Hazardous Materials and Train Derailment Emergency Planning Guide for School Districts and Community Colleges

Volume 3: Threat and Hazard Assessments

2021 Edition

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APPLICATION

School districts and community colleges can use this document to guide the preparation of their emergency plans. Here, users will find a list of requirements of the Texas Education Code that apply today, along with known industry standards, and recommended actions and best practices that they can consider based on specific needs or circumstance, as applicable. The guide is data-driven and was developed following a comprehensive review of federal and state requirements, latest research literature, and input from professionals with specialized expertise in hazardous materials, train derailments, emergency management, and school safety. The information provided in this guide does not, and is not intended to, constitute legal advice; instead, all information, content, and materials available here are for general information purposes only. The content is provided "as is;" no representations are made that the content is error-free. Users are encouraged to contact their local counsel and/or local experts to obtain the most up-to-date legal or other information that applies to their case.

CONTENTS

LIST OF ACRONYMS

BLEVE	boiling liquid expanding vapor explosion
CAS	Chemical Abstracts Service
DEMC	district emergency management coordinator
EMC	emergency management coordinator
EOC	emergency operations center
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right to Know Act
ERG	Emergency Response Guidebook
GIS	geographic information systems
Hazmat	hazardous materials
HHFT	high-hazard flammable train
HIT	heat-induced tear
HMEP	Hazardous Materials Emergency Preparedness
HMIRT	Hazardous Materials Incident Response Team
HVAC	heating, ventilation, and air conditioning
LEPC	Local Emergency Planning Committee
LPG	liquified petroleum gas
NAICS	North American Industry Classification System
NAID	North American Identification Number
NOAA	National Oceanographic and Atmospheric Administration
NPMS	National Pipeline Mapping System
PHMSA	Pipeline and Hazardous Materials Safety Administration
PST	petroleum storage tank
RMP	Risk Management Program
SDS	Safety Data Sheet
SRO	school resource officer
TCEQ	Texas Commission on Environmental Quality
TDEM	Texas Division of Emergency Management
TEC	Texas Education Code
TxDOT	Texas Department of Transportation

TxSSC	Texas School Safety Center
UNID	United Nations Identification Number
UST	underground storage tank

I. INTRODUCTION

This volume provides districts with a step-by-step approach to assessing threats and hazards to school districts from hazardous materials (hazmat) incidents. Districts can use this information in their plans to prevent, prepare for, respond to, recovery from, and mitigate hazmat incidents. Appendices to this volume provide specific instructions for conducting an independent assessment of hazmat threats and hazards.

Implementing hazardous materials safety precautions and emergency planning for hazardous materials incidents in schools **does not require advanced training or knowledge**.

This volume and appendices provide a process that school districts and community colleges can use independently and assess their hazmat threats and hazards. While any district can perform a rudimentary assessment like that described herein, they should consult experts whenever possible. As outlined in the first volume of this guide, districts conducting a threat and hazard assessment or other emergency planning activity should consult with:

- Municipal or county emergency management coordinators (EMCs) or offices of emergency management.
- Local Emergency Planning Committees (LEPCs).
- Texas Division of Emergency Management (TDEM) district coordinators.
- Local fire, police, and EMS leadership.
- Rail, pipeline, and chemical facility owners and operators in the vicinity of district property.
- Regional councils of government.

Additionally, the state agencies whose websites and resources appear in this volume may also assist, including Texas Commission on Environmental Quality (TCEQ) regional offices and the Texas Railroad Commission.[1]

Finally, school districts and community colleges conducting threat and hazard assessments should request assistance from local planning/zoning offices or other organizations or individuals with experience using geographic information systems (GIS). Using some of the resources identified in this guide, a trained GIS operator can provide more advanced map products to aid in threat and hazard assessment. Further, districts may want to coordinate their threat and hazard assessments with community assessments, turning them into a team effort.

This volume is organized as follows: First, it explains the three potential hazmat threats and hazards, their potential impacts, and the potential responses that comprise the Hazmat 3-3-3 model. Next, it outlines how districts can use threat and hazard information to improve their plans, policies, and procedures through example cases. Finally, Appendices outline how your district can evaluate school and facility distances to rail lines, pipelines, roadways, and hazmat facilities.

1 Texas Commission on Environmental Quality, "Office of Compliance and Enforcement," https://www.tceq.texas.gov/agency/organization/oce.html; Texas Railroad Commission, "Locations," https://www.rrc.texas.gov/about-us/locations/

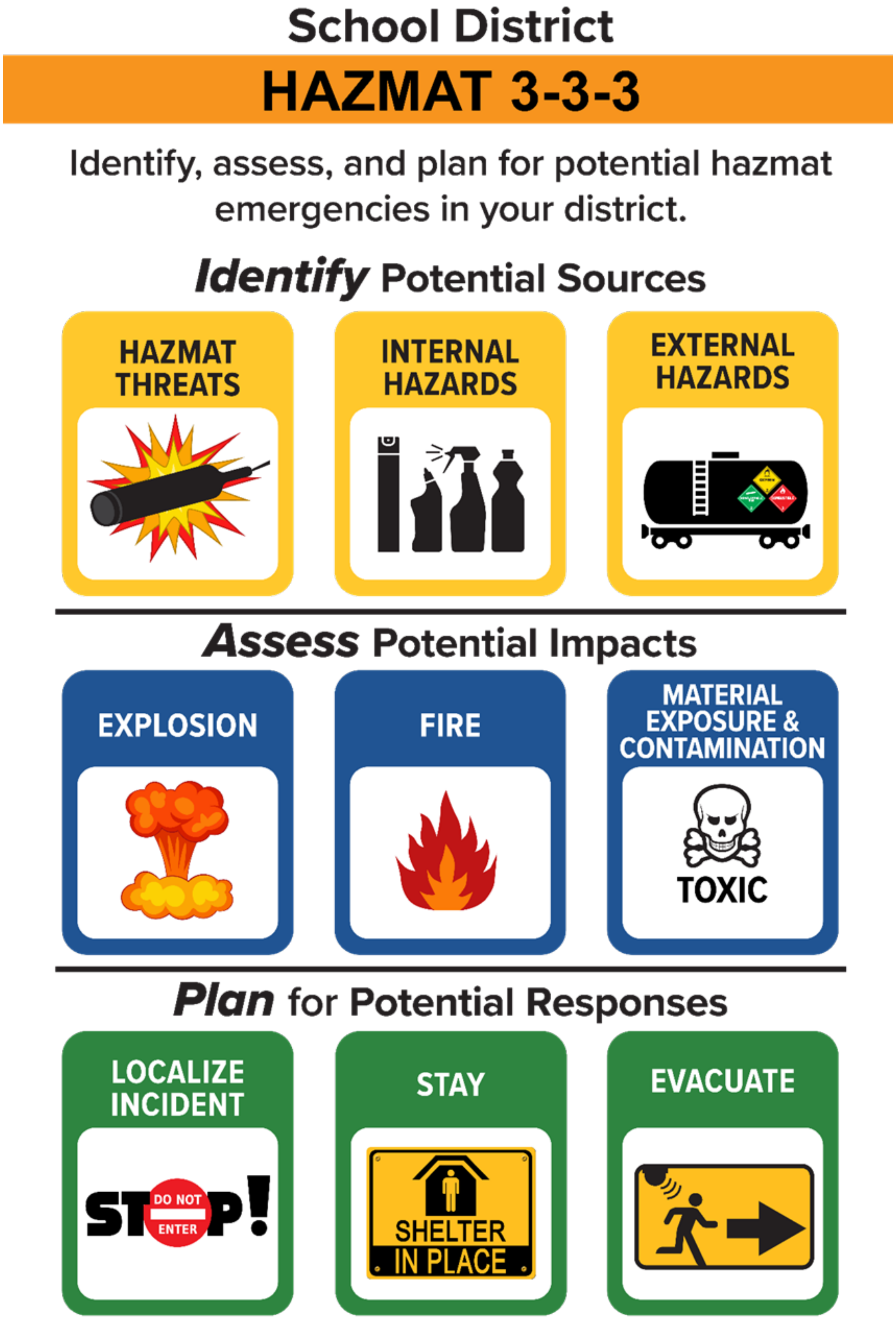

Figure 1. 3-3-3 Model.

II. HAZMAT THREATS AND HAZARDS

Volume 1 of this guide introduces the 3-3-3 model to evaluate potential hazmat threats and hazards—three threats and hazards, three impacts/consequences, and three responses. While a simplification, this model allows schools to assess and plan for threats and hazards without extensive outside support or technical knowledge. The model also makes evaluating the threats and hazards simpler. Volume 3 (this document) provides a more in-depth explanation about the model, and your school district can use it to assess potential hazards and threats.

The **three hazmat threats and hazards** to schools are:

- **External hazmat hazards**—hazmat transportation routes and facilities proximate to school district property that may produce accidental releases near school property that affect school operations.
- **Internal hazmat hazards**— hazmat incidents that may occur on school district property involving material under district control (e.g., science laboratory accidents or custodial chemicals).
- **Internal/External Hazmat threats**— deliberate use of any other toxic or hazardous substances on or near school district property with the intent to cause harm or instill fear (e.g., pepper spray, chemical bombs or other improvised explosives).

This section examines the threats and hazards from hazmat to schools and community colleges. Section III of this volume discusses the **three impacts/consequences** of hazmat incidents and how they affect planning. Section IV of this volume discusses the **three hazmat responses**.

Takeaways

- The three primary hazmat threats and hazards to school districts are threats, internal hazards, and external hazards.
- Handle hazmat threats through existing threat assessment processes for active shooters and other threats.
- Internal hazards come from hazmat stored and used on district property.
- External hazards come from fixed facilities like chemical plants, storage tanks, or transportation-—rail, road, or pipeline.

Internal and External Hazmat Threats

Internal and external hazmat threats to schools come from individuals who deliberately release or plan to deliberately release hazardous materials within a school or school district with the intent to cause fear or harm.

Internal threats involve students, faculty, or staff deliberately releasing hazardous materials on school grounds. A high number of hazardous materials incidents on or near school campuses involve:

- The deliberate or accidental release or use of pepper spray, stink bombs, or other irritants in self-defense or as part of student pranks.
- Students acquiring bomb-making materials or experimenting with or using improvised chemical bombs or explosive devices. These devices, often associated with the destruction of mailboxes, pose explosive and chemical contamination threats. Further, individuals may experiment with more dangerous devices like pipe bombs and Molotov cocktails. In rarer cases, bomb-making activity may indicate students planning or preparing for school shootings/attacks. Several previous attacks involved the use of such devices in addition to firearms, and a significant percentage of averted attacks involved plans to use bombs.[2]

Additionally, individuals not associated with schools may deliberately release hazardous materials to incite fear or cause harm that may affect or target schools. These **external hazmat threats** include acts of terrorism involving hazardous materials or chemical, biological, radiological, nuclear, or explosive (CBRNe) weapons or materials. Identifying and preventing this threat is usually not a school district's responsibility. However, school districts should remain informed of such threats and collaborate with law enforcement regarding potential threats.

Certain school-related activities and athletic events at school district facilities like stadiums or sporting arenas may need to incorporate additional measures into their plans, policies, and procedures to mitigate external threats and plan for mass decontamination and security screening. Facility managers and districts should coordinate with local law enforcement, fire departments, EMS, and emergency management regarding external threats, especially when planning large gatherings like athletic events, performances, and graduation ceremonies.

Internal Hazards

Internal hazards come from hazardous materials stored and used on school property.

Internal hazards involve the accidental release or improper use of hazardous materials stored, used, or otherwise present on school property, or the accidental release of hazardous materials caused by improper maintenance of heating, ventilation, and air conditioning (HVAC) systems, incinerators, or combustible gas fittings.[3] These may include:

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2 Source: Daniels, Jeffery. *A Preliminary Report on the Police Foundations Averted School Violence Database*. Washington, DC: Office of Community Oriented Policing Services, 2019. https://cops.usdoj.gov/RIC/Publications/cops-w0871-pub.pdf. According to this report, 31.4 percent of averted school violence incidents in the database involved the planned use of bombs.

3 Gas leaks in and near schools are a common hazardous materials incident across the United States.

- The production of carbon monoxide from improperly maintained heating systems, incinerators, or blocked ventilation systems.
- Propane or natural gas leaks from storage tanks, kitchen appliances, vending equipment, or improperly maintained heating systems.
- Mercury or mercury vapor from broken thermometers, projector bulbs, or science laboratories.
- Chemicals stored or used in science laboratories.
- Swimming pool chemicals.
- Chemicals or materials stored and used in other athletic facilities (e.g., carbon dioxide canisters in vending areas, detergents, disinfectants, insecticides, and herbicides).
- Fertilizers, herbicides, pesticides, or cleaning chemicals stored and used by custodial and maintenance staff.
- Fuel or oil for lawnmowers, weedwhackers, leaf blowers, or other small engines.
- Fuel, oil, and other chemicals used in transportation facilities and bus yards.
- Biological contamination by ill or diseased students, faculty, or staff.
- Toxic mold or other contamination within a building or HVAC system caused by inadequate cleaning, ventilation, maintenance, or other issues leading to illness among building occupants.
- Releases from oil or gas activity occurring on district property leased to private oil and gas companies or property immediately adjacent to district property.

Prevention activities are the prima ry means for addressing internal hazards. Schools can decrease their risks from internal hazards by conducting annual hazmat inventories and disposal activities. Additionally, schools can develop procedures for evaluating materials and replace both material and activities with safer alternatives. See Sections III and VI for more on this topic.

External Hazards

Four external sources pose external hazards to schools and school properties.

External hazards come from industrial fa cilities, storage tanks, pipelines, roadways, and rail lines near schools where hazmat production, storage, use, or transportation occurs.

Railroads

See Appendix A for one way to determine if any of your schools meet the legal threshold requiring a district derailment plan. Your local emergency management and fire department can also offer insight into the threats posed by rail lines in your community. Your fire department should have access to the AskRail application (www.askrail.com), which allows them to determine train contents in case of a derailment. Hazardous Materials Commodity Flow Studies can also include evaluations of railway transportation in a community. See Appendix C for information on obtaining Hazardous Materials Emergency Preparedness (HMEP) funding for such studies. Communities may also receive further information and training from Texas's three Class I railroads (Figure 2). First responders can obtain free hazmat training from TRANSCAER, an industry-funded training program. Associated Web sites for the three Class I railroads are:

- https://www.bnsfhazmat.com/ (BNSF Railway);
- https://www.kcsouthern.com/en-us/ship-with-us/safety-security/safety-security (Kansas City Southern Railroad); and
- https://www.up.com/aboutup/community/safety/hmm/index.htm (Union Pacific Railroad).

Burlington, Northern, and Santa Fe (BNSF)

Director, Public Affairs
Tel: 817-867-6427
Fax: 817-352-7925

Union Pacific (UP)

Assistant Vice President, Public Affairs - Southern Region
24125 Aldine Westfield Rd.
Spring, TX 77373
Phone:281-350-7501
Fax:402-233-2978

Kansas City Southern Railroad (KCS)

PublicSafety@kcsouthern.com
318-676-6296

Figure 2. Class I Rail Operators in Texas.

Additionally, several smaller (Class III) railroads operate in different areas of Texas. These serve specific industrial areas or are shortline railroads focused on particular commodities or services to certain areas. Some operators run lines and yards in and around port facilities. Many of these Class III rail lines exist around the state, and some do not carry hazardous materials. If a school is near one of these shortlines, further inquiries to the railroad will help determine the hazard exposure.

Recent years have seen the acquisition of several shortline rail operators by larger conglomerates. In Texas, these include some lines operated by Watco and the Genesee and Wyoming Railroad. The following contact information and the websites of these two large Class III operators can help identify the lines these railroads operate and the commodities they carry:

- **Watco**—Travis Herod, senior vice president of environmental, health, and safety, therod@watco.com.
- **Genesee and Wyoming Railroad**—Operations Headquarters, Safety, Operations, Training, and Purchasing, (904) 596-1045.

Focus on **active rail lines that may transport hazardous materials**, not mass transit or light rail lines with dedicated rights of way.

