COMPETENCY GUIDELINES
FOR RESPONDERS TO INCIDENTS OF FLAMMABLE LIQUIDS IN TRANSPORT, HIGH-HAZARD FLAMMABLE TRAINS

DEVELOPED WITH THE NATIONAL FIRE PROTECTION ASSOCIATION
REQUEST FOR COMMENTS

This publication contains information aimed to help industry and public sector responders respond to high hazard rail incidents. Developed through several months of discussion and input from both public and private sector organizations, there will be areas that require further deliberation and refinement. This is why we invite guide users to provide their comments for consideration in future editions.

Please send your written comments to:
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Note:
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INTRODUCTION

Transport Canada’s Emergency Response Task Force (the Task Force) developed this Guideline in partnership with the National Fire Protection Association based in Quincy, Massachusetts. It is designed to enhance first responder safety during an incident involving flammable liquids transported by rail, frequently referred to as High-Hazard Flammable Trains (HHFT).

The Task Force was established by Minister of Transport Lisa Raitt in April 2014, to propose ways to enhance the response capacity to large scale rail incidents involving flammable liquids. Its members include experts from the first responder community, chemical and oil producers and distributors, rail carriers and other key industry stakeholders.

The NFPA 472 Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents is used by emergency responders to understand what competencies are required at dangerous goods (hazardous materials) incidents. However, this is intended to be a generalized standard and is not intended to be specific to individual dangerous goods (hazardous materials).

This Guideline addresses product and incident specific competencies for first responders and private sector personnel when responding to HHFT incidents. It can also help trainers and curriculum developers identify specific training content.

CANADIAN RAILWAY AND DANGEROUS GOODS TERMINOLOGY

Railways and Shippers use various terms that may be encountered and should be understood.

| **Alcohol Resistant - Aqueous Film Forming Foam (AR-AFFF)** | AR-AFFF concentrates, when proportioned at the appropriate rate, form a vapor-suppressing seal to rapidly control both:
• **hydrocarbon fuel fires** (e.g. diesel, gasoline, kerosene); and
• **polar solvent fuel fires** (alcohol, ketones, methanol, and MTBE products). |
<p>| <strong>A.P.I.E.</strong> | An incident assessment methodology: Analyze, Plan, Implement, Evaluate, as identified in NFPA Standard 472. |
| <strong>Aqueous Film Forming Foam (AFFF)</strong> | AFFF concentrates, when proportioned at the appropriate rate, form a vapor-suppressing seal to control hydrocarbon spill fires (e.g. diesel, gasoline, kerosene). |
| <strong>AskRail™</strong> | A mobile application to access train information during an emergency. AskRail™ allows first responders to view real time information on rail cars through their mobile devices for use in emergencies and for training purposes. Available by contacting Canadian National (CN) or Canadian Pacific (CP) Railway. |
| <strong>Authority Having Jurisdiction (AHJ)</strong> | A governmental body or agency authorized to enforce regulations and/or take action(s) within the boundaries of municipal, provincial/territorial, first nations or federal governance. |</p>
<table>
<thead>
<tr>
<th><strong>Boiling Liquid Expanding Vapor Explosion (BLEVE)</strong></th>
<th>When a vessel, such as a tank car is subjected to heating and the contents to boil and expand, the container violently explodes, often projecting pieces hundreds of meters, along with a large fireball. Pressure tank cars carrying Liquefied Petroleum Gas (LPG) such as propane can BLEVE when exposed to fire.</th>
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<tr>
<td><strong>CANUTEC</strong></td>
<td>Canadian Transport Emergency Centre (CANUTEC) operated by Transport Canada’s Transportation of Dangerous Goods (TDG) Directorate.</td>
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<tr>
<td><strong>Dangerous Goods Officer (DGO) or Hazardous Materials Officer (HMO)</strong></td>
<td>A railway employee specially trained and qualified for dealing with a dangerous goods incident. These people have extensive knowledge and expertise useful in developing an Incident Action Plan under a Unified Command Structure.</td>
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</tbody>
</table>
| **D.E.C.I.D.E.** | An incident assessment methodology used for decision making in dangerous goods (hazardous materials) emergencies. It consists of six steps:  
1. Detect hazardous materials presence;  
2. Estimating likely harm without intervention;  
3. Choosing response objectives;  
4. Identifying actions options;  
5. Doing the best options and  
| **Disciplined Approach Chart** | This reference tool helps identify factors to consider when managing a flammable liquids incident in a manner consistent with the A.P.I.E. approach. |
| **Emergency Response Assistance Plan (ERAP)** | A specialized response plan the Canadian law requires shippers of certain dangerous goods (hazardous materials) to submit for Transport Canada approval. ERAPs make expert technical advice and specialized equipment available to supplement first responder resources (Transportation of Dangerous Goods Act and the TDG Regulations, Part 7). |
| **Emergency Response Guidebook (ERG)** | A Guidebook for first responders during the initial phase of a Dangerous Goods/Hazardous Materials Transportation Incident. Published by Transport Canada in cooperation with U.S. Department of Transportation, PHMSA and Mexico Secretariat of Transportation and Communication. |
| **Equilibrium** | Describes the point in which the fire is no longer expanding and has achieved a “steady state” of fire and container behaviour. For example:  
- The fire is confined to a specific area with little probability of growth in either size or intensity.  
- There is low probability of additional heat induced tears or container breaches caused by fire impingement directly upon tank cars.  
- There are no current pressure relief device (PRD) activations indicating continued heating of tank cars. |
| **Flammable Liquids** | Class 3 dangerous goods regulated in Canada by federal legislation (Transportation of Dangerous Goods Act and the TDG Regulations). |
| **Hazardous materials and weapons of mass destruction (WMD)** | American term for all classes of dangerous goods including those used as a weapon in terrorist or criminal activities. |
| **Heat Induced Tears (HIT)** | Under the intense heat of a fire, non-pressure tank cars containing flammable liquids can tear, generally at the top or headspace depending on car orientation, causing the product to suddenly vent at high speed, generating a fireball and an intense heat wave. A highly variable and unpredictable event known to occur in 20 minutes or less. |
| **High-Hazard Flammable Trains (HHFT)** | A continuous block of 20 or more tank cars loaded with a flammable liquid, or 35 or more tank cars loaded with a flammable liquid dispersed through a train. |
| **Key Route** | Any track on which, over a period of one year, has carried 10,000 or more loaded tank cars or loaded intermodal portable tanks containing dangerous goods, as defined in the Transportation of Dangerous Goods Act, 1992 or any combination thereof that includes 10,000 or more loaded tank cars and loaded intermodal portable tanks. |
| **Key Train** | An engine with cars:  
- that includes one or more loaded tank cars of dangerous goods that are included in Class 2.3, Toxic Gases and of dangerous goods that are toxic by inhalation subject to Special Provision 23 of the Transportation of Dangerous Goods Regulations; or  
- that includes 20 or more loaded tank cars or loaded intermodal portable tanks containing dangerous goods, as defined in the Transportation of Dangerous Goods Act, 1992 or any combination thereof that includes 20 or more loaded tank cars and loaded intermodal portable tanks. |
<p>| <strong>Material Safety Data Sheet (MSDS) or Safety Data Sheet (SDS)</strong> | A document with information on the potential health effects of exposure and how to work safely with the material. |</p>
<table>
<thead>
<tr>
<th><strong>Pipeline and Hazardous Materials Safety Administration (PHMSA)</strong></th>
<th>The U.S. Department of Transportation agency responsible for hazardous materials regulations, similar to the Transport Canada, Transportation of Dangerous Goods Directorate.</th>
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</thead>
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<tr>
<td><strong>Pool Fire</strong></td>
<td>A fire burning above a horizontal pool of vaporizing flammable liquid fuel under conditions where the fuel has zero or very low initial momentum.</td>
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<td><strong>Pressure Relief Valve (PRV)</strong></td>
<td>A device found on tank cars designed to release gases from the container to prevent overpressure and container rupture.</td>
</tr>
<tr>
<td><strong>Remedial Measures Specialist (RMS)</strong></td>
<td>A Transport Canada TDG specialist who reviews and approves ERAPs. A RMS also promotes public safety by providing information and advice to help the Incident Commander take appropriate remedial measures at an incident site.</td>
</tr>
<tr>
<td><strong>Three Dimensional Class B Fires</strong></td>
<td>Fires with a vertical element, such as caused by a stream of flowing product discharging into a pool fire, that cannot be extinguished using foam, since it cannot achieve a vertical blanket or seal.</td>
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| **Train Consist** | A document the train crew holds, that lists and explains what a train carries, where it is located on the train, and shippers’ contact information. This is valuable information for first responders assessing the dangerous goods involved.  

