



Crude Oil Shipment by Rail:

Preparing for Hazardous Materials Transportation
Incidents

August 31, 2018

Fiscal Year 2018 Report to Congress



**Homeland
Security**

Federal Emergency Management Agency

Message from the Administrator

August 31, 2018

I am pleased to present the following report, “Crude Oil Shipment by Rail: Preparing for Hazardous Materials Transportation Incidents,” which has been prepared by the Federal Emergency Management Agency.

This document has been compiled in response to language in the Fiscal Year (FY) 2018 Joint Explanatory Statement, which accompanies the FY 2018 Department of Homeland Security Appropriations Act (P.L. 115-141).

Pursuant to congressional requirements, this report is being provided to the following Members of Congress:

The Honorable Kevin Yoder
Chairman, House Appropriations Subcommittee on Homeland Security

The Honorable Lucille Roybal-Allard
Ranking Member, House Appropriations Subcommittee on Homeland Security

The Honorable Shelley Moore Capito
Chairman, Senate Appropriations Subcommittee on Homeland Security

The Honorable Jon Tester
Ranking Member, Senate Appropriations Subcommittee on Homeland Security

Inquiries relating to this report may be directed to me at (202) 646-3900.

Sincerely,



Brock Long
Administrator
Federal Emergency Management Agency





Crude Oil Shipment by Rail: Preparing for Hazardous Materials Transportation Incidents

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I. Legislative Language

This document has been compiled in response to language in the Fiscal Year (FY) 2018 Joint Explanatory Statement that accompanies the FY 2018 Department of Homeland Security (DHS) Appropriations Act (P.L. 115-141). The FY 2018 Joint Explanatory Statement states:

FEMA is directed to submit a report to the Committees, not later than 90 days after the date of enactment of this Act, on its efforts through grants and training to address the unique challenges faced by first responders related to the shipment of crude oil by rail. The report shall describe the effectiveness of current training programs and any need for additional training or curriculum improvements.

II. Discussion

The Federal Emergency Management Agency (FEMA) supports the National Preparedness System (NPS), which outlines an organized process for everyone in the whole community to move forward with their preparedness activities and to achieve the National Preparedness Goal. The National Training and Education System (NTES) supports the NPS and consists of the nationwide network of training and education providers and students who build and sustain capabilities for a more secure and resilient Nation. The NTES enables better outcomes for jurisdictions and students by aligning and simplifying access to the right resources and by ensuring that learning content is relevant and effective, and addresses the need.

A. Trends in Preparedness for Hazardous Materials Transportation Incidents

A combination of several preparedness resources, including the Threat and Hazard Identification and Risk Assessment (THIRA), State Preparedness Report (SPR), Biannual Strategy Implementation Report, and National Preparedness Report, highlight preparedness trends related to transporting hazardous materials (HAZMAT).

Identifying Gaps: Threats, Hazards, and Risks Related to the Transportation of HAZMAT

Each year, states, territories, major urban areas, and tribes conduct a THIRA to better understand their threats and hazards and to set targets for their preparedness capabilities. As part of this assessment, jurisdictions identify the threats and hazards of primary concern to their communities and describe their potential impacts. In 2016, 42 out of 114 jurisdictions identified a potential chemical HAZMAT release involving rail transportation (including crude oil) as a threat or hazard in their THIRAs.

Identifying Gaps: State Capabilities for Addressing HAZMAT Incidents

Jurisdictions also use the THIRA to set targets for building and sustaining each of the 32 core capabilities identified in the National Preparedness Goal. Each year, states and territories use the SPR to assess their capabilities, rating each of the core capabilities on a 1–5 scale to indicate the gap between their current capabilities and their THIRA targets. A rating of 5 indicates that the jurisdiction is close to or has met its target, whereas a rating of 1 indicates little-to-no capability and that substantial development still may be necessary to meet the capability target. FEMA considers ratings of 4 and 5 to indicate proficiency. Rather than a single overall rating, states and territories assess themselves in five different areas for each core capability: planning, organization, equipment, training, and exercises.

