COMMONWEALTH OF MASSACHUSETTS

Large Volume/High Concentration Ethanol Incident Response Planning Guidance

August 2025

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1. Introduction

Ethanol is the primary chemical used to oxygenate reformulated gasoline. It has been a component of blended motor vehicle fuels in the United States since the early 1970's. Since 2000, it has come into greater use as an alternative to fuel additives such as methyl tertiary butyl ether (MTBE). Ethanol is also used in greater concentrations (up to 85%) in blended fuels as an alternative to gasoline itself for use in automobiles specially designed to run on it.

Note: in the context of this Large Volume/High Concentration (LV/HC) Ethanol Incident Response Planning Guidance (the "Guide") the term "ethanol" typically refers to denatured ethanol (i.e., ethanol with 2% to 5% (but may be as high as 7%) gasoline or other denaturant added to make the ethanol unfit for drinking).

Ethanol is transported over land and water by railroad tank cars, tanker transports (i.e., tractor-trailer tank trucks), and marine vessels (i.e., barges and tank ships). It is not presently transported via pipeline in Massachusetts because of its particular hazards (such as corrosivity) that differ from those of more ubiquitous fuels, such as gasoline. As the infrastructure for ethanol storage and transportation expands throughout Massachusetts, local emergency planners and first responders must be aware of the ethanol that may be stored and/or transported within their jurisdictions and the resources that are available for response and must plan accordingly.

Large volumes of ethanol are commonly shipped by unit trains, up to 3.2 million gallons, and large barges that can transport up to 2.5 million gallons. In Massachusetts, at least two to three ethanol unit trains currently travel through the state per week, as well as one ethanol barge per week. The number of trains and barges transporting denatured ethanol (95%-98% ethanol) through the state are anticipated to increase in the future.

Releases of LV/HC ethanol into the environment have been relatively few since ethanol first gained prominence as a fuel and fuel additive. However, some of the incidents that have resulted in releases affected railroads, roadways, and waterways. Emergency planners and first responders can learn from these incidents and can use this Guide document to better prepare for responses to emergency incidents involving LV/HC ethanol.

a. Purpose

This Guide was created to assist local emergency managers and responders in developing plans for emergency incidents primarily involving railroad tank cars transporting ethanol; however, the Guide may also be useful in planning for emergency incidents involving marine vessels, tanker transports, and/or storage facilities. This Guide suggests procedures to be used when planning a response to an emergency incident involving LV/HC ethanol, such as a railroad derailment with an ethanol release and/or fire.

By providing background information and standardized planning guidance, a plan created following this Guide can provide responders with a better understanding of an incident situation and facilitate a more organized and successful response. The methods set forth in this Guide also encourage dialogue between responders and the LV/HC ethanol transporters and owners/operators of ethanol facilities located or operating within their areas of responsibility.

***Important Note**: If the cause of the release/incident is known or suspected to be an intentional act the Incident Commander should immediately notify the appropriate law enforcement agency and the U.S. Federal Bureau of Investigation (FBI) Boston Field Office at (857) 386-2000. Ask the operator for the Weapons of Mass Destruction Coordinator.*

b. Scope

This Guide is a tool to inform local and state planners and responders about: ethanol incident profiles; national standards and practices; and the Commonwealth LV/HC ethanol incident response posture.

c. Policies

The Guide is a supporting document to the Large Volume/High Concentration Ethanol Incident Response Plan (LV/HC Ethanol Incident Plan). The Guide is based on national industry practice and/or regulations from the National Fire Protection Association (NFPA), U.S. Department of Transportation (USDOT), Pipeline and Hazardous Materials Safety Administration (PHMSA), National Response Team (NRT), U.S. Environmental Protection Agency (USEPA) and industry trade organizations, and Commonwealth of Massachusetts regulations, policies, and procedures (including the Massachusetts Department of Environmental Protection [MassDEP]Massachusetts Contingency Plan and the United State Coast Guard [USCG] Area Contingency Plans [ACPs]). The Guide is intended as reference material only.

2. ETHANOL PROFILE AND BEHAVIOR

The following sections describe the chemical and physical properties of ethanol and briefly describe how ethanol is used in Massachusetts.

a. Chemical/Physical Properties of Pure Ethanol

Ethanol has different chemical properties as compared to standard gasoline, so the fate and transport of ethanol from a spill will be different than for gasoline or other hydrocarbons. These properties are summarized in **Table 1**, below, and described in **Section 2.a.i** and the National response Team Quick Reference provided in **Attachment 7**.

Table 1: Chemical/Physical Properties of Ethanol	
Formula (pure ethanol)	C2-H6-O
Molecular Weight (pure ethanol)	46.07
Color/Form (pure ethanol)	Clear, colorless, very mobile liquid
Odor (pure ethanol)	Mild, like wine or whiskey
Transported as hazardous material	Yes - DOT Class 3, UN 1170 – Ethyl Alcohol UN 1987 – Denatured Fuel Ethanol – US UN 3475 – Denatured Fuel Ethanol - Canada
Ionization Potential	10.47eV
Flash Point	Varies, denatured ethanol as low as -5^{o} F

Table 1: Chemical/Physical Properties of Ethanol	
Boiling Point	Varies: PGII = 165-175° F.
Reid Vapor Pressure	2.3 psi
Viscosity in Centipoise (CPS) @ ~60 °F:	1.19
API Gravity	46° - 49°
Specific Gravity	0.79 (Floats on water)
Vapor Density	1.59 (Heavier than Air)
Flammable Range	Lower Flammable Limit: 3.3% Upper Flammable Limit: 19%
Solubility (pure ethanol)	High – readily mixes with water and organic solvents
Benzene content	Generally less than 1.0%
Evaporation Rate (temperature dependent)	>1 (High Evaporation Rate)
Sources: HSDB 2011 and NFPA 472	

i. Properties of Ethanol

1. Ethanol (ethyl alcohol), as referred to in this Guide, is typically denatured ethanol with 2% to 5% (but may be as high as 7%) gasoline added as the denaturant.
2. Colorless liquid with a characteristic alcohol odor.
3. Polar solvent that is completely miscible (soluble) in water.
4. A good electrical conductor, so electrocution and ignition hazards (e.g., static electricity) may be present.
5. Ethanol component and denaturant (i.e., gasoline) will separate on contact with water (surface water, groundwater, or firefighting water); the ethanol component will readily mix with water and the denaturant will typically separate and float on the water surface.
6. Ethanol concentrations in water are flammable at concentrations of 20% ethanol and may be flammable at concentrations as low as 10% ethanol.
7. Vapors are heavier than air (vapor density 1.59) and hang low to the ground.
8. Flash point is 55° F for pure ethanol, which decreases, and may be as low as -5 ° F when denatured with gasoline.
9. Diluted ethanol has higher flash points: 20% ethanol in water has a flash point of 97° F; 10% ethanol in water has a flash point of 120° F.
10. For ethanol vapors in air the lower flammable limit (LFL) is 3.3% and the upper flammable limit (UFL) is 19% (i.e., the flammable range is 3.3% to 19%).
11. Below an outside temperature of approximately 51° F, vapor pressure is outside the flammable range (i.e., ethanol cannot evaporate rapidly enough to achieve a vapor concentration within the flammable range).

ii. Ethanol Use and Transport

Key points regarding the use and transportation of ethanol are listed below and additional detailed information on ethanol transportation in Massachusetts is provided in **Section 3**.

1. High concentration ethanol includes denatured ethanol (93% to 97% ethanol; 3% to 7% gasoline) and E-85 motor fuel (85% ethanol; 15% gasoline).
2. Ethanol is a USDOT Class 3 (Flammable or Combustible Liquid) and placards on shipments typically have label 1987 or 3475; pure ethanol may have label 1170 or 3065 (See **Attachment 3** for more information on placards used for ethanol transportation).
3. Ethanol is blended into nearly half the gasoline produced in the United States, including most of the gasoline used in Massachusetts – typically 10% ethanol in the gasoline/ethanol mixture (also known as E-10).
4. Ethanol-blended fuels, including E-85, are available in Massachusetts.
5. Ethanol use continues to increase, as well as fuel stations offering E-85.
6. Large volume transportation of high concentration ethanol within the Commonwealth occurs primarily via rail (railroad tank cars) and water (barges), and to some extent via road.
7. The most common type of tank car used to transport ethanol since 2015 is the DOT 111, but CJC 1232 tank cars (jacketed and non-jacketed) are also used; newer, safer type DOT 117 tank cars are being phased in for general use for transporting ethanol.
8. Transloading of ethanol, where ethanol is moved from a railroad tank car to a tanker transport (i.e., tractor-trailer tank trucks) on a rail siding, may occur on rail sidings that generally have minimal fire control equipment.
9. Depending on the type and scope of the incident, supplemental state resources may be required to assist in responding to an ethanol release.

b. Ethanol Hazards and Impacts

The following sections describe the potential health hazards and environmental impacts related to ethanol and are intended to provide context to planning for the response to an LV/HC ethanol release.

i. Ethanol Health Hazards

Key health hazards are summarized below and additional information on the health hazards associated with ethanol can be found on-line in Safety Data Sheets for “denatured fuel ethanol.”

1. Ethanol is a flammable liquid that may affect target organs (e.g., blood, kidneys, the reproductive system, liver, upper respiratory tract, skin, central nervous system [CNS], and eye [lens or cornea) and may contain benzene or other known carcinogens in the denaturant.
2. In the eyes, ethanol may cause severe irritation, redness, tearing, blurred vision and conjunctivitis.

3. If inhaled, ethanol may cause nasal and respiratory tract irritation and loss of consciousness, coma, respiratory arrest, and/or sudden death, particularly in instances involving long term exposure and/or exposure to high concentration vapors.
4. Ethanol is harmful or fatal if swallowed and aspiration into the lungs may cause severe chemical pneumonitis or pulmonary edema/hemorrhage, which can be fatal.
5. Water intakes (e.g., drinking, process, aquaculture, or cooling water) may be impacted because ethanol rapidly affects the entire water column of the receiving water body and cannot be easily removed, so owners/operators of water intakes that may be threatened need to be warned.
6. Wastewater treatment plants (WWTP) may be impacted if ethanol enters them via sewers or storm drains because ethanol, either directly or due to the decreased dissolved oxygen levels caused by biodegradation of ethanol, may kill the microbes used in the treatment process, so owners/operators of WWTP that may be threatened need to be warned.
7. Ethanol that enters a storm water drain system or a sewer system poses a danger from flammable liquid and vapors in the lines.

ii. Ethanol Environmental Impacts

Key environmental impacts and hazards are summarized below and additional information on the potential environmental impacts from an LV/HC ethanol release can be found in the MassDEP (2011) report: Large Volume Ethanol Spills (see **Attachment 2: Selected References** for the full citation).

1. The denaturant in ethanol tends to separate on contact with water (surface water or groundwater) because the ethanol readily mixes with the water and denaturants, such as gasoline, will float on the water surface.
2. Ethanol in surface water bodies (e.g., lakes, ponds, streams, rivers) is rapidly biodegraded, but the biodegradation decreases the dissolved oxygen levels.
3. Fish and other aquatic organisms may be killed by direct contact with high concentrations of ethanol or decreased dissolved oxygen levels in water due to ethanol biodegradation.
4. Ethanol released into a surface water body will impact recreational uses of the water body until the ethanol is degraded or removed.
5. Aeration of water bodies may increase the dissolved oxygen in the water and increase biodegradation of ethanol, but aeration needs to be kept in the ethanol plume and guidance for optimizing aeration (air volumes, bubble size, contact time) is not available.
6. Water quality monitoring should occur in water bodies that may be affected and downstream from ethanol release locations to determine if dissolved oxygen levels are approaching anoxic or toxic levels.
7. Ethanol typically biodegrades rapidly in groundwater, but anaerobic biodegradation of ethanol in groundwater produces methane, which may reach or exceed the lower flammable limits and cause a secondary hazard.