**Note:** the train consist may also be called the *Train Journal* or *Compressed Waybill.* |
| **Unit train** | A train made up of a single commodity such as grain, coal and potash. Unit trains are now transporting flammable liquids including crude oil and ethanol. These trains can consist of upwards of 120 cars. |
CHAPTER 1: COMPETENCIES FOR RESPONDERS TO INCIDENTS OF FLAMMABLE LIQUIDS IN TRANSPORT, HIGH-HAZARD FLAMMABLE TRAINS

1.1 Scope and Purpose

The Guideline describes the basic levels of competence suggested for responders to incidents involving high-hazard flammable trains (HHFT). It applies to individuals, organizations or agencies that respond to a HHFT incident and are intended for use in any risk-based response.

The purpose of the Guideline is to provide information that will help increase responder and public safety during HHFT incidents and prevent exposure to potential dangers that could cause serious injury or fatalities.

1.2 Key Competencies for Each Level of Response

This Chapter outlines the basic competencies for response to incidents involving HHFT by Response Level for awareness level personnel, operations level responders, incident commanders, and specialist employees.

Awareness Level Response
Operations Level Response
Incident Command Level Response
Specialist Employee C Level Response
Specialist Employee B Level Response
Specialist Employee A Level Response

Within each Response Level, the current NFPA Standard 472 is outlined, followed by the knowledge and skills that are specific to incidents involving HHFT.

Note: This Guideline is not intended to restrict any authority having jurisdiction (AHJ) from exceeding the recommended training and competencies.

1.3 Beyond NFPA Standard 472: Analysis and Recommendations for Knowledge and Skills Specific to HHFT Incidents

The NFPA Standard 472 requirements are outlined in the grey boxes on the following pages for each level of response. The knowledge and skills specifically required for HHFT incidents not currently included in the NFPA Standard 472 are listed below.
Awareness Level Response

NFPA Standard 472 (2013)

4.1.1.1 Awareness level personnel shall be persons who, in the course of their normal duties, could encounter an emergency involving hazardous materials/weapons of mass destruction (WMD) and who are expected to recognize the presence of the hazardous materials/WMD, protect themselves, call for trained personnel, and secure the area.

4.2 Analyzing the Incident.

4.2.1 Detecting the Presence of Hazardous Materials/WMD.

4.2.2 Surveying Hazardous Materials/WMD Incidents.

4.2.3 Collecting Hazard Information.

Additional **knowledge** specific to HHFT incidents beyond NFPA Standard 472:

- Chemical and physical properties specific to flammable liquids (petroleum, ethanol);
- Type, condition and behavior of tank cars;
- Railway safety for first responders;
- Stabilizing the incident (e.g., risk factors such as fire spread, explosion, toxic gases);
- Environmental factors and impacts;
- Defensive control measures;
- Evacuation considerations;
- Available resources such as CANUTEC, ERG, ERAPs, RMS, AskRail™, train consist/shipping documents, municipal emergency plans, etc.

Additional **skills** specific to HHFT incidents beyond NFPA Standard 472:

- Use the ERG;
- Recognize and understand a train consist.
Additional **knowledge** specific to HHFT incidents **beyond NFPA Standard 472**:  
- Local rail line owner/operator contact information (i.e. CN Rail, CP Rail, short line).

Additional **skills** specific to HHFT incidents **beyond NFPA Standard 472**:  
- Notify specific rail line (CN Rail, CP Rail, short line, etc.);
- Secure scene/deny access.

Additional **knowledge** and **skills** specific to HHFT incidents **beyond NFPA Standard 472**:  
- N/A
Operations Level Response

NFPA Standard 472 (2013)

5.1.1.1 The operations level responder shall be that person who responds to hazardous materials/weapons of mass destruction (WMD) incidents for the purpose of protecting nearby persons, the environment, or property from the effects of the release.

5.2 Analyzing the Incident

5.2.1 Surveying Hazardous Materials/WMD Incidents.

5.2.2 Collecting Hazard and Response Information.

5.2.3 Predicting the Likely Behavior of a Material and Its Container.

5.2.4 Estimating Potential Harm.

Additional **knowledge** specific to HHFT incidents beyond NFPA Standard 472:

- Railway safety for first responders;
- Stabilizing the incident (e.g. risk factors – fire spread, explosion, toxic gases);
- Environmental factors and impacts;
- Control measures for non-intervention/defensive operations;
- Foam types, volumes required, large capacity foam equipment operation, application techniques;
- Size up for water management;
- Chemical and physical properties specific to flammable liquids (petroleum, ethanol);
- Rail tank car anatomy;
- Incident Timeline Chart (PHMSA) (section 2.6);
- Awareness to the presence of toxic and flammable vapours.

Additional **skills** specific to HHFT incidents beyond NFPA Standard 472:

- Control measures of non-intervention/defensive operations;
- Apply foam types, volumes required operate large capacity foam equipment, use application techniques;
- Identify pressurized/non-pressurized/jacketed/non-jacketed rail tank cars;
- Select and use Air Monitoring Equipment.
Additional knowledge specific to HHFT incidents beyond NFPA Standard 472:
• Risk assessment/reduction – fire spread, explosion, toxic gases;
• Water management;
• Foam types, volumes required, large capacity foam equipment operation, application techniques;
• Evacuation considerations (note: “Shelter in Place” may not be an option if structures are at risk from fire);
• Resources needed and available from both government and private sector (CANUTEC, ERG, ERAPs, RMS, etc.);
• Intervention or non-intervention strategies;
• Environmental factors and impacts;
• Decontamination of personnel and PPE.

Additional skills specific to HHFT incidents beyond NFPA Standard 472:
• N/A

NFPA Standard 472 (2013)
5.4 Implementing the Planned Response.
5.4.1 Establishing Scene Control.
5.4.2 Preserving Evidence.
5.4.3 Initiating the Incident Command System.
5.4.4 Using Personal Protective Equipment.

Additional knowledge specific to HHFT incidents beyond NFPA Standard 472:
• Evacuation considerations, protective action considerations (ex: Lac Mégantic, QC);
• Detection of toxic and flammable vapours (H₂S levels);
• Available detection and air monitoring equipment;
• Chemical and physical properties specific to flammable liquids (e.g. petroleum, ethanol, benzene) that may affect the selection of PPE, and procedures for decontamination of personnel, equipment, and PPE.
Additional **skills** specific to HHFT incidents beyond NFPA Standard 472:

- Perform product control techniques specific to flammable liquid vapour/product including underground infrastructure networks (e.g. sewers, water mains, electrical conduits);
- Describe appropriate level of IMS/ICS of the AHJ (i.e., ICS I-200 level);
- Work within a Unified Command Structure;
- Perform decontamination of personnel, equipment and PPE;
- Select and use detection and monitoring equipment.

NFPA Standard 472 (2013)

5.5 Evaluating Progress

5.5.1 Evaluating the Status of Planned Response.
5.5.2 Communicating the Status of Planned Response.

Additional **knowledge** specific to HHFT incidents beyond NFPA Standard 472:

- Incident stabilization (e.g. risk factors – fire spread, explosion, toxic gases);
- Incident Timeline Chart for HHFT (PHMSA);
- Tank car and product behaviour (e.g. HIT vs. BLEVE, PRV, boil over, froth over).

Additional **skills** specific to HHFT incidents beyond NFPA Standard 472:

- Assess stability of the incident (e.g. risk factors – fire spread, explosion, toxic gases) critical emergency conditions related to HIT vs. BLEVE, PRV, froth over etc.;
- Describe the Incident Timeline Chart for HHFT (PHMSA);
- Describe the behaviours associated with the tank car and product (HIT vs. BLEVE, PRV, boil over, froth over etc.).

NFPA Standard 472 (2013)

5.6 Terminating the Incident. (Reserved)

Additional **knowledge and skills** specific to HHFT incidents beyond NFPA Standard 472:

- N/A
Incident Command Level Response

NFPA Standard 472 (2013)

8.1.1.1 The incident commander (IC) at hazardous materials/WMD incidents shall be that person responsible for all incident activities, including the development of strategies and tactics and the ordering and release of resources as designated by the authority having jurisdiction (AHJ).

8.2 Analyzing the Incident.

8.2.1 Collecting and Interpreting Hazard and Response Information.

8.2.2 Estimating Potential Outcomes.

Additional knowledge specific to HHFT incidents beyond NFPA Standard 472:

- Advantages and limitations of available resources (CANUTEC, ERAP, RMS, ERG, AskRail™, Flammable Liquid Technical Advisor, train consist/shipping documents, Disciplined Approach Chart, municipal emergency plans etc.);
- Rail incident preplanning that identifies typical dangerous goods movements through the community;
- Outcomes of tactical objectives (non-intervention, defensive/offensive);
- Potential of water supply and water runoff;
- Assessment as part of a response methodology such as: Disciplined Approach Chart, A.P.I.E., and D.E.C.I.D.E.;
- Health risks associated with the physical and biological effects of chemicals found in flammable liquids such as crude oil, refined products, and ethanol (e.g. hydrogen sulfide, benzene).