Five core capabilities that are particularly relevant to preparing for, responding to, and recovering from a threat or hazard related to HAZMAT transportation are:

- Environmental response/health and safety,
- Public health, healthcare, and emergency medical services,
- Critical transportation,
- Infrastructure systems, and
- Logistics and supply chain management.

Table 1 highlights the 2017 SPR proficiency ratings (the percentage of ratings that were 4s or 5s in 2017) for these relevant core capabilities. States and territories also indicate specific gaps in each core capability, expressed as functions or activities related to the capability. Table 1 indicates the activities and functions in which states and territories most frequently reported capability gaps.

Table 1: 2017 HAZMAT SPR Proficiency Ratings and Gaps by Core Capability

Core Capability	Proficiency (% of 4/5 Responses)	Most Frequently Reported Capability Gaps
Environmental response/health and safety	More than half (52%) of the ratings indicate proficiency	<ul style="list-style-type: none"> • Decontamination • Health and safety monitoring and assessment • HAZMAT cleanup
Public health, healthcare, and emergency medical services	More than half (59%) of the ratings indicate proficiency	<ul style="list-style-type: none"> • Medical surge • Medical countermeasures • Emergency medical services
Critical transportation	Less than half (49%) of the ratings indicate proficiency	<ul style="list-style-type: none"> • Evacuation • Delivery of response assets • Establishing access
Infrastructure systems	Less than half (30%) of the ratings indicate proficiency	<ul style="list-style-type: none"> • Infrastructure site assessments • Power restoration
Logistics and supply chain management	Less than half (34%) of the ratings indicate proficiency	<ul style="list-style-type: none"> • Resource management • Donation management

B. Addressing Gaps Related to HAZMAT Incidents through Training

FEMA has invested \$15.1 million in FYs 2015, 2016, and 2017, as shown in Table 2, to support 13 training courses related to HAZMAT transportation incidents. Training includes classroom and Web-based deliveries. From 2015 to 2016, FEMA supported 136 classroom sessions and trained more than 2,400 first responders and emergency management personnel. Web-based courses trained an additional 69,000 individuals. FEMA also provided training in other skills and capabilities needed for incident response, including the Incident Command System.

Training details are provided in Tables 3 and 4. FEMA preparedness grant recipients also are authorized to use their funding to address HAZMAT core capability gaps through developing and attending training as an allowable cost under their awards.

Table 2: FEMA Investments in Transportation of HAZMAT-Related Training

Training Provider	FY 2015	FY 2016	FY 2017
Transportation Technology Center, Inc. (TTCI)	\$5,000,000	\$5,000,000	\$5,000,000
Emergency Management Institute (EMI) ¹	\$46,366	\$57,456	\$75,181
Total	\$5,046,366	\$5,057,456	\$5,075,181
Grand Total			\$15,179,003

Methodology for Determining Training Needs

FEMA applies a training needs assessment to identify and prioritize gaps by analyzing the following training-related data:

- Threats and hazards (e.g., crude-by-rail, high flammability hazards),
- The student (i.e., profession, position, and level of responsibility),
- Applicable policy, doctrine, and statutes such as National Fire Protection Association standards,
- Type of training gap (i.e., knowledge or skills, or both),
- Existing training resources,
- Reports from industry,
- Lessons learned from exercises,
- After-action reports addressing actual HAZMAT incidents, and
- Supply and demand factors such as seasonal and production fluctuations.

Courses are created, modified, or archived on the basis of needs assessment results. Instructional systems design experts use the information from the training course needs assessment to create learning objectives for FEMA’s HAZMAT training courses.

FEMA Training Providers

FEMA’s Transportation of HAZMAT training courses are developed and delivered through a network of providers that include the TTCI Security and Emergency Response Training Center (SERTC) and EMI.

¹ EMI calculates the cost for Web-based courses at \$1.80 per course completion and conducts the virtual tabletop exercises with government employees rather than with contract support.