8. Long-term exposure to ethanol that infiltrates the soils and/or enters the groundwater may harm vegetation, even at low concentrations (e.g., 1% to 5% ethanol); however, ethanol tends to dissipate quickly in the soil due to biodegradation or dispersion into deeper soils and/or the groundwater.

c. Ethanol Behavior and Response Considerations

The information and guidance below lends context to planning for the response to an LV/HC ethanol release. This information is also summarized in the "Quick Reference" Guide for Ethanol Incident Response presented in **Attachment 7**.

i. Ethanol Firefighting Considerations

1. It is generally better to control and contain an LV/HC ethanol fire and let it burn out. Fire suppression should only be attempted for life safety (i.e., rescue), and only if an offensive strategy can be implemented safely.
2. Ethanol and ethanol fuel blends have different properties than gasoline and require different firefighting techniques and equipment than gasoline or other hydrocarbons.
3. Under fire conditions, high concentration ethanol has less visible smoke than a gasoline fire, and ethanol burns with a virtually invisible flame after the denaturant (typically gasoline) burns off.
4. Incident heat flux from an ethanol fire can be 2 to 5 times greater than the incident heat flux from a gasoline fire.
5. Only Alcohol Resistant Aqueous Film-Forming Foam (AR AFFF) and copious amounts of water are effective fire suppression techniques for fire involving ethanol.
6. AR-AFFF appears to be effective only when using a Type II discharge scenario (i.e., fixed discharge applied to a vertical surface so as to provide a more gentle application that minimizes plunging or submergence).
7. Massive quantities of foam concentrate and water and large application devices are required to handle a serious ethanol fire.
8. Foam Concentrations will be mixed and applied per manufacturer's instructions
9. Although the available amounts of AR-AFFF foam and other resources may not be sufficient to put out an LV/HC ethanol fire, foam may can be used in other ways to control an incident. For example, if ethanol enters a storm drain or sewer, AR-AFFF foam can be used to suppress vapors in the lines and minimize the potential for igniting the vapors and causing additional damage.
10. In general, do not expect a local airport Aircraft Rescue and Firefighting vehicle to effectively fight an ethanol fire; the FAA requires airport firefighting vehicles to carry straight AFFF for aviation fuel fires, not AR foam. Note that the Massachusetts Port Authority Fire Department has capabilities that have AR-AFFF foam concentrate and these units are located at Boston Logan International Airport as described in **Attachment 4**.

11. Large foam caches of AR AFFF that may be critical to successful fire control are strategically located throughout Massachusetts in readily transportable large volume containers (see **Attachment 4**).

ii. Ethanol Spill Response Considerations

1. The response effort for an LV/HC ethanol incident is expected to last up to 72 to 96 hours before the hazards from the incident are sufficiently reduced and the incident can enter remediation and recovery phases.
2. Ethanol and ethanol fuel blends have different properties than gasoline and require different spill response techniques and equipment than gasoline or other hydrocarbons.
3. Leaks should be stopped (e.g., valves closed, leaks plugged) if this can be done safely.
4. Spills should be prevented from entering storm water systems, sewers and waterways, as well as basements and confined spaces.
5. Ethanol can be contained by diking and/or damming with dirt, sand, or portable containment systems.
6. Ethanol readily mixes with water and once it enters waterways it is not easily recoverable by emergency responders.
7. Most vacuum trucks will not effectively recover ethanol unless they have special filters designed for polar solvents.
8. Absorb or cover with dry earth, sand, or other noncombustible material.
9. Absorb with water-absorbent materials (cat litter, pads, booms, etc.) – universal absorbents may be effective (check with manufacturer); “oil only” absorbents, pads, and booms will only absorb the gasoline component, but not ethanol.
10. Use clean non-sparking tools to collect absorbed material.
11. Ethanol may harm water supplies used for drinking, process, aquaculture, or cooling water, as well as WWTP, so warn owners/operators of water intakes and WWTP that may be threatened.
12. Aeration of water bodies may be effective in increasing the dissolved oxygen in the water and increasing the biological degradation of ethanol.

3. ETHANOL TRANSPORT IN MASSACHUSETTS

In Massachusetts, railroad deliveries of ethanol generally originate in the Midwest and the rail deliveries are typically in unit trains (i.e., a freight train consisting of railcars hauling only one dedicated commodity). Ethanol may be transported via rail throughout the Commonwealth, as shown on the potential route maps in **Attachment 5**; however, at present, ethanol is generally transported through Massachusetts to a marine terminal in Providence, Rhode Island, where the ethanol is transferred to barges for delivery to marine terminals in Boston Harbor and elsewhere. The current railroad route to the marine terminal passes through several dense urban areas, including Pittsfield, West Springfield, Springfield, Greenfield, and Worcester in Massachusetts, as well as Providence, Rhode Island.

Typically, two to three ethanol unit trains currently travel through Massachusetts per week and generally one ethanol barge arrives in Boston Harbor per week. The number of trains and barges transporting ethanol through Massachusetts may increase in the future, especially if the use of higher ethanol blends for motor fuels becomes more prevalent, as expected.

a. Identification of Local Bulk Ethanol Sources and Potential Incidents

Local emergency planners are encouraged to conduct a basic inventory of bulk ethanol sources within their jurisdictions. Being familiar with staff and response capabilities of ethanol facilities and transportation modes before an incident occurs can make the difference between a safe and effective response and one that may be slower, less organized and effective, and even less safe.

The following sections discuss ethanol transportation primarily via railroad tank cars (**Section 3.b.**) and to a lesser extent via marine vessels (**Section 3.c.**).

b. Railroad Tank Cars

The most common mode of transporting large volumes of high concentration ethanol in Massachusetts is via rail transport. Commonly referred to as a “virtual pipeline,” a single-unit train typically has 80 to 100 tank cars and may contain upwards of 3 million gallons of (up to 100 tank cars with approximately 30,000 gallons per tank car).

Tank cars with ethanol may also be included in a train with mixed freight cars. Information on the contents of the freight cars (including tank cars) and the location of each car is on the waybill (i.e., shipping papers). The train conductor and railroad dispatcher each have a copy of the waybill.

The most common type of tank car used to transport ethanol since 2015 is the DOT 111, but CJC 1232 tank cars (jacketed and non-jacketed) are also used; newer, safer DOT 117 (TC-117) tank cars are being phased in for general use for transporting ethanol. **Figure 1** shows a typical tank car used to haul ethanol. Rail tank cars that carry ethanol usually have a capacities in the range of approximately 24,000 to 32,000 gallons. Standard terms that are used when referring to tank cars are as follow:

- **A-end** — the end of a railcar that is opposite the end equipped with the hand brake (see B-end and **Figure 2**).
- **B-end** — the end of a railcar where the hand brake is attached (see **Figure 2**). If both ends of the railcar have a hand brake, the car will be stenciled A-END and B-END. When facing the B-end, the sides of the railcar are identified as the Right Side and Left Side, respectively.
- **Reporting Mark and Car’s Number** – a tank car’s reporting mark (also called the initials) is typically three to four letters to identify the car’s owner (marks ending with an X denote that the car is not owned by a railroad) and the car’s number is the up to six digit number that follows the initials and is the tank car’s unique identifier. The reporting mark and car’s number are required to be marked on each side of the car at the left side (when looking at the car) and in the center of each end of the car.

Rail tank cars are usually unloaded on private sidings or railroad-siding facilities equipped for transferring flammable or combustible liquids to on-site or nearby storage tanks. In addition, transloading ethanol, where ethanol is moved from a railroad tank car to a tanker transport on a rail siding, may occur on rail sidings that have minimal fire control equipment.

The fittings for unloading railroad tank cars are not uniform; different manufacturers use different fittings and there are five or more different fittings currently in use. To determine the correct outlet fittings for a tank car, the tank car manufacturer's name and the tank car's serial number is needed. This information is located on the identification plates (also called Builder's Plates), which are located on the body bolster webs on the right side at the A-end and the left side at the B-end (i.e., end where the handbrake is located) of each tank car. **Figure 3** shows the location of a tank car's identification plate and **Figure 4** shows information on the identification plate.

Figure 1 – Rail tank car typically used to carry ethanol and similar products. The tank car's initials and car number are shown at the left side (PLCX 129026). This car's capacity is 29,815 gallons and the exterior length is 67 feet, 11 inches.

(Source: MassDEP (2011) report: Large Volume Ethanol Spills)

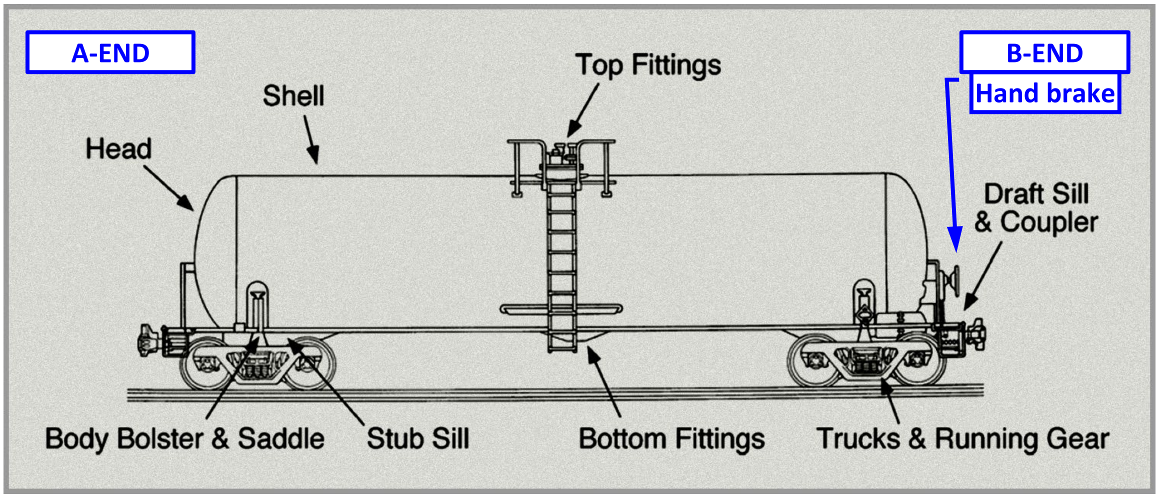


Figure 2 – Railroad tank car (DOT 111 type) with the A-end and B-end indicated. Key components of the tank cars are also indicated.

(Source: http://3.bp.blogspot.com/-XAKGG88aTmw/UjFQrvcBhuI/AAAAAAAAPIM/sZ3s5oAZUzk/s1600/Non-Jacketed-Non-Pressure-T.jpg)

Figure 3 – Location of a tank car identification plate. This can be found on the bolster web at the left side of the B End (courtesy Providence and Worcester Railroad).

Figure 4 – Close-up of an identification plate. This shows the tank car manufacturer and the car's serial number on the first two lines (courtesy Providence and Worcester Railroad).

c. Marine Vessels

This section discusses the marine vessels used for transportation of ethanol, which include tank barges and tank ships. Tank barges are more commonly used to transport ethanol than tank ships in the United States. Tank barges and ships that are certified to carry chemicals such as ethanol are constructed differently than those that carry oil (e.g., coated or stainless steel for cargo tanks is used to withstand corrosivity of the chemicals they carry.)

Shippers of "certain dangerous cargoes," such as ethanol, are required to provide the USCG with notice of scheduled arrivals at least 24 hours, but not more than 96 hours, before arriving at the terminal for a cargo transfer. Local emergency planners are encouraged to familiarize themselves with the types of marine traffic that may call facilities located within their jurisdiction, or that transit water bodies in or adjacent to their jurisdictions.

i. Tank Barges

On the navigable waterways of Massachusetts, such as along the coast and in Boston Harbor, ethanol is generally shipped in tank barges. Tank barges are non-self-propelled vessels that use tugs to push or tow them to move across waters. **Figure 5** shows an illustration of a typical inland tank barge. They have minimal or no crew accommodations onboard and are typically used for inland and coastwise trade. Tank barges used to ship ethanol usually have cargo capacities of 15,000 to 30,000 barrels (630,000 to 1,260,000 gallons) per vessel.