Additionally, passenger lines operate in Texas. Amtrak does not have a dedicated right of way in Texas and runs on the Class I lines. A derailment involving an Amtrak train presents challenges and may damage property but has limited hazmat besides locomotive fuels. The state's metropolitan areas have light rail and regional commuter rail lines, with dedicated rail lines. For light rail and other dedicated rail lines for passenger traffic, the potential hazmat exposures are minimal.

Finally, the Texas Department of Transportation (TxDOT) has a Rail Division that includes a Rail Safety Inspection Program. For more information, visit https://www.txdot.gov/inside-txdot/division/rail.html. If your district has a question or concern about the safety of rail lines or railcars in the vicinity of your schools, you can contact TxDOT at (512) 416-2376.

Hazardous Materials Facilities

Many industrial and commercial facilities use hazardous materials. Your LEPC can provide a list of facilities in your community whose storage of hazardous chemicals reaches a certain threshold defined in law (known as Tier II facilities). These industrial and commercial facilities include:

- Chemical storage tank yards.
- Industrial facilities.
- Laboratories and research facilities.
- Chemical production facilities (including small-batch producers).
- Propane storage and propane delivery companies.
- Water treatment facilities.

Additionally, other industrial and commercial facilities use, produce, and store hazardous materials in your community. Some are regulated under different laws, while others are less of a hazard than those identified previously. The specific circumstances of your district and a school's proximity to such facilities will determine the hazard exposure. Local emergency management and your LEPC can assist school districts in identifying these hazards, which include:

- Nuclear power plants and research reactors.
- Companies using or storing radiological sources (including well loggers, nondestructive testing companies, and industrial facilities).
- Oil and gas exploration, extraction, or distribution facilities.
- Hazardous waste storage or disposal sites.
- Hospitals, medical facilities, research facilities, or other producers of infectious waste or material.
- Warehouses and distribution facilities.
- Vehicle service facilities and filling stations.
- Above ground and under ground storage tanks (including filling stations)

Research shows that schools' proximity to hazardous materials facilities aligns with certain socioeconomic factors, an issue of social justice in some jurisdictions. Studies find that the poorer a population or the higher the number of minority students, the more likely a school is close to a hazardous materials facility.[4] Districts should maintain awareness of such inequities and address them when building new schools.

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[4] See:

- Tinney, Veronica A., Jerad M. Denton, Lucy Sciallo-Tyler, and Jerome A. Paulson. "School Siting near Industrial Chemical Facilities: Findings from the U.S. Chemical Safety Board's Investigation of the West Fertilizer Explosion." *Environmental Health Perspectives*, Vol. 124, No. 10, October 2016, pp. 1493–1496. http://dx.doi.org/10.1289/EHP132.

Pipelines

Texas has more pipelines than any other state. Many of these transit near schools and school district facilities. For more information about determining your district's exposure to pipeline hazards, consult the Texas School Safety Center (TxSSC) Pipeline Safety Toolkit at https://txssc.txstate.edu/tools/pipeline-safety/ and Appendix B.

One of Texas's more frequent pipeline incidents results from excavation related to construction or underground utilities. Underground pipelines crisscross the state, and natural gas and liquified petroleum gases travel throughout many neighborhoods and business areas via underground lines. Texas maintains a one-call number, 811Texas.org. Any company or individual preparing to excavate can call or log on to the website and have existing lines marked before digging. However, not every company or individual uses the service, and accidents continue to happen. School districts may wish to monitor and coordinate with construction companies and public utilities excavating near their properties. A pipeline or other underground utility line breach can disrupt school operations and pose immediate dangers leading to an evacuation.

Roadways

Roadway hazmat exposures are some of the most complex and challenging to determine in many communities. While most roadway hazmat transportation happens safely, roadway transportation accidents involving hazardous materials are the most common hazardous materials incident in the United States. Further, hazmat transporters may be present on any roadway.[5] Most interstates, U.S. highways, and state highways in Texas have hazmat traffic. Local roads and streets may carry hazmat from small industries and businesses, oil and gas exploration, propane or heating oil deliveries, or fuel transportation to and from filling stations and other underground storage tank locations.

Your local emergency management may have information from a Hazardous Materials Commodity Flow Study conducted in your community. If not, your local emergency management can request funding for such a study via the HMEP grant program administered by TDEM. See Appendix C for more information on how to assess roadway transportation hazards.

- Stretesky, Paul B., and Michael J. Lynch. "Environmental Hazards and School Segregation in Hillsborough County, Florida, 1987–1999." *Sociological Quarterly*, Vol. 43, No. 4, Autumn, 2002, pp. 553–573. https://www.jstor.org/stable/4120939.
- Union of Concerned Scientists. "Double Jeopardy in Houston: Acute and Chronic Chemical Exposures Pose Disproportionate Risks for Marginalized Communities." 2016. https://www.jstor.org/stable/resrep17254.
- Johnson, Glenn S., Steven C. Washington, Denae W. King, and Jamila M. Gomez. "Air Quality and Health Issues along Houston's Ship Channel: An Exploratory Environmental Justice Analysis of a Vulnerable Community (Pleasantville)." *Race, Gender and Class*, Vol. 21, No. ¾, 2014, pp. 273–303. https://www.jstor.org/stable/43496996.

[5] A few larger metropolitan areas in Texas have designated hazardous cargo routes on some highways and interstates passing through their jurisdictions, though compliance varies with such ordinances.

Take Action

- Use Appendices A, B, C, and D to assess your district hazard exposures for:
  - Properties within 1,000 yards of a rail line.
  - Properties within 1,000 yards of hazmat-related facilities and industry.
  - Properties within 1,000 yards of a pipeline.
  - Properties within 1,000 yards of a roadway with hazmat transport.
  - reduce internal threats and hazards.
- Evaluate your threat assessment process and educate stakeholders on the threat of hazmat attacks.
- Conduct districtwide/schoolwide hazmat inventories to assess and

III. HAZARDOUS MATERIALS INCIDENT IMPACTS

Introduction

Understanding the three potential impacts/consequences that hazmat incidents may produce aids in understanding the responses and how these impacts affect schools, especially near known hazards like those discussed in the previous section.

Most **hazardous materials incident impacts** fall into three broad categories:

- Explosion.
- Fire.
- Material spill, release or exposure.

These are not mutually exclusive categories—a substance may pose a threat of all three impacts or a combination of impacts, such as a fire leading to an explosion. The impact of material release or exposure is an uncontrolled release of a chemical, biological, or radiological substance that contaminates the environment, people, structures, and equipment or endangers life or health.

Takeaways

- The three potential impacts or consequences in any hazmat incident are explosion, fire, and material spill/release/exposure.
- Fire and flammable gases pose particular explosive hazards when combined.
  - Gas leaks can find an ignition source and cause flash fires and explosions.
  - Propane tanks subjected to heat or a leak can suffer a boiling liquid evaporating vapor explosion, an especially dangerous type of incident.
- Flammable liquids like fuels, combustible liquids like petroleum products, and flammable gases like propane are two of the more likely hazmats to transit near schools, even in residential areas.
- The release of material in a hazmat incident can expose those in the vicinity or downwind of an incident to airborne toxic vapors, chemical contamination, radiation, or infectious material.
- First responders assess the impact of any hazmat incident and make decisions about shelter in place or evacuation by determining:
  - An initial isolation zone—a circle around the incident where first responders evacuate everyone.
  - A downwind protective action distance—a cone downwind from an incident in which people areinstructed to shelter in place or evacuate depending on the incident.

Explosion

Explosions from some hazardous substances may occur without warning, and their effects can be catastrophic. Some explosive hazards include inherently explosive materials. Other explosions occur when flammable liquids or gas vapors become sufficiently concentrated due to the quantity released or their concentration in an enclosed space.

Explosive threats are both internal and external. Explosive impacts can come from internal or external threat devices. Other explosive impacts are from internal accidents or improper maintenance. For example, a gas appliance or supply line leak inside a school can cause an explosion if the vapor reaches an ignition source. Propane tanks are another potentially explosive source kept on school property.

External hazards producing explosive impacts come from cargo containers, tanker trucks or railcars, or facilities near schools with explosive compounds or contents. A few explosive hazards involve explosive dust, powders, or granular materials in the presence of an ignition source, such as in the West, Texas, incident in 2013. Dust is also the cause of grain silo explosions.

Additionally, some chemical substances pose particular dangers because of their reactivity with air or water or their temperature sensitivity. A few substances can violently self-polymerize or spontaneously react in an incident. This spontaneous reaction can produce fires and explosive impacts. Some of these reactive materials regularly move through Texas's petrochemical manufacturing areas and on major roadways that connect these areas to the rest of the country.

Compressed gases also pose explosive hazards. Any compressed gas tank or cylinder can violently rupture if over-pressurized or damaged.[6] Ruptures can produce a rocketing effect, even in large compressed gas containers and tanker trucks. One of the more common compressed gas dangers overlooked on school campuses is the carbon dioxide tanks used to run soda dispensing machines in cafeterias or vending areas at athletic venues. Propane tanks are in vending areas, too, often for grills or stoves at outdoor athletic venues. If damaged, pressurized tanks can turn into dangerous rockets. Leaking or improperly closed valves can create dangerously explosive environments in confined spaces, or create an oxygen-deficient atmosphere in an enclosed space.

The most dangerous explosive hazards related to compressed gases or liquids under pressure are the effects of heat and escaping gas from tanks containing liquified petroleum gas (LPG), including propane. Known as boiling liquid expanding vapor explosions (BLEVEs), these explosive events occur when fire heats the tank's contents or the tank suffers damage. In these cases, the tank may suddenly and violently rupture, sending fragments of the tank flying from a rapidly expanding fireball. **Because of the BLEVE danger, very large LPG storage tanks are some of the few hazards listed in the Pipeline and Hazardous Materials Safety Administration's (PHMSA's) *Emergency Response Guidebook* (ERG) with initial isolation zones greater than 1,000 yards.** Tanks that size are, fortunately, uncommon but they do exist. If your district or community college identifies one in proximity to a school, even if it is more than

6 Overpressurization can occur due to filling errors, or happen when a tank is heated – causing the internal pressure to increase beyond the tank's specifications. If a fire occurs in an area with pressure cylinders of any kind, the cylinders can explode without warning, injuring bystanders or responders.

1,000 yards away, you should plan for an immediate evacuation in an incident involving that facility.

Heat-induced tears (HITs) are another unique explosive hazard associated with the shipment and storage of flammable liquids. A HIT occurs when a tank is exposed to the extreme heat of a fire, causing the metal to soften and the pressure inside the tank to increase until a tear in the metal occurs, pushing out the liquid and vapors at high speed in an explosive fireball and heatwave. The difference between a HIT and a BLEVE is that HITs involve liquids, and HITs do not typically produce shrapnel as extensive as BLEVEs but can still result in catastrophic container failure.

Fire

Hazard Class 3 (flammable liquids) and Hazard Class 2 (flammable, non-flammable, and toxic gases) are the most common types of hazardous materials transported by any means in the United States. In many places, the most commonly transported materials are Class 3 liquids, including gasoline, diesel, fuel oil, and other petroleum products. Class 3 flammable liquids also include crude oil transported from wellheads to refining facilities and a broad range of other flammable liquids carried in trucks, pipelines, and railroads.

The primary hazards from Class 3 materials and flammable Class 2 gases are fire (an example is shown in Figure 3) and explosion. Non-flammable Class 2 tanks can also explode under some conditions. Due to their volume in shipping, Class 3 flammable liquids are the material most commonly involved in hazmat incidents, especially on roadways. In addition to the gasoline or diesel used in our personal and commercial vehicles, bulk fuel trucks service fueling stations, carrying thousands of gallons of fuel. Individual railcars can carry over 30,000 gallons of liquid fuel. Very long trains can also carry flammable liquids like ethanol or flammable gases like liquified natural gas. These trains may stretch for some distance and include many railcars full of flammable liquids or gases. In a derailment, such trains pose acute dangers. New rules govern the operation of some of these types of trains, especially those carrying crude oil. These rules classify certain trains as high-hazard flammable trains (HHFTs) subject to special regulation.[7]

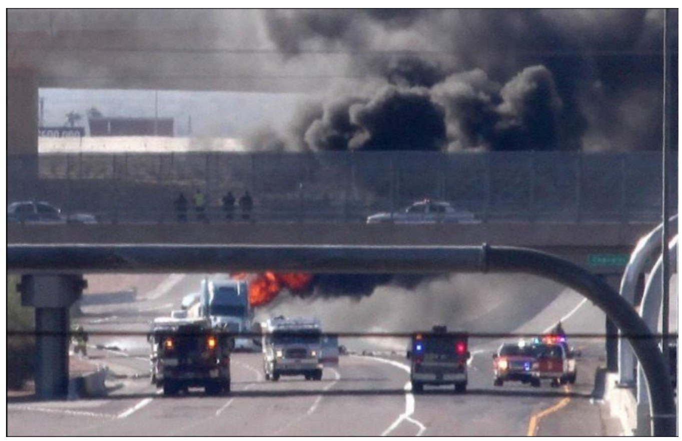


Figure 3. Smoke and flames from a fuel tanker crash on I-10 in Arizona closed the roadway and resulted in a school evacuation. Image source: Ahwatukee Foothill News/Darryl Webb. Used with permission.

According to the ERG, for many large flammable liquid spills where there is fire or possibility of fire, the initial isolation distance is 800 meters (1/2 mile) in all directions. However, some

[7] Since 2015, HHFTs fall under new safety regulations including upgraded, safer tanks; routing and speed limitations; and increased information sharing and coordination between railroad operators and state and local officials. See 49 CFR 174.310.

substances react violently with air, water, other chemicals, or temperature changes. These substances may ignite spontaneously and pose significant fire or explosion hazards if involved in an incident. Such highly reactive substances have initial isolation distances that can extend to 1,000 meters.

Some flammable substances also have protective action distances that extend many miles beyond a spill due to the chemicals' toxic effects. Having more than one potential impact is common. Many chemicals have more than one hazard class, so a toxic chemical that is also flammable might have a larger initial isolation zone due to its toxic hazard rather than its flammability. Finally, while some other flammables may not pose a significant toxic hazard when they are not on fire, smoke from a fire involving that material may pose toxic effects or cause respiratory problems in sensitive populations downwind.

Material Spill, Release, or Exposure

The uncontrolled release of hazardous materials as a solid, liquid, or gas poses several potential dangers, like explosions or fire, discussed previously. For some chemicals, the primary danger comes from toxic effects produced by the spill of some substances. Depending on the state (solid, liquid, or gas), weather, and circumstances of the release, some substances may produce toxic effects in people, plants, and animals for many miles downwind of an incident. Other substances may not be toxic but can still injure or kill. For example, nitrogen is not toxic to humans (it makes up nearly 80 percent of the air we breathe). However, a tanker carrying refrigerated liquid nitrogen under pressure involved in an incident can asphyxiate people close to a leak. The evaporating liquid nitrogen displaces oxygen in the vicinity. Liquid nitrogen can also cause severe burns and frostbite injuries if it gets on the skin.[8] As with all compressed gases, there is always the danger of a ruptured vessel producing a rocket effect or an explosion due to over-pressurization, both of which can physically damage structures and injure people.

For the most dangerous or toxic substances involved in a large spill, the recommended initial isolation distance is 1,000 meters (1,093 yards). However, unlike hazards where the danger is exclusively fire or explosion, the protective action distances for chemical releases may extend many miles downwind beyond this initial isolation area. In liquid spills or releases of heavier-than-air gases, the hazards flow downhill and downwind of the incident site along with the material.

Additionally, some releases of material pose unique hazards, especially those related to radiation or infectious material.

Radiation Contamination or Exposure

Radioactive sources are present in nearly every community. In addition to medical-related sources, radioactive material is in soil density gauges and well loggers common in certain construction activities and the oil/gas industry. Likewise, nondestructive testing companies use highly radioactive sources to perform certain inspections and testing of materials using special radiation cameras. Inside their containment in undamaged equipment, these sources pose little to no hazard. Even if removed from containment or damaged accidentally, the potential radiation

[8] Carbon dioxide, another commonly shipped non-toxic gas, has similar effects.

exposure distance is relatively small. Even for highly radioactive materials, the initial isolation distances are typically no more than 100 meters. Districts should be aware of such hazards, but most will not require additional planning other than that outlined more generally in this guide.