FEMA Courses Related to Transportation of HAZMAT

Several FEMA training courses address HAZMAT incident response:

- Tank Car Specialist (TTCI)
- Highway Emergency Response Specialist (TTCI)
- Leadership and Management of Surface Transportation Incidents (TTCI)
- Hazardous Materials/Weapons of Mass Destruction Technician for Surface Transportation (TTCI)
- Surface Transportation Emergency Preparedness and Security (STEPS) involves three courses: (1) STEPS - Freight, (2) STEPS - Mass Transit and Passenger Rail, and (3) STEPS - Senior Officials (TTCI)
- Crude-by-Rail Emergency Response (TTCI)
- Tactical Hazardous Materials Operations for Surface Transportation (TTCI)
- An Introduction to Hazardous Materials (EMI)
- An Orientation to Hazardous Material for Medical Personnel (EMI)
- Emergency Support Function (ESF) #10 - Oil and Hazardous Material Response (EMI)
- Virtual Tabletop Exercises (VTTX): Gasoline Transportation and Bakken Oil Rail Transportation (EMI)

Course descriptions are provided in the Appendix.

C. Assessing the Effectiveness of FEMA's HAZMAT Training

FEMA applies the results of the previously described needs assessment with training evaluation data to determine if training programs are achieving desired results. FEMA evaluates training using the Kirkpatrick Model, a worldwide standard for determining the effectiveness of training. As part of this evaluation, students complete a survey pre- and post-training to identify gains in the student's knowledge, skills, and abilities. FEMA analyzes the evaluation data along with the learning objectives and testing materials, resulting in curriculum improvements and/or modifications as required to support increased and improved learning.

Tables 3 and 4 summarize the results of FEMA's evaluation of the Transportation of HAZMAT-related training programs previously listed. Course names also include their categorization as performance- or awareness-level courses. Awareness-level courses are designed for responders who require the skills necessary to recognize and report a potential catastrophic incident or who are likely to witness or investigate an event involving the use of hazardous and/or explosive devices. Performance-level courses are designed for first responders who perform tasks during the initial response to a catastrophic event, such as safeguarding the at-risk public, rescuing survivors, or decontaminating survivors.

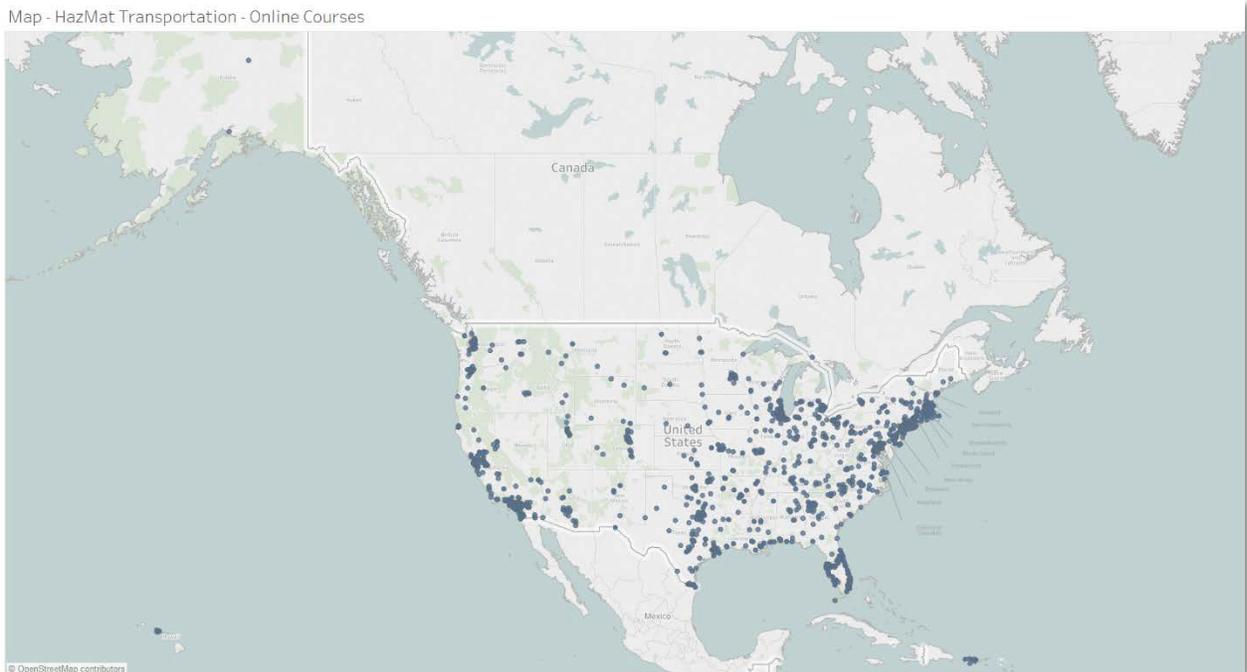
Table 3: Survey Results – TTCI Courses (2015-2017)