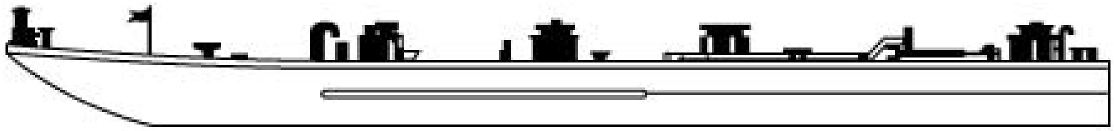


Figure 5 – Side-view drawing of a typical inland tank barge.
(Source: MassDEP (2011) report: Large Volume Ethanol Spills)

ii. Tank Ships

Tank ships are self-propelled, ocean-going vessels with crew accommodations that can engage in international trade. **Figure 6** shows an illustration of a typical tanker ship. Tank ships are required to have certain firefighting equipment, and crews are required to be trained in fighting fires onboard. However, one ship may carry several different chemicals in its segregated cargo tanks, each with its own hazards.

Figure 6 – A chemical carrier tank ship. This ship, while carrying 3.5 million gallons of ethanol, exploded and sank 50 miles off Chincoteague, Virginia, in February 2004. (Source: MassDEP (2011) report: Large Volume Ethanol Spills)

4. Ethanol Incident Response Planning

Advanced planning for LV/HC incident response involves pre-identifying sources for resources needed to respond and recover from an emergency incident.

Responsible Parties (i.e., carriers) are responsible for maintaining vendor contracts for LV/HC incident response, containment, and recovery. These carriers are identified in **Attachment 6**.

Local jurisdictions and state agencies may also engage in the following pre-event contracts to provide an effective response to typical LV/HC ethanol incidents:

- Spill response, containment, and cleanup
- Emergency worker base camps and typed support packages;
- Designated community shelter;
- Transportation support;
- Debris/waste removal and disposal services;
- Other supplies, equipment and human resource needs;
- Personnel; and
- IT and communications.

AN LV/HC ethanol incident may require a large number of resources and generate significant media attention. Therefore, advanced planning should identify pre-designated staging areas for responders and their equipment and supplies, as well as identify pre-designated press areas for the media crews and equipment that may arrive.

a. Initial Steps for Planning

The recommended first step in preparing for a response to an ethanol incident is to conduct a hazard analysis for a particular jurisdictional area. Local emergency planners (including representatives from the fire department (FD)) can conduct a hazard analysis by identifying the following:

- Local bulk ethanol sources (i.e., various modes of transportation that handle ethanol in the jurisdiction, as well as bulk storage facilities)
- Resources that are available to respond to an LV/HC ethanol incident

Information collected from the hazard analysis will be critical for developing an effective response plan. For preparedness purposes, local emergency planners should meet with rail operators to discuss the routes, frequency of travel, and, perhaps, schedules of ethanol trains that may operate in or transit through their jurisdictions.

Where applicable, local emergency planners should also meet with the ethanol storage facility operators in their jurisdictions to familiarize themselves with each facility and its equipment, systems, and response plans and resources. In addition, local emergency planners should discuss trucking operations with each facility to understand the routes, frequency of travel, and, perhaps, schedules of ethanol tanker transports that may operate in or transit through their jurisdictions.

b. Summary of Recent Incidents and Lessons Learned

This section and the following section summarize the observations and findings from a study of significant recent ethanol train derailments. These sections describe the lessons learned from these incidents and provide context and insights that should be considered when developing or updating an LV/HC ethanol response plan.

Nationally, eighteen ethanol train derailments occurred between 2006 and 2025. All the derailments involved railroad tank cars transporting ethanol in DOT 111 and/or CPC 1232 tank cars. The focus of the study was on the number of cars derailed, approximate train speeds at the time of the derailment, number of cars breached, amount of product released, and whether or not a subsequent fire ensued.

In addition to identifying the location, date, and responsible railroad, the study focused on four key areas to guide emergency response planners. These included:

1. Number of cars derailed vs. Number of Cars Breached – In the identified events, ethanol tank trains were made up of 32 to 114 tank cars coupled in sequence. Understanding the relationship of cars derailed vs. cars breached provides a useful reference point for emergency planners and responders for developing strategy and tactics.
2. Derailments that resulted in tank car fires – Understanding the number of derailments that resulted in tank cars breaching and a subsequent fire provides perspective on the need for fire suppression and/or exposure protection requirements.
3. Total gallons released – Understanding the potential for product release allows emergency planners and responders to consider credible spill control and recovery scenarios.
4. Track speed at time of derailment – Track speed at the time of the derailment provides a useful perspective when compared to the number of cars that derailed and breached.

The identified derailments incidents used in the study are summarized in **Table 3**, below.

Table 3: Summary of Significant Ethanol Train Derailment Incidents (2006 to 2025)							
LOCATION	**DATE**	**RAILROAD**	**CARS DERAILED**	**CARS BREACHED**	**FIRE**	**GALLONS RELEASED**	**SPEED (Mph)**
1. East Palestine, OH	02/03/2023	NS	38	3	Yes	unknown	43
2. Raymond, MN	03/30/2023	BNSF	23	10	Yes	28,900	43
3. Oklaunion, TX	01/08/2022	BNSF	37	28	Yes	601,819	50
4. Draffin, KY	2/13/2020	CSX	4	2	Yes	38,400	25
5. Fort Worth, TX	4/24/2019	UP	26	3	Yes	65,270	26
6. Graettinger, IA	03/10/2017	UP	20	14	Yes	322,000	28
7. Lesterville, SD	9/19/2015	BNSF	7	2	Yes	49,743	10
8. Bon Homme, SD	9/19/2015	BNSF	7	3	Yes	49,748	10
9. Alma, WI	7/11/2015	BNSF	32	5	No	20,000	Unknown
10. Dubuque, IA	2/4/2015	CP	14	8	Yes	53,000	24
11. Charles City, IA	5/2/2013	CP	5	2	No	49,000	24
12. Plevna, MT	8/5/2012	BNSF	18	12	Yes	245,335	23
13. Columbus, OH	7/11/2012	NS	3	3	Yes	54,748	25
14. Tiskilwa, IL	10/7/2011	IIRR	10	9	Yes	162,000	37
15. Arcadia, OH	2/6/2011	NS	31	31	Yes	834,840	46
16. Cherry Valley, IL	6/19/2009	CN	15	13	Yes	323,963	36
17. Painesville, OH	10/10/2007	CSX	7	4	Yes	52,200	48
18. New Brighton, PA	10/20/2006	NS	23	20	Yes	485,278	37
				Totals		**Averages**	
			320	**172**	**16**	**202,132**	**31**

Primary Sources for Derailment Incident Information in Table 3:

1 NTSB Accident Report, NTSB RIR-24-05, 06/25/2024
2 NTSB Preliminary Report,RRD23LR009, 04/13/2023
3 NTSB Accident Report, HZIR-23-01, 09/27/2023
4 NTSB Accident Report, RIR-22-13, 10/18/2022
5 NTSB Accident Report, RAB-21-03, 08/03/2021
6 NTSB Accident Report, RAR-18-02, 10/30/2018
7 NTSB Accident Report, RAB-17-07, 06/26/2017
8 FRA (Federal Railroad Administration) Accident Report F 6180.54
9 News sources
10 FRA Accident Report 1000170207 and Emergency Order No. 30 Notice 1
11 FRA Accident Report F 6180.54
12 FRA Accident Report F 6180.54
13 NTSB Accident Report NTSB/RAB-14/08, 9/18/2014
14 NTSB Accident Report NTSB/RAB-13/02, 8/14/2013
15 FRA Accident Report F6180.54 and PHMSA Incident Report
16 NTSB Accident Report, NTSB/RAR-12/01, 2/14/2012
17 NTSB Investigation DCA08FR001, Report, 6/1/2009 and PHMSA
18 NTSB Accident Report, NTSB/RAR-08/02, 5/13/2008

Notes for Table 3:

1. FRA – Federal Railway Administration
   NTSB – National Transportation Safety Board
   BNSF – Burlington Northern Santa Fe
   CP – Canadian Pacific
   NS – Norfolk Southern
   IIRR – Iowa Interstate Railroad
   CN – Canadian National
   CSX – CSX Transportation
   UP – Union Pacific
2. Some media sources were used to supplement information from NTSB and FRA reports.

The study revealed that some of the planning assumptions for an ethanol train derailment and subsequent fire, where applicable, are as follows:

- Most ethanol tank train derailments will result in car failures regardless of tank car type;
- Expect a rapid escalation in the incident, which will require a rapid response and the need for an Incident Management Team;
- After railroad tank cars breach and ethanol starts burning, there is generally less than two hours when offensive firefighting strategies can be effectively implemented;
- Expect large volumes of ethanol to be released and/or involved in fire, so long term environmental impacts from burning off product versus impacts to water or soil should be considered; and
- The risk of breach and failure during a low-speed derailment in an urban area where low speeds may be required is still significant.

c. Credible Worst Case Scenarios

i. Urban Areas

In urban areas identified as High Threat Urban Areas (HTUA), the speeds of High Hazard Flammable Trains (HHFT), which include the ethanol trains identified in **Table 3**, are limited to less than 40 miles per hour (mph) by federal regulations if any of the cars containing a Class 3 flammable liquid, such as ethanol, do not meet the new tank car design specifications. Note that HHFTs generally travel at much lower speeds in urban or densely populated areas. In Massachusetts, the only HTUA encompasses Boston, Cambridge, and a 10-mile buffer extending from the border of the combined area.

Table 3, above, includes five derailments of ethanol trains traveling at typical speeds that would be expected in urban or densely populated areas: approximately 10 mph to 24 mph. In these incidents, the train derailments generally had fewer tank cars breach (i.e., two to twelve cars breach; typically less than half the cars that derail) and resulted in fires in two of the five incidents presented in **Table 3**. The amount of ethanol released in these incidents was in the range of 20,000 to 245,335 gallons and were generally less than 53,000 gallons.

ii. Rural Areas

In areas not identified as HTUA, HHFT speeds are limited to 50 mph by federal regulations. **Table 3**, above, includes six derailments of ethanol trains traveling at typical speeds that would be expected in rural areas: approximately 25 mph to 48 mph. In these incidents, 3 to 31 tank cars derailed and most or all of the tank cars that derailed generally breached. In addition, all these incidents resulted in large releases of ethanol (i.e., 52,200 to 834,840 gallons with an average of 308,338 gallons released) and all of these resulted in fires.

d. Ethanol Incident Response Timeline with Benchmarks

The HHFT Incident Timeline from NFPA 472, as shown in **Figure 7**, below, was developed as a training tool to help local emergency planners and fire departments "connect the dots" for incident action planning considerations. This timeline illustrates the relationship between the behavior of the tank car(s) and their contents and strategic response options. It is important to note that specific timeline elements are based on typical or average fire behavior at an incident and the times will vary based upon incident dynamics and local/regional response times and operational capabilities.

