Fire Inspector I

CHAPTER TWELVE

ENSURING PROPER STORAGE HANDLING PRACTICES

Part 1

Slide 1	Welcome to part one of Chapter 12, Part 1 Ensuring Proper Storage and Handling Practices. In this Part we will discuss: • The classification of flammable and combustible liquids • The classifications of flammable and combustible gasses • The classifications of hazardous materials • The labelling system for hazardous materials including flammable and combustible liquids and gasses • The storage and handle or hazardous materials, including flammable and combustible liquids and gasses • How to ensure that hazardous materials are stored, handled, and used in accordance with all applicable codes, standards, and policies. • Describe the fire protection systems and equipment that are appropriate for use with hazardous materials
Slide 2	More and more hazards have become commonplace in many occupancies, especially in small quantities. Today it is common to find flammable liquids such as gasoline, and flammable gases such as propane, in use in many occupancies normally considered low hazard. These may include retail outlets, small maintenance, and repair shops, and even storage sheds. Also, many industrial facilities utilize flammable and combustible liquids and gases, as part of their everyday operations. It is important that fire inspectors understand the hazards associated with flammable and combustible liquids and flammable gases. It is also important to be able to recognize the presence of other hazardous materials and know where to find the relevant information regarding the hazards of the material and the required safeguards.
Slide 3	The classification of flammable and combustible liquids can be found in Part 4 of the National and Provincial Fire Codes as well as in *NFPA 30, Flammable and Combustible Liquids Code.* The classification system is primarily based on the flash point of the liquid which is the minimum temperature at which sufficient vapours are given off to form an ignitable mixture with air. Flammable liquids have a flash point below 37.8 degrees C or 100 degrees F. Combustible liquids have a flashpoint above 37.8 degrees C or 100 degrees F. The fire code identifies three classes of liquids as class 1, 2 and 3. Flammable liquids are Class 1 while combustible liquids are class 2 or class 3. Class 1 liquids are the most hazardous from a fire safety standpoint due to their readily ignitable nature.
Slide 4	Class 1 liquids include all flammable liquids, including acetone, alcohols, ethanol, gasoline, and toluene. Class 1 liquids are subdivided into three

	subgroups Class 1A, 1B and 1C. Class 1A liquids-includes flammable liquids with flashpoints below 22.8 C (73F) and with boiling points below 37.8C or (100F). Typical Class IA liquids include ethylene oxide, methyl chloride, and pentane. These products are highly volatile due to their low boiling points and are often used in chemical manufacturing processes to produce other materials. Pentane for example is used in the manufacturing of polystyrene which is an insulation product or the common cup.
Slide 5	Class 1B liquids-include flammable liquids with flashpoints below 22.8C, and with boiling points at or above 100F (37.8C). One of the more common classifications of flammable liquids, this range includes such chemicals as acetone, benzene, ethanol, gasoline, isopropyl alcohol, and toluene. Chemicals in this classification are commonly used as liquid fuels and as cleaning and degreasing agents. Class 1C liquids-include flammable liquids with flashpoints above 22.8C and below 37.8C. Ethyl alcohol in solution with water (20 to 50 percent mixture), nitromethane, and turpentine are examples of Class 1C flammable liquids. Nitromethane or Nitro as it is more commonly known, is a polar liquid commonly used as a solvent in a variety of industrial applications such as in extractions, as a reaction medium, and as a cleaning solvent. It is also used as a fuel in auto racing. The Nitro product shown in this photo is for sale online but comes with this disclaimer.
Slide 6	Class 2 and Class 3 liquids include all combustible liquids. Combustible liquids are liquids with flashpoints at or above 37.8C or 100 degrees f. Class 2 liquids-includes combustible liquids that have flashpoints at or above 37.8 degrees C or 100F and below 60 degrees C or 140 degrees F. Examples of Class 2 liquids include diesel fuel, mineral spirits, and Stoddard solvent. Stoddard solvent, or more commonly known as Varsol, is a widely used, petroleum based, organic solvent that is often referred to as dry cleaning safety solvent. It is used as paint thinner, a solvent in some types of photocopier toners, in some printing inks, as a dry-cleaning solvent, and as a general cleaner and degreaser.
Slide 7	Class 3 liquids are divided into two subgroups, 3A and 3B. Class 3A liquids-include combustible liquids that have flashpoints at or above 60c (140F) and below 93c or 200F. Heavier combustible liquids in this classification include creosote oil and kerosene which may be found in wood preservative operations or as a fuel source in various types of occupancies.
Slide 8	Class 3B liquids-include combustible liquids that have flashpoints at or above 93C or 200F. Class 3B liquids include hydrocarbons and oils such as