Course	Number of Classes	Total Trained 2015 – 2017	Percent Reporting Increase in Knowledge, Skills, and Abilities
Tank Car Specialist (Performance)	34	527	55.8%
Highway Emergency Response Specialist (Performance)	38	782	73.2%
Leadership and Management of Surface Transportation Incidents (Performance)	21	174	28.2%
Hazardous Materials/Weapons of Mass Destruction Technician for Surface Transportation (Performance)	23	321	56.8%
STEPS for Freight by Rail or Highway (Performance)	10	156	54.8%
STEPS for Mass Transit and Passenger Rail (Performance)	3	47	25.4%
STEPS for Senior Officials or Administrators (Performance)	7	98	57.7%
Crude-by-Rail Emergency Response (Performance)	75	1,540	23.3%
Tactical Hazardous Materials Operations for Surface Transportation (Performance)	1	21	32.9%

Table 4: Survey Results – EMI Courses (2015-2017)²

Course	Number of Classes	Total Trained 2015 - 2017	Percent Reporting Increase in Knowledge, Skill, and Abilities
An Introduction to Hazardous Materials (Awareness)	Self-Study (start time determined by student)	94,188	N/A
An Orientation to Hazardous Materials for Medical Personnel (Awareness)	Self-Study (start time determined by student)	13,587	N/A
ESF #10 – Oil and Hazardous Materials Response (Awareness)	Self-Study (start time determined by student)	3,258	N/A
VTTX: Gasoline Transportation and Bakken Oil Rail Transportation (Performance)	9	854	N/A

Figure 2: Student location of EMI Course Completions (2015 - 2017)



² EMI conducts Kirkpatrick Level 2 learning assessment on courses that are a minimum of 2 days or 16 contact hours in duration. These courses do not meet the criteria for this assessment.

SERTC Training Demand

The majority of FEMA’s performance-level training for HAZMAT transportation incidents is provided through TTCI’s SERTC. SERTC has the largest collection in the United States of full-sized rail cars that are used as training aids. Demand for TTCI’s training is high. TTCI currently has reached full operational capacity and has more than 400 students awaiting slots for 5 of the 9 courses, including more than 190 students for the Highway Emergency Response Specialist course and more than 80 students for the Crude-by-Rail Emergency Response course.

FEMA Collaboration

In 2015, DOT, the U.S. Environmental Protection Agency (EPA), and FEMA collected information from 48 states and the District of Columbia on their preparedness efforts for responding to and mitigating the impacts of crude-by-rail incidents. The majority of states reported that their response plans for HAZMAT are sufficient to manage a crude oil train derailment. However, 23 states—including 7 with primary rail lines designated for crude-by-rail shipments—reported shortfalls in first responder training. States attributed these shortfalls to shortages in local responder staffing, which prevents responders from taking leave to attend specialized training courses.

D. Next Steps: Optimizing FEMA’s Transportation of HAZMAT Training

P.L. 114-321 directs FEMA to establish the Railroad Emergency Services Preparedness, Operational Needs, and Safety Evaluation (RESPONSE) Subcommittee under its National Advisory Council (NAC) to provide recommendations for improving emergency responder training and resource allocation for HAZMAT incidents involving railroads. The RESPONSE Subcommittee comprises federal officials from DHS, DOT, the National Transportation Safety Board, and EPA, as well as other experts from nonfederal entities.