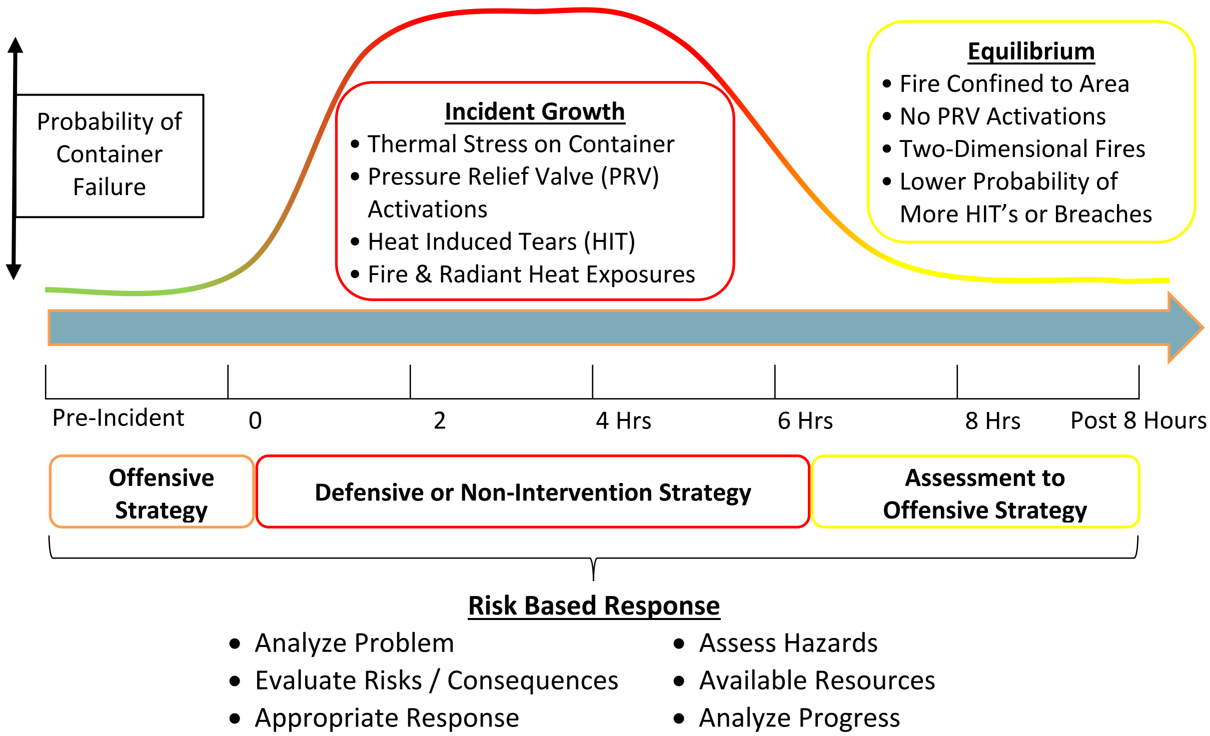


Figure 7 – Response timeline for railroad incident. Schematic representation of the incident progression for a "typical" LV/HC ethanol train derailment.

Almost always it is better to let an LV/HC ethanol fire burn and only attempt offensive tactics for life safety (i.e., rescue). As **Figure 7** illustrates, the Incident Commander only has up to approximately two hours to implement an effective offensive firefighting strategy; however, the offensive strategy should not be implemented if there are not adequate water, AR-AFFF concentrate, and trained firefighters available for the estimated size and needs of a given incident. Note that receiving permission from the regulatory agencies for in situ burning of released ethanol to re-ignite a fire after it has been suppressed is not expected to be granted in a timely manner.

The Incident Timeline in **Figure 7** focuses upon the first operational period (approximately eight hours). The curve represents the probability of container failures, which in turn leads to a cascading and growing response scenario. The initial container stress / breach / release behaviors will be directly influenced by the speed of the train, the kinetic energy associated with the derailment, and the properties of the commodities being transported. After the initial mechanical stress caused by the derailment forces, subsequent container stress / breach / release behaviors will be thermal or fire focused.

Incident growth will generally follow the process of:

- thermal stress from the initial fire upon the tank cars (level of thermal stress will be influenced by the presence and integrity of thermal blanket protection);
- subsequent activation of tank car pressure relief valves (PRV);
- continued thermal stress on adjoining tank cars from a combination of both pool fires and pressure-fed fires from PRV's;
- increasing probability of container failures through heat induced tears; and
- subsequent fire and radiant heat exposures on surrounding exposures when explosive release events occur.

Fires will continue to burn off the available ethanol until such time that the incident achieves a level of "equilibrium" when the fire is confined and is no longer growing in size or scope, there are no further PRV activations, and the fire scenario is primarily a two-dimensional scenario, with any three-dimensional pressure-fed fires decreasing in intensity. At a major incident, this equilibrium may not be achieved for approximately 8 to 12 hours after the start of the incident. Once equilibrium is achieved, the likelihood of additional heat induced tears (HIT), or tank car breaches is greatly reduced.

e. Urban Response Considerations

Urban environments are the towns and cities characterized by large and/or dense populations and number of critical facilities that may be impacted by an incident involving LV/HC ethanol. Key factors to be considered for accidents in urban areas include, but are not limited to, the following:

1. Fire or the potential for a fire (note that it is often better to let an LV/HC ethanol fire burn and only attempt offensive tactics for life safety).
   - defensive tactics (control and containment),
   - offensive tactics, and/or
   - non-intervention tactics.

2. Evacuation
   - hospitals and medical centers,
   - long-term care facilities (nursing homes, rest homes, assisted living),
   - schools and daycare centers,
   - colleges and universities, and/or
   - residences and businesses; and

3. Highway or road closures
   - commuter transit routes (bus, rail).

4. Release Containment:
   - flow into storm drains or sewers, and/or

- flow down streets or natural drainages.
- into water bodies or waterways,
- into environmentally sensitive areas.

f. Rural Response Considerations

Rural environments are generally sparsely populated areas with fewer facilities that may be impacted by an accident involving LV/HC ethanol. In addition, railroad lines may be in relatively remote locations that are not close to established roads, which may make getting the resources needed close to the accident scene difficult. Key factors to be considered for accidents in rural areas include, but are not limited to, the following:

1. Fire or the potential for a fire
   - access to incident,
   - allow fire to burn.

2. Evacuation
   - hospitals and medical centers,
   - long-term care facilities (nursing homes, rest homes, assisted living),
   - schools and daycare centers,
   - colleges and universities, and/or
   - residences and businesses.

3. Highway or road closures.

4. Release Containment:
   - flow into natural drainages,
   - into water bodies or waterways,
   - into environmentally sensitive areas.

g. Marine/Navigable Waterways Response Considerations

Barges that may be used for transporting ethanol generally come through the Cape Cod Canal and into Boston Harbor. Along these navigable waterways, there are populations and/or facilities that may be impacted by an accident involving LV/HC ethanol. In addition, commercial and recreational vessel traffic, as well as adjacent infrastructure (e.g., bridges, dock/piers) may be affected. Key factors to be considered for accidents in marine environments include, but are not limited to, the following:

1. Fire or the potential for a fire
   - allow fire to burn,
   - move vessel to safe location.

2. Evacuation
   - distance from shore,
   - residences and businesses,
   - commercial and recreational vessel traffic.

3. Bridge or road closures.
4. Release Containment:
   - not practicable on water.

h. Potential Water Contamination

i. Contamination of Surface Water and Water Sources

A release that enters surface waters may impact drinking water supplies, as well as process water, aquaculture, or cooling water. Specifically, a release may directly enter (e.g., from an adjacent rail line) or flow into a reservoir, lake stream, river, or other surface water body in the vicinity or upstream of water intakes.

In water, the ethanol component will readily mix with water and the denaturant will separate and float on the water surface. Therefore, the water users who will be potentially impacted will need to be informed of the incident, so they can determine if their intake(s) needs to be shut down and for how long.

In addition, impacts from ethanol entering a surface water body may cause significant fish kills. This may be due to direct contact with ethanol or because the natural degradation of ethanol will deplete the oxygen in the water. Furthermore, ethanol release into a surface water body may impact the recreational uses of the water body.

ii. Contamination of Groundwater

Ethanol may also infiltrate into the groundwater and potentially impact groundwater. This may impact public and private water sources for drinking and other uses, so the users will need to be notified. In addition, biodegradation of ethanol in groundwater may release large quantities of methane and acetaldehyde, so potential long-term impacts, such as methane build-ups in confined spaces (e.g., cellars, basements, under concrete slabs), need to be monitored.

5. Massachusetts Ethanol Incident Response

a. General

The details for the Massachusetts Ethanol Incident Response are found in the LV/HC Ethanol Incident Annex.

- **Attachment 4** includes a list of current foam caches.
- **Attachment 5** includes a map showing ethanol transportation routes.
- **Attachment 6** has contact information for ethanol carriers.
- **Attachment 7** is a “quick reference” guide for LV/HC ethanol incidents that summarizes the key points of the concept of operations for local FDs as well as a checklist for summarizing critical information about an ethanol incident

6. ROLES AND RESPONSIBILITIES

Section III C of the CEMP Hazardous Materials Annex (ESF-10) describes the command-and-control structure and agency responsibilities for hazardous materials (HAZMAT) response operations. In addition, the LV/HC Ethanol Incident Plan discusses the roles and responsibilities for the local, regional, state and federal agencies, as well as for the carriers and their contractors, in more detail. The following sections discuss the command-and-control structure and agency responsibilities as these specifically apply to the LV/HC ethanol incident response.

a. On-scene Command and General Staff

i. Fire Department

The Fire Chief of the local FD or her/his designee will typically be the initial IC; however, the senior firefighter may have the role of Incident Commander (IC) until properly relieved by the Fire Chief or her/his designee. The IC will establish the UC and an ICP at the scene of the incident as early in the incident as practicable. Note that for a barge incident, the USCG will be the IC until the UC is established, and the USCG will set up the ICP.

A “Quick Reference” card for responding to an LV /HC ethanol incident is provided in **Attachment 7** for use by the IC/UC.

ii. Local / State Police

Local police and the Massachusetts State Police will support the incident response by providing security functions, as necessary.

iii. Massachusetts Department of Environmental Protection

MassDEP works in conjunction with the Executive Office of Environmental Affairs and MEMA to coordinate efforts of ESF 10, and MassDEP technicians are trained and equipped for spill response. In addition, MassDEP’s on-call spill response contractors may be activated to conduct response actions, if the carrier is unable to hire an appropriate contractor or respond in a timely manner.

iv. Regional HAZMAT Response Teams

The Commonwealth of Massachusetts has five HazMat response districts (illustrated in Figure 8 below), and each district has an HMRT. District five merged with District four on July 1, 2025. These teams have resources staged at various locations throughout their districts to reduce initial response time. HMRTs can be requested directly by the on-scene Incident Commander as needed. HMRTs are an asset of the Department of Fire Services but upon being dispatched to a HazMat incident, HMRTs are included in the on-scene ICS structure, and deploy as part of a Tiered System. DFS HMRT ranks hazmat incidents from Tier 1 to Tier 5. As the tiers escalate, the amount of personnel and equipment also expands proportionately. This allows for a sufficient response as the type of Hazmat Incident expands in scope, complexity, or danger. See Appendix B for additional details on the Tiered Hazmat Response System utilized by the DFS HMRT.