Additional skills specific to HHFT incidents beyond NFPA Standard 472:

- N/A

NFPA Standard 472 (2013)

8.3 Planning the Response

8.3.1 Identifying Response Objectives.

8.3.2 Identifying the Potential Response Options.

8.3.3 Approving the Level of Personal Protective Equipment.

8.3.4 Developing an Incident Action Plan.

Additional knowledge specific to HHFT incidents beyond NFPA Standard 472:

- Significant volume of product involved, assess the incident based on the PHMSA chart for the time frames for non-intervention, defensive and offensive appropriate to those time frames (section 2.6);
- Possible response options to accomplish a given response objective;
• Purpose of each product control technique as it relates to a flammable liquid rail incident;
• Requirements for specialized information and advice;
• Requirements for specialized resources and equipment (section 2.12);
• Strategies and consultation with subject matter experts to determine specific objectives;
• Advantages and limitations of decontamination methods for PPE, appropriate for flammable liquids incidents.

Additional skills specific to HHFT incidents beyond NFPA Standard 472:
• N/A

NFPA Standard 472 (2013)

8.4 Implementing the Planned Response

8.4.1 Implementing an Incident Command System.
8.4.2 Directing Resources (Private and Governmental).
8.4.3 Providing a Focal Point for Information Transfer to the Media and Elected Officials.

Additional knowledge specific to HHFT incidents beyond NFPA Standard 472:
• Roles and responsibilities of government and private agencies and industry at HHFT Incidents (i.e. Railway personnel and resources, Emergency Response Contractors, Flammable Liquid Technical Advisor, ERAP, RMS). See Roles and Responsibilities Table in section 2.11.

Additional skills specific to HHFT incidents beyond NFPA Standard 472:
• N/A

NFPA Standard 472 (2013)

8.5 Evaluating Progress

8.5.1 Evaluating Progress of the Incident Action Plan.
8.5.2 Transferring Command and Control both During the Response Phase and the Post-Response Phase.

Additional knowledge specific to HHFT incidents beyond NFPA Standard 472:
• Context of PHMSA Incident Timeline given that the scale and scope of these large incidents and availability of resources and equipment and other factors to be able to evaluate progress;
• Unified Command and continued evaluation of Incident Action Plan (IAP) progress.

Additional skills specific to HHFT incidents beyond NFPA Standard 472:
• N/A
NFPA Standard 472 (2013)

8.6 Terminating the Incident.

8.6.1 Terminating Response Operations
8.6.2 Conducting a Debriefing.
8.6.3 Conducting a Critique.
8.6.4 Reporting and Documenting the Hazardous Materials/WMD Incident.

Additional **knowledge** specific to HHFT incidents **beyond NFPA Standard 472**:
- Business and community continuity to allow the return to normalcy as soon as possible.

Additional **skills** specific to HHFT incidents **beyond NFPA Standard 472**:
- N/A
Specialist Employee C Level Response

NFPA Standard 472 (2013)

9.2.1.1.1 The specialist employee C shall be that person who responds to incidents involving hazardous materials/WMD and/or containers in the organization’s area of specialization, and the following:

(1) Consistent with the emergency response plan and/or standard operating procedures, the specialist employee C can be called on to gather and record information, provide technical advice, and arrange for technical assistance.

(2) The specialist employee C does not enter the hot or warm zone at an emergency.

9.2.1.1.2 The specialist employee C shall be trained to meet all competencies at the awareness level (see Chapter 4) relative to the organization’s area of specialization and all additional competencies in Section 9.2.

9.2.2 Analyzing the Incident.

9.2.2.1 Providing Information on the Hazards and Harmful Effects of Specific Hazardous Materials/WMD.

9.2.2.2 Providing Information on the Characteristics of Specific Containers

Additional **knowledge and skills** specific to HHFT incidents beyond NFPA Standard 472:

Specialist Employee C shall advise the Incident Commander of the:

- Chemical’s hazards and harmful effects;
- Characteristics of the containers; and
- Response information for that chemical.
Additional **knowledge and skills** specific to HHFT incidents beyond NFPA Standard 472:

Specialist Employee C shall advise the Incident Commander of the:

- Response information for that chemical;
- Potential response options and their consequences;
- Personal protective equipment necessary for various response options;
- Technical decontamination process for various response options;
- Federal or provincial regulations that relate to the handling, transportation, and disposal of that chemical.

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**NFPA Standard 472 (2013)**

9.2.3 Planning the Response


9.2.3.2 Providing Information on Potential Response Options for Specific Containers. (NFPA 472, 2013)
Specialist Employee B Level Response

NFPA Standard 472 (2013)

9.3.1.1.1 The specialist employee B shall be that person who, in the course of regular job duties, works with or is trained in the hazards of specific chemicals or containers in the individual’s area of specialization and the following:

(1) Because of the employee’s education, training, or work experience, the specialist employee B can be called on to respond to incidents involving these chemicals or containers.

(2) The specialist employee B can be used to gather and record information, provide technical advice, and provide technical assistance (including work in the hot zone) at the incident, consistent with the emergency response plan and/or standard operating procedures.

9.3.1.1.2 The specialist employee B shall be trained to meet all competencies at the awareness level (see Chapter 4) relative to the organization’s area of specialization, all competencies at the specialist employee C level (see Section 9.2), and all additional competencies in Section 9.3.

9.3.2 Analyzing the Incident.

9.3.2.1 Providing and Interpreting Information on Hazards of Specific Hazardous Materials/WMD.

9.3.2.2 Providing Information on Characteristics of Specific Containers.

9.3.2.3 Providing Information on Concentrations of Hazardous Materials/WMD.

9.3.3 Planning the Response

9.3.3.1 Providing Information on Potential Response Options and Consequences for Specific Hazardous Materials/WMD.

9.3.3.2 Providing Information on Personal Protective Equipment (PPE) Requirements.

9.3.3.3 Providing Information on Decontamination Methods.

9.3.3.4 Providing Information on Handling and Disposal Regulations.

9.3.3.5 Developing an Incident Action Plan.

Additional knowledge and skills specific to HHFT incidents beyond NFPA Standard 472:

Specialist Employee B shall advise the Incident Commander of the:

- Chemical’s hazards and harmful effects of specific dangerous goods (hazardous materials) and the potential consequences
- Container’s characteristics and potential behavior
- Concentrations of the released chemical and the implications of that information
Additional **knowledge and skills** specific to HHFT incidents **beyond NFPA Standard 472:**

Specialist Employee B shall, in conjunction with the Incident Commander:

- Develop an IAP, consistent with the ERP and/or standard operating procedures (SOP) and within the capabilities of the available resources, for handling hazardous materials or containers.

Additional **knowledge and skills** specific to HHFT incidents **beyond NFPA Standard 472:**

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**NFPA Standard 472 (2013)**

9.3.4 Implementing the Planned Response

9.3.4.1 Performing Response Options Specified in the Incident Action Plan
9.3.4.2 Using Personal Protective Equipment (PPE).

Specialist Employee B shall:

- Perform the assigned actions consistent with the ERP and/or standard operating procedures.

Additional **knowledge and skills** specific to HHFT incidents **beyond NFPA Standard 472:**

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**NFPA Standard 472 (2013)**

9.3.5 Evaluating Progress.

9.3.5.1 Providing an Evaluation of the Effectiveness of Selected Response Options.
9.3.5.2 Reporting and Documenting the Incident.

Specialist Employee B shall advise the Incident Commander of the:

- Effectiveness of the selected response options;
- Reporting and subsequent documentation requirements consistent with the emergency response plan and/or standard operating procedures.
Specialist Employee A Level Response

NFPA Standard 472 (2013)

9.4.1.1.1 The specialist employee A shall be that person who is specifically trained to handle incidents involving chemicals or containers for chemicals used in the organization’s area of specialization, and the following:

(1) Consistent with the emergency response plan and/or standard operating procedures, the specialist employee A is able to analyze an incident involving chemicals within his or her organization’s area of specialization.

(2) The specialist employee A can then plan a response to that incident, implement the planned response within the capabilities of the resources available, and evaluate the progress of the planned response.

9.4.1.1.2 The specialist employee A shall be trained to meet all competencies at the awareness level (see Chapter 4) relative to the organization’s area of specialization, all competencies at the specialist employee C level (see Section 9.2), and all competencies at the hazardous materials technician level (see Chapter 7) relative to the hazardous materials/WMD and containers used in the organization’s area of specialization. (NFPA 472, 2013)

9.4.2 Analyzing the Incident, Planning the Response, Implementing, Evaluation. The specialist employee A shall demonstrate competencies at the Specialist Employee C level and the hazardous materials technician relative to hazardous materials/WMD and containers used in the organization’s area of specialization.

Additional knowledge specific to HHFT incidents beyond NFPA Standard 472:

- N/A

Additional skills specific to HHFT incidents beyond NFPA Standard 472:

- N/A
CHAPTER 2: EXPLANATORY MATERIAL FOR CANADIAN RESPONDERS

2.1 Introduction

Flammable liquids, Crude oil and ethanol in particular, are being transported by rail in very large volumes through many North American communities. When major rail incidents occur with flammable liquids, the emergency response can present serious challenges to first responders. They need to be better prepared to face unique emergency response requirements due to the scale and complexity of these types of incidents.