Specifically, the subcommittee will examine (per P.L. 114-321):

- The quality and application of training for state and local emergency responders related to rail HAZMAT incidents, including training for emergency responders serving small communities near railroads;
- The availability and effectiveness of federal, state, local, and nongovernmental funding levels related to training emergency responders for rail HAZMAT incidents, including emergency responders serving small communities near railroads; and
- The strategy for integrating commodity flow studies, mapping, and rail and HAZMAT databases for state and local emergency responders and increasing the rate of access to the individual responder in existing or emerging communications technology.

The full subcommittee began meeting in May 2017 and submitted a report to the NAC in November 2017, which included recommendations for review, approval, and submission as appropriate to the FEMA Administrator on the above topics, specified timeframes for implementing the recommendations, and proposed recommendations for congressional action.

Curriculum Improvements

FEMA will use the NAC recommendations to inform work through NTES. This work includes specific curriculum improvements such as better alignment of learning objectives to core capabilities and specific threats and hazards, as well as an improved training needs assessment process that leads to a more targeted curriculum (e.g., performance objectives more closely match the conditions likely to be encountered by first responders).

FEMA created NTES to help implement the Post-Katrina Emergency Management Reform Act of 2006 (P.L. 109-295). This act calls for “a national training program to implement the national preparedness goal, National Incident Management System, National Response Plan, and other related plans and strategies.” FEMA uses NTES to optimize training and education investments and activities through analytics and enhanced partnerships, including the efforts to address transportation of HAZMAT. NTES partnerships include FEMA engagement with a network of stakeholders in federal, state, and local agencies; the transportation industry; training providers; national and international associations; and academia.

NTES data collection and analysis activities include THIRA and SPR, as well as congressional reports, U.S. Government Accountability Office documents, federal and local program data, industry reports, research studies, after-action reports, and lessons-learned studies. Results of this NTES effort will be used to review and potentially to reprioritize resource allocations in order to modernize coursework where necessary and to increase training capacity.

E. The Way Ahead - A Comprehensive All-Hazards Approach

FEMA advocates a community-based, all-hazards approach for protecting lives, property, and the environment. Although the causes of emergencies can vary greatly, many of the effects do not. For example, a rail transportation incident could lead to an evacuation of a community or mass care for individuals—in the same way that chemical spills, floods, wildfires, HAZMAT releases, and radiological dispersal devices may lead a jurisdiction to issue an evacuation order and open shelters. Even though each hazard’s characteristics (e.g., speed of onset, size of the affected area) are different, the general tasks for conducting an evacuation and mass care operations are the same.³ Therefore, FEMA is exploring ways to improve evacuation and mass care within the all-hazards construct to complement the rail safety programs.

Evacuation and Shelter-in-Place Planning

Many communities designate evacuation zones and routes to get citizens to safety in the event of a hurricane or major storm. Evacuation planning principles and decision practices can apply to other threats and hazards that a community may face. Situations such as wildfires, power plant emergencies, dam failures, and hazardous material releases may require officials to order residents to evacuate. FEMA continues to explore the most effective means for local communities to plan, order, and conduct evacuation events. FEMA’s activities will produce

³ Comprehensive Preparedness Guide 101

guidance, technical assistance, and optimized learning that reflect improved approaches to evacuation for the whole community.

FEMA's National Integration Center Technical Assistance Program provided direct support to the Baltimore Urban Area Security Initiative from 2015 to 2017 to help with its evacuation planning efforts, and currently is working with the Georgia Emergency Management Agency and participating counties to develop and/or refine their evacuation plans and to incorporate emerging concepts and principles for evacuation planning. These emerging concepts and principles include, but are not limited to, the following:

- Move the fewest number of people the shortest possible distance;
- Consider shelter-in-place the first/default option when feasible; and
- Conduct zone-based evacuation targeting the most vulnerable areas, limiting the need for evacuating large areas that are not under the threat of a hazard.

Ware County, one of the counties participating in the current evacuation and shelter-in-place technical assistance with Georgia, is home of the largest CSX computerized railyard on the East Coast.