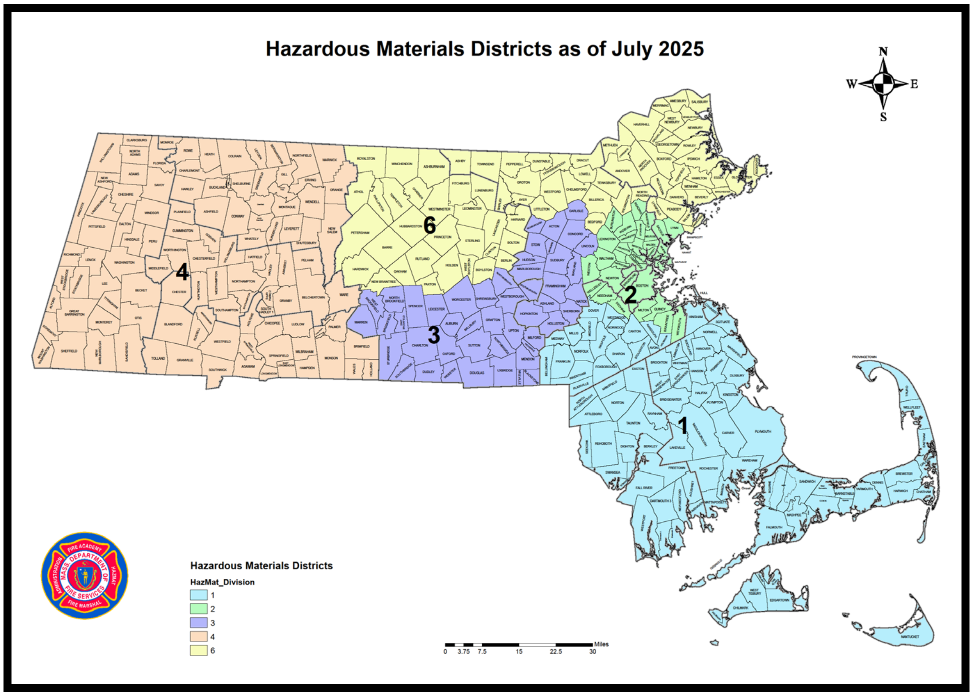


Figure 8-Hazardous Materials Districts

b. Municipal EMAs and Agencies

i. Logistics Support

The response effort for an LV/HC ethanol incident is expected to last up to 72 to 96 hours before the hazards from the incident are sufficiently reduced and the incident can enter remediation and recovery phases. The local emergency management agency (EMA) and other municipal agencies can provide logistics support for the response to an LV/HC ethanol incident. Specifically, the local EMA can interface with MEMA to coordinate regional and state resources and also assist in coordinating local support actions, such as evacuations. In addition, the local Department of Public Works (DPW) can provide support for road closures (e.g., personnel, barriers) and equipment and materials for spill containment, including, but not limited to, front-end loaders, bulldozers, soil, sand, sandbags, and plastic sheeting.

ii. Water/Wastewater Agency

As noted above ethanol readily mixes with water, but the denaturant will separate and float on the water. Therefore, the release from a typical railroad tank car (30,000-gallon capacity) may result in 28,500 gallons of ethanol entering the water and 1,500 gallons of denaturant (i.e., gasoline) floating on the water.

Ethanol will rapidly affect the entire water column, so surface water and groundwater (well) sources that are used for drinking, process water, aquaculture, or cooling water may be impacted by released ethanol. If there is a potential for a spill to impact any of these water sources, the municipality or firm that uses the water needs to be notified of the potential impacts, so they can take the appropriate actions to stop drawing water from the source and/or treating water that is used.

Ethanol that enters a storm water drain system or a sewer system poses a danger from flammable liquid and vapors in the lines. In addition, the ethanol may disrupt the proper functioning of a receiving wastewater treatment plant (WWTP) because the ethanol may kill the bacteria used in wastewater treatment. Therefore, the municipality or firm that runs the WWTP should be notified if ethanol enters storm water drain systems or sewers.

c. Carrier

The carrier who has an LV/HC ethanol incident is financially responsible for the incident response and its clean-up and remediation. Also, the carrier responsible will provide technical and tactical support, including equipment and personnel, to the response effort and other carriers may make their resources available upon request, as described in **Sections 3.g.ii** and **3.g.iii**.

d. MEMA Command and General Staff – State Emergency Operations Center

The Massachusetts Emergency Management Agency will:

- Work with federal, state, and local agencies to identify potential emergencies, mitigate risks, and support response and remediation efforts if necessary.
- Notify federal response authorities and other required state authorities as needed.
- As needed, coordinate state-level response activities and resources based on the CEMP and MAESF structures.
- As needed, provide coordination surrounding Public Information.

The SEOC will provide a supportive and coordinative role in LV/HC incident responses as needed. This will include logistics and resource support, situational awareness management and dissemination, Incident tracking and documentation, and communications coordination. These roles are defined further in the CEMP.

MEMA SEOC will coordinate with the Incident Command Post through the relevant Regional Emergency Operations Center (when appropriate).

e. Support ESF Responsibilities – other state agencies

Other state and regional agencies will support the response effort for an LV/HC ethanol incident, as described in the LV/HC Ethanol Incident Plan. Depending on the response needs and potential impacts from the incident, MEMA may stand up ESF-10, ESF-4, and other ESF’s for support.

f. Federal Agencies and Other Resources

Federal agency responsibilities are outlined in the National Response Framework (NRF) and the National Incident Management System (NIMS). Federal resources are available specifically for incidents that expand beyond available local, state, and mutual aid resources.

Specifically, the USEPA will likely be involved in the response effort for an LV/HC ethanol incident if there is a release of a significant amount of ethanol and/or a fire; the USCG will be involved in the response to a marine incident. The USEPA and USCG not only can provide technical and scientific support, but they also have established contracts with spill response contractors, who maintain minimum staffing levels and stockpiles of spill response equipment that may be employed. MassDEP is expected to be the primary point of contact with these agencies.

7. Direction and Control

Direction and control of the LV/HC ethanol incident will be managed on scene using the Incident Command System (ICS). A Unified Command (UC) approach is recommended when an LV/HC ethanol incident involves several jurisdictions and/or several agencies from the same political jurisdiction. Upon request or arrival, state agencies may form a UC with the local on-scene IC. The UC allows the agencies and/or jurisdictions with responsibilities for an LV/HC ethanol incident to establish a common set of incident response objectives and strategies.

State agencies will provide personnel and resources to support the LV/HC response effort, as requested. Personnel from operating departments/agencies assigned to LV/HC incident response responsibilities will remain under the control of their own departments/agencies but will function under the technical supervision of the direct report within the ICS.

8. Attachments

1. Acronyms and Abbreviations
2. Selected References
3. Placards for Ethanol Transportation
4. Massachusetts Foam Caches
5. Maps of Common LV/HC Ethanol Transportation Routes
6. Contact information for carriers of Large Volume/High Concentration Ethanol
7. “Quick Reference” Guide for Ethanol Incident Response

Attachment 1 - ACRONYMS AND ABBREVIATIONS

The following acronyms and abbreviations are used in this Planning Guidance.

ACPs	Area Contingency Plans
AR-AFFF	Alcohol-Resistant Aqueous Film-Forming Foam
CEMP	Massachusetts Comprehensive Emergency Management Plan
CFR	Code of Federal Regulations
CMR	Code of Massachusetts Regulations
DFS	Massachusetts Department of Fire Services
DPH	Massachusetts Department of Public Health
DPW	Department of Public Works
EMA	Emergency Management Agency
Ethanol	Denatured ethanol (i.e., ethanol with 3% to 5% gasoline added)
FBI	Federal Bureau of Investigation
FD	Fire Department
FRA	Federal Railroad Administration
gpm	gallons per minute
HAZMAT	Hazardous materials
HHFT	High Hazard Flammable Trains
HIT	Heat induced tears
HMRT	Hazardous Material Response Team
HTUA	High Threat Urban Areas
IC	Incident Commander
ICP	Incident Command Post
ICS	Incident Command System
LFL	lower flammable limit
LV/HC	Large Volume/High Concentration
MassDEP	Massachusetts Department of Environmental Protection
MassDOT	Massachusetts Department of Transportation
ESF-4	Emergency Support Function 10 – Firefighting
ESF-10	Emergency Support Function 10 – Environmental Protection and Hazardous
MCP	Massachusetts Contingency Plan
MEMA	Massachusetts Emergency Management Agency
MEP	Massachusetts Environmental Police
mph	miles per hour

MTBE	methyl tertiary butyl ether
NFPA	National Fire Protection Association
NIMS	National Incident Management System
NRC	National Response Center
NRF	National Response Framework
NRT	National Response Team
OSRO	oil spill response organizations
PHMSA	Pipeline and Hazardous Materials Safety Administration
PIO	Public Information Officer
PRV	Pressure Relief Valve
RP	Responsible Party
RRT	Regional Response Team
SEOC	State Emergency Operations Center
UC	Unified Command
UFL	upper flammable limit
USCG	United States Coast Guard
USDOT	U.S. Department of Transportation
USEPA	United States Environmental Protection Agency
WWTP	Wastewater Treatment Plant

Attachment 2 - SELECTED REFERENCES

Listed below are selected references that were used to develop this Planning Guidance to the CEMP Hazardous Materials Annex.

Association of American Railroads, Transportation Technology Center, Inc., Bureau of Explosives, Field Guide to Tank Cars, 2010

Association of American Railroads, Bureau of Explosives, United States Hazardous Materials Instructions for Rail, January 2011

Franklin Regional Council of Governments, Ethanol Response Plan

International Association of Fire Chiefs, Responding to Ethanol Incidents, March 2008

International Association of Fire Chiefs for the Renewable Fuels Association, Unit Train Derailment Site Case Study: Emergency Response Tactics, March 2015

Interstate Technology & Regulatory Council (ITRC) Biofuels Team, Biofuels: Release Prevention, Environmental Behavior, and Remediation, September 2011

ITEC Refining and Marketing Company Ltd., Material Safety Data Sheet Denatured Fuel Ethanol.

Massachusetts Department of Environmental Protection (MassDEP), Large Volume Ethanol Spills – Environmental Impacts and Response Options, prepared by Shaw's Environmental and Infrastructure Group, July 2011

Massachusetts Department of Transportation (MassDOT), Office of Transportation Planning, Report on the Safety Impacts of Ethanol Transportation by Rail, March 2013

National Fire Protection Association (NFPA), High-Hazard Flammable Liquid (HHFT) Trains On-Scene Incident Commander Field Guide, Draft #2, May 2016

National Response Team, Quick Reference Guide: Fuel Grade Ethanol Spills (including E85), 2010

Renewable Fuels Association, Fuel Ethanol: Guideline for Release Prevention & Impact Mitigation, March 2013

Attachment 3 - Placards for Ethanol Transportation

Ethanol, including denatured ethanol, is classified by USDOT as a Class 3 Flammable Liquid. Therefore, shipments of ethanol are required to have placards. Placards on shipments of high concentration ethanol may be labeled as follows:

Identification Number	Shipping Name / Description	Placard
1987	Denatured alcohol; alcohols n.o.s.[1]; 95% to 99% ethanol	
3475	Ethanol and gasoline mixture, with more than 10% ethanol (typically up to 94% ethanol)	
1170	Ethanol or ethanol solution (typically 100% ethanol that has not been denatured)	
3065	Alcoholic beverages (ethanol for consumption)	

[1] n.o.s. – not otherwise specified

Attachment 4 - MASSACHUSETTS FOAM CACHES

Massachusetts AR-AFFF Foam Response Capabilities

(Source: Massachusetts Emergency Management Agency Survey October 2024)