This Guideline aims to better define the knowledge, skills and training that technical advisors from industry, public first responders (including incident command staff and firefighters), federal government specialists (e.g. CANUTEC Advisors, RMS) need to be qualified to safely mitigate these large scale incidents.

It is expected that as part of their organization’s training and education program, responders to these incidents, both public first responders and private sector responders, should have acquired the essential knowledge and skills to qualify them to undertake assigned roles and responsibilities at emergency incidents. Training based on the following standards or their equivalent form the foundation for many of the competencies required:

- NFPA 1001: Standard for Fire Fighter Professional Qualifications
- NFPA 1081: Industrial Fire Brigade Member Professional Qualifications
- ICS Canada – ICS I-100, I-200, I-300

Note: Depending on their organization’s mandate and service standard, responders may be trained to varying levels of competency (e.g. NFPA Standard 472 Awareness Level vs. Tank Car Specialist).

Intended Users

This Guideline is intended specifically for Canadian firefighters and other first responders called to respond to a railway incident involving flammable liquids. The following information will help to:

- assess the situation at a derailment;
- protect themselves and the public by securing the scene; and
- provide an accurate and scene size-up and valuable information to specialized teams arriving on the scene.
Many agencies and organizations may be called for information or called to attend a railway incident scene. Their representatives may find this information useful in planning a coordinated response. These agencies and positions include (see Table 1):

- Municipal Emergency Planner
- Firefighter 1 and 2
- Flammable Liquids Technical Advisor - Level C/B/A
- Fire Department Hazardous Materials Response Team
- CANUTEC Advisor
- Fire Department Incident Commander
- Rail Road Dangerous Goods Officer
- Remedial Measures Specialist
- ERAP or RR Emergency Response Contractor leader
- ERAP or RR Emergency Response Contractor worker
Table 1: Recommended Minimum Levels of Training for: Planning and Initiating a Response to Incidents Involving HHFT in Canada

<table>
<thead>
<tr>
<th>Role</th>
<th>HHFT Awareness</th>
<th>HHFT Operations</th>
<th>HHFT Specialist</th>
<th>HHFT Practical Skills</th>
<th>NFPA 472 Level</th>
<th>ICS Level</th>
<th>NFPA 1001</th>
<th>NFPA 1081</th>
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<td>Municipal Emergency Planner</td>
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<td>Awareness Level 100</td>
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<td>optional</td>
<td></td>
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</tbody>
</table>

*As per standard occupational health and safety regulations, workers should have the requisite knowledge and skills training equivalent to the duties and responsibilities they may be assigned to perform.
2.2 Recognize the Presence of Flammable Liquids

Persons who, in the course of their normal duties, could encounter a dangerous goods emergency are expected to recognize the presence of the dangerous goods. During transport, flammable liquids are identified on the container (tank cars) by placards with a UN number as shown in the sample placards below:

![Sample placards](image1)

In terms of volumes, the majority of flammable liquids currently transported by rail are Crude oil UN 1267, Ethanol UN 1170 or UN 1987, Ethanol/Gasoline mixture UN 3475 and Diesel Fuel UN 1202.

2.3 Incident Safety

Safety Precautions: Five Steps

Standard safety procedures to take during the initial phase of a response to an incident are identified in the Emergency Response Guidebook. Some additional safety measures at a railway incident are important to remember.

**STEP ONE: DO NOT RUSH IN**

- Keep personnel and vehicles a safe distance from the scene
- Cautiously approach the scene of an incident from uphill, upwind or upstream.
- Stay clear of vapor, fumes, smoke, spills and railway lines.

**STEP TWO: SECURE THE SCENE**

- Call the Railways’ emergency response phone number, if you have it. Advise them of the incident and instruct them to shut down the rail line and stop any movements of locomotives and cars.
- If you do not have the Railways emergency number call CANUTEC and ask them to contact the Railway to shut down the railway lines.
- Isolate the area and protect yourself and others.

**STEP THREE: IDENTIFY THE HAZARDS AND ASSESS THE SITUATION**

- Identify the dangerous goods carried in the means of containment.
- Look for dangerous goods placards on the tank car and for container labels.
- Ask to see the shipping documents and the train consist: ask the rail crew if possible, otherwise contact CANUTEC.
- Further information can be provided by accessing the Rail car identification chart and the Material Safety Data Sheet (MSDS) - now referred to as Safety Data Sheet (SDS).

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STEP FOUR: GET HELP

✓ Call CANUTEC for immediate advice from their specially trained personnel.
✓ Call the shipper to get information on the type of product by calling the emergency contact phone number on the shipping document, if available.
✓ Call the ERAP contact phone number on the shipping document if available. CANUTEC can also provide the ERAP contact phone number.

STEP FIVE: RESPOND

✓ Enter the site only when wearing appropriate personal protective equipment.
✓ Rescue attempts and protecting property must be weighed against you becoming part of the problem.
✓ Establish Incident Command and a command post.
✓ Continually reassess the situation and modify response accordingly.
✓ Consider safety of the people in the immediate area first, including your own safety.

Remember: Do NOT rush in!

FIRST RESPONDER SAFETY

Railway Safety – Securing the scene
It is vitally important that any first responder, contractor or non-railway person notify the railway of their presence on railway property as there is always a danger of train movement from train operations on mainlines including multi-track, switching movements either manned or remote control, and free rolling railway cars in switching operations in yard environments. Only qualified railway personnel can provide positive track protection and information on the layout of the railway property.

Personal Protective Equipment
One of the first steps in any response to an incident is to choose and wear appropriate Personal Protection Equipment (PPE). Before choosing the proper personal protective equipment, exposure risks must be considered. Exposure to flame and heat is one of the hazards presented by the flammable liquids.

Fire Exposure and Respiratory Protection
Structural fire fighter clothing will provide a degree of protection from fire exposure and a self-contained breathing apparatus provides protection from inhalation exposure from smoke, benzene and hydrogen sulfide that may be present.

Crude oil and Hydrogen Sulfide (H₂S)
Hydrogen sulfide (H₂S) is a colorless gas found naturally in some crude oils. It is heavier than air, toxic, corrosive, flammable, explosive, and is very dangerous when inhaled.

Recent studies that measured H₂S concentration in the vapour phase above crude oils carried in tank cars can have identified very high levels that can range up to 65,000 ppm. Everyone handling petroleum crude oil in bulk should protect themselves by using appropriate Personal Protective Equipment.
The American Conference of Governmental Industrial Hygienists (ACGIH®) recommended exposure limit for hydrogen sulfide is:

- ACGIH® TLV® - TWA: 1 ppm
- ACGIH® TLV® - STEL [C]: 5 ppm

Where:
TLV® = Threshold Limit Value
STEL = Short-Term Exposure Limit
TWA = Time-Weighted Average
C = Ceiling limit

**Air Monitoring**

During a derailment that involves the release or potential release of Flammable Liquids, air monitoring needs to be conducted to quantify the exposures to the workers and the community. Until air monitoring is established and testing conducted you should consider the immediate area of the incident (hot zone) as requiring respiratory protection in the form of self-contained breathing apparatus.

**2.4 Chemical Hazards and Harmful Effects of Specific Flammable Liquids**

**CRUDE OIL**

Crude oil is designated as a Class 3 dangerous good - Flammable Liquid.

Under the United Nation classification system, crude oil is designated as UN 1267, or when it contains higher levels of hydrogen sulfide, as UN 3494. But within these classifications, crudes can range from a viscous tar-like substance, to something looking and flowing like water.

The main hazards associated with crude oils are its flammability, volatility and the presence of other chemicals including:

- **Hydrogen Sulfide**, a colourless gas that smells like rotten eggs in very low concentration, which dissipates quickly in air and can kill suddenly.
- **Benzene**, also found in crude oil where the primary exposure method is by inhalation.

**Proper breathing apparatus should be worn to protect against exposure to both these chemicals, and others including combustion by-products.**

**Crude Oil Basic Properties**

Crude oil can be characterized using five different measures:

1. **Viscosity** means a liquid’s resistance to flow. Cold molasses, for example, is very viscous. Water flows easily, so has a low viscosity. Different types of crude can have different viscosity.

2. **Temperature** has a major effect on a liquid’s viscosity. This is why a fluid’s viscosity is measured with temperature.

3. **Specific gravity** indicates what a flammable liquids’ weight is compared to water. This is important in a response, especially near a river or lake, because the oil’s ability to float on water or not, will determine response strategies.

4. **Boiling point** indicates at which temperature it can change its state from a liquid to a gas throughout the bulk of the liquid. Crude oil contains many different hydrocarbon compounds ranging from the lightest compound of methane gas with a boiling point of -160°C, up to the very thick and heavy compound of bitumen that boils at around 525°C.
5. **Flash point** is the temperature required to produce a vapor/air mixture above the liquid fuel that ignites, when exposed to an open flame. A low Flash Point means that vapor from gasoline and light crudes will ignite easily and at very low temperatures.