The efforts of the National Integration Center's Technical Assistance Program are consistent with FEMA's 6-step planning process outlined in Comprehensive Preparedness Guide 101: Developing and Maintaining Emergency Operations Plans (Version 2.0). This planning process is flexible and allows communities to adapt it to varying characteristics and situations as appropriate on the basis of their size, known risks, and available planning resources. Building off of the evacuation and shelter-in-place technical assistance, the National Integration Center also is working to develop state planning guidance and an executive-level decision analysis checklist.

Mass Care

The term mass care refers to a wide range of activities that provide support to individuals and families who temporarily are displaced or otherwise affected by a disaster or emergency that disrupts their ability to provide for their basic needs. Mass care services, including the activating and operating shelters, begin as soon as a disaster is imminent or occurs and continues through the recovery phase. Mass care may involve living with many people in a confined space, which can be difficult and unpleasant. Similar to the focus on improving evacuation, FEMA has opportunities to improve approaches to mass care through research, guidance, technical assistance, and optimized training to reflect the mass care best practices for the Nation.

III. Conclusion

FEMA has taken major steps to advance preparedness for HAZMAT transportation incidents, including crude-by-rail incidents. In FYs 2015, 2016, and 2017, FEMA has invested more than \$15 million in HAZMAT-related training for thousands of first responders and other personnel, as well as in training for other skills and capabilities necessary for incident response. FEMA remains dedicated to supporting state, local, tribal, and territorial efforts to prepare for all hazards, including HAZMAT transportation incidents, by providing world-class and doctrinally sound training and education. Using the NTES, FEMA will continue to engage the Nation's first responders and other stakeholders to refine and improve training to address their needs and to strengthen the Nation's capabilities to respond to HAZMAT transportation incidents and other hazardous events.

IV. Appendix: HAZMAT Training Providers and Course Information

FEMA's hazardous materials (HAZMAT) training courses are developed and delivered through a network of providers that include the Transportation Technology Center, Inc. (TTCI) Security and Emergency Response Training Center and the Emergency Management Institute (EMI).

FEMA offers courses at the awareness, performance, management, and planning levels to accommodate different job functions of the first responder community. Awareness-level courses are designed for responders who require the skills necessary to recognize and report a potential catastrophic incident or who are likely to witness or investigate an event involving the use of hazardous and/or explosive devices. Performance-level courses are designed for first responders who perform tasks during the initial response to a catastrophic event, such as safeguarding the at-risk public, rescuing victims, or decontaminating victims. Management- and planning-level courses are designed for managers who build plans and coordinate the response to a mass consequence manmade or natural event.

TTCI

TTCI, located in Pueblo, Colorado, offers 9 performance-level courses addressing planning and response for HAZMAT transportation incidents. The Security and Emergency Response Training Center utilizes a 4-phase residential training approach consisting of lectures with classroom presentations and group discussion, laboratory component teardowns, field activities, and applied full-scale exercise/scenario making up, at a minimum, 60 percent of course time in hands-on activities to provide a blended learning opportunity.

The ***Tank Car Specialist*** course focuses on fundamental knowledge and skills associated with an emergency response to a rail surface transportation incident involving HAZMAT. The course provides technical knowledge pertaining to tank cars, including damage assessment, oversight for product removal, and movement of damaged tank and other rail cars present. This course includes a large-scale hands-on scenario involving a 45-railcar derailment.

The ***Highway Emergency Response Specialist*** course focuses on fundamentals and skills associated with an emergency response to a highway emergency involving HAZMAT. This course teaches the technical skills and knowledge required for the safe response to incidents involving highway transportation, including cargo tanks, containers, and freight vans. Participants conduct incident site assessments, container damage assessments, and containment of leaking containers.

The ***Leadership and Management of Surface Transportation Incidents*** course is designed to enhance the participants' knowledge that will help them to establish effective objectives, strategies, tactics, and decisions when assuming the command and/or general staffing roles that are critical when responding to various modes of surface transportation HAZMAT incidents.