Foam Capabilites

Location	Ownership	Fire District	HSAC Region	MassDEP Region	Unit Type[1]	Type of Foam Concentrate	Amount of Foam Concentrate[2]	Onboard tank, tote, or buckets	Stockpile (not on truck/trailer)
Ayer	Muni	6	NERAC	CERO 2	OBT	AR-SFFF Universal Green 3%-3%	90	OBT and Buckets	5 gal Buckets
Brockton	Muni	2	SERAC	CERO 2	OBT	AR-AFFF 3 % Universal Green	1060	OBT and Buckets	5 gal Buckets
Chelsea	Muni	13	MBHSAC	NERO 3	AFT/OBT	AR-AFFF 3 % or 6%	800	OBT/AFT/Tote	Totes
East Longmeadow	Muni	11	WERAC	WERO 1		AR-Synthetic 3%	140	Buckets	5 gal Buckets
Fairhaven	Muni	3	SERAC	SERO 4		AR-AFFF 3%	55	Buckets	
Gardner	Muni	8	CMHSAC	CERO 2	OBT	AR-AFFF 3%; Class A	215	Buckets	
Grafton	Muni	7	CMHSAC	CERO 2	AFT	AR-AFFF 3% Univ.l Gold (PFAS)	275		
Hatfield	Muni	10	WERAC	WERO 1		AFFF 0.1 to 1% ; AR-AFFF 3 to 6%	50	Buckets	5 gal Buckets
Hopkinton	Muni	14	NERAC	CERO 2	OBT	AR-AFFF Green Plus 3% Synth	350	OBT and Tender	
Lawrence	Muni	15	NERAC	NERO 3	AFT	AFFF PFAS Free 3%	300	AFT and Buckets	5 gal Buckets
Lynn	Muni	13	NERAC	NERO 3		AR-AFFF 3% to 6%	50	Buckets	5 gal Buckets
Medway	Muni	4	CMHSAC	CERO 2	OBT	Fluorine free synthetic foam 3-6%	550	OBT and Drum	55 gal Drums
Milford	Muni	14	CMHSAC	CERO 2	OBT	Synthetic Foam 3%	105	OBT and Buckets	
North Andover	Muni	15	NERAC	NERO 3	FT	AR-AFFF 3% or 6%	500		
Norton	Muni	3	SERAC	SERO 4		AR-AFFF 0.5%	340	OBT and Buckets	5 gal Buckets
Onset	Muni	2	SERAC	SERO 4	OBT	Fluorine Free Class A/B 3%	205	OBT and Buckets	5 gal Buckets
Plymouth	Muni	2	SERAC	SERO 4		Nova Cool, Silvex .1% to .5%	130	Buckets	5 gal Buckets
Sandwich	Muni	1	SERAC	SERO 4	AFT	AFFF 1% and 3%	565	Trailer / Buckets	5 gal Buckets
Southborough	Muni	14	CMHSAC	CERO 2	OBT	Synthetic Foam Novacool, 0.4%	50	OBT and Buckets	5 gal Buckets
Springfield	Muni	11	WERAC	WERO 1		AR-SFFF 3%	350	Buckets	5 gal Buckets
Sunderland	Muni	9	WERAC	WERO 1		Phos Chek WD881 Class A Synthetic Foam 0.1% to 1%	75	OBT and Buckets	
Sutton	Muni	7	CMHSAC	CERO 2	OBT	AR-AFFF	360	OBT and Buckets	5 gal Buckets
Weston	Muni	13	NERAC	NERO 3	OBT	Synthetic Foam 0.5%	260	OBT and Buckets	5 gal Buckets
Devens, MA	Muni	6&8	CMHSAC	CERO 2		Green PFAS free AR-AFFF 1-3%	50	Trailer / Buckets	
Nantucket	Muni	1	SERAC	SERO 4	AFT	PFAS AR-AFFF 1% - 3%	500	Trailer	
Tisbury	Muni	1	SERAC	SERO 4	AFT	PFAS AR-AFFF 1% - 3%	500	Trailer	

Aircraft Fire Equipment - AR-AFFF

Location	Ownership	Fire District	HSAC Region	MassDEP Region	Unit Type[1]	Type of Foam Concentrate	Amount of Foam Concentrate[2]	Onboard tank, tote, or buckets	Stockpile (not on truck)
Logan Airport 1	MassPort	13	MBHSAC	NERO 3	OBT	ANSUL T-Storm AR-AFFF 3%	1,275	OBT, Trailer	55-gal drums
Logan Airport Marine	MassPort	13	MBHSAC	NERO 3	FT	ANSUL T-Storm AR-AFFF 3%	537.5	Tank and Bucket	500 gal tank/ 5-gal bucket
Hanscom AFB	MassPort	14	WERAC	WERO 1	OBT	ANSUL T-Storm AR-AFFF 3%	220		
Joint Base Cape Cod	Mass State	1	SERAC	SERO 4		BIOEX Fluorine Free (F3) MIL Spec 3%	1260	OBT/FT/Tote	

Aircraft Fire Equipment - NOT AR-AFFF

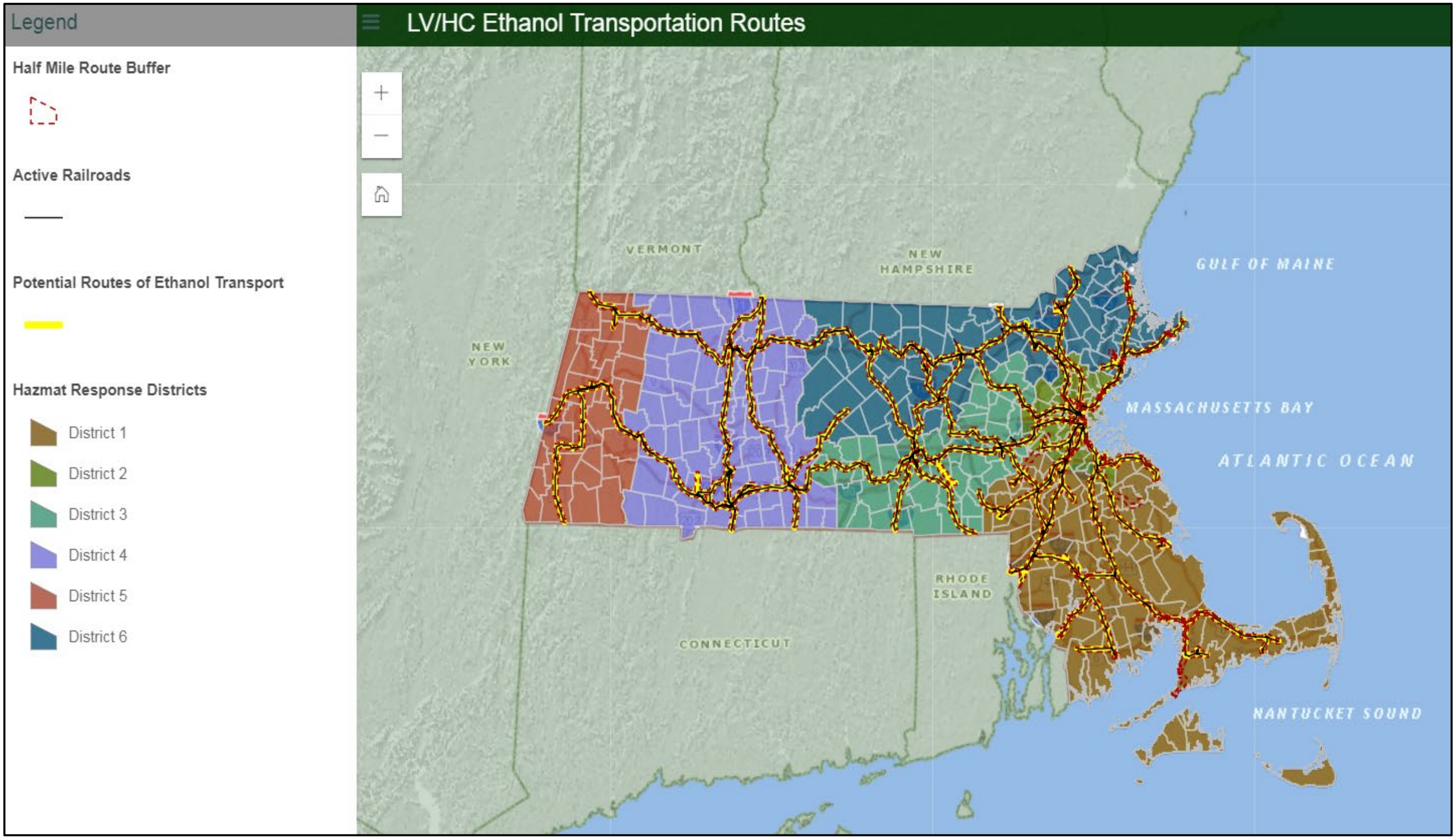
Location	Ownership	Fire District	HSAC Region	MassDEP Region	Unit Type[1]	Type of Foam Concentrate	Amount of Foam Concentrate[2]	Onboard tank, tote, or buckets	Stockpile (not on truck)
MMR Otis AFB	Military	1	SERAC	SERO 4	FT	AFFF 3%			
Worcester Airport	MassPort	7 & 8	CRHSAC	CERO 2	OBT	Milspec ANSUL Ansulite 3% AFFF	2800	OBT	
Westover AFB	Military	11	WERAC	WERO 1	FT	AFFF 3%			
Logan Airport 1	MassPort	13	MBHSAC	NERO 3	OBT	Milspec ANSUL Ansulite 3% AFFF	8,245	OBT, Trailer, Drum, buckets	5-gal buckets
Logan Airport 2	MassPort	13	MBHSAC	NERO 3	OBT	Milspec ANSUL Ansulite 3% AFFF	2,760	OBT, Trailer, Drum, buckets	
Logan Airport Marine	MassPort	13	NERAC	NERO 3		Milspec ANSUL Ansulite/ Propack 3% AFFF	17.5	Buckets	5-gal containers
Logan Airport Marine	MassPort	13	NERAC	NERO 3		High Expansion 1 1/2% National Foam	20	Buckets	5-gal containers
Hanscom AFB	MassPort	14	WERAC	WERO 1	OBT	Milspec ANSUL Ansulite 3% AFFF	2720	OBT	
Hanscom AFB	Military	14	WERAC	WERO 1	FT	AFFF 3%			

Stockpiles of AR-AFFF

Location	Ownership	Fire District	HSAC Region	MassDEP Region	Unit Type[1]	Type of Foam Concentrate	Amount of Foam Concentrate[2]	Tote or buckets (Forklift?)	Already on a truck?
FT&S Tyngsboro	Vendor	All			Tender	AR-AFFF 1% - 3%	550	Tank	Yes
FT&S Tyngsboro	Vendor	All			Box truck	AR-AFFF 1% - 3%	450	Drum (8)	Yes
FT&S Tyngsboro	Vendor	All			Facility	AR-AFFF 1% - 3%	1,000	Drum (20)	No
FT&S Springfield	Vendor	All			Box truck				
FT&S Springfield	Vendor	All			Facility				
Braintree (CITGO 1)	Industry	13	NERAC	NERO 3	Trailer	AR-AFFF 3% - 6% UC working to replace with non-PFAS			
Braintree (CITGO 2)	Industry	13	NERAC	NERO 3	Trailer	AR-AFFF 3% - 6% UC working to replace with non-PFAS			
Braintree (CITGO 2)	Industry	13	NERAC	NERO 3	Trailer	AR-AFFF 3% - 6% UC working to replace with non-PFAS			

Notes:
1. AFT = Attack Foam Trailer (includes foam monitor); FT = Foam Trailer (no monitor); OBT=Onboard Tank
2. Amount in gallons

Attachment 5 - Maps of Common LV/HC Ethanol Transportation Routes



Maps of Common LV/HC Ethanol Transportation Routes provided by MEMA separately. Massachusetts OLIVER Layers to identify potentially exposed populations and facilities are summarized below, for local ethanol response planning:

State Facilities

State Lease Facilities Max 20000
DCAM Lease Facilities Max 20000
State Lease Facilities Min 20000
DCAM Lease Facilities Min 20000

Cultural Resources

Schools: Pre-kindergarten to High School Buildings
Schools: Pre-kindergarten to High School Labels

Infrastructure

Acute Care Hospitals: Acute Care Hospitals Buildings
Acute Care Hospitals: Acute Care Hospitals Labels
Dams: Dams (by Hazards Code)
Dams: Dams (by Hazards Code) Labels
Fire Stations: Fire Stations
Fire Stations: Fire Stations Labels
MassDOT Roads: Major MassDOT Roads: Major MassDOT Routes
MassDOT Roads: MassDOT Roads: MassDOT Roads by Road Type
Long Term Care Residences: Long Term Care Residences
Long Term Care Residences: Long Term Care Residences Labels
Police Stations: Police Stations
Police Stations: Police Stations Labels
Prisons: Prison Buildings
Schools: College and University Buildings
Schools: College and University Buildings Labels
Schools: Pre-kindergarten to High School Buildings
Schools: Pre-kindergarten to High School Labels
Town Halls: Town Halls
Town Halls: Town Halls Labels
Trains: Railroads: Railroads – Active Service
Trains: Railroads: Railroads by Type of Service

Physical Resources

Public Water Supplies: Public Water Supplies

Regulated Areas

Surface Water Protection Areas: Zone A
Surface Water Protection Areas: Zone B
Surface Water Protection Areas: Zone C
Wellhead Protection Areas: IWPAs
Wellhead Protection Areas: Zone Is
Wellhead Protection Areas: Zone IIs