**ETHANOL**

Ethanol (UN 1170, UN 1987 or UN 3475) is another Class 3 Flammable Liquid transported in large volumes by rail. It is a polar solvent (mixes with water) produced primarily from corn and wheat for use as a renewable fuel. Ethanol for use as a fuel is de-natured by adding gasoline to the product, to make it unfit for drinking. The U.S. ships this de-natured ethanol under UN 1987, while Canada ships it under UN 3475.

Ethanol is commonly added to Gasoline (UN 1203) in proportions of 10%. In some instances it is added to gasoline at higher percentages, then the gasoline is classified as UN 3475. That classification lets first responders know they must use alcohol resistant foam (AR-AFFF) to extinguish the fire.

**Ethanol Basic Properties**

Ethanol is a clear, colorless, flammable solvent; also known as ethyl alcohol, grain spirits, or neat alcohol (anhydrous). The Ethanol in transportation fuels has been denatured, generally by adding 2-5% gasoline (denatured fuel ethanol), rendering it unfit for drinking.

Ethanol is a polar solvent, totally miscible (mixes completely) in water.

The flash point of gasoline is -42°C (-45°F); whereas the flash point of ethanol is -20°C (-5°F). Flash point is the lowest temperature at which a flammable liquid can form an ignitable mixture in air near the surface of the liquid. The lower the value is, the easier it is to ignite. This is the minimum temperature at which a liquid gives off vapor in sufficient concentrations to allow the substance to ignite.

**2.5 Type, Condition and Behaviour of Tank Cars**

Flammable liquids are transported in non-pressure tank cars with capacities of approximately 125,000 litres (33,000 U.S. gallons) and weights of approximately 130,000 kilograms (286,000 lbs).

Currently, the most common tank car is a DOT111 with about 90,000 in service. There is also the CPC-1232 tank car model, which has additional protection features.

Both these models are being phased out of service over a number of years and replaced with the TC/DOT117 tank car. The new TC/DOT117 have enhancements to reduce the potential for the release of product in the event of an incident and will be equipped with thermal protection (jacketed) to better protect the tank from fire.

Due to the tremendous weight and forces involved in a derailment, large numbers of tank cars can be seriously damaged with loss of product, and often result in multiple cars on fire as well as “pool fires” of liquid spreading out from the loss of product. These pool fires can spread to buildings, surrounding lands and waterways creating greater risks to life, property and the environment.

**Jacketed vs. Non-jacketed Tank Cars**

Thermal protection on tank cars is achieved by applying insulation between the inner tank and an outer steel cover or jacket. Jacketed tank cars are able to resist the heat of a fire better than non-jacketed tank cars. There is no way for first responders to easily identify jacketed tank cars.

**Fire Spread**

**Boil Over**

In rail incidents involving flammable liquids, there is always the possibility of a boil over. A boil over may occur if water that has accumulated in the bottom of the tank car boils and suddenly pushes the flammable liquid out of holes in the car. Boil overs:

- spread the flammable liquids, creating pools of flammable liquids and spreading the fire itself.
- are one of the many reasons why just throwing water at a rail incident can make things much worse.

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2 Information from Ethanol Emergency Response Coalition Training Guide
Froth over/Slop over
Slop overs and froth overs are much less dramatic than boil overs, but they still pose a serious risk.

- **A slop over** happens when the froth in a container like a rail car spills over the rim with a minimum of intensity.
- **Froth overs** are a steady spill over the rim, or a slop over that continues over time.

Potential Rail Car Failure

**Explosions or Container Breach: Heat Induced Tear Versus BLEVE**

Many firefighters are familiar with the term BLEVE; a Boiling Liquid Expanding Vapor Explosion. When a vessel, such as a tank car is subjected to heating and the contents to boil and expand, the container violently explodes, often projecting pieces hundreds of meters, along with a large fireball. Pressure tank cars carrying Liquefied Petroleum Gas (LPG) such as propane can BLEVE when exposed to fire.

When exposed to intense heat, non-pressure rail cars can fail and cause heat induced tears (HIT) to open up. Heat induced tears are highly variable and unpredictable, and have been known to occur in 20 minutes or less of the incident occurring. In these cases, a sudden HIT may occur, releasing large quantities of flammable liquid that form a “fireball”. However, unlike in a BLEVE, the tank car is generally not propelled over long distances from an explosion.

Once a HIT has occurred, the tank is breached and pressure is release.

It is extremely important for first responders to understand and be prepared for a sudden HIT to occur at these incidents.

Where flame impingement has occurred, consult the ERG for which protective actions to take. In all cases, avoid rushing-in and think safety.

2.6 Flammable Liquid Unit Trains: Incident Timelines

The following information is referenced from the Transportation Rail Incident Preparedness & Response: Flammable Liquid Unit Trains (TRIP-R) program developed through the U.S. Department of Transportation – Pipeline and Hazardous Materials Safety Administration (DOT-PHMSA).

**Incident Timeline Notes**

- Training tool only – designed to show the relationship between:
  - Behavior of the tank car(s) and their contents
  - Key incident management benchmarks
  - Strategic response options
- Specific response timeline elements will vary based upon local response timelines and operational capabilities
- Train speed and energy will directly influence container breach and the size/scope of the incident
- Container breaches have occurred as soon as 20 minutes and as long as 8 hours+
STRESS/BREACH/RELEASE BEHAVIOURS

Incident Growth
- Thermal Stress on Container
- PRV Activations
- Heat Induced Tears (HIT)
- Fire & Radiant Heat Exposures

Equilibrium
- Fire Confined to Area
- No PRV Activations
- Two-Dimensional Fires
- Lower Probability of More HITs or Breaches

Probability of Container Failure

Pre-Incident 0 Hrs 2 Hrs 4 Hrs 6 Hrs 8 Hrs Post 8 Hours

PLAN TRAIN EXERCISE

Provisional
HMO/HMRT On-Scene

Regional
HMO/DGO On-Scene

Provisional/Federal
Tech Specs On-Scene

Unified Response Org

Local

Local/Regional

PROBLEM VS. RESPONSE TIMELINE

Incident Growth
- Thermal Stress on Container
- PRV Activations
- Heat Induced Tears (HIT)
- Fire & Radiant Heat Exposures

Equilibrium
- Fire Confined to Area
- No PRV Activations
- Two-Dimensional Fires
- Lower Probability of More HITs or Breaches

Pre-Incident 0 Hrs 2 Hrs 4 Hrs 6 Hrs 8 Hrs Post 8 Hours

Probability of Container Failure

Offensive Strategy?

Defensive or Non-Intervention Strategy

Assessment to Offensive Strategy

Risk Based Response
- Analyze Problem
- Assess Hazards
- Evaluate Risks / Consequences
- Available Resources
- Appropriate Response
RISK-BASED RESPONSE
Risk Based Response is defined by NFPA Standard 472 as a systematic process by which responders analyze a problem involving hazardous materials, assess the hazards, evaluate the potential consequences, and determine appropriate response actions based upon facts, science, and the circumstances of the incident. The acronym A.P.I.E. describes this methodology:

- Assess the incident
- Plan the response
- Implement the response
- Evaluate the progress of the response

Incident size-up initiates the process of assessing the hazards and evaluating the potential risks at a HHFT scenario. As part of a risk-based response process, understanding the behavior of the container involved, its contents, the location of the incident and surrounding exposures are critical elements in determining whether responders should and can safely intervene.

The acronym D.E.C.I.D.E. is another incident assessment methodology used for decision making in hazardous materials emergencies. It consists of six steps:

1. Detect hazardous materials presence;
2. Estimating likely harm without intervention;
3. Choosing response objectives;
4. Identifying actions options;
5. Doing the best options and

SITE ASSESSMENT AND STABILITY
First responders need to recognize the risk factors inherent to the type, condition and behavior of tank cars; fire spread, explosion, toxic gases and site conditions.

Knowing what specific factors and conditions to look for in a HHFT incident can be challenging and something most first responders are not familiar with. To assist in this evaluation, Imperial Oil, (supported by the Chemistry Industry Association of Canada and the Canadian Fuels Association) developed The Disciplined Approach Chart (section 2.10), a tool specific to these incidents.

2.7 Incident Management: Incident Command System (ICS)
In Canada, whether an emergency occurs in a large city, small town, rural village or First Nations community, the response is a responsibility of the local government, acting as the Authority Having Jurisdiction (AHJ) within the boundaries of their community. The AHJ is usually represented by the emergency services (police, fire, EMS).

Coordinating response operations at the scene of a major rail incident can present many challenges, and smaller emergency response organizations may be overwhelmed by the multitude of governmental agencies and related organizations that will ultimately appear on-scene.

These various players must all work together seamlessly for the best possible result.

First responders should be trained in ICS to levels appropriate to their role at an incident and use of the ICS Canada training courses for I-100, I-200 would help ensure interoperability with the railways and other private sector and government organizations.

Unified Command Structure
ICS includes the use of a Unified Command Structure to better coordinate response operations in a large scale emergency. Once the Incident Command Post is operational, responders must assess and determine the appropriate response strategy.
2.8 Response Strategies and Environmental Factors

Most fire service emergencies are “high intensity, short duration events” terminated in a matter of hours or within a single operational period. In contrast, major environmental incidents such as HHFT derailments are long duration events that will extend over several days.

Taking a risk-based response is critical to safe and successful management of the incident. All initial decisions should be driven by a risk-based size-up process, based upon product/container(s) behaviour, incident location and exposures, and incident potential.

Unified command will be critical for the successful management of the incident.

This section explains decision making and response. It is important to start by the implementation of the Incident Command System (ICS) using a Unified Command Structure (UCS) to develop an appropriate response strategy. Once this in place the response strategy can be implemented.

RESPONSE STRATEGIES WHEN FACED WITH A SPILL WITHOUT A FIRE

While not all flammable liquid spills result in a fire when the incident occurs, ignition is always a concern responders must keep in mind when developing a response strategy. Spills on land or in water require special equipment and procedures to reduce the impact of the spill.

Environmental Factors

Environmental damage is a major concern that could have long term impacts made worse by well intentioned actions when trying to extinguish a fire. Contamination of water supplies and lands need to be considered priorities.

Spill on Land

When oil or other flammable liquid is spilled on land, a top priority is to minimize the spread of product both horizontally and vertically. Response strategies include using dikes, berms, dams, trenches and pits, based on time; environment; and available equipment.

Oil Spill on Water

First responder spill control capabilities will focus mainly on defensive tactics for non-fire scenarios to either keep product out of the water or protect downstream water intakes and sensitive areas.

Most first response agencies do not have much spill control capability, especially if waterways are involved. Most spill control resources (both land and water-based) would come from ERAP response organizations, and emergency response contractors or in cooperation with Provincial or Federal Ministry of Environment.

Booming strategies help minimize the spread of spilled oil on water and concentrate it for recovery.

Ethanol Spill on Water

Since ethanol will mix with water, it cannot be contained or collected using booms once it is in a body of water.

RESPONSE STRATEGIES WHEN FACED WITH A FIRE

A rail incident involving flammable liquids is very complex and dangerous. Attempting anything beyond non-intervention can easily make a bad situation much worse. Until properly trained personnel are available, first responders must focus on securing the scene and ensuring their own safety and public safety.

Three main courses of action can be considered when faced with a fire:

- **Non-Intervention**
- **Defensive Strategy**
- **Offensive Strategy**
Non-Intervention
This strategy allows the flammable liquid to burn until the bulk of the flammable liquid has been consumed, then to extinguish the remaining fires. This is the preferred course of action when rail tank cars carry huge quantities of flammable liquids and traditional firefighting strategies and tactics may not be effective in these situations. The safest and most effective strategy is often to simply let the liquids burn off rather than to take risks in a dangerous situation.

The first priority for First Responders is securing the scene, ensuring their own safety and the public safety.

Defensive strategy
The two objectives of this strategy are:

1. Ensure the incident does not spread causing additional property damage or threat to the public or environment.
2. Cool the tank cars that are exposed to fire to minimize the potential of a sudden heat induced tear, and additional fire growth.

Before choosing this course of action, responders should consider several important factors. For example,

- Most crude oil and burning crude oil will float on water. If you start cooling tank cars, you need to control the run off so that you are not spreading the fire or enlarging the footprint of the incident causing more environmental damage.
- You may need large quantities of water for an extended period of time.

Note: Cooling a tank car is effective when the water spray is not evaporating on contact with the tank. If you hear a loud, shrill noise much like air escaping, it could be from the tank’s pressure relief device (PRV), or if you see blisters being formed in the steel on top of the tank car, this could mean that cooling may not be effective.

Carefully monitor the operations and know when to pull back.

Do not spray cooling water directly into a breached tank car containing flammable liquids. Water in breached tank cars can lead to a dangerous slop over, froth over or potentially a boil over.

If a tank car has already been breached, the tank car cannot build pressure so a heat induced tear is not possible. Therefore, you do not need to cool tank cars that have holes in them.

Mitigation Strategies: Controlling Run-Off

Most crude oil floats on water and will burn on water. It is imperative to:

- understand specifically where the crude is flowing; and
- identify ways to keep the crude oil and run off safely contained at the source; or divert the spilled crude oil and run-off away from exposure and sensitive environmental areas.

Offensive Strategy
This course of action involves attempting to extinguish the fire.

Never conduct offensive actions unless under the direct supervision of trained personnel and being specifically told to by trained personnel under an Incident Command System.

Flammable liquid firefighting and Class B foam operations require large water supplies to support cooling operations, exposure protection and fire extinguishment. Most railway lines do not have hydrant–based water supplies immediately available. In addition, using natural water sources such as streams and rivers may not be easily and safely accessible.
As indicated in the Response Timeline chart, it will usually take several hours before an Incident Commander can safely consider an offensive strategy. This time is needed not only for the incident to achieve “Equilibrium” but also for enough resources to arrive and prepare for starting an offensive strategy. These resources include railway personnel and equipment, ERAP personnel and equipment, emergency response contractors and fire mutual aid resources.

2.9 Fire Suppression Foam and Equipment

Foam Types

Extinguishing flammable liquid fires requires the use of firefighting foam such as Aqueous Film Forming Foam (AFFF) or Alcohol Resistant-Aqueous Film Forming Foam (AR-AFFF).

Most municipal fire departments do not have these resources (i.e. sufficient quantities of the correct foam concentrate, foam pumps or eductors, foam aerating nozzles etc.) and the specialized training required. Fire departments should evaluate their current capabilities and determine whether or not they have the means to properly mitigate a rail car HHFT incident in their jurisdiction.

Three Dimensional Fires – Dry Chemical Use

Three Dimensional fires – such as those caused by a stream of flowing product discharging into a pool fire, cannot be extinguished using foam as it cannot achieve a blanket or seal in the vertical element. Therefore, using dry chemical extinguishing agents would be necessary if the flow of the fuel cannot be stopped.

FIRE SUPPRESSION FOAM

Class B foams are the recommended extinguishing agents. Foam applications during a derailment can be extremely challenging due to the large quantity of flammable liquid involved and other factors such as multiple tank cars involved, limited access and track structure design.

Application Rates

Before Attempting Offensive Operations:

- Make sure you have enough properly trained and protected responders for a safe operation;
- Conduct a thorough recon of the site to clearly identify the types of fire, spills, pool fires and that there is no flammable liquid still leaking out of tank cars causing three dimensional fires;
- Identify the correct extinguishing agent (foam concentrate, dry chemical), equipment, and trained personnel;
- Ensure there is enough foam, dry chemical, sustainable water supply for the planned offensive operation and to maintain a post suppression foam blanket to prevent re-ignition if required.
- Apply these products correctly using the appropriate rate and methods.
2.10 Flammable Liquid (TDG) Emergency Response Chart – A Disciplined Approach

The Disciplined Approach Chart is a process responders use to help protect life, property and the environment in a safe & efficient manner.

This version is based on The Disciplined Approach to Emergency Response originally developed by Imperial Oil and supported by the Chemistry Industry Association of Canada (2010); and is sponsored by the Chemistry Industry Association of Canada (2015)

How to use the Disciplined Approach Chart:

**Situation Analysis**

Start by analyzing the situation. The goal is to define and prioritize critical objectives: what needs to be protected (life, property, and environment) from what hazards? This includes identifying and analyzing:

- The problem (nature and quantity of material, type and condition of Container; stability of the incident);
- Modifying conditions (location, time and weather conditions);
- Potential losses (affected area): from the list of potential losses, identify and prioritize those that are critical.
- Control measures: determine the right kind and amount of resources needed to protect life, property and environment.

**Strategies and Tactics**

Develop the response and restoration tactics to meet the critical objectives, including:

- Establishing Incident Command Structure
- Protecting from Additional Losses
- Stabilizing the hazard
- Planning Fire Interventions
- Mitigating the hazard
- Following Recovery and Clean Up Strategies.

**Implementation**

Does the situation stabilize, intensify or change in other ways? if yes, return to the Situation Analysis Modifying Conditions list.
# Situation Analysis

## Control Measures

1. **Carrier (railway) Emergency Response (ER) Plan**
2. **Community ER Plan**
   - Community First Responders; fire, police, EMS
   - EMO
3. **Consignor/shipper ERAP and trained personnel**
   - FL Technical Advisor
   - Specialist for other products
   - Response resources
4. **Marine Response Organization.**
5. **Control agents**
   - Firefighting: water/foam
   - Dispersants
6. **Support services**
   - Aerial surveillance, dispersion modeling
7. **Federal, Provincial, Territorial, Municipal, First Nations**
   - Environment, transportation, natural resources
   - Other
8. **Utilities**
   - Electricity, gas, telephone, fibre optics
9. **Product information**
   - Manufacturer, CANUTEC, CHEMTREC

## Potential Losses

1. **People**
   - Fatality
   - Injury
2. **Property**
   - Private
   - Public
   - Infrastructure
3. **Environment**
   - Drinking water
   - Lakes, rivers or streams
   - Soil/ground water
   - Wildlife/habitat
4. **Public Communications**
   - Media type
   - Government
   - Community
   - Special interest

## Nature & Quantity of Material

| 1. UN Number & Shipping Name |
| 2. Quantity spilled |
| 3. Quantity at risk |
| 4. Physical and chemical properties |
| 5. Dangerous goods ERAP |

## Type, Condition & Behaviour of Container

| 1. Mode of transport |
| 2. Means of Containment |
| 3. Fixed Facilities |
| 4. Danger of failure |
| 5. Failure |

## Stage of Incident

| 1. Stable |
| 2. Unstable |

## Location

| Remote |
| Rural |
| Urban/suburban |
| Difficult terrain |
| Limited access |
| Land spill |
| Involves body of water |
| Effects of terrain on product location & migration |

## Time

| Time of incident |
| Time of notification |
| Time of day |
| Day of week |

## Weather Conditions

| Temperature |
| Wind direction |
| Wind speed |
| Humidity |
| Air inversion |
| Precipitation |
| Weather forecast |

## Affected Area

| People |
| Property |
| Environment |
| Public Communications |

## Resources

| Carrier (railway) Emergency Response (ER) Plan |
| Community ER Plan |
| Community First Responders; fire, police, EMS |
| EMO |
| Consignor/shipper ERAP and trained personnel |
| FL Technical Advisor |
| Specialist for other products |
| Response resources |
| Marine Response Organization |
| Control agents |
| Support services |
| Utilities |
| Product information |

## Problem

| Mode of transport |
| Means of Containment |
| Fixed Facilities |
| Danger of failure |
| Failure |

## Modifying Conditions

| Temperature |
| Wind direction |
| Wind speed |
| Humidity |
| Air inversion |
| Precipitation |
| Weather forecast |

## Nature & Quantity of Material

| UN Number & Shipping Name |
| Quantity spilled |
| Quantity at risk |
| Physical and chemical properties |
| Dangerous goods ERAP |

## Type, Condition & Behaviour of Container

| Mode of transport |
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| Utilities |
| Product information |
## STRATEGIES AND TACTICS

### Response Strategies

<table>
<thead>
<tr>
<th>Establish Incident Management</th>
<th>Protect Potential Losses</th>
<th>Stabilize the Hazard</th>
<th>Fire Intervention</th>
<th>Mitigate the Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. Property</td>
<td>5. Place barrier to prevent impact on container</td>
<td>5. Place barrier to prevent impact on container</td>
<td>5. Support services for health and social services</td>
</tr>
<tr>
<td></td>
<td>b. Domestic animals &amp; wildlife</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Environment</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Fire Intervention

- Defensive Action:
  - remove sources
  - control burn
  - remove other ignition sources
  - protect exposures
  - remove fuel
  - divert/contain spilled material

- Offensive Action:
  - water
  - foam
  - chemical

- Non-Intervention:
  - let substance burn

### Stabilize the Hazard

- Ignition:
  - remove sources
  - control burn
  - stop the leak
  - plug/patch
  - capping kit

- Contain:
  - dam/dike
  - boom
  - prevent container failure
  - cool
  - depressurize

- Non-Intervention:
  - let substance burn

### Implement

Does situation stabilize, intensify or other change? If yes, return to **Modifying Conditions**.
2.11 Railway Dangerous Goods Incidents - Roles and Responsibilities Table

<table>
<thead>
<tr>
<th>AGENCY/ORGANIZATION</th>
<th>ROLES AND RESPONSIBILITIES AT AN HHFT INCIDENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAILWAYS</td>
<td>When an incident occurs railways respond through their internal Emergency Response Plans (ERPs).</td>
</tr>
<tr>
<td>Note: This section of the table identifies Roles and Responsibilities that Class 1 railways (CN and CP) are able to assume.</td>
<td>- Train Crew reports incident, starting a callout process.</td>
</tr>
<tr>
<td>Short line railways do not have the same level of resources available.</td>
<td>- The railway then:</td>
</tr>
<tr>
<td></td>
<td>- Notifies First Responders – police, fire, ambulance immediately</td>
</tr>
<tr>
<td></td>
<td>- Report the incident to (as required by regulation):</td>
</tr>
<tr>
<td></td>
<td>- Transportation Safety Board</td>
</tr>
<tr>
<td></td>
<td>- TDG (Transport Canada – CANUTEC)</td>
</tr>
<tr>
<td></td>
<td>- Environmental Authorities</td>
</tr>
<tr>
<td></td>
<td>- Local authorities</td>
</tr>
<tr>
<td></td>
<td>- Secures product identification and emergency handling information</td>
</tr>
<tr>
<td></td>
<td>- Mobilizes operations, engineering, mechanical, environmental services, claims and community relations to the site, as required.</td>
</tr>
<tr>
<td></td>
<td>- Notifies Consignor/ERAP holder(s)</td>
</tr>
<tr>
<td>Notes:</td>
<td>- If commodity is Dangerous Goods, the consignor or contractor may mobilize to site</td>
</tr>
<tr>
<td></td>
<td>- Depending on incident severity and type, specialized contracted services are notified and mobilized to the site.</td>
</tr>
</tbody>
</table>

**Incident Command**

Railways (RR) are prepared to function in any capacity within any ICS structure.

The Senior Transportation Officer or his designate at the scene is the RR’s On Scene Responses Coordinator (OSRC) to interface with the Incident Commander under the ICS Operations Branch.

The Train Crew will provide the train documents to the IC. In absence of the Train crew the documents can be obtained via the Rail Traffic Controller, RR Police, or the RR OSRC.

A RR Incident/Operations Command Centre is set up. Major Organization Components in a typical railroad structure (under Operations Branch in ICS):

- Transportation – protect incident scene from trains – arrange movement of cars
- Mechanical – order heavy equipment for wrecking operations
- Engineering – re-build track and build track to support re-railing/transload operations
- Safety/Risk Management
  - Environment & HazMat Team
  - Works within ICS
### AGENCY/ORGANIZATION

<table>
<thead>
<tr>
<th>ROLES AND RESPONSIBILITIES AT AN HHFT INCIDENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Conduct damage assessment and mitigate leaks and spills</td>
</tr>
<tr>
<td>• Arrange for transloading of product, if required.</td>
</tr>
<tr>
<td>• Work with ERAP holder/contractor, as required</td>
</tr>
<tr>
<td>• Public Affairs – address public dislocated or evacuated</td>
</tr>
<tr>
<td>• Accident Investigation</td>
</tr>
</tbody>
</table>

**Debriefing**

- Incidents are “debriefed” among railway personnel and regulators
- If serious incidents affect the community, the railway participates in debriefings with Community representatives, local leaders and first responders

**Responsibilities:**

- Protect life and health
- Protect property and the environment
- Ensure and provide for business continuity

### FIRE SERVICE

First responder, usually Authority Having Jurisdiction

- Assess situation, establish incident command, make notifications, secure scene with Police, rescue of persons at risk, if possible, consider evacuations, develop Incident Action Plan, call for additional resources
- Fire suppression, rescue, traffic control
- Fire control, incident stabilization
- Fire service decontamination

First Nations fire services, through their funding agreements with AANDC, are primarily funded to suppress fires in residential occupancies and facilities funded through AANDC.

Many First Nations’ fire services provide protection above and beyond those identified as part of the funding formula to include additional fires and rescue.

The First Nations must determine an appropriate level of service provision, and as such where financial, policy, etc. implications come into play, it is their responsibility to provide for those services.

### POLICE SERVICE

- On-scene Security, Traffic/Crowd Management, Investigation, Evacuation,
- Family/Community Support,
- Incident Command (depending on nature of Incident)
- Support – manage security, zones, evacuation,
- Victim Identification, assist Coroner
- Investigation under Criminal Code