	asphalt, coconut oil, glycerin, linseed oil, peanut oil, propylene glycol, and paraffin wax. These items are generally stable and considered non-hazardous at normal temperatures and pressures and are used in a variety of construction, lubrication, antifreeze, or food processes in a wide variety of occupancies. In addition to the material presented here some frequently asked questions about flammable and combustible liquids can be found in the additional resources section of this Chapter.
Slide 9	We are now ready to take a look at gases which are classified by NFPA 55, Compressed Gases & Cryogenic Fluids Code as presenting either a physical or health hazard. Canadian fire codes mainly deal with the storage of cylinders of dangerous goods classified as compressed gases. It is expected that gas installations that are not covered in the Canadian fire codes will conform to good engineering practice, such as that described in NFPA 55. Gases classified as creating a physical hazard are those that, when subjected to changes in their safe storage environment, become extremely unstable and burn, explode, or react rapidly and violently with combustible materials. Changes in temperature, pressure, mechanical shock, or exposure to an ignition source can generate a reaction that will cause great physical damage. References: NFPA 55-2016 NFC A-3.1.1.4. NFCA-5.5.5.3.(5)(b) and (7)(b)
Slide 10	Pyrophoric gases are flammable gases that spontaneously ignite in air. Examples of pyrophoric gases include silane and phosphine. Storage of pyrophoric gases is a special concern because these gases do not require a source of ignition to burn. Pyrophoric gases are not used widely and are most likely to be found in semiconductor manufacturing facilities. Exposure to air or moisture can cause these materials to burn and create flammable or corrosive by-products. Since they are typically packaged and stored under an inert atmosphere, under oil, or within a solvent, appropriate methods must be utilized to preserve the material during storage and while dispensing.
Slide 11	The normal oxygen content in air is 21 percent. At slightly higher oxygen concentrations, for example 25 percent, combustible materials ignite more readily and burn much faster. Fires in atmospheres enriched with oxidizing gases are very hard to extinguish and can spread rapidly. Oxidizing gases include any gases containing oxygen at higher than atmospheric concentrations above 23 to 25 percent such as, nitrogen

	oxides, and halogen gases such as chlorine and fluorine. These gases can react rapidly and violently with combustible materials such as: • Organic (carbon-containing) substances such as most flammable gases, flammable and combustible liquids, oils, greases, many plastics and fabers • Finely divided metals • Other oxidizable substances such as hydrogen, sulphur or sulphur compounds, silicon and ammonia or ammonia compounds. Fires or explosions can result.
Slide 12	Flammable gases come in a wide variety, but they all have one thing in common. They will burn when they are mixed with air or oxygen in the right proportions. Examples of flammable gases are propane, hydrogen, butane, methane, ethylene, acetylene, ammonia, ethane, and silane. Every flammable gas has a lower and upper flammable limit or LEL and UEL. Mixtures of flammable gas and air will ignite only within this range and when an ignition source is provided. Flammable gases are often shipped and stored in a liquid state and a flammable gas exists at a temperature that not only exceeds its flashpoint, but usually well above it. Because of this, flammable gases can always ignite.
Slide 13	Unstable reactive gases are gases that will undergo violent changes when subjected to shock or changes in temperature or pressure. NFPA 55 identifies four classes of unstable reactive gases. Class 1 gases are those that are normally stable but will become unstable with increases in temperature and pressure. Class 2 gases will undergo violent changes at higher temperature and pressures. Class 3 gases are those that could detonate or explode on their own but need a strong initiating source or to be heated when confined. Class 4 gases are those that can detonate or explode at normal temperatures and pressures.
Slide 14	Some compressed gases are chemically unstable. If exposed to slight temperature or pressure increases, or mechanical shock, they can readily undergo chemical reactions such as polymerization or decomposition. These reactions may become violent, resulting in fire or explosion. Some dangerously reactive gases have other chemicals, called inhibitors, added to prevent these hazardous reactions. Common dangerously reactive gases are acetylene, 1.3 butadiene, methyl acetylene, vinyl chloride, tetrafluoroethylene, and vinyl fluoride.
Slide 15	Now we will look at the health hazards classifications associated with various gases. Gases classified as creating a health hazard are those that, if released into the atmosphere and a person is exposed to them, could

	result in irritation, burns, asphyxiation, and destruction of tissue. We will discuss three classifications in this category: • Toxic or highly toxic gases • Cryogenic gases, and • Corrosive gases Many compressed gases are toxic or highly toxic. They could cause various health problems depending on the specific gas, its concentration, the length of exposure and the route of exposure, inhalation, eye, or skin contact. Contact between the skin or eye and liquefied gases can freeze the tissue and result in a burn-like injury.
Slide 16	Some gases can present a serious life hazard if they are released into the atmosphere. Toxic gases are poisonous or cause irritation when inhaled, include chlorine, hydrogen sulfide, sulfur dioxide, ammonia, carbon monoxide and arsine. Toxic gases have a lethal concentration in air between 200 and 2,000 ppm by volume of gas or vapour, or between 2 and 20 mg/l of dust, fume, or mist. Highly toxic gases have a lethal concentration in air of 200 ppm or less by volume of gas or vapour or 2 mg/l or less of dust, fume, or mist. Toxic and Highly Toxic gases are found in a wide range of industries and are labeled “poison gas” for shipment.
Slide 17	Cryogenic liquids are liquefied gases that are kept in their liquid state at extremely low temperatures. The word "cryogenic" means "producing, or related to, low temperatures," and all cryogenic liquids are extremely cold. Cryogenic liquids have boiling points below -150°C (- 238°F). All cryogenic liquids are gases at normal temperatures and pressures. All cryogenic liquids have two properties in common: they are extremely cold, and upon release small amounts of liquid expand into large volumes of gas. The vapours and gases released from cryogenic liquids also remain very cold. They often condense the moisture in air, creating a highly visible fog. In poorly insulated containers, some cryogenic liquids condense the surrounding air, forming a liquid air mixture. Cryogenic liquids are classified as "compressed gases" according to WHMIS 1988 criteria. Details of these criteria can be found in the Controlled Products Regulations.
Slide 18	Some compressed gases are corrosive. They can burn and destroy body tissues on contact. Corrosive gases can also attack and corrode metals. They begin to cause irreversible damage as soon as they touch the skin, eyes, respiratory tract, digestive tract, or the metal.

	Corrosive materials are present in most industrial workplaces. Acids, bases (which include caustics or alkalis), and other chemicals may be corrosive as well. Everyone who works with corrosives must be aware of their hazards and how to work safely with them. Some corrosive gases are also flammable so they can easily catch fire and burn or explode.
Slide 19	Because most gases are difficult to observe directly, they are described using four physical properties or characteristics: pressure, temperature, volume, and density. The term pressure refers to the average force that the gas exerts on the surface of the container. Temperature is related to the motions of the molecules and atoms that make up the gas. The volume of gas is NOT a property of the gas directly, but a property of the container. and can vary over a wide range because the particles are free to move closer together when constrained by pressure or volume. Until they are used, gases must be completely confined in containers for transportation, transfer, and storage. For economic necessity and ease of use, as much gas as possible is placed in the container. This results in transportation and storage of gases in the liquid as well as the gaseous state.
Slide 20	A compressed gas is a substance that is a gas at normal room temperature and pressure, and is contained under pressure, usually in a cylinder. There are three major groups of compressed gases stored in cylinders: liquefied, non-liquefied and dissolved gases. In each case, the pressure of the gas in the cylinder is commonly given in units of kilopascals (kPa) or pounds per square inch gauge (psig). Liquefied gases are gases which can become liquids at normal temperatures when they are inside cylinders under pressure. They exist inside the cylinder in a liquid-vapour balance or equilibrium. Initially the cylinder is almost full of liquid, and gas fills the space above the liquid. As gas is removed from the cylinder, enough liquid evaporates to replace it, keeping the pressure in the cylinder constant. Anhydrous ammonia, chlorine, propane, nitrous oxide, and carbon dioxide are examples of liquefied gases.
Slide 21	Non-liquefied gases are also known as compressed, pressurized or permanent gases. These gases do not become liquid when they are compressed at normal temperatures, even at very high pressures. Common examples of these are oxygen, nitrogen, helium, and argon.

	Dissolved Gases: Acetylene is the only common dissolved gas. Acetylene is chemically very unstable. Even at atmospheric pressure, acetylene gas can explode. Nevertheless, acetylene is routinely stored and used safely in cylinders at high pressures (up to 250 psig at 21°C). This is possible because acetylene cylinders are fully packed with an inert, porous filler. The filler is saturated with acetone or other suitable solvent. When acetylene gas is added to the cylinder, the gas dissolves in the acetone. Acetylene in solution is stable.
Slide 22	Classification by use: Some common gases have been categorized by their main use into three main groups being; Fuel gases, Industrial gases and Medical gases. This form of classification is not as precise as classification by physical properties and there can be overlapping use with many gases. Fuel gases are any one of several fuels that under ordinary conditions are gaseous. The most common fuel gases are natural gas and liquefied-petroleum gases. These gases are a source of potential heat energy or light energy that can be readily distributed through pipes from the point of origin to the place of consumption. Fuel gas is contrasted with liquid fuels and from solid fuels, though some fuel gases are liquefied for storage or transport. While their gaseous nature has advantages, avoiding the difficulty of transporting solid fuel and the dangers of spillage inherent in liquid fuels, it also has limitation. It is possible for a fuel gas to be undetected and collect in certain areas, leading to the risk of a gas explosion. To avoid this, odorants are added to most fuel gases so that they can be identified by a distinct smell.
Slide 23	Industrial gases are the gaseous materials that are manufactured for use in industry. The principal gases provided are nitrogen, oxygen, carbon dioxide, argon, hydrogen, helium, and acetylene, although many other gases and mixtures are also available in gas cylinders. Industrial gases are used in a wide range of industries, like oil and gas, petrochemicals, mining, steelmaking, environmental protection, medicine, food production and preservation, water treatment, fertilizers, electronics, and aerospace.
Slide 24	Medical gases are the most specialized use classification. Medical gases are widely used in hospitals and other healthcare facilities as well as private residences. They are used to supply specialized gases and gas mixtures for medical purposes such as anesthesia and respiratory therapy.

	Products deemed to be medical gases include but are not limited to oxygen, medical air, nitrous oxide, and carbon dioxide. Medical gas systems in care facilities are generally required to be monitored by alarm systems for abnormal (high or low) gas pressure in areas such as operating theatres, intensive care units, recovery rooms, or major treatment rooms. Medical gas systems are commonly colour coded to identify their contents. Emergency shut-off valves, or zone valves, are often installed in order to stop gas flowing to an area in the event of fire or substantial leak, as well as for service. Valves may be positioned at the entrance to departments, with access provided via emergency pull-out windows.
Slide 25	Hazardous materials is a term widely used in the US but in Canada the term dangerous goods is more common. In the US a hazardous material, as defined by the U.S. Department of Transportation, DOT, is a material that poses an unreasonable risk to the health and safety of emergency personnel, the public, and/or the environment if it is not properly managed and controlled during handling, storage, manufacturing, processing, packaging, use and disposal, or transportation. In Canada hazardous materials are known as dangerous goods and include hazardous waste products. The fire code defines Dangerous Goods as meaning materials or substances that are regulated by the Transportation of Dangerous Goods Regulation or classified as controlled products under the Hazardous Products Regulation. The Hazardous Products Regulations (HPR) specify the criteria for classifying hazards posed by chemical products and requirements for product labels and Safety Data Sheets (SDSs). Reference: NFC Division A A-1.4.1.2.(1) Gov of Canada FAQ Hazardous Products Regulations
Slide 26	The following information is taken from the 2015 National Building Code, Division A, Notes to Part 1 Compliance: Note A-1.4.1.2.(1) states: In previous editions of the National Fire Code, the terminology used to identify dangerous goods came from the “Transportation of Dangerous Goods Regulations (TDGR).” The TDGR applies solely to the adequate identification of hazards related to dangerous goods in the contexts of transportation and emergency response.

	Dangerous goods in the workplace are identified in accordance with the "Workplace Hazardous Materials Information System (WHMIS)," established in accordance with the Hazardous Products Act. The WHMIS identification system is specifically designed with the end users of the product in mind. Reference: NFC (2015) Division A A-1.4.1.2.(1) Dangerous Goods
Slide 27	WHMIS was created in response to the Canadian workers' right to know about the safety and health hazards that may be associated with the materials or chemicals they use at work. Exposure to hazardous materials can cause or contribute to many serious health effects. Some hazardous materials are safety hazards and can cause fires or explosions. WHMIS was created to help stop the injuries, illnesses, deaths, medical costs, and fires caused by hazardous materials. WHMIS is a comprehensive plan for providing information on the safe use of hazardous materials used in Canadian workplaces. Information is provided by means of product labels, material safety data sheets (MSDS) and worker education programs. WHMIS first became law in 1988 through a series of complementary federal, provincial, and territorial legislation and regulations.
Slide 28	This edition of the fire code identifies dangerous goods as products regulated by the TDGR or classified under the WHMIS. In order to harmonize these two nomenclatures for dangerous goods, class descriptors were developed taking into consideration both the TDGR and WHMIS classification systems. The NFC 2015 nomenclature uses a descriptive approach to classifying dangerous goods, which is similar to the one used by the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) developed by the United Nations. Canada has actively participated in the development of the GHS and has committed to its implementation through the TDGR and WHMIS regulations. The NFC nomenclature takes a common-sense approach that corresponds more closely to how people ordinarily refer to dangerous goods, blending TDGR and WHMIS terminology without using non-descript numbers and letters as previously found in the NFC, TDGR and WHMIS. To learn more, see the additional learning opportunities section of this chapter.

	Reference: NFC (2015) Division A A-1.4.1.2. (1) Dangerous Goods
Slide 29	WHMIS originates at the federal level in Canada. Health Canada coordinates the administration of the WHMIS program and serves as the coordinator for the governance and administration of WHMIS in Canada. Health Canada also acts as the secretariat for this federal, provincial, and territorial government partnership system. Each Province and Territory is responsible to communicate to its stakeholders what measures will be acceptable to ensure worker health and safety in workplaces within their jurisdiction. To learn about the WHMIS requirements for your jurisdiction, please visit WHMIS.org and click on the interactive map shown in this slide. The map will take you to the current WHMIS requirements for your jurisdiction.
Slide 30	The purpose of the United Nations Globally Harmonized System of Classification and Labeling of Chemicals or GHS, is to provide a system for standardizing and harmonizing the classification and labeling of chemicals internationally. It is a logical and comprehensive approach to: • Defining health, physical, and environmental hazards of chemicals • Creating classification processes that use available data on chemicals for comparison with the defined hazard criteria • Communicating hazard information, as well as protective measures, on labels and Safety Data Sheets (SDS) Many countries already have regulatory systems in place for these types of requirements. These systems may be similar in content and approach, but their differences are significant enough to require multiple classifications, labels, and safety data sheets for the same product. This leads to inconsistent protection for those potentially exposed to the chemicals, as well as creating extensive regulatory burdens on companies producing chemicals. More information on GHS is available in the GHS Classification System Guide in the additional resources section of this Chapter. References: GHS Classification System Guide
Slide 31	There are more than 80,000 chemicals registered in the US with an estimated 2,000 new ones added annually. Logically, there are a similar number in Canada.

	As a fire inspector, you must be able to recognize the presence of dangerous goods, analyze the available information, and ensure that the dangerous goods are stored and handled safely. You must also be able to communicate the information on the physical or toxic hazards present in a format useable by fire fighters and other emergency responders. As the fire inspector you will often be the point of contact between your agency and the person or facility with the dangerous goods or hazardous materials. You are also likely to be the person most familiar with the facility and in the best position to verify and update information based on previous involvement.
Slide 32	CANUTEC is the Canadian Transport Emergency Centre operated by the Transportation of Dangerous Goods (TDG) Directorate of Transport Canada. The Directorate's overall mandate is to promote public safety in the transportation of dangerous goods by all modes. CANUTEC was established in 1979 and is one of the major safety programs Transport Canada delivers to promote the safe movement of people and goods throughout Canada. CANUTEC is a national advisory service that assists emergency response personnel in handling dangerous goods emergencies on a 24/7 basis. The emergency centre is staffed by bilingual scientists specializing in chemistry or a related field and trained in emergency response. The emergency response advisors are experienced in interpreting technical information from various scientific sources including Material Safety Data Sheets (MSDS) in order to provide pertinent and timely advice.
Slide 33	Sometimes manufacturing processes generate hazardous materials and hazardous waste. Hazardous waste is the material that remains after a processes or manufacturing plant has used some of the material and it is no longer pure or has been chemically altered to an unusable form. It can also be products used in the home that are no longer required. Hazardous waste can be just as dangerous as the original chemicals, so they need to be disposed of in a safe and environmentally friendly manor. In Canada, all levels of government contribute to environmental protection and have a role to play in managing hazardous waste and hazardous recyclable material. • The federal government regulates transboundary movements of hazardous waste and hazardous recyclable material, in addition to negotiating international agreements related to chemicals and waste.

Slide 34	• Provincial and territorial governments establish measures and criteria for licensing hazardous-waste producers, carriers, and treatment facilities, in addition to controlling the movement of waste within their jurisdictions. • Municipal and regional governments establish collection, recycling, composting and disposal programs in their communities. Among other things, hazardous waste may be corrosive, infectious, reactive, or toxic. It can have the potential to harm human health or the environment. Hazardous waste can range from paints, oils, solvents to acids, heavy metals, and pesticides. The Provinces and Territories have waste management regulations that govern the production, storage, treatment, recycling, or discharge of more than a prescribed quantity of hazardous waste. As an additional learning opportunity review the various waste management Acts and Regulations in your Province or Territory and your local jurisdiction. Determine when permits are required and the application process so you can answer questions and inform clients. Links to the Provincial and Territorial jurisdiction legislation can be found in the additional resource section of this chapter.
Slide 35	An Emergency Response Guidebook was developed by Transport Canada, the US Department of Transportation and the Secretariat of Transport and Communications of Mexico, with help from Argentina. This guidebook is for firefighters, police, and other emergency responders who are often the first to arrive at a transportation incident involving dangerous goods and is intended to be carried in every public safety vehicle. The guide will help first responders: • Identify hazards based on the material involved in a transportation incident • Protect themselves and the public during the initial response to an incident This guide does not: • Include information on the physical or chemical properties of dangerous goods • Replace emergency response training, knowledge, and good judgment

	• To address every possible factor related to that incident Take the time to read the guidebook before you need it in an emergency!
Slide 36	The emergency response guide is designed for dangerous goods incidents on a highway or rail line. It may be less useful at fixed-facility locations, on aircraft or vessels. It should only be used for the "initial response phase" following arrival at the scene. It can help confirm the presence and/or identification of dangerous goods, provide information about initial protective action and scene securement, and if assistance of qualified personnel is required. The ERG includes 62 "Guides" that identify the primary hazards associated with the applicable general category of hazardous material and general guidance on how to respond to incidents involving that category. The primary purpose of ERG is to direct the emergency responders to the most appropriate guides, based on the incident. The ERG also provides guidance regarding recommended evacuation distances, if applicable.
Slide 37	TDG Regulations require containers of dangerous materials be marked to show the nature of the danger. TDG labeling provides a quick identification of the container contents, and hazard class, in the event of an emergency or an accidental release. It also informs transportation and loading dock workers about the materials they are handling. There are two types of markings used. In general, labels are used on small means of containment and placards are used on large means of containment. Means of containment refers to the vessel, vehicle, or other container used to safely hold a dangerous material.
Slide 38	The TDG regulations divide containers into two categories: small means of containment and large means of containment. A “small means of containment” are containers that have a water capacity of less than 450 liters. These types of containers include drums, barrels, bulk containers, boxes, jerricans, bags, and cylinders. A “large means of containment” is a container with a water capacity that is greater than 450 liters. Containers that are a large means of containment include: tanker truck trailers, railroad tank cars, intermediate bulk containers, and large portable tanks. All containers holding dangerous materials that are transported, must be marked with a durable, visible, weather-resistant, and legible marking before the container is loaded for transport. In general, placards are used for large means of containment and labels are used for small means of containment.

Slide 39	Labels, placards, and other markings often enable fire inspectors to identify a hazardous product. Marking systems, when used correctly, indicate the presence of hazardous materials, and provide information about the substances. This chapter cannot cover every marking system but will acquaint you with the most common. Placards are diamond-shaped indicators found on large means of containment vessels that must be placed on all four sides of highway transport vehicles, railroad tank cars, and other forms of transportation carrying hazardous materials. Each side of a placard must be at least 250 mm in length and meet size, shape, and colour requirements specified by the regulating body. Labels which are found on small means of containment packages are smaller than placards but have the same diamond shape. Each side of a label must be at least 100 mm in length but can be reduced to 30 mm to fit smaller containers.
Slide 40	A placard may identify the broad hazard class (flammable, poison, corrosive, etc.) that a tank contains, while the labels on a box inside a truck relates only to the potential hazard inside that package. There also is a “Dangerous” placard which indicates that more than one hazard class in contained in the same load. The DOT system is a broad spectrum look at chemical hazards. The Emergency Response Guide organizes chemicals into nine basic hazard classes, or families, the members of which exhibit similar properties.
Slide 41	The nine DOT chemical families recognized in the ERG are the following: • Class 1, Explosives • Class 2, Gases • Class 3, Flammable combustible liquids • Class 4, Flammable solids • Class 5, Oxidizers • Class 6, Poisons • Class 7, Radioactive materials • Class 8, Corrosives Class 9, Other regulated materials, or ORM the DOT systems do not require that all chemical shipments be marked with placards or labels. In many instances, the package or tank must contain a certain amount of hazardous material before a placard is required. As an example, the

	"1000- pound rule" applies to blasting agents, flammable and nonflammable gases, flammable or combustible liquids, flammable solids, air reactive solids, oxidizers and organic peroxides, poison solids, corrosives, and miscellaneous material. Placards are required for these materials only when the shipments weigh more than 1000 pounds or 455 kg.
Slide 42	Some chemicals are so hazardous that shipping any amount of them requires the use of labels or placards. These would include Class 1.1, 1.2 or 1.3 explosives, poison gases, water reactive solids and high lever radioactive solids. A four-digit identification number, the United Nations (UN) or North American (NA) number, may be required on some placards. This number identifies the specific material being shipped. In this example, the number identifies the product as UN 1789 which is Hydrochloric Acid.
Slide 43	The Emergency Response Guide, is divided into colored sections: yellow, blue, orange and green. In the yellow section, chemicals are listed numerically by their four-digit UN or NA identification number. As an example, number 1017 identifies chlorine. Use the yellow section when the UN number is known or can be identified. The entries include the name of the chemical and the emergency action guide number. The blue section is the section where the chemicals are listed alphabetically by name. The entry will include the emergency action guide number and the identification number, similar to the yellow section.
Slide 44	The orange section contains the emergency action guides. Guide numbers are organized by general hazard class and indicate what basic emergency actions should be taken. Lastly, the green section is organized numerically by UN and NA identification number and provides the initial isolation distances for specific materials. Chemicals included in this section are highlighted in the blue or yellow sections. Any materials listed in the green section are always extremely hazardous. Transport Canada has a short video called "Overview of the Emergency Response Guidebook (ERG) 2020" which is a very good additional learning opportunity that you can access from the Addition Resources section of this chapter.
Slide 45	While the DOT hazardous materials marking system is used when materials are being transported, the National Fire Protection Association's NFPA 704 hazard identification system is designed for fixed facility use. NFPA 704 is not referenced in Canadian fire or building codes so unless it is adopted by the local jurisdiction it is purely voluntary, but it provides an

	excellent best practice resource guide for fire inspectors to use in some instances. NFPA 704 placards may be found on the outside of buildings, on doorways to chemical storage area, and on fixed storage tanks. The NFPA 704 is a diamond shaped placard, which itself is broken into four smaller diamonds, each representing a particular property or characteristic posed by the material.
Slide 46	The blue diamond indicates the health hazard. The top red diamond indicated flammability. The yellow diamond indicated reactivity, and the bottom white diamond is used for special symbols and handling instructions. Each diamond will contain a number between 0 to 4 with 0 being the least hazardous and 4 the most hazardous. The white quadrant will not have a number but may contain special symbols, such as a burning O for oxidizing capability or a W with a slash through it to indicate that the product reacts with water. For more information on the NFPA 704 system, consult NFPA 704, Standard System for the Identification of the Hazards of Materials for Emergency Response.
Slide 47	There is a possibility that interpretation of the number systems used in NFPA 704 and that used in the Emergency Response guide can cause confusion. In the GHS and the ERG, the lower the number the higher the hazard rating while in NFPA 704 the higher the number the higher the hazard. Please watch the following short NFPA video which explains this issue.
Slide 48	Video.
Slide 49	Safety Data Sheets or SDS as they are now known replace the old Material Safety Data Sheets or MSDS in the new Globally Harmonized System of Classification and Labelling of Chemicals (GHS) A common source of information about a particular chemical is the safety data sheet specific to that substance. Essentially, an SDS provides basic information about the chemical makeup of a substance, the potential hazards it presents, appropriate first aid in the event of an exposure, and other pertinent data for safe handling of the material. Employees should not have to ask for an SDS, as they should be readily available. SDS's must be maintained on site and be readily accessible to employees when they are in their work area.

	Electronic access and other alternatives to maintaining paper copies are permitted as long as no barriers to immediate employee access are created.
Slide 50	Transportation of dangerous goods regulations require a shipping document as defined by the TDG Regulations. Simply put, the shipping document it is a paper that contains required information about the dangerous goods being handled, offered for transport, or transported. Shipping documents identify the dangerous goods being transported. In some cases, a shipping document may be required, even when placards are not. A shipping document is always required unless an exemption state otherwise. To use an exemption, the shipper must follow all the conditions listed, otherwise the entire TDG Regulations apply. This includes the names and addresses of the shipper and the receiver, identify the material being shipped, and specifies the quantity and weight of each part of the shipment.
Slide 51	Shipping documents for road and highway transportation are called bills of lading or freight bills and should be located in the cab of the vehicle. Vehicle and rail transport may also have that information available from their dispatch centres. There are no specific forms for the documents traveling by road or rail, but they must contain for required information. In the case of dangerous good shipped by aircraft the shipping document must have red hatchings on the left and right margins that slant to the left or to the right, as shown in this example. Electronic shipping documents are not permitted while in transit. A paper copy of the shipping document must accompany the dangerous goods at all times.
Slide 52	Some DOT hazard classes require shippers to assign packaging groups based on the material's flash point and toxicity. The packing group indicates the degree of danger of a product or substance. A packaging group designation may signal that the material poses a greater hazard than similar materials in a hazard class. The three packaging group designations are: • Packing group I indicates great danger • Packing group II indicates moderate danger • Packing group III indicates minor danger

	The packing group also determines the degree of protective packaging required. Packages and containers for dangerous goods that have passed rigorous performance testing usually bear UN specification marks as shown in this diagram. X, Y and Z will be used to indicate whether the package is appropriate for all 3 packing groups or just 1 packing group.
Slide 53	This concludes Part one of Chapter 12, Ensuring Proper Storage and Handling Practices. In this part we discussed: • The classification of flammable and combustible liquids that can be found in Part 4 of the National and Provincial Fire Codes as well as NFPA 30 • Characteristics of flammable and combustible liquids including their flash points and classes 1,2 & 3 and their sub-groups • The classifications of flammable and combustible gasses and that Canadian fire codes deal mainly with cylinder storage • The Pyrophoric gases are flammable gases that spontaneously ignite in air • Oxidizing gases can react rapidly and violently • Unstable reactive gases are gases that will undergo violent changes when subjected to shock or changes in temperature or pressure
Slide 54	• Health hazards classifications associated with various gases • Cryogenic liquids are liquefied gases that are kept in their liquid state at extremely low temperatures • Corrosive gases can burn and destroy body tissues on contact • Corrosive materials are present in most industrial workplaces • Physical States of Gases are described using four physical properties or characteristics: pressure, temperature, volume, and density • Pressure refers to force on the surface of the container - Temperature is related to the motions of the molecules - Volume relates to the capacity of the container - Density is the amount of mass per unit volume • The most common fuel gases are natural gas and liquefied-petroleum gases • Fuel gases can be liquefied for storage or transport by pressure
Slide 55	• Medical gases are used to supply specialized gases for medical purposes • Hazardous material is a term widely used in the US but in Canada the term dangerous goods is more common • WHMIS is a comprehensive plan for providing information on the safe use of hazardous materials used in Canadian workplaces

	• Health Canada coordinates the administration of the WHMIS program • The purpose of the United Nations Globally Harmonized System of Classification and Labeling of Chemicals or GHS, is to provide a system for standard classification and labeling of chemicals internationally • CANUTEC is a national advisory service that assists emergency response personnel in handling dangerous goods emergencies on a 24/7 basis • Hazardous waste can be just as dangerous as the original chemicals
Slide 56	• Provincial and territorial governments establish measures and criteria for licensing hazardous-waste producers • Th Emergency Response Guidebook (ERG) is for firefighters, police, and other emergency responders who are the first to arrive at a transportation incident involving dangerous goods and is intended to be carried in every public safety vehicle. • The ERG helps responders identify hazards and protect themselves and the public during the initial response to an incident • There are nine DOT chemical families recognized in the ERG • TDG labeling provides a quick identification of the container contents, and hazard class • Two types of markings used - labels are used on small means of containment and placards are used on large means of containment • Some chemicals are so hazardous that shipping any amount of them requires the use of labels or placards • The ERG is divided into sections and colour coded yellow, blue, orange, and green
Slide 57	• The orange section contains the emergency response guides • NFPA 704 Is designed for fixed facility use. • NFPA 704 placards are divided into 4 colour coded section blue is health – red is flammability – yellow represents reactivity and white is used for special symbols. Each section contains a number between 0 to 4 with 0 being the least hazardous and 4 the most hazardous. • The NFPA 704 hazard rating of 0 to 4 conflicts with GHS and could cause confusion for responders • MSDS and their replacement with SDS And we finished Part 1 with Shipping documents and packaging • Packaging groups 1,2, and 3 with Group 1 presenting the highest level of danger