Attachment 6 - CONTACT INFORMATION FOR LARGE VOLUME/HIGH CONCENTRATION ETHANOL

1. Railroads

Emergency Contact Numbers for Massachusetts Common Freight Carriers (i.e., railroads)

- **Bay Colony Railroad (BCLR)** .... 24-hour Emergency Number: (855) 300-6193
- **Connecticut Southern Railroad (CSO)** .... 24-hour Emergency Number: (866) 527-3499
- **CSX Transportation (CSXT)** .... 24-hour Emergency Number: (800) 232-0144
- **East Brookfield and Spencer Railroad (EBSR)** .... Office: (508) 885-4664
- **Fore River Transportation Corporation (FRVT; operates on the Massachusetts Water Resources Authority [MWRA] tracks**) .... MWRA Security Center (877) 697-6972
- **Grafton and Upton Railroad (GU)** .... Dispatcher: (508) 481-6095
- **Housatonic Railroad (HRRC)** .... Dispatcher: (860) 824-0850
  .... or Headquarters: (860) 824-7936
- **Massachusetts Central Railroad (MCER)** .... 24-hour Contact Number: (978) 355-0029
- **Massachusetts Coastal Railroad (MC)** .... Office: (508) 291-2116
  .... 24-hour Emergency Number: 888-783-4316
- **New England Central Railroad (NECR)** .... 24-hour Emergency Number: (866) 527-3499
- **Pan Am Railways (ST)** .... 24-hour Emergency Number: (800) 955-9208
- **Pan Am Southern (PAS)** .... 24-hour Emergency Number: (800) 955-9208
- **Pioneer Valley Railroad (PVRR)** .... Emergency Number: (800) 613-2212
- **Providence & Worcester Railroad (PW)** .... 24-hour Number: (802) 527-3499

2. Tug and Barge Companies

For information on the carrier for an incident on a navigable water, such as a barge incident, contact the U.S. Coast Guard (USCG) at the USCG Command Center telephone: (617) 223-5757. All shipments of “certain dangerous cargoes,” such as ethanol, are required to provide the USCG with notice of scheduled arrivals at least 24 hours, but not more than 96 hours, before arriving at the terminal for a cargo transfer.

Attachment 7 - "Quick Reference" Guide for Ethanol Incident Response

Incident Commander's Quick Reference

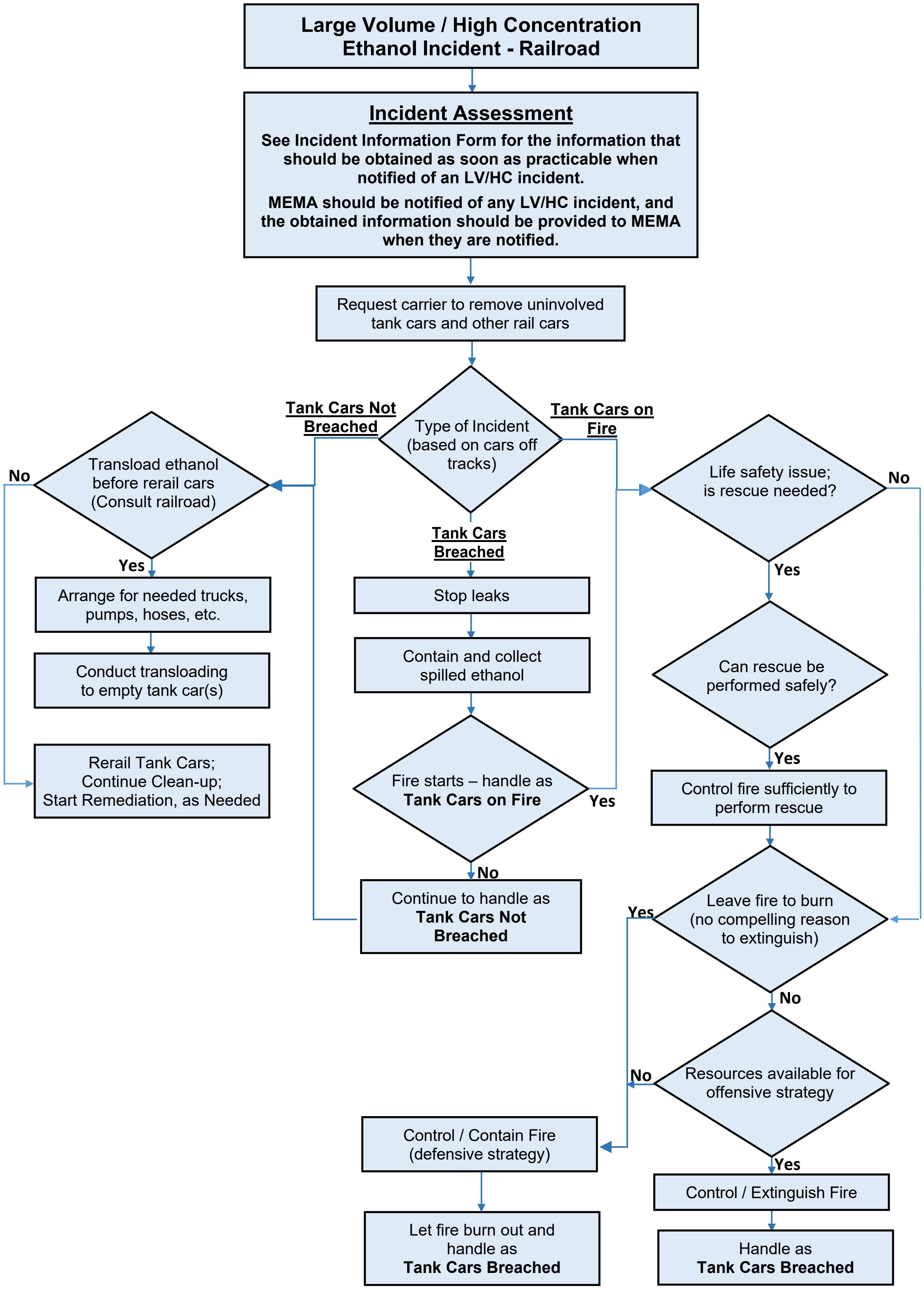
Contacts for Incident Support

- MA Department of Environmental Protection (MassDEP) 1-888-304-1133
- Massachusetts Emergency Management Agency (MEMA) (508) 820-2000

Critical Information for an Ethanol or Denatured Ethanol Incident

1. It is usually better to control and contain an LV/HC ethanol fire and let it burn out. Fire suppression should only be attempted for life safety (i.e., rescue), and only if an offensive strategy can be implemented safely.
2. Placards on ethanol shipments may be 1987 (denatured ethanol; 95% to 99% ethanol), 3475 (ethanol and gasoline mixture; up to 94% ethanol), 1170 (ethanol or ethyl alcohol; 100% ethanol), or 3065 (alcoholic beverage).
3. After railroad tank cars breach and ethanol starts burning, there are less than two hours when offensive firefighting strategies can be effectively implemented.
4. Response efforts for LV/HC ethanol incidents are expected to last up to 72 to 96 hours before the hazards are sufficiently reduced and the incident can enter remediation and recovery phases.
5. Large quantities of Alcohol Resistant Aqueous Film-Forming Foam (AR AFFF) and huge amounts of water are needed to fight an ethanol fire, and AR-AFFF is effective only when using a Type II discharge scenario to minimize plunging or submergence.
6. 500 gallons of foam concentrate mixed at 3% (mixed with 16,300 gallons of water) can handle a spill about 75 feet by 75 feet (5,600 square feet) and requires a foam application rate of 1,100 gallons per minute (gpm) for 15 minutes.
7. Ethanol will mix completely with water and is a good electrical conductor, so electrocution and ignition hazards (e.g., static electricity) may be present.
8. Ethanol vapors heavier than air (vapor density 1.59); ethanol is easily ignitable in open air with a flammable range of 3.3% (LFL) to 19% (UFL).
9. Ethanol burns with a nearly invisible flame and has less visible smoke than burning hydrocarbons, such as gasoline or crude oil.
10. Radiant heat flux from a burning ethanol fire can be 2 to 5 times greater than radiant heat flux from a gasoline fire.
11. Ethanol spills should be prevented from entering storm water systems, sewers, and waterways, as well as basements and confined spaces.
12. Ethanol can be contained on land by diking and/or damming with dirt, sand, plastic sheeting, or portable containment systems. Fire-resistant booms laid on the ground may be used to contain burning ethanol. Note: containment booms are ineffective on water because ethanol does not float.
13. Oil-only absorbents will not work with ethanol or denatured ethanol.
14. Surface and underground (well) water sources, such as used for public drinking water, industrial process/cooling water, or agriculture, can be severely impacted by an ethanol release. Rapid notification to shut down these water withdrawals is critical to protect these systems' infrastructure.
15. Ethanol that gets into storm water systems or sewers can damage wastewater treatment plants because the ethanol may kill the bacteria used in wastewater treatment.

See the LV/HC Ethanol Incident Response Plan for additional information.


Large Volume / High Concentration Ethanol Incident - Railroad
Incident Assessment
See Incident Information Form for the information that should be obtained as soon as practicable when notified of an LV/HC incident.
MEMA should be notified of any LV/HC incident, and the obtained information should be provided to MEMA when they are notified.
Request carrier to remove uninvolved tank cars and other rail cars
Type of Incident (based on cars off tracks)
Tank Cars Not Breached
Tank Cars on Fire
Tank Cars Breached
Transload ethanol before rerail cars (Consult railroad)
No
Yes
Arrange for needed trucks, pumps, hoses, etc.
Conduct transloading to empty tank car(s)
Rerail Tank Cars; Continue Clean-up; Start Remediation, as Needed
Stop leaks
Contain and collect spilled ethanol
Fire starts – handle as Tank Cars on Fire
Yes
No
Continue to handle as Tank Cars Not Breached
Life safety issue; is rescue needed?
No
Yes
Can rescue be performed safely?
Yes
Control fire sufficiently to perform rescue
Leave fire to burn (no compelling reason to extinguish)
Yes
No
Resources available for offensive strategy
No
Yes
Control / Contain Fire (defensive strategy)
Let fire burn out and handle as Tank Cars Breached
Control / Extinguish Fire
Handle as Tank Cars Breached

Incident Information Form

Do Not Delay Notifications While Obtaining the Information

Incident Information Date: Time:	
Carrier Name:	
Carrier Contact:	
Address or Location:	
Nearest City:	**Distance:**
Involved Parties: Individual Reporting	**Incident Commander**
Name:	
Position:	
Telephone Number:	
Organization:	
Incident Details	
Type of Units:	**Type of Product:**
Number of Units:	**Number of Units Breached:**
Estimated Quantity Spilled:	**Is flow stopped? YES NO**
Is Spill Contained? YES NO If NO, Direction and Speed Spilled Product Flowing:	
Spill Enter Water or a storm drain or sewer system (the System)? YES NO	
If YES, Name of Water Body / System:	
If YES, Estimated Quantity in Water / System:	
If YES, Direction and Speed in Water / System:	
Injuries? YES NO If YES, Number:	**Fatalities? YES NO If YES, Number:**
Is there fire? YES NO If YES, Number of Units Involved:	
Evacuation necessary? YES NO If YES, Distance/Area Evacuated:	
Additional Information/Comments:	