### EMERGENCY MEDICAL SERVICE

Support – medical services – treat, triage, transport
<table>
<thead>
<tr>
<th>AGENCY/ORGANIZATION</th>
<th>ROLES AND RESPONSIBILITIES AT AN HHFT INCIDENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CANUTEC</td>
<td>Provides TDG technical and scientific advice and communicates to first responders ERAP information such as MSDS (SDS) information, arranges conference calls with industry experts and others.</td>
</tr>
<tr>
<td>TRANSPORT CANADA</td>
<td>TC TDG Inspectors or Remedial Measures Specialists (RMS) provide advice and expertise to Incident Command on emergency response, provide technical support and understand the ERAP requirements, work with Industry and Contractors to ensure public safety and may be part of Unified Command.</td>
</tr>
<tr>
<td>Transportation of Dangerous Goods Directorate</td>
<td></td>
</tr>
<tr>
<td>Compliance and Response Branch</td>
<td></td>
</tr>
<tr>
<td>TRANSPORT CANADA</td>
<td>Investigates incident.</td>
</tr>
<tr>
<td>Transportation of Dangerous Goods Directorate (TDG)</td>
<td>Recommends incident prevention and response.</td>
</tr>
<tr>
<td>TRANSPORTATION SAFETY BOARD</td>
<td></td>
</tr>
<tr>
<td>ERAP HOLDER</td>
<td>If the product is “ERAPable”, the consignor/importer must be able to provide technical knowledge on product and ensure response assistance is available (either directly or via contracted service)</td>
</tr>
<tr>
<td>ERAP EMERGENCY RESPONSE ORGANIZATION</td>
<td>Provides the response coordination as per the approved ERAP, which may include:</td>
</tr>
<tr>
<td></td>
<td>1. Emergency Call Centre</td>
</tr>
<tr>
<td></td>
<td>2. Initial response support via over the phone support from a Technical Advisor</td>
</tr>
<tr>
<td></td>
<td>3. On-site assistance with response tactics, logistics, safety and communications provided by a Technical Advisor and/or response team</td>
</tr>
<tr>
<td></td>
<td>Establish and maintain training and records for competency standards and responses</td>
</tr>
<tr>
<td>EMERGENCY RESPONSE CONTRACTOR(S)</td>
<td>Provides for hire, hands-on, on-scene emergency response within the railway operations sector.</td>
</tr>
<tr>
<td></td>
<td>Conducts recovery, mitigation and clean-up activities</td>
</tr>
<tr>
<td>PROVINCIAL/TERRITORIAL MINISTRY OF ENVIRONMENT</td>
<td>Inspects &amp; investigates environmental impacts (if leaves federal site or if there is a possibility of an adverse effect on the environment off federal site); Provides advice on environmental concerns to Incident Command; provides local technical knowledge, organizes/directs mitigation of environmental impact of incident in areas under Provincial/Territorial jurisdiction.</td>
</tr>
<tr>
<td>AGENCY/ORGANIZATION</td>
<td>ROLES AND RESPONSIBILITIES AT AN HHFT INCIDENT</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>ENVIRONMENT CANADA</td>
<td>Through its National Environmental Emergencies Centre (NEEC) available 24/7, Environment Canada provides Incident Command with scientific and technical advice on environmental concerns; Provides local technical knowledge, organizes/directs mitigation of environmental impact of incident in areas under federal jurisdiction such as: Preparing weather forecasts, contaminant dispersion and trajectory modelling, fate and behaviour of hazardous substances, setting clean-up priorities and techniques, as well as protecting sensitive ecosystems and wildlife such as migratory birds and fish; conducting on-site sampling, monitoring and chemical testing by trained and equipped subject matter experts conducting laboratory analysis including targeted research specific to the incident in support of its departmental mandate and/or incident decision-makers; Issues directions to the responsible party to take all reasonable and appropriate measures to minimize the potential or real impacts to the environment and human life or health.</td>
</tr>
<tr>
<td>MINISTRY OF LABOUR/ CSST IN QUÉBEC</td>
<td>Provides advice on health and safety requirements for emergency responders at the incident.</td>
</tr>
<tr>
<td>MINISTRY OF HEALTH, BOARD OF HEALTH</td>
<td>Provides technical assistance and evaluates possible public health concerns such as fumes, smoke, water quality etc. and notifies public.</td>
</tr>
<tr>
<td>LOCAL AUTHORITY/ EMERGENCY PLANNING</td>
<td>Participates in emergency planning, activates MEP, declares a state of emergency (if necessary); Coordinates emergency response assistance for public and support to the Incident Command.</td>
</tr>
<tr>
<td>PROVINCIAL/ TERRITORIAL EMERGENCY MANAGEMENT AGENCY</td>
<td>Coordinates provincial resourcing; Coordinates provincial communication strategy, passage of information to provincial/territorial officials, field officer liaison; Supports local emergency response; provides technical knowledge, additional resources.</td>
</tr>
<tr>
<td>PROVINCIAL TDG AUTHORITY</td>
<td>Provides response technical advice/resource coordination Serves as liaison b/w CANUTEC, TC, Provincial Operations Center, province, municipalities, emergency responders, ER teams, etc.; Conducts Inspections &amp; Investigations; Supports local emergency response for areas of provincial/territorial responsibility.</td>
</tr>
<tr>
<td>OTHER PROVINCIAL RAIL SAFETY</td>
<td>For provincially regulated sites: Provides: information &amp; coordination; Technical advice/coordination; Conducts Investigations.</td>
</tr>
</tbody>
</table>
2.12 Specialized Resources Available to Canadian First Responders

Transport Canada

- **The Transportation of Dangerous Goods Directorate** delivers the national program to promote public safety during the transportation of dangerous goods. It serves as the major source of regulatory development, information and guidance on dangerous goods transport for the public, industry and government employees.

- **Remedial Measures Specialists** assess industry’s Emergency Response Assistance Plans (ERAPs). They will also travel to significant transportation dangerous goods incident sites to ensure public safety and to oversee the management of an activated ERAP. A RMS may, using the powers of a TDG Inspector, detain or direct as required.

- **CANUTEC (Canadian Transport Emergency Centre)** provides 24-hour-a-day bilingual emergency advisory and regulatory information services. CANUTEC’s experienced professional chemists help emergency responders during a dangerous goods incident.
  - [https://www.tc.gc.ca/eng/canutec/menu.htm](https://www.tc.gc.ca/eng/canutec/menu.htm)

- **The Emergency Response Guidebook** was developed jointly by CANUTEC (Transport Canada), the U.S. Department of Transportation, and the Secretariat of Communications and Transportation of Mexico. The ERG provides valuable information on the hazards of the chemicals and recommended responses to accidents involving dangerous goods. It is intended to help first responders determine immediate and general on-site response to an accident involving specific dangerous goods.

- An **ERAP or Emergency Response Assistance Plan** describes how the shipper of higher risk dangerous goods will respond in the event of a transportation incident. The Transportation of Dangerous Goods Regulations require ERAPs for dangerous goods that require special expertise and response equipment to respond to an incident. The plan can help local emergency responders by providing them with technical experts and specially trained and equipped emergency response personnel at the scene of an incident. The ERAP will:
  - describe the specialized response capabilities, equipment and procedures the shipper has available to support a response to incidents involving high risk dangerous goods.
  - address emergency preparedness, including personnel training, response exercises and equipment maintenance.

  The ERAP plans supplement those of the local and provincial authorities, and must be integrated with other organizations to help mitigate the consequences of an incident. This integration is usually accomplished by working within an incident management system – usually an Incident Command System or Incident Command Structure.

- **Canadian Association of Fire Chiefs (CAFC) & Canadian Association of Petroleum Producers (CAPP)**

  - **Emergency Preparedness for Rail Incidents Involving Flammable Liquids’ Program** CAFC and CAPP have signed a memorandum of understanding that formalizes the commitment to jointly develop an online general safety presentation. This presentation provides first responders with the information they need to be able to:
    a) assess hazards at the scene of a rail incident involving flammable liquids;
    b) identify who to contact and the available resources; and
    c) respond appropriately in an emergency involving rail cars.

  - **Enform**, the safety association for Canada’s oil and natural gas industry, is leading the program development and delivery, while CAFC is acting as the primary advocate for first responders. CAPP will continue to support the program by providing subject matter expertise on flammable liquid hydrocarbons in collaboration with Enform.
Railway Association of Canada delivers railway emergency response courses at the Justice Institute of British Columbia (JIBC). This specialized course provides specific, rail based emergency response training to persons who are already trained in technical response to dangerous goods incidents.


TRANSCAER®, the Transportation Community Awareness and Emergency Response initiative was started in Canada in 1985 by the Chemistry Industry Association of Canada (CIAC). Today, it is led by the CIAC and RAC. TRANSCAER® exists to make sure that communities are informed about the products being moved through their area by road and rail, and what measures are in place to ensure their safe transportation. TRANSCAER® members work with municipal officials, emergency responders, and residents along transportation routes, to assist them in developing and evaluating their community emergency response plans.

- [www.transcaer.ca](http://www.transcaer.ca)

**Additional Reference Material:**

- AskRail™ [www.askrail.us](http://www.askrail.us)
- Crude Oil and Ethanol training course hosted by CP Rail, provided at Ontario Fire College
- Enform Online Awareness Course: Emergency Preparedness for Rail Incident Involving Flammable Liquids in Canada
  - [http://www.enform.ca/](http://www.enform.ca/)
- Ethanol Emergency Response Coalition (EEEC) offers training programs and other resources.
  - [http://ethanolresponse.com/resources/](http://ethanolresponse.com/resources/)
- National Fire Protection Association [www.nfpa.org](http://www.nfpa.org)
- Transport Canada - TDG - Information on ERAPs, CANUTEC and Remedial Measures Specialists
- National Transportation Safety Board (U.S.) Safety Recommendation R-14-005 - TO THE PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION: Revise the spill response planning thresholds contained in Title 49 Code of Federal Regulations Part 130 to require comprehensive response plans to effectively provide for the carriers’ ability to respond to worst-case discharges resulting from accidents involving unit trains or blocks of tank cars transporting oil and petroleum products.