The curriculum also augments the participants' knowledge of terrorist and other criminal attacks that potentially could be used against surface transportation.

The ***Hazardous Materials/Weapons of Mass Destruction Technician for Surface Transportation*** course provides students with the training necessary to analyze the chemical and physical properties of HAZMAT transported in various surface transportation containers and includes extensive hands-on practice of actions and a full-scale exercise to simulate surface transportation incidents.

Surface Transportation Emergency Preparedness and Security consists of three courses: ***Freight, Mass Transit and Passenger Rail***, and ***Senior Officials***. The goal is to provide participants with the training necessary for emergencies involving surface transportation freight and passenger systems. Participants are trained to identify the hazards and apply this information to prioritize organizational management needs, resource allocation, evacuation strategies, and response operations. Participants demonstrate proficiency during an incident while providing solutions to minimize the impact to the responders, the citizens, the environment, and the critical infrastructure of a community. Special emphasis on National Special Security Events is provided in each course.

The ***Crude-by-Rail Emergency Response*** course provides first responders with the basic knowledge, skills, and abilities to respond to incidents involving crude-by-rail. The program is delivered over 3 days (24 hours) with more than 60 percent of the course delivered as a field exercise. The course covers the history of crude oil, chemical and physical properties of the different crude oil transported, basic site and damage assessment, tank car design and construction, tactical product control methods including the application of firefighting foam agents, water and spill control procedures, planning for crude oil incidents, and environmental impacts. The practical training evolutions culminate in a full-scale derailment exercise.

The ***Tactical Hazardous Materials Operations for Surface Transportation*** course is designed to provide participants in law enforcement with advanced knowledge and practical skills needed to respond to a complex and tactical surface transportation incident involving HAZMAT and weapons of mass destruction. Participants learn to respond properly to emergency incidents involving various modes of mass transit transportation, including heavy, medium, and light rail systems, as well as commercial and school buses. Participants learn to operate tactical weapons using Simunition®, nonlethal training weapons and ammunition, while wearing chemical protective clothing and respiratory systems.

EMI

EMI, located in Emmitsburg, Maryland, offers 3 awareness-level courses and one performance-level course.

The 10-hour general introductory course, ***An Introduction to Hazardous Materials***, provides information regarding the roles of federal, state, local, and tribal governments in reducing HAZMAT risks and the processes to identify possible terrorist targets of opportunity in the use

of toxic industrial chemicals as weapons of mass destruction to identify what communities can do to increase their preparedness to respond to HAZMAT incidents.

The 10-hour course, *An Orientation to Hazardous Materials for Medical Personnel*, provides information to medical personnel on the different modes of transportation and how to identify hazardous material properly.

The 30-minute course, *Emergency Support Function (ESF) #10 - Oil and Hazardous Materials Response*, provides instruction on the types of partnerships formed between ESF #10 and response agencies and organizations dealing with HAZMAT and various modes of transportation.

EMI also conducts *Virtual Tabletop Exercises (VTTX)*. Two of these exercises address *Gasoline Transportation* and *Bakken Oil Rail Transportation*. These VTTX events are discussion-based exercises conducted with multiple remote video teleconference sites over a period of 3 days, in separate 4-hour sessions (12 hours total).

V. Abbreviations

Abbreviation	Definition
DHS	U.S. Department of Homeland Security
DOT	U.S. Department of Transportation
EMI	Emergency Management Institute
EPA	U.S. Environmental Protection Agency
ESF	Emergency Support Function
FEMA	Federal Emergency Management Agency
HAZMAT	Hazardous Materials
NAC	National Advisory Council
NPS	National Preparedness System
NTES	National Training and Education System
PHMSA	Pipeline and Hazardous Materials Safety Administration
RESPONSE	Railroad Emergency Services Preparedness, Operational Needs, and Safety Evaluation
SERTC	Security and Emergency Response Training Center
SPR	State Preparedness Report
STEPS	Surface Transportation Emergency Preparedness and Security
THIRA	Threat and Hazard Identification and Risk Assessment
TTCI	Transportation Technology Center, Inc.
VTTX	Virtual Tabletop Exercises