Large Volume/High Concentration Ethanol Incident Response Quick Reference

Prepared by TRC JUNE 2016

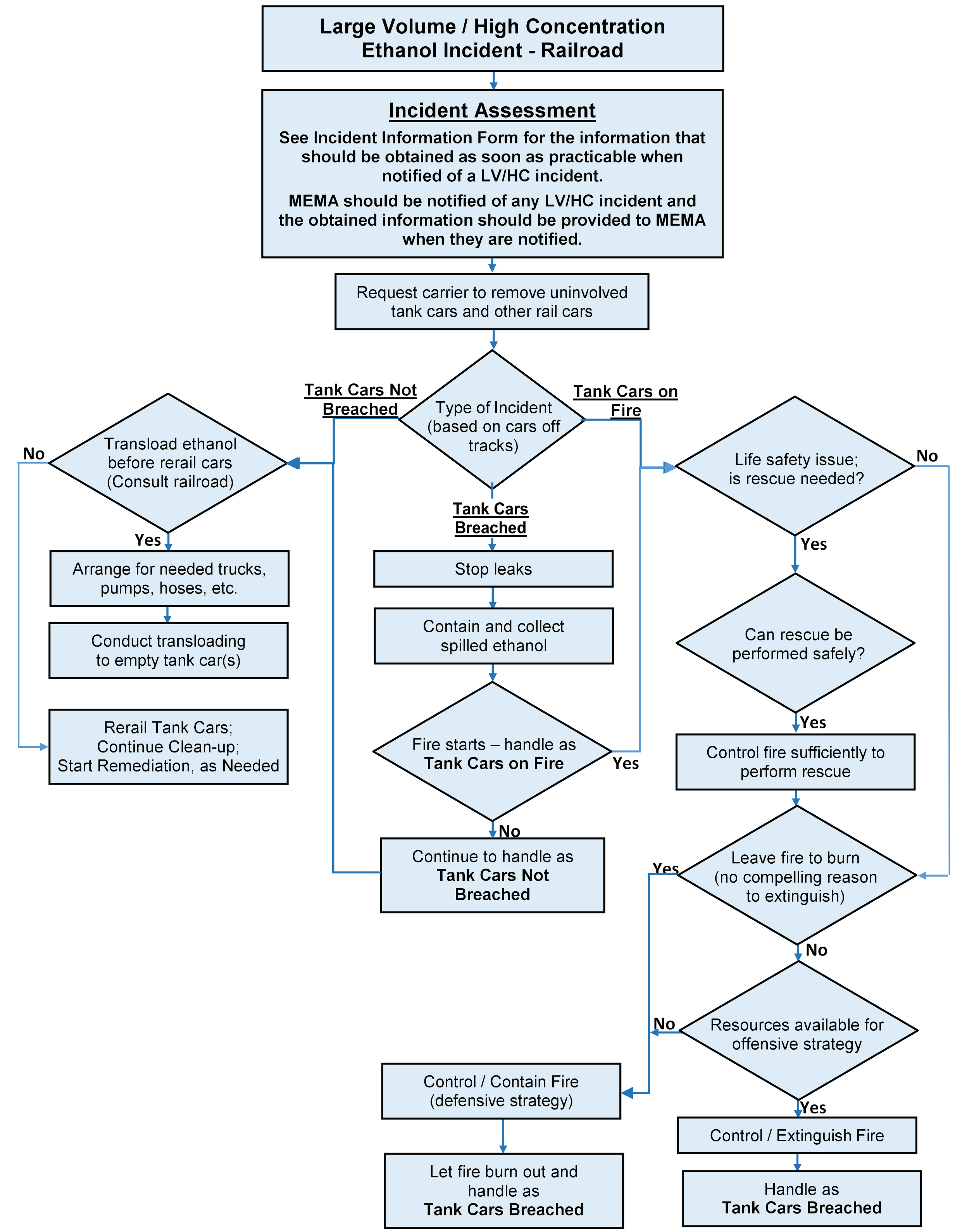
Emergency Contacts for Incident

Critical Information
Ethanol or Denatured Ethanol Incident

- Plan for response effort to last up to 72 to 96 hours.
- Preferred to control and contain a LV/HC ethanol fire and let it burn out. Only attempt fire suppression for life safety (i.e., rescue) and only if it can be done safely.
- There are less than two hours after railroad tank cars breach and fire starts before incident growth expected to make efforts to suppress fire ineffective.
- Placards on shipments: Typ. 1987 (denatured ethanol; 95% to 99% ethanol), 3475 (ethanol/gasoline mixture; ≤ 94% ethanol), 1170 (ethanol; 100% ethanol).
- Large quantities of AR AFFF and huge amounts of water are needed to fight an ethanol fire and AR-AFFF is effective only with a Type II discharge to minimize plunging or submergence.
- 500 gallons of foam concentrate mixed at 3% (mixed with 16,300 gallons of water) can handle a spill about 75 ft by 75 ft (5,600 sq ft; 370 gallons, 6 inches deep). Required foam application rate of 1,100 gpm for 15 minutes.
- In water, the ethanol component will readily mix with water and the denaturant will separate and float on the water surface.
- Ethanol and ethanol mixed with water are good electrical conductors. Electrocution and ignition hazards (e.g., static electricity) may be present.

See the MEMA LV/HC Ethanol Incident Response Planning Guidance for additional information

- Ethanol vapors (vapor density 1.59) heavier than air; vapors ignite easily in air - flammable range: 3.3% to 19%.
- Ethanol burns with a nearly invisible flame and has less visible smoke than burning gasoline or crude oil.
- Radiant heat flux from a burning ethanol fire can be 2 to 5 times greater than radiant heat flux from a gasoline fire.
- Prevent ethanol spills from entering storm water systems, sewers, and waterways (and basements and confined spaces); vapors in confined spaces are explosion hazard.
- Oil-only absorbents do not work for denatured ethanol, use universal absorbents or water absorbing material.
- Contain ethanol on land by diking and/or damming with dirt, sand, plastic sheeting, or portable containment systems. Fire-resistant booms laid on the ground may be used to contain burning ethanol. **Note:** containment booms not effective on water since ethanol does not float.
- The HMRT are trained and equipped to stop leaks and MassDEP technicians are trained and equipped for spill containment and collection, so both agencies may be needed for the incident response.



Notes:

Primary Activities

Primary objective for a LV/HC ethanol incident is life safety; secondary objectives are the protection of property and the environment. To achieve these objectives, the primary response activities include fire control and spill control.

Firefighting

It is preferred to control and contain a LV/HC ethanol fire and let it burn out. Only attempt fire suppression for life safety (i.e., rescue) and only if it can be done safely. Generally, the Incident Commander has less than approximately two hours to implement an effective offensive firefighting strategy; however, do not start an offensive strategy if there are not adequate water, AR-AFFF concentrate, and trained firefighters available for the estimated size and needs of a given incident.

After six to 12 hours, most of the ethanol will have burned, infiltrated into the ground, and/or become sufficiently diluted with water, and offensive tactics to extinguish any remaining fire may be appropriate.

Spill Response

To prevent potential serious environmental impacts and since ethanol is relatively clean burning, control and containment and allowing ethanol to burn off is preferred if it catches fire. Note that receiving permission from the regulatory agencies for in situ burning of released ethanol to re-ignite a fire after it has been suppressed is not expected to be granted in a timely manner.

Secondary Activities

Security - Establishing and maintain a perimeter, crowd control, and traffic control.

Communication - Primary communication between the Incident Command Post, the local EMAs, and SEOC is via radio, telephone, and e-mail. It is imperative that these systems be activated and/or installed as soon as practicable after the Incident Command Post (ICP) has been established.

Public Information - Warnings and on-going service announcements and/or information sharing, will be coordinated. In addition, the UC must approve information disseminated regarding the specific incident, including press releases and media interviews.

Evacuation/Shelter-in-Place - When a LV/HC ethanol incident impacts or has the ability to impact the nearby population, a shelter-in-place or evacuation decision must be made.

Clean-up, Remediation, and Recovery - Once the response phase of a LV/HC ethanol release is complete, recovery actions and remediation activities will begin. Depending on the incident, the recovery action process is usually overseen by MassDEP.

Ethanol Spill Response Considerations

- Response effort for a LV/HC ethanol incident is expected to last up to 72 to 96 hours before the hazards from the incident are sufficiently reduced and the incident can enter remediation and recovery phases.
- Ethanol and denaturant (i.e., gasoline) will separate on contact with water (surface water, groundwater, or firefighting water); ethanol component will readily mix with water and the denaturant will typically separate and float on the water surface.
- Ethanol and ethanol fuel blends have different properties than gasoline and require different spill response techniques and equipment than gasoline or diesel fuel.
- Leaks should be stopped (e.g., valves closed, leaks plugged) if this can be done safely.
- Surface and underground (well) water sources (drinking water, process water, cooling water, aquaculture), can be severely impacted by an ethanol release. Rapid notification to shut down these water withdrawls is critical to protecting these systems' infrastructure.
- Spills should be prevented from entering storm water systems, sewers and waterways, as well as basements and confined spaces.
- Ethanol in storm water systems or sewers can damage wastewater treatment plants because the ethanol kills the bacteria used in wastewater treatment.
- Ethanol can be contained by diking and/or damming with dirt, sand, or portable containment systems.
- Ethanol readily mixes with water and once it enters waterways it is not easily recoverable by emergency responders.
- Ethanol in surface water bodies may cause significant fish kills and other damage by direct contact and/or depleting dissolved oxygen fish and other water life need.
- Aeration of water bodies may be effective in increasing the dissolved oxygen in the water and increasing thee biological degradation of ethanol.
- Most vacuum trucks will not work to recover ethanol, unless they have special filters designed for polar solvents.
- Absorb with water-absorbent materials (cat litter, pads, booms, etc.) – universal absorbents may be effective (check with manufacturer); "oil only" absorbents, pads, and booms will only absorb the gasoline component, but not ethanol.
- Use clean non-sparking tools to collect absorbed material.
- Ethanol may harm water supplies used for drinking, process, aquaculture, or cooling water, as well as WWTP, so warn owners/operators of water intakes and WWTP that may be threatened.

Ethanol Firefighting Considerations

- Ethanol and ethanol fuel blends have different properties than gasoline and require different firefighting techniques and equipment than gasoline or other hydrocarbons.
- Under fire conditions, high concentration ethanol has less visible smoke than a gasoline fire and ethanol burns with a virtually invisible flame after the denaturant (typically gasoline) burns off, so thermal imaging devices or other means (e.g., straw broom held above suspected areas) should be used to detect areas that may still be burning.
- Incident heat flux from an ethanol fire can be 2 to 5 times greater than the incident heat flux from a gasoline fire.
- Only AR-AFFF and copious amounts of water are effective fire suppression techniques for fire involving ethanol.
- 500 gallons of foam concentrate mixed at 3% (mixed with 16,300 gallons of water) can handle a spill about 75 ft by 75 ft (5,600 sq ft; 370 gallons, 6 inches deep). Required foam application rate of 1,100 gpm for 15 minutes.
- AR-AFFF appears to be effective only when using a Type II discharge scenario (i.e., fixed discharge applied to a vertical surface so as to provide a more gentle application that minimizes plunging or submergence).
- Foam does not work if material is too hot, so if foam is to be applied to an ethanol fire, surfaces may need to be cooled first.
- Massive quantities of foam concentrate and water, large application devices, and well-trained personnel are required to handle a large volume ethanol fire – do not expect to have adequate resources to fight a rail car fire.
- Although available AR-AFFF foam and other resources may not be sufficient to put out a LV/HC ethanol fire, foam may can be used in other ways to control an incident. For example, if ethanol enters a storm drain or sewer, AR-AFFF foam can be used to suppress vapors in the lines and minimize the potential for igniting the vapors and causing additional damage.
- Large foam caches of AR-AFFF strategically located and readily transportable in large volume containers are critical to successful fire control and extinguishment.
- In general, do not expect a local airport Aircraft Rescue and Firefighting vehicle to effectively fight an ethanol fire; the FAA requires airport firefighting vehicles to carry straight AFFF for aviation fuel fires, not AR-AFFF. Note that the Massachusetts Port Authority Fire Department has one fire engine (Engine 5) and a foam trailer (Foam Trailer 1) that have AR-AFFF foam concentrate and these units are located at Boston Logan International

Shipping Name / Description	Placard
Denatured alcohol; alcohols not otherwise specified; 95% to 99% ethanol	
Ethanol and gasoline mixture, with more than 10% ethanol (typically up to 94% ethanol)	
Ethanol or ethanol solution (typically 100% ethanol that has not been denatured)	
Alcoholic beverages (ethanol for consumption)	

Notes: