIBLE MATERIAL**



Flammable or combustible materials will ignite and continue to burn if exposed to a flame or source of ignition.

Materials are classified as a flammable gas, flammable aerosol, flammable liquid, combustible liquid, flammable solid or reactive flammable material.

*Methane, acetone, gasoline, and lithium hydride are examples of flammable materials.*

#### **Class C - OXIDIZING MATERIAL**



An oxidizing material may or may not burn itself, but will release oxygen or another oxidizing substance, and thereby causes or contributes to the combustion of another material.

*Ozone, chlorine, and nitrogen dioxide are oxidizing materials. These chemicals will support a fire and are highly reactive.*

## **Class D - POISONOUS AND INFECTIOUS MATERIAL**

### **D1- Materials Causing Immediate and Serious Toxic Effects**



These materials may be classified as toxic or very toxic based on information such as Lethal Dose (injected) or Lethal Concentration (inhaled).

*Examples: Styrene, hydrogen cyanide are very toxic substances.*

### **Class D2 - Materials Causing Other Toxic Effects**



A pure substance or mixture that may be any one of the following: a carcinogen, teratogen, reproductive toxin, respiratory tract sensitizer, irritant or chronic toxic hazard.

*Examples: Asbestos causes cancer, ammonia is an irritant.*

### **Class D3 - Biohazardous Infectious Material**



This classification includes any organisms and the toxins produced by these organisms that have been shown to cause disease or are believed to cause disease in either humans or animals.

*For example, a blood sample containing the Hepatitis B virus is a biohazardous infectious material. It may cause hepatitis in persons exposed to it.*

## **Class E - CORROSIVE MATERIAL**



Corrosive materials can attack (corrode) metals or cause permanent damage to human tissues such as the skin and eyes on contact. Burning, scarring, and blindness may result from skin or eye contact.

Corrosive materials may also cause metal containers or structural materials to become weak and eventually to leak or collapse.

*Sulfuric acid, hydrochloric acid and caustic soda are examples of corrosive substances.*

## **Class F - DANGEROUSLY REACTIVE MATERIAL**



Dangerously reactive materials may undergo vigorous polymerization, decomposition or condensation. They may react violently under conditions of shock or an increase in pressure or temperature. They may also react vigorously with water to release a toxic gas.

*Hydrazine, and benzoyl peroxide are examples of dangerously reactive materials.*

Note: Although required by law, TDG and WHMIS regulations may not always be followed and some workplaces are exempt. I.E. Farms

Other sources of information on hazardous materials in the workplace include the local Poison Control Centre, Emergency Response Guidebook

## **EMS Response to a Hazardous Materials Incident**

Many HazMat incidents are dispatched as traffic accidents, poisonings, or unknown problem calls. Your initial actions build the crucial groundwork for the remainder of the incident. Your specific responsibilities include the following:

1. Identifying the emergency as a hazardous incident
2. Establishing command and control zones
3. Identifying the hazardous materials
4. Establishing a medical treatment sector

**As always, your first priority is your own safety.** If the scene is dangerous, EMS personnel should immediately leave the scene and relocate to a position of safety. Never attempt a hazardous materials rescue unless you are properly trained and equipped. If you have no training, radio immediately for help. While you are waiting, protect yourself and the bystanders by keeping away from the danger (stay upwind and uphill). Avoid contact with any unidentified material, regardless of the level of protection offered by your clothing or equipment. If the scene is not safe, EMS crew should retreat and not enter the scene until it has been made safe by trained personnel. Consider use of your ambulance PA (bull horn) as a method to alert bystanders to keep back.

*The desire to help patients should take second priority to the need for EMS personnel to assure their own personal safety. Often several would be rescuers have perished in attempts to rescue someone who had already died as a result of their exposure to a hazardous environment.*

### **Scene Assessment**

Always consider the possibility of a HazMat incident. For example, if you are called to an unknown emergency, ask yourself: Is the call to the location of a previous hazmat incident? Is there an emergency plan for the location? These might indicate that a risk exists. Use all the pre-arrival information available to you to decide on the best course of action. If a HazMat incident is suspected, approach the scene from the upwind side.

As you approach the scene, use binoculars to begin to assess the scene. Identify any placards on vehicles, buildings, or containers. Proceed with caution. Too many paramedics discover a HazMat incident only after they are in the middle of it. Use all your senses, coupled with a high index of suspicion. A number of visual clues can indicate a possible hazardous material:

- Smoking or self-igniting materials
- Extraordinary fire conditions, strange colored flames or smoke
- Boiling or spattering of materials that have not been heated
- Wavy or unusual vapours over a container of liquid material
- Coloured vapour clouds
- Frost near a container leak (may indicate a liquid coolant)

- Unusual condition of containers (peeling or discoloration of finishes, unexpected deterioration, deformity, or unexpected operation of pressure-relief valves).
- Unusual signs and symptoms exhibited in your patients

Remember, you may not be able to see or smell a hazardous material. Some are odourless and colourless. Others have properties that can deaden your senses. Always assume that the area surrounding a spill or leak is dangerous.

### **Safety Precautions**

The potential injury from exposure to hazardous materials is related to the toxicity, flammability, and reactivity of a particular substance. Approach cautiously from upwind and uphill. Resist the urge to rush in, as others cannot be helped until the situation has been fully assessed. If hazardous materials are present, EMS personnel must not enter the scene unless they are trained and have taken all precautionary measures including appropriate respiratory equipment and all other PPE.

### **Secure the Scene**

Without entering the immediate hazard area, isolate the area and assure the safety of any bystanders. Keep people away from the scene and outside the safety perimeter. Having a plan in place as to how best to accomplish this task can be valuable. It is possible that two EMS personnel could be needed to control a large area until more help arrives. How will your department accomplish this task?

### **Identify the Hazards**

Placards, container labels, shipping documents, material safety data sheets and/or knowledgeable persons on the scene are valuable information sources. Evaluate all available information and consult the recommended guide to reduce risks. Contact CANUTEC (613-996-6666) as soon as possible. In addition to information found in the ERG, they can provide more detailed response objectives.

Assess The Situation: Consider the following:

- Is there a fire, spill or leak?
- What are the weather conditions like?
- What is the terrain like?
- Who/what is at risk: people, property or the environment?
- What actions should be taken: Is evacuation necessary?
- What can be done immediately?

### **Obtain Help**

Notify responsible agencies and call for assistance from qualified personnel i.e. fire, police, HazMat etc.

### **Respond**

Respond in an appropriate manner. The first duty is to consider the safety of the people in the immediate area, including your own. Establish a command post and lines of communication. Once properly trained personnel with appropriate personal protective equipment have established that it is safe for them to do so casualties will be rescued. At all times, a safety perimeter should be established which clearly identifies an exclusion zone. Only properly trained emergency responders in appropriate personal protective equipment should be allowed in the hot zone.

Always keep in mind that anyone who was exposed to the hazardous materials is considered contaminated, until proven otherwise. This includes members of the civilian population, as well as responders. These people may require thorough decontamination.

### **Above All**

Do not walk into or touch spilled material. Avoid inhalation of fumes, smoke and vapors, even if no dangerous goods are known to be involved. Do not assume that gases or vapors are harmless because of lack of a smell – odorless gases or vapors may be harmful.

### **Scene Control**

The first agency on the scene has several responsibilities. These include: detecting and identifying the materials involved, assessing the risk of exposure to rescue personnel and others, considering the potential for fire or explosion, gathering information from on site personnel or other sources and confining and controlling the incident. In addition, a command post should be established and safety distances and zones defined.

### **Safety Zones**

Once the presence of hazardous materials has been identified, the scene should be separated into hot, warm, and cold zones.

**The hot zone or exclusion zone:** is the area that includes the hazardous material and any surrounding area that may be exposed to gasses, vapours, mist, dust or run-off. All rescue personnel and vehicles should be stationed outside this zone. The only people allowed in the exclusion zone are properly trained, properly attired response personnel (in appropriate personal protective equipment – PPE – based on the products involved). Removal of the victims from this zone is done in an expedient manner. Rapid extraction is performed to begin the decontamination process. Patient care in this zone is usually counterproductive, because the patient is still exposed to the product(s) that made them ill in the first place. Any invasive procedures, such as intubation or IV starts, and procedures such as insertion of OPA's / NPA's, or using a BVM may actually cause the hazardous materials to enter the patient's body more rapidly. The decision to perform patient care in the Hot Zone must be evaluated carefully to determine if even minimal care within the hot zone, prior to removal of contaminants, will cause more harm than good.

**The warm zone:** is a larger buffer area that surrounds the hot zone with hot and cold end corridors. PPE is still required; however it is usually considered a safer environment for workers. When responders leave the hot zone, they are decontaminated in the warm zone, thus spreading contamination into this area. In the warm zone most EMS activities are conducted including decontamination and patient care procedures. Of course the EMS personnel must be properly equipped in the required PPE.

**The cold zone:** is the area that surrounds the warm zone. It is restricted to responders, but is usually considered safe, requiring only minimal protective clothing. It includes the command post, equipment and response personnel staging area, treatment area, transportation staging area, rehab area for responders. All responders at the incident – EMS as well as police, hazmat, firefighters – would be staging from this area. Further patient triaging and treatment takes place in this area, prior to transportation to a health care facility.

Only individuals trained in HazMat and wearing the proper PPE should enter the warm and hot zones.

Since patient's skin and clothing may contain hazardous material, a decontamination area should be set up in the warm zone. Decontamination is the process of removing and properly disposing of hazardous materials from equipment, patients and rescue personnel. Anyone leaving the hot zone must pass through the decontamination area. Fire-fighters and HazMat team members should ensure outer gear is rinsed or washed in the decontamination area before it is removed.

### **Patient Care at a HazMat Incident**

Patient care at a HazMat incident should address the following issues:

- Trauma as a result of other related mechanisms such as vehicle collision, fire or explosion.
- Injury and harm resulting from exposure to the toxic hazardous substance.

Treat the patient's injuries as you would any other injury. There are very few specific antidotes or treatments for exposure to most hazardous materials. As different people may respond differently to the same hazardous materials, therefore your focus should be on supportive care and efficient transport to the hospital. Treatment is based on the specific hazardous material involved. CANUTEC, Poison Control, MDS sheets and subject matter experts / reference texts will provide specific information based on the material involved. Treatment may vary based on information provided and all resources should be contacted during an incident to ascertain which treatment – at the scene, enroute in the ambulance, and at the receiving facility – would be most beneficial to the patient(s).

Most serious injuries and deaths from hazardous materials result from airway and breathing problems. Therefore, be sure to maintain patient airway and administer oxygen

at 10-15L/min with a non rebreathe mask if the patient appears to be in distress. Be prepared to assist with ventilations if indicated by increased respiratory distress.

If time required for full decontamination should prove fatal and rapid transport is required, ensure the PPE is increased as appropriate. At least this should include chemical compatible gloves, goggles or face shield, chemical protective coveralls and respiratory protection. The decision to transport this type of patient rests with the incident commander, who will base his or her decision on recommendations made by the HazMat team. The contaminant should not be spread to a hospital or receiving facility. Notify the facility as soon as possible to allow them to prepare to receive the patient.

To decontaminate the ambulance and equipment, refer to infection control guidelines and subject matter experts.

### **Medical Monitoring of EMS Personnel**

Situations involving hazardous materials are amongst the most dangerous and therefore a medical monitoring program should be part of any EMS/HazMat system. Medical examinations are required for members of a HazMat response team and employees who may have been exposed to hazardous substances. Other components of a Hazmat medical monitoring program may include required medical care, medical monitoring during a hazardous materials incident, record keeping and periodic evaluation of the surveillance program.



Medical monitoring should include assessment protocols that involve a “pre-entry / post entry” examination to establish health history and a vital sign baseline for any rescuer who will be exposed to a hazardous substance. This should include:

- Temperature, pulse, respiration and blood pressure measurements
- Cardiac rhythm
- Body weight
- Cognitive and motor skills
- Hydration

Individuals should also be advised of expected symptoms of illness or exposure before entry. These symptoms can be found on MSDS, in reference textbooks or by talking with subject matter experts.

Remember that emergency responders working in protective clothing and equipment are susceptible to heat illness and dehydration. Most PPE prevents cooling through evaporation, conduction, convection or radiation. Heat stress factors are affected by the

dehydration of the rescuer, degree of physical fitness, ambient air temperature, and the degree and duration of physical activity.

## **Documentation**

Documentation is a necessary component of Hazmat medical monitoring and rehabilitation operations. At a minimum, documentation should include the following:

- The hazardous substance
- The toxicity and danger of secondary contamination
- Use of PPE and any breakthrough that may have occurred
- The level of decontamination performed or required
- Medical treatment or use of anti-dotes
- The method of transportation and destination

## **Incident Management Systems**

At a hazmat incident or mass casualty incident, EMS, fire, HazMat, and police from many different areas may all be involved in some way. Clear lines of responsibility and authority must be ensured. This is accomplished through a pre-established system that identifies who is in charge and who reports to whom. Major incidents often require a command post, the designated field command centre. The officer in charge of all fire, the officer in charge of all HazMat, all EMS and all law enforcement operations is under the direction of an *incident commander*. In addition to unified command, this system ensures that the actions and skill of each different type of responder are properly coordinated. The following link will take you to the Manitoba Emergency Services free online Incident Command System 100 program. The program takes 1 to 2 hours to complete and covers the system widely used in MB. [http://www.firecomm.gov.mb.ca/mesc\\_student\\_precourse\\_ics.html](http://www.firecomm.gov.mb.ca/mesc_student_precourse_ics.html)

### **Incident Management systems may be structured as follows:**

Extrication Sector - for disentangling and removing patients from the scene

Triage Sector – for establishing treatment and transport priorities

Treatment Sector – where more thorough assessments are made and on scene treatment is begun while transport is being arranged

Transportation Sector – where ambulance and crews are organized

Staging Sector – holding area for ambulances and crews until they can be assigned a particular task

Supply Sector – an area in which to assemble extra equipment and supplies

Mobile Command Centre – usually a vehicle or building on scene where the EMS commander establishes an office.

If you arrive on a scene after command has been established, advise the dispatcher that you are on scene and “reporting to command”. Find the command post and report for assignment. You may be assigned to a sector and a sector officer. When you have completed your assigned task, report back to that same sector officer for another assignment.

The success of any incident management system depends on all personnel performing their assigned tasks and working within the system. Always remember that the “cost of doing your own thing” may include the loss of lives.

## **Multiple Casualty Incidents**

A mass casualty event is a situation where the demand on available equipment and personnel resources is so great that the system is stretched to its limit and beyond. Obvious examples would be an airplane crash or severe tornado in a residential area. However, incidents involving 2 or more patients should be managed by triaging the patient’s condition and matching their needs with the available resources.

When responding to any emergency, ask yourself the following questions:

- How many seriously injured patients can you effectively care for and transport in your ambulance? One? Two?
- If the ambulance can carry two patients, do you have the appropriately trained personnel to managed two seriously injured patients?
- What happens if you have three patients to deal with?
- What do you do when two vehicles, each carrying 4 passengers, crash head on at highway speed?

At any call involving more than one patient, you cannot just start at the nearest patient, assessing and treating each patient in turn. A more rapid method must be used to focus on the patients who have the greatest need. This method is called triage.

## KEY COMPONENTS OF MASS CASUALTY INCIDENT

- Incident commander, command post and incident management system
- On site communications system
- Adequate supply of long back boards, straps or ties
- Extrication / retrieval group
- Triage officer and designated triage centre
- Staffed patient collection and treatment area
- Supply location adjacent to the treatment area
- Transport officer, transport area, and transport crew
- Staging area to hold resources until they are needed
- Fire and law enforcement personnel
- Secure perimeter

### **Triage**

Triage is a French word that means “sorting.” Triage is the determination of priority treatment for multiple casualties through medical screening and sorting. This sorting or process of classifying results in patients being placed into one of three general priority categories:



**RED** – High Priority:

- casualties who need immediate treatment and transport in order to survive

**YELLOW** – Intermediate Priority:

- those who will most likely survive but whose treatment and transportation can be temporarily delayed

**GREEN** – Low Priority

- casualties who require little or no treatment or whose treatment and transportation can be delayed until last

**BLACK** – Lowest Priority

- Casualties not expected to survive even with treatment and those whose vital signs are absent. If resources are limited, treat salvageable patients before these patients

In mass casualty triage two factors determine priority:

1. Urgency
2. Potential for survival

A rapid system for field triage in mass casualty settings is included in Table 1.

*Table 1*

<b>Basic Triage Principles</b>	
<b>RED Highest Priority</b>	<b>YELLOW Intermediate Priority</b>
<ul style="list-style-type: none"> <li>• Airway and breathing difficulties</li> <li>• Shock</li> <li>• Uncontrolled or suspected severe bleeding</li> <li>• Open chest or abdominal wounds</li> <li>• Any pneumothorax</li> <li>• Severe head injuries or head injuries with decreasing levels of consciousness</li> <li>• Severe medical problems, such as: poisoning, diabetes with complications, and cardiac emergencies, etc</li> </ul>	<ul style="list-style-type: none"> <li>• Burns without complications</li> <li>• Major open or multiple fractures</li> <li>• Back injuries with or without spinal cord damage</li> <li>• Eye injuries</li> <li>• Stable abdominal injuries</li> </ul>
<b>GREEN Low Priority</b>	<b>BLACK Lowest Priority</b>
<ul style="list-style-type: none"> <li>• Fractures, sprains or strains, lacerations, soft tissue injuries or other injuries of a minor nature</li> <li>• Psychological problems</li> <li>• No injuries</li> </ul>	<ul style="list-style-type: none"> <li>• Obvious mortal (devastating) wounds where death appears reasonably certain (if sufficient personnel are not available to care for numerous other patients.</li> <li>• Obvious death</li> <li>• Cardiac arrest (if sufficient personnel are not available to care for numerous other patients)</li> </ul>

This list gives examples of some of the triage sorting that should occur. This process will be affected by the ability and qualifications of response personnel, resources on scene and the proximity of definitive care facilities.



Triage tags

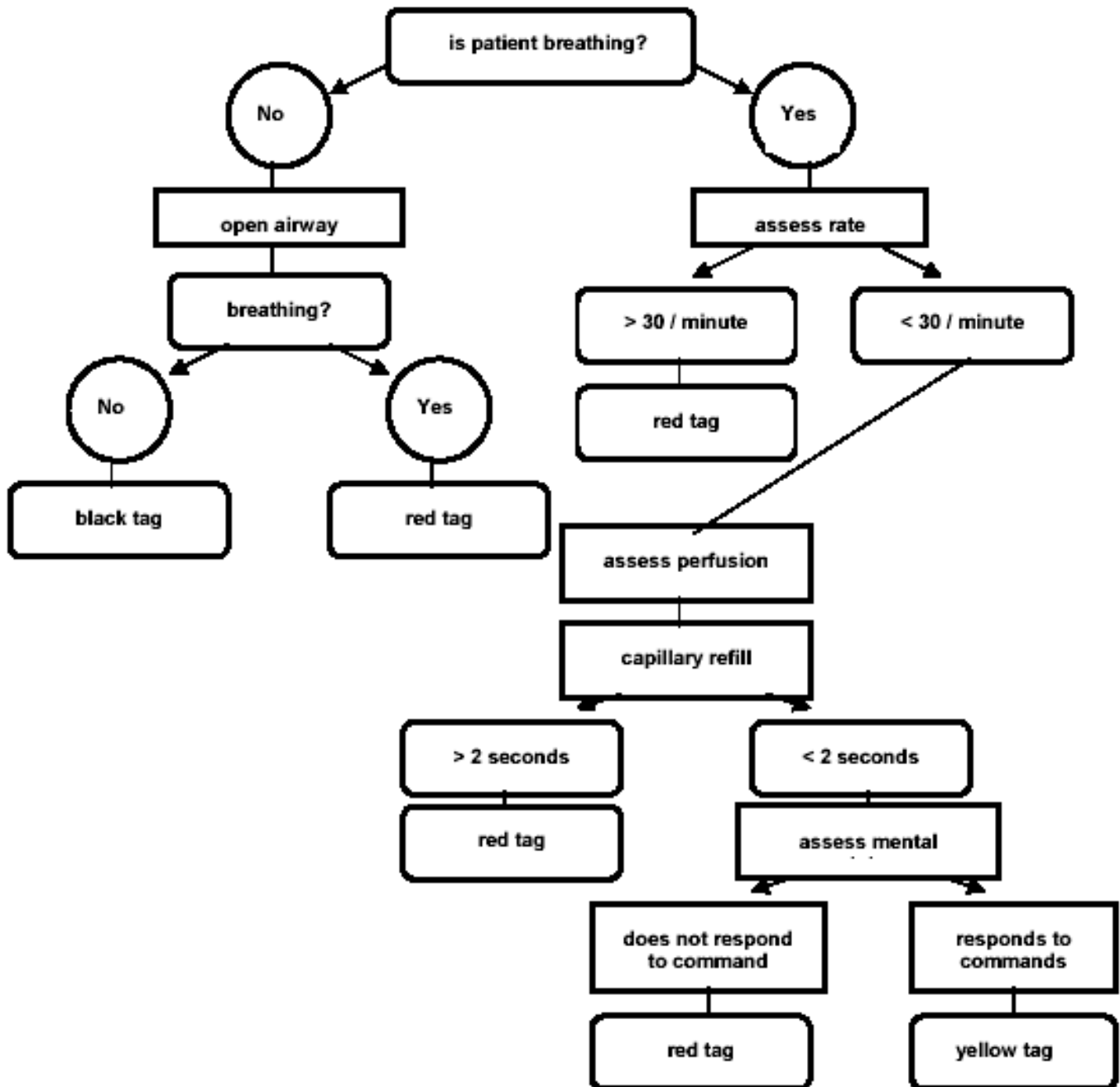


Triage tape

**Table 2. S.T.A.R.T. for Mass Casualty Settings.  
General Practices:**

S.T.A.R.T. refers to simple triage and rapid treatment

→ it is designed for rapid assessment and categorization of a multiple patients in minimal time



Triage should begin as part of the initial scene assessment. One of the senior responding EMS personnel should be in charge of the medical response and establish and remain in contact with the incident commander. This person must assume control to oversee priority of patient treatment and transport as well as delegation of equipment and resources. This person must remain in charge until relieved by a suitably qualified individual. Initial triage must be conducted rapidly and carefully ensuring no patients are missed.

### ***Triage Procedures***

1. A safety perimeter must be established.
2. Personal protective equipment and body substance isolation techniques should be utilized as appropriate.
3. All providers and bystanders should be protected from hazards as appropriate.
4. Number and type of casualties should be estimated and the information forwarded to the dispatch centre as well as designated site commander.
5. Receiving health care facilities should be notified as to the numbers of patients and estimated severity of injuries. Communication with health care facilities, other ambulance units, rescue vehicles, and other responding agencies is paramount to the successful management of a mass casualty situation. Inability to communicate effectively with responding agencies and facilities is the most common problem in managing a mass casualty situation.
6. Call for additional assistance as required and initiate disaster protocol, if the situation meets the established criteria.
7. The total number of casualties should be assessed and reassessed regularly.
8. All patients should be moved through a central triage area (table 3). The triage officer should be an experienced EMS professional with prior training for this task. The triage officer must perform a rapid assessment, no more than 30 seconds long, and decide in which of the four triage categories the patient belongs. A decision to move or centralize patients prior to triage and treatment will depend on distribution of patients at the site, scene assessment and safety, and available resources.
9. Initial survey should occur on all patients including rapid assessment (ABC's); open the airway for unconscious patients and give two ventilations if necessary. Tag all patients using triage tags.

10. Initial treatment and stabilization should occur prior to patients being moved unless resources do not permit this.
11. After initial triage, move patients into treatment areas broken down to smaller workable groups by category. Correct immediate life threatening conditions and conduct a secondary survey on all patients. Remember that triage is a dynamic, ongoing process. Each patient's condition must be routinely evaluated on the basis of the following considerations:
  - Is the patient improving? Can he/she be moved to a lower level of care?
  - Is the patient deteriorating? Does he/she need more immediate transport?

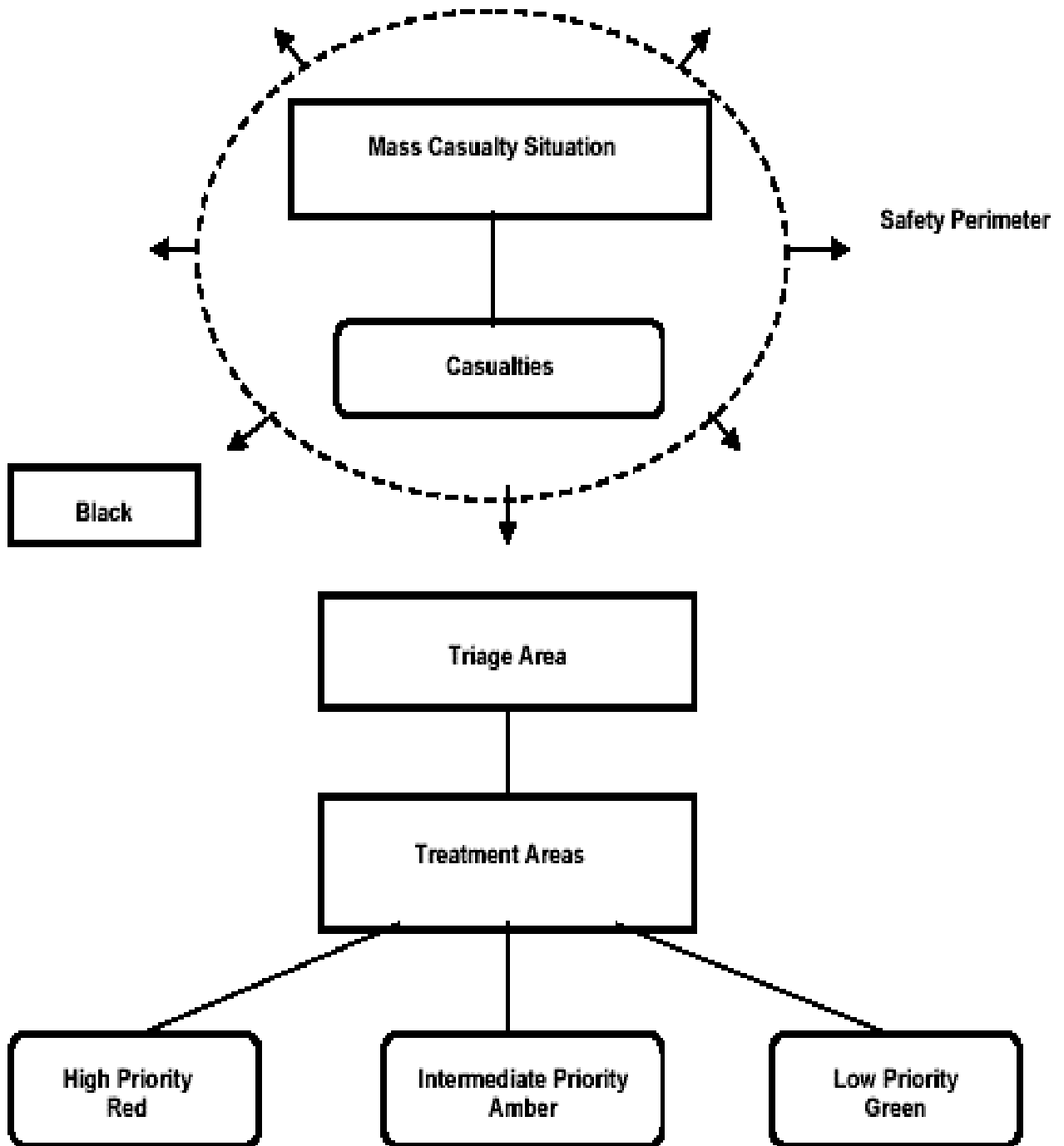
For example, a patient may be assigned high priority (red) due to severe external bleeding. However, once the bleeding is controlled, the patients triage priority may change.

12. Efforts at the treatment centre will be focused on red tagged patients followed by yellow tagged patients. The treatment officer, who should be experienced in the stabilization of trauma patients, directs EMS personnel providing assessment and treatment. The treatment officer should determine which patients of the same colour tag should be transported next.

These patients should then be moved nearest the transport area where the transport officer directs the loading of patients into the ambulances and instructs the driver as to what hospital the patient is to be taken.

13. Treatment and triage continue until all patients have been treated and transported.
14. In a mass casualty situation, prolonged effort in assessing and treating patients in the low / lowest priority group is inappropriate if it delays the assessment and treatment of the remaining patients. This delay may result in unnecessary deterioration or death of a patient who might otherwise have been saved through basic interventions. If additional resources become available, low priority patients should be reassessed and treated as appropriate.
15. Implementation of local critical incident stress protocols should be considered early in the incident.
16. A morgue for the dead should be established in a different location from the triage and treatment areas.

Table 3. Casualty Flow Chart



EMS personnel are responsible for being familiar with

- Disaster plans for their service, community and region
- Communication procedures
- Criteria for activating different levels of response
- Their roles and responsibilities in a mass casualty incident

## **Critical Incident Stress Management**

Critical Incident Stress is a potential hazard for rescue personnel who are exposed to major events. Critical Incident Stress Debriefings should be part of post disaster standard operating procedures. Basic services that should be made available are:

- On-scene support for obviously distressed personnel
- Defusing services immediately after a large scale incident
- Critical incident stress debriefing 24 – 72 hours after an event for emergency personnel involved in a stressful incident.
- Follow-up services to ensure that people are recovering.

Other approaches that help to manage stress include employee assistance programs, counselling, spouse support, family life programs, pastoral services and periodic stress evaluations.

In Manitoba the Office of the Fire Commissioner organizes the delivery of Critical Incident Stress debriefings.

## **References**

Emergency Care and Transportation of the Sick and Injured, Seventh Edition, Bruce D. Browner, MD, FAAOS; Lenworth M. Jacobs, MD, MPH, FACS; Andrew N. Pollak, MD, EMT-P, FAAOS, AAOS, Jones and Bartlett Publishers 1999

“Mosby’s Paramedic Textbook”, Second edition, Mick J. Saunders, Mosby Inc. c 2000

Office of the Fire Commissioner, Hazardous Materials Technician Team

Paramedic Emergency Care, 3rd Edition, Brady, Prentice Hall Inc., 1997

Transport Canada, [www.tc.gc.ca](http://www.tc.gc.ca)

“Triage, Emergency Treatment Guidelines”, Manitoba Health Emergency Services, August 2002.

“Scene Assessment, Emergency Treatment Guidelines”, Manitoba Health Emergency Services, August 2002.

University of Toronto Caretaking Services Employee Safety Handbook  
Facilities and Services ~ Office of Environmental Health and Safety

The University of Winnipeg WHMIS Information,  
[www.uwinnipeg.ca/web/faculty/admin/hr/safety/whmis.htm](http://www.uwinnipeg.ca/web/faculty/admin/hr/safety/whmis.htm)

Shirley Dufresne, Marc Watt and David Lind