School districts and community colleges near Texas's two nuclear power plants, the National Nuclear Security Administration PANTEX Plant, or other facilities with radioactive hazards require additional planning. State and local agreements with these facilities and specific federal regulations govern the planning requirements for those near the power plants and PANTEX. If they have not already done so, school districts affected by these agreements and regulations should coordinate radiation emergency planning and preparedness activities directly with local emergency management and the nuclear facilities.

While rarely a problem, several internal hazards can pose radioactive hazards. Some smoke detectors contain americium-241, a small radioactive source that can pose a hazard if damaged or disposed of improperly. Likewise, some high schools and community colleges use low-level radioactive sources in chemistry or physics laboratories. In rarer cases, schools find old radioactive sources or chemicals during hazmat inventories in long-forgotten corners of storage rooms or uncover buried items in excavations. Because they require special disposal, such sources may require outside support.

Infectious Materials and Biological Waste

In addition to the hazards and threats from hazardous chemicals and radioactive materials, infectious materials, medical waste, and biological wastes from sewage and other sources can pose issues if such a shipment's contents are released or spread during an accident. Similarly, such hazards pose internal hazards to schools, such as improper sharps disposal or failure to observe bloodborne pathogen protection when cleaning up vomitus or blood. One outcome of the COVID-19 pandemic is that schools have gained experience and instituted many measures that address biological exposure, from mask-wearing to improved air circulation.

Likewise, as the COVID-19 pandemic showed, infection precautions produce waste from used masks, gloves, and other materials, which may pose a danger if handled or disposed of improperly. Something as simple as a blocked sewer drain may result in sewage contamination (a form of biological contamination), requiring a localized evacuation and cleanup.

Spills and accidents involving infectious material or biological waste are rare. Usually, they pose little danger outside the immediate vicinity. For most schools, the biggest concern for infectious material and biological waste is internal: infectious disease outbreaks like COVID-19; bloodborne pathogen protection related to sharps or cleanup of body fluids; disposal of potentially contaminated masks, gloves, or other protective equipment; or sewage issues.

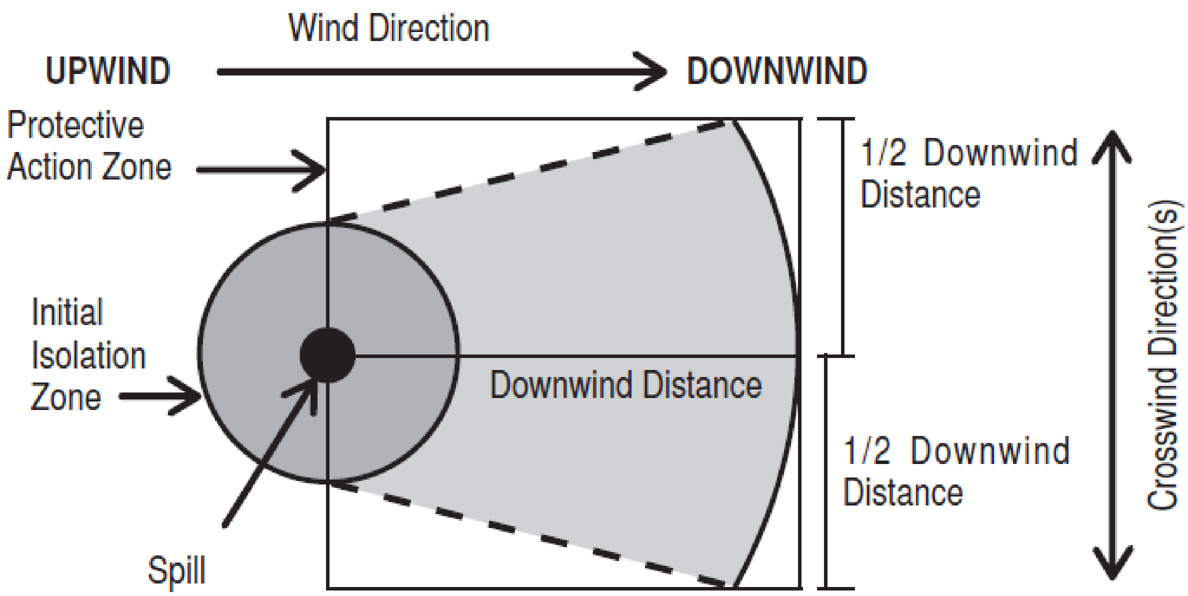
Understanding Hazmat Incident Impacts

When a hazmat incident occurs, emergency responders estimate impacts (and response actions) based on two distances:

- **Initial isolation distance**—the radius of the evacuation area (initial isolation zone) around an incident where the danger is significant.

- **Protective action distance**—the length of a downwind cone or oval-shaped area (protective action zone) downwind from a chemical release that may stretch for miles, where chemical dispersion, vapor, smoke, or other contaminants may require further evacuations and shelter in place, depending on circumstances and concentrations.

Figure 4 illustrates these two zones.



Source: Pipeline and Hazardous Materials Safety Administration *2020 Emergency Response Guidebook*, page 295 (public domain)

Figure 4. Diagram of Initial Isolation and Protective Action Zone.

Initial Isolation Distance

The initial isolation distances listed in the ERG for large spills of most high-hazard materials range from 800 meters (1/2 mile) to 1,000 meters (1,094 yards). For schools in proximity (1,000 meters or less) of a high-level hazard, evacuation or shelter in place is the likely response for a significant incident. While the initial isolation distance for many hazardous materials in large spills is less than 1,000 meters, some materials have initial isolation distances greater than 1,000 meters when spilled or released in sufficient quantity.[9] The 1,000-yard standard of Texas Education Code (TEC) Section 37.018 generally aligns with the ERG's initial isolation distances for most of the most dangerous hazmat. It is not a universal rule but a helpful yardstick.

In a significant event like a train derailment, when the material release is unknown, and the threat of explosion or fire exists, responders generally use the 1,000 yards as the initial isolation distance until they identify the threat and hazard. In many cases, they will order an evacuation of this area or even larger areas. Establishing this zone and either narrowing or expanding is a significant priority for responders to any hazmat incident and one of the first actions they take.

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9 For example, some large propane tanks over 5,812 gallons with potential for a BLEVE have minimum evacuation distances greater than 1,000 yards. See Pipeline and Hazardous Materials Safety Administration, *2020 Emergency Response Guidebook*, https://www.phmsa.dot.gov/hazmat/erg/emergency-response-guidebook-erg

Because of the threat of fire and explosion, initial isolation zones are circular, centered around the incident location for most incidents. For example, an initial isolation distance around a tanker truck spill might extend hundreds or even thousands of yards in all directions around the truck. Train derailments may be different. Due to their linear nature, derailment initial isolation zones take the shape of ovals, extending down the track, sometimes for miles. Alternately, derailments can consist of different incident sites at different points along the rail line, affecting different school properties in different ways.

Protective Action Distance

Protective action distances are often larger in size than initial isolation distances. Responders recommend actions in these protective action zones like shelter-in-place or evacuation to protect people from imminent or potentially harmful impacts from hazmat incidents. Typically responders initiate this action once they better understand the hazard involved and establish the initial isolation zone. When evaluating the risk downwind of hazards, the response will vary depending on the material involved, weather conditions, and concentration levels downwind. First Responders establish an incident command to make such decisions.

As responders gain more information about the incident and conditions, they may alter the isolation and protective action zones. As responders mitigate the incident, they will often reduce areas and distances for protective actions. However, weather or condition changes may sometimes require responders to extend or adjust isolation and protective action distances during a response. Hazmat scenes are fluid, evolving events, and the downwind hazards from an event often change.

The changing nature of such incidents requires districts and community colleges to communicate with first responders and their community emergency operations centers (EOCs) *throughout* a hazmat incident and during the recovery afterward. Schools must coordinate their response with local responders, and direct communication links are essential. These links allow incident commanders to communicate changes in protective actions and other important response information to the affected population quickly and frequently. These links also allow schools to communicate resource needs and the essential information incident commanders need for shelter and evacuation decisions in the protective action zone.

Assessing Incident Impacts in Smaller Incidents

Every year, faculty and students in schools across the United States suffer injuries from science lab experiments gone awry. Likewise, custodial workers and maintenance technicians suffer injuries due to the improper use of chemicals or other substances. Usually, these incidents are localized, affect only a few individuals, and cause minimal structural damage. However, they still cause real trauma, some of it life-threatening or permanently disfiguring.

Prevention is the primary means of reducing the risk from such incidents—regular hazmat inventories and disposal of old or unused chemicals can reduce many risks. Further, schools should make sure all hazmat stored or used on school property has a Safety Data Sheet (SDS) kept near the material and in a centralized location. Districts should have procedures for evaluating the risk posed by certain substances and lab experiments or demonstrations. Safer alternatives for some substances can reduce risks. Likewise, instead of a more dangerous experiment or demonstration, videos or other means of illustration can help prevent many injuries.

In the event of a spill or incident involving hazmat kept or used on school property, the primary initial information resource for the school's response is the SDS, which should provide the necessary safety and response information. Consult the SDS before using any material and in the event of an incident. See Section VI for more information on reading and understanding SDS.

Take Action

- Educate key leaders on the impacts of hazmat incidents, initial isolation distances, and protective action distances and how they affect a shelter-in-place or evacuation decision.
- Ensure the district emergency management coordinator has access to a copy of the ERG and understands its use.
- Collect and keep up-to-date copies of Safety Data Sheets for hazmat stored and used within the district at centralized, accessible locations and properties with those chemicals

IV. HAZMAT RESPONSES AND CAPABILITIES ASSESSMENT

Overview of the Responses

The **three responses** to hazmat incidents are:

- LOCALIZE INCIDENT (Isolate, Deny Entry, & Contain).
- STAY (Shelter-in-Place).
- EVACUATE (Hazmat Evacuation).

This section discusses these responses and their levels in the sample plans.

LOCALIZE INCIDENT (Isolate, Deny Entry, & Contain): Level I

This response is to a localized hazmat incident requiring isolation, containment, first aid, and decontamination. Its characteristics are:

- It usually affects a small area within a building or campus/property.
- School or facility address it at their level/campus with minimal impacts on the district level.
- The response is likely part of existing science laboratory or custodial procedures, though likely included in current emergency plans/procedures.

Takeaways

- The three responses to hazmat incidents at a district level are LOCALIZE INCIDENT (Isolate, Deny Entry, & Contain), STAY (Shelter-in-Place), and EVACUATE (Hazmat Evacuation.
- Most districts already have a localized incident response system in their science laboratories or other places where internal incidents tend to happen, like bus yards.
- With only minor modifications, most districts can adapt existing shelter procedures in the Standard Response Protocols (SRP) to the STAY (Shelter-in-Place) hazmat response.
- EVACUATE due to a hazmat incident is the new and more complex response for most districts—and especially important for schools within 1,000 yards of known hazards like rail lines.
- Schools, districts, and district facilities can use a team approach (the Hazardous Materials Incident Response Team or equivalent) to improve their readiness to act during a hazmat incident.

- Examples include:
  - Releases of irritants (e.g., pepper spray or mace).
  - Science laboratory accidents/spills.
  - Mercury spills from laboratories, bulbs, or other equipment.
  - Incidental spills contained and cleaned up with localized isolation, evacuation, hasty decontamination, and first aid for anyone contaminated or injured.
  - Larger spills requiring localized evacuation and outside support for cleanup or decontamination.

STAY (Shelter-In-Place): Level II

This response is to a hazmat incident requiring shelter in place. STAY (shelter-in-place) is a modified form of the SHELTER drill in the TxSSC Standard Response Protocol (SRP). STAY (shelter-in-place) is the default response to an external hazard unless instructed otherwise by first responders, or if the danger from explosion or fire impacts is immediate, or when the release of toxic material poses an immediate danger to life and health that sheltering cannot mitigate.

Its characteristics are:

- The primary hazard to the property is the exposure of people to toxic vapors, which may be lower indoors than out.
- Affects an entire property (may affect multiple properties/buildings).
- Attempts to seal a building from outside ingress of toxic vapors by sealing windows and doors and turning off HVAC systems.
- Occurs at a school/facility level with district emergency management coordinator (DEMC) or district support (may occur at more than one property/building).
- Likely part of existing plans and procedures (modified part of the Texas Standard Response Protocol).
- May shift to an evacuation.
- The default response to all significant hazmat events near schools until first responders or district officials provide further instructions, except when the immediacy of the danger signals evacuation (e.g., a train derailment with fire/explosion adjacent to school property).
- Primarily used when the incident site is some distance from the property (more than 1,000 yards) and the property is not in the initial isolation zone. The affected property is some distance and downwind from the incident but outside the initial isolation zone.
- Examples:
  - Train derailments.
  - Chemical plant releases.
  - Aerial herbicide or pesticide spraying upwind near school property.
  - Tanker truck accidents.
  - Pipeline leaks.
  - An external hazmat incident affecting the school or district facility where concentrations of toxic or dangerous vapors are low enough to justify shelter in place rather than an evacuation.

EVACUATE (Hazmat Evacuation): Level III

This response is to a hazmat incident requiring evacuation. Its characteristics are:

- The primary hazard to the property can be any of the three impacts – explosion, fire, or toxic vapors at a level unsafe to shelter in place.
- The danger presented poses an immediate threat to life and health.
- Not currently a part of many school plans (different than most other evacuations).
- May affect multiple district properties.
- Can require movement, on foot, over a distance up to 1,000 yards crosswind or upwind and (possibly) uphill, where evacuees can meet transportation to a shelter/reunification site.
- Vertical evacuation involves moving from lower to higher levels, if an option.
- Offsite evacuation requires transportation and activation of a shelter and reunification plan at locations not under shelter-in-place or evacuation orders.
- Examples:
    - Gas leak or carbon monoxide alarm.
    - Train derailments within 1,000 yards of a school/facility.
    - Chemical plant accidents within 1,000 yards of a school/facility.
    - Tanker trucks incidents within 1,000 yards of a school/facility.
    - Pipeline leaks within 1,000 yards of a school/facility.
    - Explosives or other hazards near a school/facility (e.g., a truck bomb or other vehicle-borne improvised explosive device).
    - Any other external hazmat incident affecting the school or district facility that forces an evacuation due to the immediacy of the threat.

Hazardous Materials Incident Response Teams

As previously noted, the sample plans and this guide recommend forming Hazardous Materials Incident Response Teams (HMIRTs) or incorporating hazmat-awareness-trained individuals in existing Incident Response Teams at the school and facility level. HMIRTs or their equivalent are not responders, nor are they hazmat experts. Instead, they have some additional training and knowledge about the school's hazmat response procedures. They facilitate the response at a campus level. Using a team approach ensures that a few knowledgeable personnel are always on campus during an emergency, know what to do, and can initiate one of the three responses.

Response at the District Level

If HMIRTs or other incident response teams facilitate the response at the campus level, DEMCs facilitate things at the district level. DEMCs do this through three primary roles:

- **Advisor**—providing information and guidance to leaders and HMIRT/response teams at the campus level and the district's leaders.
- **Coordination and liaison**—coordinating the district response between campuses/HMIRTs, first responders at an incident command post, and the community via the community EOC.

- **Resource provider**—coordinating resources needed for the response that the district possesses, like school buses/transportation, or obtains through contract, like hazmat contractors; and working through the community EOC to obtain outside resources or via memorandums of understanding or mutual aid agreements they may have with neighboring districts or other response organizations.

Functioning in these three roles, the DEMC can execute the district plan, and any district plan should address all three areas. The critical interfaces and communication requirements are between the DEMC and the individual properties within the district; and between the DEMC, first responders, and the community EOC. The DEMC is the critical link between district leaders, individual schools/properties, and the community.

Evaluating district capabilities begins with the capabilities of the DEMC and the district team. Because the responsibilities are significant, especially in larger districts, districts should resource their DEMC role appropriately. At a minimum, districts should consider providing DEMCs with additional personnel in an emergency, emulating the team approach at the campus/property level. This district-level Incident Response Team can consist of any number of people at the district level. Potential members include:

- District superintendent.
- Assistant superintendent.
- School police, security director, or supervisor.
- District nurse or supervisor of district nurses.
- Transportation director or supervisor.
- Custodial or maintenance director or supervisor.
- Accounting or finance personnel (for cost tracking and recovery).

Additionally, several districts in the state assign a liaison to their community EOCs. A liaison to the EOC is a recommended best practice but not possible in all districts due to staffing or other issues. However, in a major disaster like a derailment, the DEMC or another knowledgeable district representative should plan to move to the community EOC. In large-scale incidents, even if they affect only a single campus, the number of response organizations involved and the community response as a whole will depend heavily on the ease with which the district integrates. The best way to do this is to have representatives at the EOC. Because some districts cross jurisdictional boundaries, they may need to coordinate their presence at multiple EOCs, even though they may only report to one of them in any given emergency, depending on the location of the incident.

Additionally, some districts may wish to designate a member of the HMIRT or other response team at the school/facility level responsible for interfacing with incident commanders on-scene for the initial period of any shelter in place/evacuation. As suggested elsewhere in this guide, having HMIRTs and school/facility leaders meet with the nearest fire station leadership is a vital preparedness step. Like DEMC coordination with local EOCs and LEPCs, school principals should exchange business cards with their local Fire Official long before a disaster strikes.

Assessing Response Capabilities

The primary method of assessing response capabilities for hazmat, or any other kind of emergency, is to test existing procedures and conduct after-action reviews. Organizations do this through drills and exercises. Such assessments allow districts to identify procedures that worked and those that did not. The assessments also identify resource gaps and pre-disaster coordination opportunities.

Failure to conduct an **emergency evacuation** in a signifi cant hazmat event like a derailment near a school could cost many lives. Districts must take on the responsibility and plan for such events.

In the absence of drill and exercise evaluations and after-action reviews, the next best thing is an assessment of capabilities by reviewing existing plans, procedures, and protocols.

A checklist in Appendix A of Volume 1 of this guide can assist in this process.

Regarding such assessments, the priority should be on the capabilities to conduct hazmat emergency evacuations, which is the drill and procedure most lacking across existing district plans. Most schools have shelter-in-place drills for weather or active shooters, which require only minimal modification for hazmat. Evacuation to an assembly point over an unknown distance and direction is a skill schools, facilities, and districts must prepare and plan to execute in a train derailment or other significant hazmat incident. Unlike traditional fire drills or bomb threats, the distances and the effects of wind determine the evacuation. Planning to “move to the football field” does not work in a hazmat disaster if the football field is in the initial isolation area or downwind of the incident.

Planning to “move to the football field” during an evacuation does not work - the football field may be in the initial isolation area or downwind of a hazmat incident.

Further, evacuations will be the biggest test of any district plan—they require multiple movements of large populations that may occur simultaneously at multiple properties, must include people with special needs and those with mobility challenges, involve the movement of transportation assets to locations that may be difficult to reach due to the incident, and require the execution of shelter and reunification plans at yet a third site.

Evacuation planning is complex, but districts cannot avoid that – the complexity requires their action. Failure to execute an emergency evacuation in a significant hazmat event like a derailment near a school could cost many lives. Districts must take on the responsibility to plan for such events – it is a legal and moral imperative. Protecting children is a TEC requirement and the expectation citizens have of school leadership.

Take Action

- Assess current plans for hazmat emergencies—do they include the three responses? Do your evacuation plans account for wind direction and initial isolation distances?
- Consider establishing HMIRTs or adapting existing response teams to include hazmat-aware personnel, especially schools within 1,000 yards of known potential high-consequence hazards like rail lines.
- Evaluate your district-level emergency team—does your DEMC have the necessary support to facilitate a multi-property evacuation?

V. HAZMAT THREAT AND HAZARD ASSESSMENT FOR SCHOOL DISTRICTS

Gather Information and Quantify the Hazard/Threat

The steps to gather information and quantify the hazard or threat are as follows:

1. Contact local emergency managers for the communities and counties in your district and the associated LEPCs or TDEM district coordinator(s), and request their assistance.
2. Have your school resource officers (SROs) and associated personnel involved in your threat assessment and diversion programs coordinate with local law enforcement regarding chemical bomb-making and associated activities; develop procedures to include notification and identification of such activity in your threat identification process if not already part of your threat assessment procedures.
3. Conduct a map survey of railroads in your community:
    a. Identify the rail operators. See Appendix A.
    b. Contact the rail operators and request their assistance.
    c. Exclude dedicated mass transit and light rail lines (they do not transport hazmat).
4. Find pipelines:
    a. Identify pipeline operators. See Appendix B.
    b. Contact the pipeline operators and request their assistance.
    c. Review the materials in the TxSSC School Pipeline Safety Toolkit.

Takeaways

- Seek assistance from experts when assessing hazmat threats and hazards; start with local emergency management, LEPCs, and TDEM district coordinators.
- Hazmat threat and hazard assessments gather information and evaluate district threat assessment procedures and internal and external hazards.
- Quantifying identified hazards is possible for non-experts, using resources like the ERG and Safety Data Sheets.
- Reducing internal hazards through regular hazmat inventories and less dangerous alternatives can eliminate some high-frequency hazmat incidents.
- Knowing hazards helps districts create scenarios to plan and practice against, specifically:
    - High-frequency low-impact incidents (typically minor, internal incidents).
    - Moderate-frequency moderate-impact incidents (e.g., roadway incidents involving flammable liquids or gases).
    - Low-frequency high-impact incidents (e.g., train derailments or pipeline leaks).

5. Identify and validate a list of roadways of concern:
   a. Identify roadways of concern. See Appendix C.
   b. Contact LEPCs and local/county emergency managers and request their assistance.
   c. Conduct a map survey (do this in conjunction with a rail or pipeline survey described previously).
   d. Ask the LEPC or emergency manager if they have the results from a Hazardous Materials Commodity Flow Study.
   e. If the LEPC/emergency management does not have a recent Hazardous Materials Commodity Flow Study, consider coordinating with them to request one via the TDEM Technological Hazards–administered HMEP grant program.

Figure 5: Your LEPC can help identify hazmat facilities in your district's area. (Source: Shutterstock)

6. Request Tier II facility reports from your LEPC(s) if active; otherwise, request them from county judges or local emergency management. By law, they must provide them. These reports ma y contain a lot of information. When evaluating Tier II reports, focus on:
   a. The address of the facility and emergency contact information.
   b. The business type (manufacturing, warehouse, or other).
   c. Whether they are subject to the Risk Management Program (RMP) (see Appendix D).
   d. Avoid focusing on chemical lists without external expert assistance (see Appendix D).

7. Conduct a hazardous materials inventory of all school district property:
   a. Properly dispose of excess or no longer needed material.
   b. Replace materials with less hazardous alternatives whenever possible.
   c. Collect Safety Data Sheets (SDSs) for each retained item.
   d. Safely and securely store all hazardous materials according to SDS guidelines.
   e. Include the location and security of any aboveground or underground propane or fuel tanks on district property in your inventory.

8. (Depending on local circumstances) discuss and identify other potential technological hazards with local emergency management and the LEPC, specifically:
   a. Facilities that may use or store hazardous materials near schools that do not meet Emergency Planning and Community Right to Know Act (EPCRA) reporting requirements for Tier II reporting.
   b. Radiological hazards near schools—nuclear power plants, research reactors, isotope production facilities, well-logging equipment storage facilities, and some non-destructive testing (NDT) companies.

c. The presence of oil/gas wellheads in proximity to schools and the owners/operators of those wellheads and other oil/gas production activities within the district, including exploration and drilling.
d. Large aboveground LPG tanks in the vicinity of a school, not on district property (BLEVE/HIT hazards).

When information gathering is complete, the district should possess the following:

- A list or map of railways, pipelines, roadways of concern, and hazmat-related industrial or storage facilities within 1,000 yards of district-owned property lines, including the operators' contact information and the properties affected.
- If available, the results of any Hazardous Materials Commodity Flow Study information regarding roadways of concern.
- A list and SDSs for all hazardous materials stored and used by the school district, the properties that store and use the materials, and the storage locations on those properties.
- Documented procedures for identifying school-aged or district-related individuals associated with chemical bomb-making and related criminal activities.
- (Depending on local circumstances) a list of other facilities of concern and the hazard involved (e.g., nuclear power plants).

> If your district has **personnel trained in the use of GIS**, request their assistance in your hazard and threat analysis. Community planning offices also have personnel and tools to assist in your process that can produce map products for district use.

Quantifying and Reducing Internal Hazards

Research suggests that most hazardous materials incidents affecting schools are internal incidents. Internal hazards are the only hazards schools have direct control over and can most easily reduce or prevent. Regular inventories and a district-level safety program allow districts to identify internal hazards and reduce them, especially those associated with science laboratories, pools, fuel for equipment and vehicles, and herbicides for athletic fields and landscaping.

Mercury from thermometers, projector bulbs, or certain light fixtures is a leading cause of school-related hazmat incidents. Laboratory experiments gone wrong, especially demonstrations involving dangerous chemicals or procedures, are another frequent cause of evacuation and severe injury in science laboratories. Prevent or mitigate these hazards by replacing the material with safer alternates or implementing procedures to reduce incident likelihood.

Maintenance schedules and upkeep also play a role in internal hazards. Low air quality due to improperly maintained heating or cooling systems could result in carbon monoxide or mold contamination, both common problems across the United States. Improperly maintained gas fittings for natural gas lines or LPG/propane tanks can result in gas leaks, another leading cause of school evacuations.

Hazmat Threats

The primary focus on threats is no different from the existing threat identification and prevention procedures schools use to identify potential active shooters or other threats of violence, with only an expansion to include the threat from chemical bomb-making activity if not already incorporated into existing threat assessment procedures. SROs and local law enforcement can assist in this process.

A growing problem for schools involves the release of chemical irritants on school grounds or in school facilities, either deliberately or by accident. These incidents involve the discharge of personal protection devices containing irritants like pepper spray or Mace™. Of the internal threats, these are the most difficult to quantify. For SROs or staff who may carry such devices, the school may wish to develop indoor use procedures to reduce the likelihood of a problem. When used indoors, especially in confined spaces, such devices can result in wider evacuations and produce symptoms beyond the intended target, especially in vulnerable populations and those with respiratory disease. Further, indoor use can concentrate the effect of such devices. It may take some time for the air to clear in small spaces following irritant use, causing additional problems.

Schools may have security measures to deter students from carrying chemical irritant devices, with varied effectiveness given their ready concealability, widespread availability, and safety perceptions. Students carrying defensive chemical devices may speak to broader issues of school violence or fears about school violence. In such cases, student use of such devices is a symptom of a more complicated problem that, if addressed, may reduce the presence of such devices on school campuses. District high schools and community colleges might also consider conducting irritant spray safety and training programs for older students. Local police or SROs can teach such courses. These programs are a straightforward addition to existing programs that teach gun safety, personal defense, or other security-related educational programs.

Information Resources

The following four primary sources provide hazardous materials information for planning and response to incidents:

- *Emergency Response Guidebook* (published every four years and currently in the 2020 edition).
- *NIOSH Pocket Guide to Chemical Hazards* (which focuses on hazardous materials in workplaces).
- CAMEO database (which compiles information from multiple sources).
- Manufacturer-provided SDSs.

Emergency Response Guidebook

First responders and hazardous materials professionals worldwide use the ERG produced by the U.S. Department of Transportation PHMSA. Most law enforcement patrol cars, fire trucks, and even many ambulances around the United States have a hardcopy ERG within the vehicle or an electronic copy of the ERG on a cellphone or installed on a vehicle-mounted computer. The ERG provides a wealth of information for responders to hazardous materials incidents. Emergency management personnel and planners use the ERG to evaluate and prepare for hazardous materials incidents. Consider asking your local EMC to request copies of the ERG for your school administrative offices and ISD vehicles.

NIOSH Pocket Guide to Chemical Hazards

The Centers for Disease Control *NIOSH Pocket Guide to Chemical Hazards* primarily focuses on hazardous materials used in industry. The guide provides information for safety professionals and workers regarding exposure limits and personal protective wear. First responders and companies storing and using hazardous materials use the guide to develop safety programs and identify personal protective equipment requirements.

CAMEO

The CAMEO database developed and jointly maintained by the National Oceanographic and Atmospheric Administration (NOAA) Office of Response and Restoration and the Environmental Protection Agency (EPA) compiles information from various sources, including the ERG SDSs, and federal regulations and guidance documents. The CAMEO database also interfaces with tools used by responders to model and map hazardous materials releases, collectively known as the CAMEO Software Suite.[10] A few districts and community colleges with robust DEMC offices or those coordinating closely with community emergency management that use CAMEO may find its associated modeling and mapping applications useful for planning.

Safety Data Sheets

Hazardous materials manufacturers must produce SDSs that provide essential information about the material, protective measures, and other response and safety information.[11] In addition to SDSs' inclusion in shipping documents, the Occupational Safety and Health Administration Hazard Communication Regulations and the Texas Hazard Communication and Worker Right to Know laws require posting SDSs in workplaces.

Which Source Does My District Use?

Of the four sources, only two generally prove helpful for most school districts. First, federal law requires that districts maintain copies of **SDSs** for chemicals under their control in science laboratories, custodial closets, swimming pools, maintenance sheds, swimming pools, and transportation yards per Hazard Communication regulations. These guides also recommend maintaining copies of all SDSs in a centralized location at each district property and centrally with the DEMC for quick reference in an emergency.

The second resource is the **ERG**. A basic understanding is necessary for most DEMCs and key individuals at a few high-risk facilities and properties. Alternately, some DEMCs with experience, time, and resources may use the CAMEO database, which references ERG information, among other sources.

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10 CAMEO is the abbreviation for Computer Aided Management of Emergency Operations. The software suite consists of a customizable database of chemicals hazards reported by facilities to local emergency management under the EPCRA, and draws information from the CAMEO Chemicals database, ALOH (a basic plume modeling program used to predict downwind hazards), and MARPLOT (which allows the viewing of information from ALOHA and CAMEO on maps).

11 Prior to 2015, U.S. manufacturers produced Material Safety Data Sheets, which did not have a regulated format. Since 2015, SDSs follow an established format that is easier to understand and is accepted worldwide under the United Nation's Globally Harmonized System.

Developing Scenarios for Planning

Gathering information and quantifying hazards and threats allow districts and community colleges to develop three general scenarios, informed by their hazard and threat assessment and using two dimensions: frequency and consequence.

Low-frequency events are rare, like a train derailment near a school or an industrial accident like the warehouse fire and ammonium nitrate explosion incident in West, Texas. Moderate-frequency events are infrequent but not uncommon. These include gas leaks in schools or a tanker truck carrying fuel involved in traffic accident near a school. While unpredictable, these sorts of events impact a small number of Texas schools every year. High-frequency events occur with annual, monthly, or even weekly regularity. While unpredictable, they are relatively commonplace and affect most districts every year. They also tend to be internal events like spills in science laboratories or the release of pepper spray on school grounds.

Consequences generally run the opposite of frequency. For example, a high-frequency event like pepper spray or a spill in a science laboratory is of relatively low consequence, impacting a part of a school like a classroom but usually not disruptive enough to affect the entire school. A moderate-consequence event like a gas leak leading to a campus-wide evacuation or a fuel spill on the road near a school has a more significant impact but remains relatively short-lived. These events' overall impact on the district is minimal because the impact typically affects only a single campus. High-consequence events like derailments cause significant disruption, last days, weeks, or months, and require a districtwide response. These events are rare but could be catastrophic.

When evaluating external hazards to school district properties, a **1,000-meter initial isolation zone** with a multi-mile downwind protective action distance is the low-frequency high-consequence scenario in most circumstances.

Lower-Frequency, Higher-Consequence Scenarios

Planning for hazardous materials emergencies tends to focus on lower-frequency, higher-consequence scenarios. Planners use these "worse-case scenarios" partly because hazardous substances are numerous and their dangers vary. By focusing on the worse cases, a plan addresses lesser threats as well. The initial isolation distance for many of the most dangerous hazardous materials is 1,000 meters (1,093 yards) when spilled in significant quantity or where there is fire, explosion, or threat of fire or explosion.[12] These large spills typically involve tanker trucks, railcars, pipelines, product transfer facilities, manufacturing or refining industrial facilities, or storage facilities like warehouses and tank farms.

When evaluating hazards and threats to school districts, the 1,000-meter initial isolation zone with a multi-mile downwind protective action distance is the lower-frequency, higher-consequence scenario to use for most circumstances.[13] For example, an unknown large spill from

[12] A very few circumstances prescribe an initial isolation distance greater than 1,000 meters. These include certain explosives and very large LPG tanks.

[13] A few districts may have particular hazards that change their scenario, for example those located next to nuclear facilities or those in proximity to industry or storage facilities whose quantity requires initial isolation zones greater than 1,000 meters.

a derailment may likely result in a 1,000-yard evacuation zone around the spill until responders mitigate the danger or substance identification determines it is less hazardous. If the derailment includes toxic materials, the downwind protective action distance might extend for miles.

Due to high industry concentrations or proximity to nuclear facilities, a few districts in the state have different specific lower-frequency, higher-consequence scenarios based on particular hazards (see Section VI for more information). Still, for more than 60 percent of Texas school districts, train derailments are a lower-frequency, higher-consequence scenario they must plan for. So, while most hazmat incidents result in less disruption than a derailment, planning for derailment incidents ensures districts can execute their plans under most eventualities and for lesser hazards if they adopt a scalable approach to the problem, used in the sample plans contained Volume 4.

Moderate-Frequency Moderate-Consequence Scenarios

While most Texas school districts must plan and prepare to respond to lower-frequency higher-consequence scenarios, particularly a train derailment as required by the TEC, there are benefits to developing moderate-frequency moderate-consequence scenarios for which they plan and practice. These include scenarios involving external hazards like a flammable liquid spill occurring on a roadway near school property or gas leaks on or near school property. Likewise, certain district facilities like bus yards or swimming pools might regularly train employees to properly handle hazardous materials regularly encountered in their jobs like fuel or chlorine. These facilities may also practice or train employees and staff to deal with incidents involving such materials because they occur more frequently and can close or disrupt an essential school function if the incident is severe enough.

The potential for roadway hazmat incidents in proximity to school property exists near many schools. In addition to flammable liquids like crude oil in some areas, fuel delivery trucks bring gasoline and diesel from transfer points near pipelines to fuel stations in all communities, often during peak traffic hours. These vehicles regularly travel on local streets and roads. Other typical hazardous material vehicles traveling on local streets and roads are propane trucks, especially in rural areas. Another is vehicles transporting welding or medical gases like acetylene or oxygen to various industries and medical facilities. All of these vehicles can and do get into traffic accidents. While relatively uncommon, these sorts of accidents, not all of which result in a release of hazardous material, occur with enough frequency to consider when planning for hazmat releases near schools. These accidents generally involve smaller quantities and smaller initial isolation zones than higher-consequence events like derailments or industrial facility accidents. These accidents typically affect only a single campus. STAY (shelter in place) is the most common response to many of these incidents. However, dangers from fire or explosion involving a tanker truck can result in evacuations.

Higher-Frequency, Lower-Consequence Scenarios

Districts plan for lower-frequency, higher-consequence scenarios, but they are more about identifying issues and gaps in capabilities or policies and procedures. If an event occurs regularly enough involving hazmat, schools should consider prevention efforts first. For example, mercury spills involving thermometers in science laboratories occur regularly (discussed further in Section VI). Schools might want to replace mercury thermometers with a non-toxic alternative.

Likewise, if a problem with spilled fuel is a frequent occurrence at bus yards or maintenance facilities, those facilities may wish to investigate the causes and implement changes in equipment, procedures, or training to address the problem.

While prevention is the best solution for high-frequency events, it is not always practical. Some hazards are a part of regular operation. In these cases, the focus is on mitigation. For example, mitigation measures might include fuel spill kits placed in a bus yard or limiting student handling of mercury-based thermometers. Schools report an increased discharge of pepper spray on campuses, which can affect school operations. Addressing the underlying safety conditions that lead to students carrying these devices on campus may reduce their use, deliberate or accidental. However, such measures will not eliminate their presence on school grounds. Instead, self-defense training or safety instruction designed to reduce accidental discharges may mitigate incident frequency. Police and security personnel may also wish to use alternate means of addressing threats indoors to avoid triggering localized evacuations.

Take Action

- Seek assistance from experts—local emergency management, LEPCs, and TDEM district coordinators.
- Conduct a district-level hazmat threat and hazard assessment.
- Conduct a districtwide hazmat inventory, and reduce internal hazards by eliminating unneeded hazmat or using less dangerous alternatives when possible.
- Develop scenarios using information from your threat and hazard assessment:
  - Lower-frequency, higher-consequence incidents (e.g., train derailments or pipeline leaks).
  - Moderate-frequency, moderate-consequence incidents (e.g., roadway incidents involving flammable liquids or gases).
  - Higher-frequency, lower-consequence incidents (usually an internal incident in a science laboratory, custodial or maintenance-related incident, or the release of pepper spray).

VI. USING HAZARD AND THREAT ASSESSMENT INFORMATION TO IMPROVE READINESS AND PLANNING

Introduction

Very few school districts include trained and certified hazardous materials technicians among their employees, nor do they need such skill sets. Still, DEMCs and other key personnel like bus and vehicle maintenance supervisors should be familiar with the information in resources like the ERG and SDSs. This section provides a basic overview of how districts might use resources like the ERG to facilitate their planning and response to hazardous materials incidents.

The following case examples provide a quick guide for using resources like the ERG and SDSs to conduct emergency planning, prepare training materials, and establish school safety procedures based on your threat and hazard analysis. The three scenarios include a small internal hazard, a roadway flammable liquid spill adjacent to a school, and the known hazard of a rail line. They are the three most common scenarios for most schools and districts, though certainly not the only ones. When using the following scenario examples, understanding the process and how it applies to your district's circumstances is more important than the individual details because your district's details will likely differ.

Takeaways

- Threat and hazard assessments drive all aspects of preparedness, especially planning, mitigation, and prevention.
- Using specific information from hazard assessments and essential references like SDSs and the ERG helps districts and schools create actionable measures to prevent incidents and reduce hazard exposures.
- This section walks through specific examples for each of the three previously discussed scenarios (high-frequency, low-consequence, moderate-frequency, moderate-consequence, and low-frequency, high-consequence), offering specific measures districts and schools may implement based on the information gathered in a threat and hazard assessment.

Higher-Frequency Lower-Consequence Scenario

One of the most common hazardous materials incidents in schools across the United States is a spill involving mercury. While generally small, some incidents can have larger effects. One incident at an Odessa, Texas, school involving mercury cost around $900,000 to clean up.[14] For this example, we address a much smaller internal incident hazard involving a small spill from a broken mercury thermometer/hydrometer. This example assumes that science teachers and their campus HMIRT identified mercury-based thermometers and hydrometers during a district-wide hazardous materials inventory.

Consulting an SDS for mercury-containing thermometers, we found eight pages of information.[15] Since the 2009 adoption of the United Nations Globally Harmonized System of Classification and Labeling of Chemicals in the United States and many other countries, most SDSs (formerly known as Material Safety Data Sheets) follow the same format:

1. Identification of the material and its uses, manufacturer or responsible party, contact information, and restrictions on use.
2. Hazard(s) identification—hazard classification and information about material hazards.
3. Composition/information on ingredients.
4. First-aid measures.
5. Fire-fighting measures.
6. Accidental release measures.
7. Handling and storage.
8. Exposure controls/personal protection.
9. Physical and chemical properties.
10. Stability and reactivity.
11. Toxicological information.
12. Ecological information (not mandatory—may not appear on all SDSs).
13. Disposal considerations (not mandatory—may not appear on all SDSs).
14. Transport information (not mandatory—may not appear on all SDSs).
15. Regulatory information (not mandatory—may not appear on all SDSs).
16. Other information—should note the date of preparation or last revision and changes made if not noted elsewhere.

SDSs are all-purpose documents. Not everything is necessary for each specific circumstance. Rather, SDSs cover information needed in all circumstances. The critical sections for school planning are accidental release measures (Section 6) and handling and storage (Section 7). For flammable materials, fire-fighting measures (Section 5) are also necessary. In this case, mercury is nonflammable.

Section 7 (handling and storage) states to only use mercury-filled thermometers and hydrometers under a chemical fume hood and store them in a dry, cool, well-ventilated place with other

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14 Source: The Washington Times. "Mercury Cleanup at Odessa School Cost Nearly $900K." April 21, 2014. https://www.washingtontimes.com/news/2014/apr/21/mercury-cleanup-at-texas-school-cost-nearly-900k/.

15 See the Fisher Scientific SDS Search engine at https://www.fishersci.com/us/en/catalog/search/sdshome.html. The SDS for a Fisher mercury thermometer or hydrometer is at https://www.fishersci.com/store/msds?partNumber=150411B&productDescription=fisherbrandtrade-engravedstem-mercury-laboratory-thermometers&vendorId=VN00002767&keyword=true&countryCode=US&language=en.

corrosives. Accidental release instructions include the requirements to evacuate and ventilate the immediate area and for responders to wear a self-contained breathing apparatus and protective suit.

Using the ERG, we find mercury associated with Guide Number 172 and ID Number 2809. Looking up Guide Number 172 in the orange pages of a printed ERG or using the phone or computer ERG application shows, among other things, instructions to isolate the spill for at least 50 meters. Further, due to the hazard, such an event is not incidental under regulations. Cleanup instructions in the SDS are beyond the cleanup capability of a school. Any elemental mercury spill should require the response of a Hazardous Materials Response Team with mercury vapor analyzers. Cleanup of mercury spills by untrained professionals often results in further spread of the material and secondary contamination.

This quick review of this information should raise some questions for a planner:

1. Do we need this? Can we replace it with something less hazardous?
2. If yes, how do we properly dispose of the ones we have?
3. If no:
    a. Where is this material currently stored and used?
    b. Is it appropriately stored?
    c. Is it used correctly?
    d. Can we reduce the number of storage and use locations?
4. What are the policies and procedures needed to:
    a. Prevent exposure?
    b. Prepare for exposures?
    c. Respond to exposures?
    d. Recover from exposures?
    e. Mitigate against the effects of exposure?
5. Do current plans, policies, and procedures address these requirements? What changes are necessary?

In this case, the most obvious solution is to get rid of all the school's mercury thermometers, thus **preventing** exposures and dispensing with the problem. The only need is to determine a proper means of disposal. Section 13 of the SDS states that the mercury in these thermometers/hydrometers falls under the Resource Conservation and Recovery Act as a U-series (U151) waste. Online searching turns up a webpage on the EPA website devoted to the disposal of mercury, like that found in thermometers. The site states that mercury thermometers are "universal wastes" that require special disposal, and some states have specific laws governing such wastes.[16] The website further recommends consulting another website (Earth911) to find local disposal options.[17]

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16 Source: Environmental Protection Agency. "Storing, Transporting and Disposing of Mercury." 2021. https://www.epa.gov/mercury/storing-transporting-and-disposing-mercury.

17 Earth911.com is a privately maintained database of recyclers and waste disposal sites. Hazardous waste disposal is different for individuals than for businesses and governments. Consult with local and municipal waste disposal sites and departments for more information regarding the specific regulations and options for your district. See: Ratcliffe, Mitch. "Where to Recycle." Earth911.com. https://search.earth911.com/.

The EPA Universal Waste website provides the necessary information about handling and packaging the thermometers for disposal.[18] Searching "Items Containing Mercury" and the zip code of the school district tells you where you might dispose of the wastes and if any special limitations apply. Several disposal options have a mail-in program where the district can ship the thermometers for approved disposal. The DEMC, in this case, needs only coordinate the preparation for disposal and contact the listed disposal companies for further instructions and to assess costs.

However, for the sake of example, the DEMC consulted with the science teachers responsible for these thermometers and discovered a specific requirement in the curriculum that required a mercury hydrometer. While admittedly unlikely, what follows explores that situation further for demonstrative purposes.

For the sake of the example, only one laboratory at a high school requires a mercury hydrometer. The other laboratories do not. The DEMC works with the laboratories and instructors to coordinate the removal and disposal of the unneeded thermometers to prevent and mitigate exposures. These science laboratories order less toxic replacements. The DEMC works with the specific instructors and laboratories to secure the remaining hydrometers and ensure instructors use and store them according to SDS instructions.

Further, the DEMC consults the ERG and SDS. The ERG states an initial isolation distance of 50 meters (150 feet) in all directions. The SDS, under Section 8, "Exposure Controls/Personal Protection," notes the following engineering measures:

> Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Knowing this, the DEMC can work with the science department using the mercury thermometers to meet the requirements of the SDS and develop further safety procedures. These might include:

- Ensuring that instructors set up the hydrometer under the fume hood before the experiment. Students do not handle the hydrometer outside the fume hood (*mitigation*).
- Posting a flip chart with response procedures in the event of a broken hydrometer referencing:
  - Evacuation of the area (50 meters/150 feet).
  - The emergency decontamination and first aid measures noted in the SDS and the ERG.
  - Ventilation measures if outside of a fume hood, including opening windows or turning on exhaust fans or other ventilation.
- Installing eyewash stations and safety showers outside the laboratory where the staff and students use and store hydrometers (*preparedness*).
- Purchasing a mercury spill kit and pre-staging it in the laboratory for use by responders (and only by responders, not school faculty or staff) in the event of an exposure (*preparedness and recovery*).

[18] EPA, "Universal Waste," https://www.epa.gov/hw/universal-waste NOTE: In addition to the federally defined Universal Waste products, Texas Universal Waste regulation includes Paint and Paint-related Wastes.

- Pre-coordinating with a local fire department or a hazardous materials contractor to respond to and clean up/decontaminate any exposed mercury and identifying a funding source for such operations (*preparedness and recovery*).
- Documenting measures taken at the school and district levels and their incorporation into district and school/facility plans, as necessary (*planning and preparedness*).

As this example shows, proceeding from identification of a hazard to a series of prevention, mitigation, preparation, response, and recovery measures to address the problem draws from three primary sources:

- Consultation with responsible parties.
- SDSs.
- The ERG.

These three are the primary sources of information for decision-making regarding hazardous materials hazards and threats.

Moderate-Frequency Moderate-Consequence Scenario

A more likely external incident scenario for many school properties not located within 1,000 yards of a known hazard like a pipeline, rail line, or industrial facility involves the spill of a Class 3 flammable liquid (e.g., gasoline, diesel, or crude oil). Some districts may have specific, more likely hazards, like wellheads adjacent to school properties that pose particular hazards they need to prepare for and practice their response.

Schools located near wellheads, pipelines, and rail lines may be more likely to experience a serious incident involving Class 3 flammables because such materials make up a large share of hazardous materials shipped in the United States. Oil wells, pipelines, and rail lines may all involve such liquids.[19] Of course, many, many other hazardous materials transit communities daily. Given their widespread prevalence, a small spill of a Class 3 flammable liquid is a more likely external hazmat threat faced by many school properties, and a large spill of Class 3 flammable liquids (thousands of gallons) is a significant external hazmat hazard for most school properties, especially at bus yards and campuses with fuel storage on or near district property.

Class 3 spills can come from many sources, including roadways, railroads, pipelines, aboveground storage tanks, nearby industrial facilities, or transfer stations. The more probable incident for many schools involves a Class 3 flammable liquid shipment in a tanker truck on the road near a district property.

The primary source of information, in this case, is the ERG Guide 128 for gasoline, diesel, and many other Class 3 flammable liquids, including crude oil. The three necessary actions for planning purposes are:

- Evacuation; take the immediate precautionary measure of isolating the spill or leak area for at least 50 meters (150 feet) in all directions.
- For a large spill, consider initial downwind evacuation for at least 300 meters (1,000 feet).

[19] Oil wells, pipelines, and storage tanks may also have flammable or toxic gas risks.

- If a tank, railcar, or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also consider initial evacuation for 800 meters (1/2 mile) in all directions.

While this example focuses on fuel, note the health warning for crude oil (UN1267) regarding toxic hydrogen sulfide gas. Also, flammable vapors can flash if they find an ignition source and will spread along the ground and settle into low or confined areas, creating explosive hazards indoors or in sewers.

Based on this information, first responders and schools can evaluate their planning and procedures. Circumstances matter in large spills like this. The ERG presents three hazard impacts, depending on circumstances:

- Fire is always possible in a Class 3 liquid spill, especially those involving traffic accidents. Circumstances will determine the likelihood of fire based on:
  - Substance spilled.
  - Quantity spilled.
  - The temperature of the liquid, atmospheric temperature, and air pressure.
  - Wind speed and direction/ventilation.
  - Presence of ignition sources.
- Explosion:
  - Flow into drains or sewers that can concentrate vapors, presenting an increased chance of explosion some distance from the accident.
  - Flashback of vapors to the tank.
- Exposure:
  - Some Class 3 liquids (like crude and gasoline) also have toxic vapors that travel in the wind direction.
  - Non-toxic vapors can also trigger respiratory distress or other symptoms, especially in those with preexisting conditions like asthma or COPD or in younger populations.

Based on these impacts, a planner can evaluate the district responses in their plan against a scenario involving a Class 3 liquid spill. Specifically:

- **STAY (Shelter-in-Place)**—A school in the vicinity of an incident will want to bring anyone outside on playgrounds or sports fields indoors before the arrival of first responders.
- **EVACUATE (Hazmat Evacuation)**—If the school or facility is within 300 meters (1,000 feet) to 800 meters (1/2 mile) of a large spill, it will likely need to evacuate upwind or crosswind, uphill, and away from the incident. If a fire is present or the incident commander determines a sufficient likelihood of fire or explosion, the school or facility may need to evacuate immediately and on foot.

Additionally, districts will want to evaluate additional measures and procedures. These might include:

- Prevention:
  - Work with local emergency management authorities to contact local fuel distributors or other shippers and discuss alternate routes away from school zones, especially during pickup and drop-off times.
- Preparedness:
  - Discuss evacuation versus shelter-in-place decision-making with your local hazmat response organization (i.e., the local fire department) based on different scenarios near properties with high hazard exposures.
  - Determine the properties with the most significant hazard exposure:
    - Inspect properties for proximity to roadways and hazards posed by storm drains, sewers, terrain (Class 3 liquids and vapors flow downhill), ignition sources, and other factors.
    - Locate filling stations, underground storage tanks, wellheads, and other facilities likely to generate Class 3 hazardous materials traffic using the procedures in Appendix C.
    - Coordinate with local emergency management and the LEPC to request a Hazardous Materials Commodity Flow Study to determine specific hazards on selected roadways.
  - Review and update plans, policies, and procedures based on consultation with the fire department and the determination of properties with the greatest hazard exposures.
- Response:
  - Discuss response times and procedures with the fire department, including times for trained and equipped hazmat teams to arrive.
  - Based on fire department input, evaluate decision making regarding shelter in place and evacuations—who will decide and when, and how will the fire department notify the school/property?
  - Evaluate pre-selected evacuation points for safety and access.
- Recovery:
  - Class 3 liquids that contaminate soil might require extensive cleanup operations. Evaluate how such an operation might affect school operations if the contamination occurred on or near school property.
- Mitigation:
  - Consult with local authorities regarding speed limits in the vicinity of the school. Slower speed can reduce both the frequency and severity of accidents.

Lower-Frequency, Higher-Consequence Scenario

The size of the downwind protective action distance/zone is the critical difference between the Class 3 flammable liquid spill example and the worse-case scenario in this section. Toxic material releases let vapors into the air that can travel many miles downwind of an incident. Another critical factor is the source. Pipelines, roadway accidents, and leaks from storage tanks are typically (though not exclusively) single-material incidents. Though single-material incidents may produce all three hazard impacts (explosion, fire, and exposure), they also typically emanate from a single primary source. While industrial incidents may also involve multiple hazards, a more-likely multiple-material threat comes from train derailments.

Figure 6: Major rail hazmat accidents are infrequent, but could be catastrophic because of the types and amounts of hazmat involved. (Source: Shutterstock)

Some trains move onlye single materials, and when a train consists of all the same type of railcar it is called a unit train (Figure 6). There are many types of unit trains and then can include High Hazard Flammable Trains (HHFTs) made up of a large number of Class 3 shipments of flammable liquids like crude oil or ethanol. HHFT trains may have from 20 to over 100 rail hazmat tankcars. However, many more trains include hazmat tankcars along with a wide variety of other shipments and railcar types—these are called manifest trains. Railroad operators must comply with federal regulations and take safety precautions regarding such shipments. Still, accidents can happen, and when they do, they can involve multiple materials that generate multiple impacts.

Train derailments can also produce linear effects, unlike incidents with a single point of origin. A derailment may produce different impacts at different points, stretching over some distance. One way to visualize this is that a derailment consists of multiple incident responses to different releases with different impacts stretching along the rail line. There is also potential for one or more incidents to interact with the others and produce secondary incidents. Further, spilled material from derailments can sometimes travel along a railbed and produce impacts at new locations some distance from the source.

Another factor in addressing rail-related incidents is that rail accidents are not exclusive to primary rail lines but can occur at industrial facilities, ports, and rail switching or storage yards. Accidents occurring at transfer points, where hazardous materials transfer from one storage or transportation container to another, are a particular problem. Many industrial facilities receive raw chemicals and materials via rail. These rail tanks and cars can stretch for miles in rail yards and sidings leading into and out of the facility, awaiting loading or unloading.

All of this means that while rare, serious railroad-related hazardous materials incidents are some of the most complex and high-impact incidents involving hazardous materials. This factor and the increased shipment of crude oil by rail over the last decade make such incidents a particular concern for schools.[20] Further, many highly toxic industrial materials ship by rail, some of which may produce effects that stretch many miles downwind, even if only a single car is affected.

Many of the planning considerations identified in the previous Class 3 scenario apply to train derailments. However, while the response to a serious incident like a train derailment at the property level is still evacuation or shelter in place, train derailments are often significantly more complex at the district level. A significant incident like a train derailment or a large industrial accident involving toxic materials can create broader effects and result in multiple school properties taking different response actions simultaneously, depending on their location. Such a widespread, multiple-campus response severely challenges district response plans.

Some of the challenges include:

- An IC is ikely (but not guaranteed) to order schools within 1,000 yards of the rail line or rail yard to evacuate.
- Schools further downwind, some many miles away, may evacuate or shelter in place for hazmat depending on the chemicals involved and quantities released. Responders determine these zones using the ERG and modeling software like the CAMEO Suite's ALOHA modeling system.
- The response to train derailments and significant industrial accidents can last days or even weeks.
- A rail incident is a linear source versus a single point source. A major train derailment produces multiple hazards stretching for some distance along the rail line.
- Freight trains have grown in length in recent years.[21]
- Derailments involve multiple cars.[22]
- A train carrying hazardous materials may carry multiple materials in different cars.
- A rail incident can produce fire and explosive hazards, including BLEVEs and HITs that cause additional releases in cars initially unaffected by the incident.
- Fire and explosive incidents in rail yards and transfer points can affect other rail cars and industrial facilities, resulting in additional releases even in unmoving trains.
- The nature of the incident, location, terrain, railbed composition and height, location of waterways, weather, and other factors all influence the effects of hazardous materials released from a rail incident and where they may travel or produce effects like explosions, fire, and exposure. These factors make such incidents highly unpredictable.

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20 Beginning in 2015, the new safety rules address HHFTs carrying large volumes of crude oil or other Class 3 flammable liquids. New rules in 2019 expanded some of the requirements of the new regulations, which require operators to share information about such shipments with state and local emergency management and develop response plans for HHFTs, among other things. See 84 Federal Register 6910, https://www.federalregister.gov/documents/2019/02/28/2019-02491/hazardous-materials-oil-spill-response-plans-and-information-sharing-for-high-hazard-flammable.

21 Source: U.S. Government Accountability Office. *Rail Safety: Freight Trains Are Getting Longer, and Additional Information Is Needed to Assess Their Impact.* GAO 19-443, Report to Congressional Requesters, May 2019. https://www.gao.gov/assets/700/699396.pdf.

22 Source: Li, Weixi, Geordie S. Roscoe, Zhipeng Zhang, M. Rapik Saat, and Christopher P. L. Barkan. "Comparison of Loaded and Empty Unit Train Derailment Characteristics." Submission to the Transportation Review Board 97th Annual Meeting, November 15, 2017. http://rail.rutgers.edu/files/Comparison_ZZP.pdf.

Given these challenges, planning considerations for school districts to consider should include the following:

- School responses to major incidents like train derailments or other incidents with toxic downwind hazards will remain the same—STAY (Shelter-in-Place) or EVACUATE (Hazmat Evacuation) for hazmat.
- District responses to such incidents may require more complex responses because different campuses respond differently depending on the incident and their location.
- District responses may require multiple simultaneous evacuations, shelter for hazmat, and initiation of reunification plans under conditions where road closures and the downwind hazards force evacuations and shelter in place of homes, businesses, and entire neighborhoods, complicating reunification efforts.
- Major incidents resulting in evacuations often lead to the implementation of shelter plans for citizens by local emergency management, which may also affect schools designated as shelter locations for citizens.
- Some schools may need to shelter students, staff, and others for an extended period.
- Evacuated students, families, staff, and citizens also require shelter for an extended period. They may be unable to return to their homes or vehicles in evacuated areas.
- Depending on the location of the incident/rail line and school transportation yards, access to buses and transportation assets may be limited and routing complex.

The following is one way for a district to evaluate its hazards related to such large-scale incidents and address these and other concerns:

1. Identify locations where such major incidents may occur:
   a. Identify hazards within 1,000 yards of district properties using the procedures outlined in Appendices A, B, C, and D.
   b. Consult with the LEPC, local emergency management, and fire department regarding hazards from railroads, pipelines, and industrial facilities.
   c. With local responders, the LEPC, and local emergency management, consult with railroad operators, industry, and pipeline companies regarding their operations and plans for incident response.
2. Work with responders, local emergency management, and the LEPC to develop a worst-case scenario involving one or more of the most severe incidents possible (e.g., a train derailment next to a school with downwind hazards affecting other school properties or the community; significant release of toxic material, explosion, or fire at an EPA RMP-regulated facility; or a pipeline explosion or release).
3. The worst-case scenario should incorporate some of the challenges that would seriously stretch the district and local response capabilities and require external support via mutual aid and support from state or federal agencies.
   a. Use this scenario as the basis for a tabletop exercise, workshop, or seminar to assess local and district plans.
   b. Use this discussion to identify specific gaps or problems in district plans and where district plans interface with or depend on local community plans or resources.

c. Address assumptions in school, district, and local plans regarding community and outside support and where mutual aid agreements or state or federal resources might be necessary.
    i. Identify resources provided by pipeline operators, industrial facilities, or rail companies and their response times (some will involve contractors with a 24-hour response time).
    ii. Address any disconnects between schools, the district, and the community regarding assumptions about support and resources and the availability of those resources (some fire or police response assets depended on by the district for more minor incidents may not be available in a significant incident like a derailment).
    iii. Identify resources needed in such a scenario from existing mutual aid agreements.
    iv. Identify resources needed in such a scenario from mutual aid that might require a new or modified agreement.
    v. Identify resources needed in such a scenario from state or federal resources.
d. Use the scenario as the basis for a full-scale community exercise to test revised plans and invite identified supporting elements and resources to participate.
    i. Funds for such exercises may be available from state or federal programs.
    ii. Railroad operators may also provide additional training, resources, and special railcars for such exercises on request. Some industrial facilities and pipeline companies may also provide resources and support.
    iii. When conducting such exercises, evaluate the response at more than one school/campus: one or more schools designated for evacuation, one or more for shelter in place for hazmat, one for reunification, and one for shelter operations for displaced community members.

4. Remember that few districts or communities can address all of the impacts of a hazardous materials disaster from a significant industrial accident or train derailment.
    a. It is okay to admit gaps and problems in response plans. Identifying those issues is an opportunity to fix them before a disaster happens.
    b. The emergency management system extends well beyond the district, community, and even the state. Outside resources will assist in a major disaster that overwhelms local communities. They exist for that purpose.
    c. Such disasters produce chaos and information problems even the most accomplished emergency managers find difficult to address.
    d. Major disasters produce situations involving tradeoffs between the "best we can do" and the optimal solution. Prior planning and preparation are vital to avoiding those tradeoffs as much as possible.
    e. Deliberately overwhelming or challenging your system in an exercise is the best way to discover areas for improvement. Exercises are always a better way to find those areas – failure is acceptable and valuable in training if you learn from it - failure in real events imperils lives.

Take Action

- Use threat and hazard assessments at the district and school level:
  - Hazmat inventories or pepper spray incidents can serve as a basis for high-frequency low-consequence measures.
  - Transportation route analysis, commodity flow information, or other hazard information from community experts can identify moderate-frequency moderate-consequence hazards and threats.
  - Use train derailments or other significant fixed or transportation hazards as a basis for low-frequency high-consequence measures.
- Adopt a building-block approach to address threats and hazards. Start with those more easily addressed and use that as a basis for more complex threats and hazards.

APPENDIX A—EVALUATE DISTANCE TO ACTIVE RAIL LINES

Legal Requirement

TEC Section 37.108 specifies:

> A school district shall include in its multi-hazard emergency operations plan a policy for responding to a train derailment near a district school. A school district is only required to adopt the policy described by this subsection if a school district facility is located within 1,000 yards of a railroad track, as measured from any point on the school's real property boundary line. The school district may use any available community resources in developing the policy described by this subsection.[23]

This requiremet applies to more than 60 percent of Texas school districts. This appendix provides a guide to using Google Earth to determine if this applies to your school(s). The procedure here focuses on rail lines but is the same for evaluating distances to roadways, industrial facilities, and pipelines with only changes in the underlying data set. This appendix also provides alternatives to this method.

Local planning offices or district employees trained in GIS can prove extremely helpful in conducting map-based evaluations of external hazards.

Alternative Methods

Schools with access to more capable GIS software may wish to use it instead of using Google Earth. Any district can use the Google Earth method at no cost and with no training. More advanced systems offer increased functionality and ease of use but may require expensive licenses and training.

The CAMEO Software Suite, provided free of charge by EPA and NOAA, includes a robust mapping product, MARPLOT, that can significantly aid districts and communities in emergency planning tasks. While its learning curve is not nearly as steep as that for more advanced GIS software, finding and downloading the appropriate datasets prove challenging unless users have a basic understanding of GIS. Many of the necessary datasets come with Google Earth by default, which is the procedure described here.

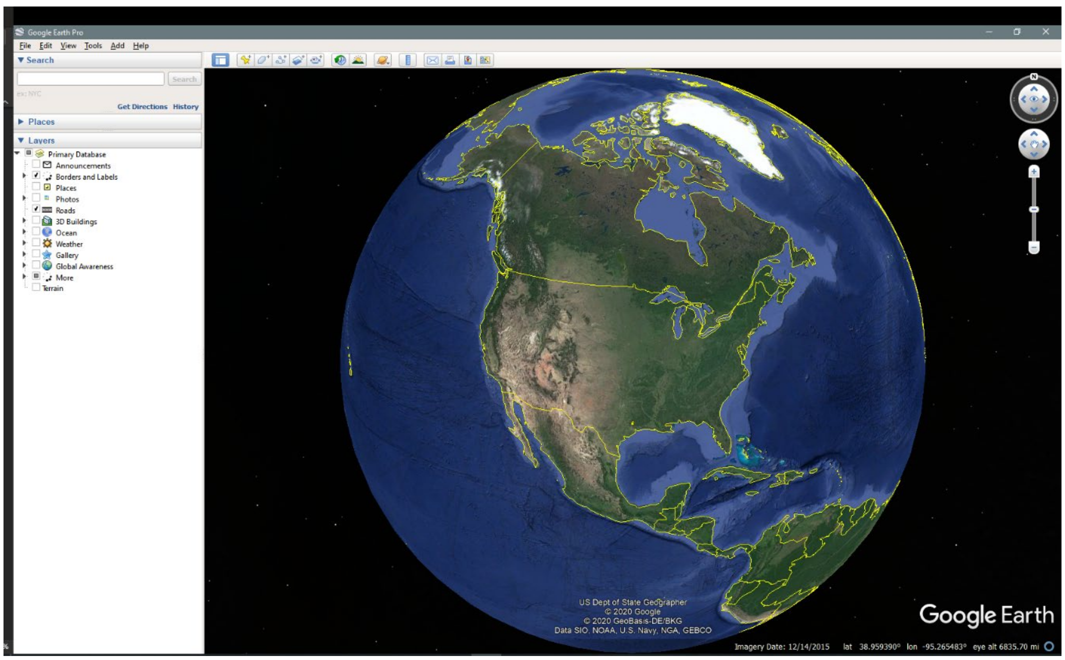
Still, larger districts and those with adequate staffing or those working closely with community emergency management or planning/zoning departments may find the CAMEO Software Suite worth learning and using. Several districts with robust emergency management programs in Texas use proprietary and custom GIS and planning tools that allow real-time collaboration

[23] The state legislature amended the code in 2021, changing the property line requirement from "a district school" to a "school district facility." This expands the requirement for districts to have a derailment plan if any property owned by the district, to include bus yards, warehouses, athletic facilities and fields, and other facilities, is within 1,000 yards of an active rail line. See this and other amendments to TEC Section 38.108: "Bill Text: TXHB3597, 2021–2022, 87th Legislature, Enrolled." Legiscan. https://legiscan.com/TX/text/HB3597/2021.

between schools, districts, and community responders. Districts with the ability to develop and support such systems report significant benefits in their emergency preparedness and response. Additionally, grant funding may be available for communities and districts to support such programs. However, such solutions are beyond the scope of this document, which focuses on the most basic solution that districts can implement without outside support and limited resources.

Instructions

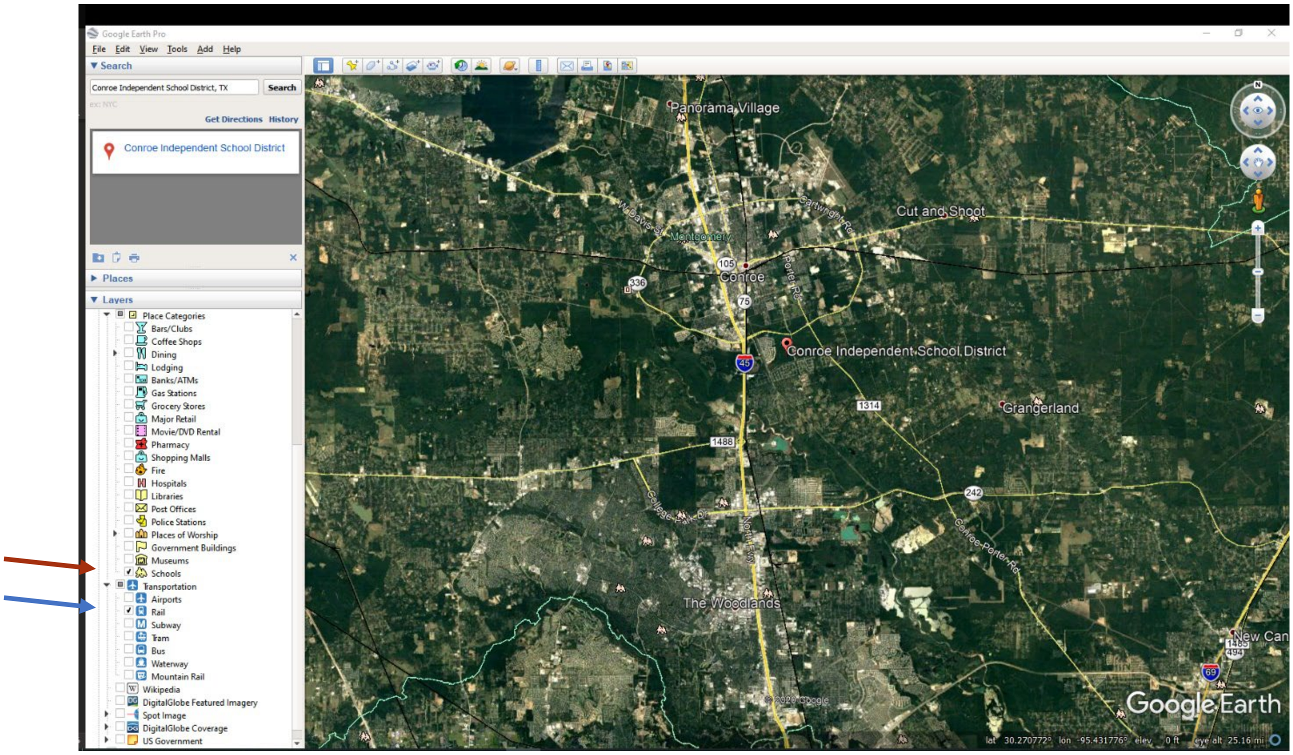
1. Download Google Earth Pro on a desktop computer: https://www.google.com/earth/versions/. You must use the Google Earth Pro desktop version to access the functions described here. The web version and Android/Apple App versions will not work.
2. After downloading and installing Google Earth Pro, open it to a screen that looks like this:



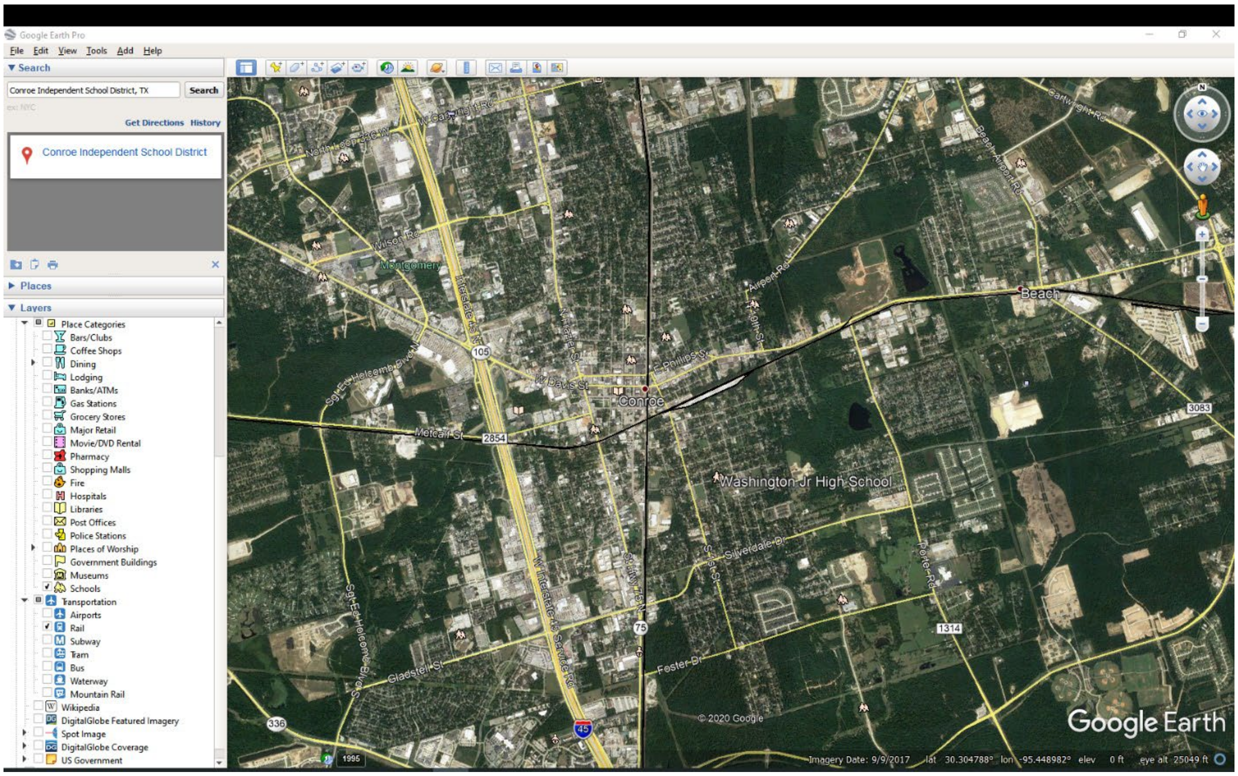
3. In the "Search" bar (top left corner), type your school district name (e.g., Smallville Consolidated ISD). This search will zoom the map to an area encompassing your district for most districts in the state. If the search does not pull up your district, try rewording the name (e.g., Smallville CISD).
4. On the left side of the screen, you will see "Layers." You will see a small arrow next to the box, "Primary Database." If not already expanded (like in the picture in step 2), click the arrow to show the options.
5. Below "Primary Database" are several options you can click on and off to display information on your map:
   a. Click on the roads (if they are not on already) to help you navigate your map.
   b. Click on the arrow next to the word "More."
   c. Click on the arrow next to the words "Place Categories."

   d. Scroll down if necessary and click on the box next to the word “Schools.”
   e. Next, click on the arrow next to the word “Transportation.”

6. Click on the box next to the word “Rail.” Highlighting railroads will highlight railroads on your map with a dark black line. See the following image:

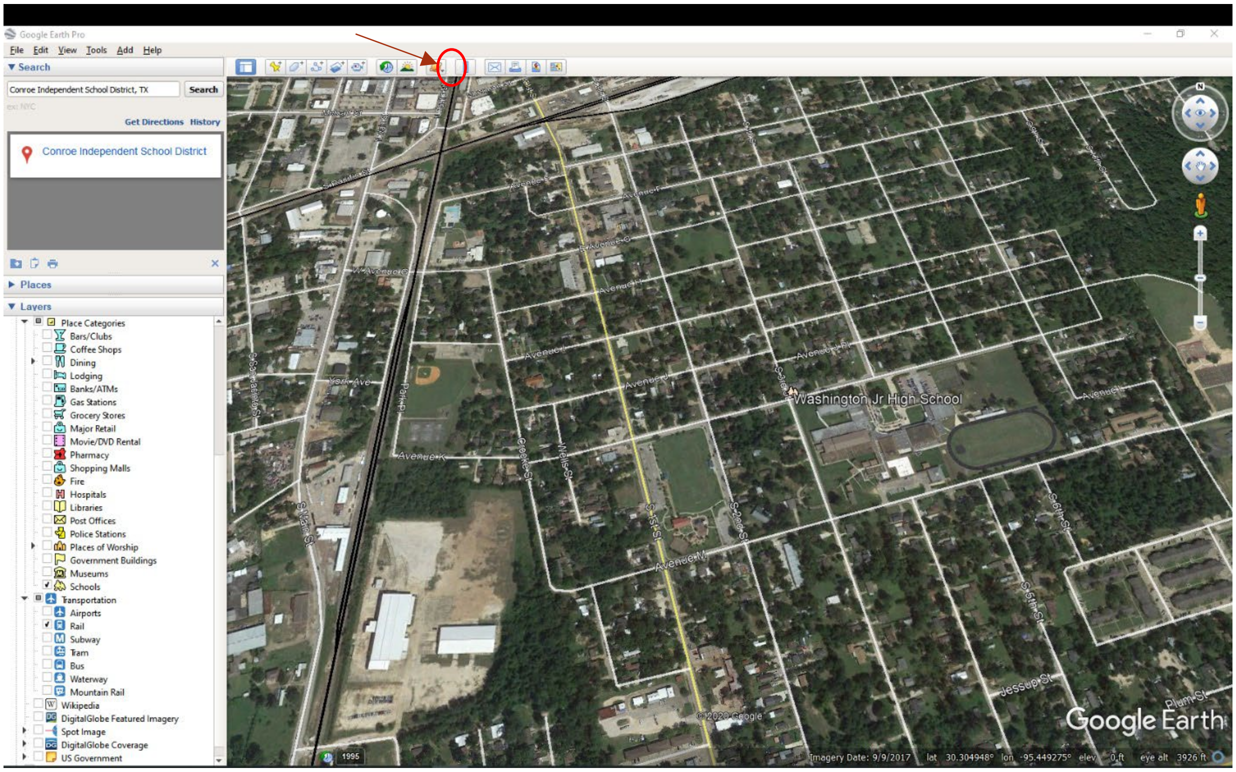


9. Use the scroll wheel on your mouse to scroll in or out of the map image. You will see a "Children Walking" icon where schools are in the Google database. If you point to the icon, it should pop up with the name of the school:



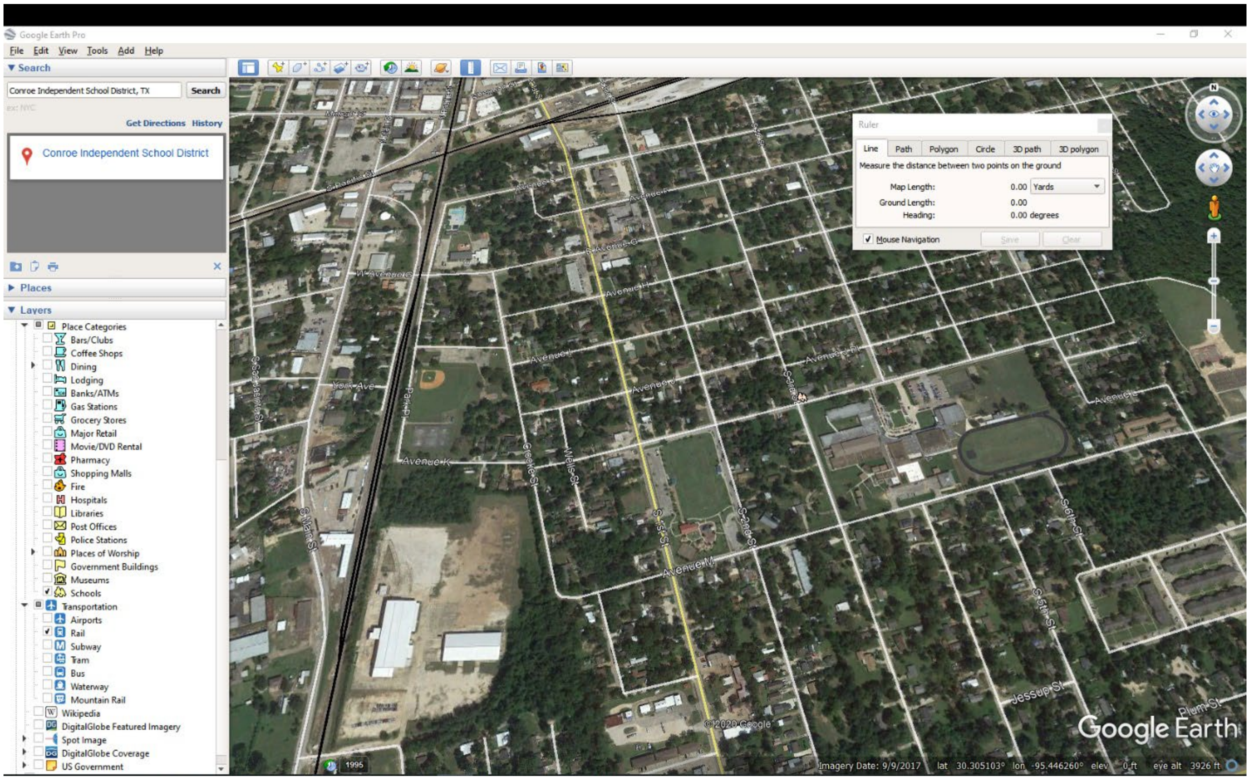
10. According to state law, a district must have a derailment/hazmat plan if any district facility "is located within 1,000 yards of a railroad track, as measured from any point on the school's real property boundary line." NOTE: Facility can include bus yards and athletic fields.

    Using the map to find the distance between railroads and property lines, locate a school near a rail line (dark black line on the map). Scroll the wheel on your mouse to zoom in until you can see both the school and the rail line, and they take up most of the screen. In the following example, you can see a junior high school on the right (the football field and track) and the rail line on the left. This image is the same school seen in the broader picture above.

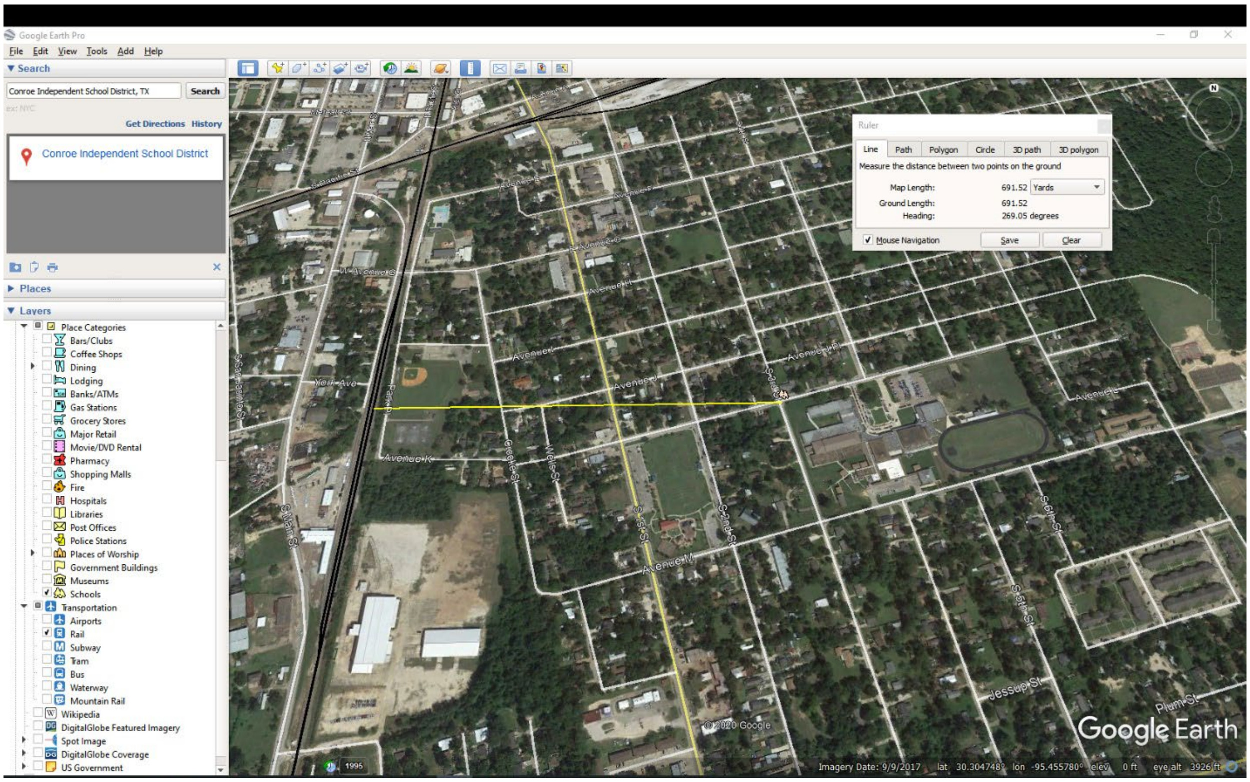


11. Now, go to the top row of icons on your screen and select the one that looks like a small ruler (circled in red on the previous image). A window will appear on your screen. If it blocks your view, move the mouse until it turns into a standard pointer inside the top blank area of the box. Click and hold the left mouse button and move the window out of your way to where you can still see it.

12. Next to the line "Map Length 0.00," there is a pull-down menu. Click on it and select "Yards" as the unit of measure. You should now have something that looks like this:



13. Now, move your mouse until the small square aiming box is on a point on the school's property line closest to the rail line. Left-click the mouse once and then move the box to the nearest point of the closest rail line. As you move, a yellow line should appear. When you reach the rail line (dark black line), left-click again, once. The box labeled "Ruler" should show the approximate distance between the two points you selected. As you can see from the following example, the school in question is within the 1000-yard zone, and the district requires a train derailment plan under state law:



14. The Federal Railroad Administration (FRA) has a website that can assist in determining railroad operators at https://fragis.fra.dot.gov/gisfrasafety/. Alternately, you may consult the TxDOT mapping tool at http://gis-txdot.opendata.arcgis.com/datasets/texas-railroads.

APPENDIX B—EVALUATE DISTANCE TO ACTIVE PIPELINES

Method

This guide uses the National Pipeline Mapping System (NPMS) website to extract information about pipelines.

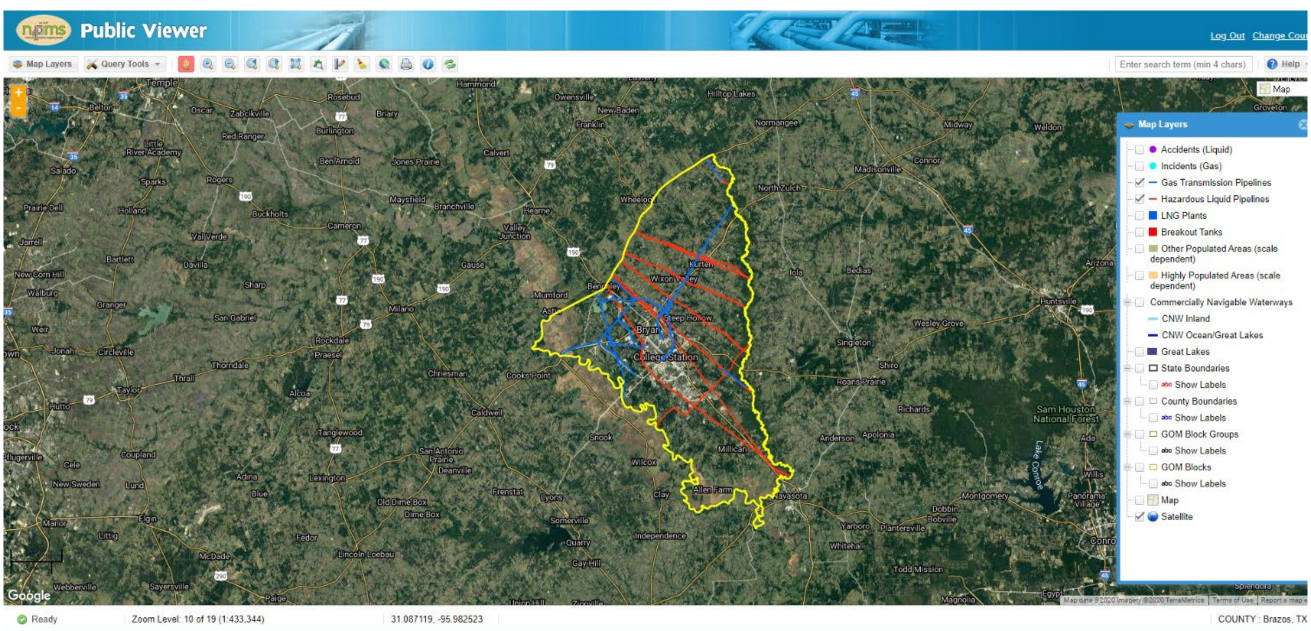
Alternatives

Districts can also:

- Find additional information on pipeline hazards using the TxSSC “Pipeline Safety Toolkit” at https://txssc.txstate.edu/tools/pipeline-safety/.
- Use the Texas Railroad Commission Public GIS Viewer at https://www.rrc.texas.gov/resource-center/research/gis-viewer/. It provides more information but requires a steeper learning curve to operate and interpret.
- Contact their regional Texas Railroad Commission Pipeline Safety office for assistance. A complete contact list is available at https://www.rrc.texas.gov/about-us/locations/#PSLocations.

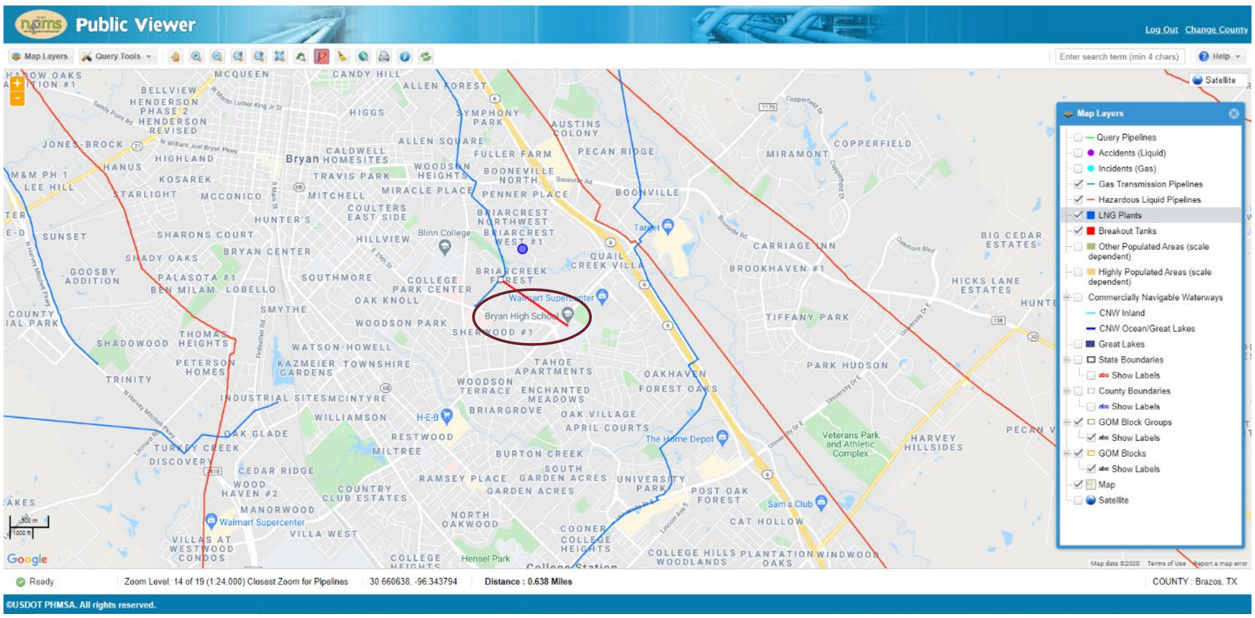
Instructions

1. Go to the NPMS Public Viewer. Enter Texas (for the state) and the county of your school or community college district - for districts spanning multiple counties, repeat this process for each county.
2. This search will take you to a window that looks like the following (for Brazos County, Texas):



3. Click on the “Gas Transmission Pipelines” and the “Hazardous Liquid Pipelines” under “Map Layers” if not checked already.
4. On the top left side of the screen, click on the “Query Tools” pulldown menu. Select “Query Pipelines.”
5. In the window that opens, click “Specific Statuses” and “Click Here to Select Values.”
6. In the next window, click “Active (Filled)” and “Active (Unfilled).” Then click OK.
7. At the bottom of the “Query Pipelines” window, click the box next to “Also Display Attributes in a Table.” Click OK.
8. The system will ask if you want to zoom in. Click OK.
9. A window should appear with a lot of information in a spreadsheet. There is a small downward-pointing arrow on the bottom of the screen with a line under it, located in the bottom middle. Click on this arrow to open a window on your computer, asking where you want to save the file. Select your location.
10. Close the data window and return to the map. Click on the box next to “Map” (rather than “Satellite”). Zoom in to Level 14 of the view (any closer, and the pipelines will disappear). The zoom level is in the bottom left of the window.
11. Here you should locate some schools in the Google database (larger schools only, mainly high schools and colleges). For elementary and middle schools, you must zoom in to level 13 (the pipelines will disappear), locate the school, remember its location, and then zoom back out to level 14 and locate where it would be if you could still see it.
12. From here, the process is like that used for rail lines. On the top ribbon bar in the viewer are a series of icons. Click on the small ruler and pencil icon next to an icon with a brush, sixth from the left. That should turn an orange color.

13. Move your cursor onto the map. Here you can measure (roughly) the distance between a school and a pipeline displayed on the map. Click on the school and then move toward the pipeline. The distance will appear on the bottom of the viewer, as shown as follows. To stop measuring, right-click your mouse. In the example that follows, Bryan High School is about 0.6 miles (1,100 yards) from the nearest gas pipeline. While this is more than 1,000 yards, it is close, and the system's measurement accuracy is rough, so it is a borderline case.



14. To identify the pipeline, right-click on it. A small window that says "Identify" should appear. Move your mouse until the finger points at "Identify," and another window appears with a portion of the map legend. Since the pipeline, in this case, is blue, select "Gas Pipelines" (for red lines, select "Hazardous Liquid Pipelines"). Left-clicking on the pipeline type will open a data window that identifies the pipeline and corresponds to an entry on the spreadsheet you downloaded earlier. In this case, the information notes the operator's name and that the line is an active and filled subsystem natural gas pipeline.

APPENDIX C—ASSESS ROADWAY HAZMAT TRANSPORT HAZARDS

For schools more than 1,000 meters from an hazmat facility, rail line, or pipeline, the most significant off-site hazard is likely from roadway transportation of hazardous materials. The overwhelming majority of reported hazardous materials incidents in the United States involve roadway transport.[24] Most hazardous materials transportation incidents involve roadway transportation accidents or accidents during the loading/unloading (transfer) of hazardous materials to or from road or rail transportation tankers. Unfortunately, hazards from road-borne hazardous materials shipments are also some of the most difficult to quantify. Because hazardous materials shipments can transit nearly any road and are the most diverse, evaluating which roads pose a threat to schools is sometimes challenging.

Appendix E lists the different classes and divisions of hazardous materials. The largest share, by hazard class, of hazardous materials transported on most roadways in the United States, are Class 3 flammable liquids (correspondingly, they are also the largest share of accidents by hazard class). Class 3 flammable shipments are not exclusive to major roadways, either. Every community has Class 3 shipments of fuel to and from filling stations daily. Crude oil (another Class 3 flammable liquid) transits many county and local roads across Texas, traveling in trucks to and from wellheads and temporary storage tanks.

Of course, roadway hazardous material transit varies from location to location. Fuels like diesel, gasoline, and crude oil from wellheads and LPG, a Class 2.1 flammable gas, are common on many local roads and in neighborhoods near schools and away from major roadways.[25] Class 8 materials (corrosive liquids) are also common on roadways and include hydrochloric and sulfuric acid. Depending on local industry, traffic patterns, and other activities, other types of hazardous materials may transit local roadways.[26] A Hazardous Materials Commodity Flow Study can help identify specific hazards on a local level.

Method

Assessing potential school district exposure to hazmat transported by roadways involves evaluating multiple sources of information, some of which only provide a generalized idea of hazards. The most accurate way of evaluating roadway hazmat transportation is a Hazardous Materials Commodity Flow Study conducted on roadways adjacent to school properties. Such studies can range from simple to complex and only capture a snapshot of the hazmat transported

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[24] Source: U.S. Department of Transportation, Bureau of Transportation Statistics. "Hazardous Materials Fatalities, Injuries, Accidents, and Property Damage Data." https://www.bts.gov/content/hazardous-materials-fatalities-injuries-accidents-and-property-damage-data.

[25] The reason Class 3 and Class 2.1 shipments tend to travel more along local and neighborhood roads is simple: these shipments are those most likely to travel to local filling stations and homes and businesses with LPG tanks located in such areas. Most other large shipments of hazardous materials follow major roadways and more direct routes to and from industry, which tends to concentrate in certain areas due to zoning and access to transportation networks like roads, rail, and waterways. Class 3 and Class 2.1 shipments may transit through local roads and neighborhoods as part of delivery routes that take them through areas not visited by other hazardous materials.

[26] Class 8 corrosive liquid shipments are the second most common, with hydrochloric acid being one of the more commonly shipped chemicals that poses particular hazards in many communities.

by road during the observation period. Although not complete, this information can help reduce uncertainty about the types and frequencies of hazmat transport in the area. The following provides an overview of methods districts can use to collaborate with local emergency management and their LEPC to assess district property exposures to roadway hazmat in a general sense.

Sources of Roadway Hazmat Transport Information

The following sources are the most accessible to school districts. These sources can provide information necessary to assess roadway hazmat transportation activity. They appear in the order of detail provided.

- Hazardous Materials Commodity Flow Studies.
- Locally maintained accident report histories.
- The TCEQ Petroleum Storage Tanks (PST) Viewer[27] and the Texas Railroad Commission Public GIS Viewer.[28]
- Map surveys.

Hazardous Materials Commodity Flow Studies

Hazardous Materials Commodity Flow Studies collect data on designated roadways and at critical intersections to determine commercial vehicle traffic and identify the hazardous materials transported. Communities throughout Texas can conduct such studies via their LEPC and grant funding administered by TDEM as part of the PHMSA HMEP grant program.[29] Communities and counties may have previous studies. Districts can discuss such reports with local emergency management organizations or their LEPC. If no studies are available or available studies are out of date, districts may wish to work with local emergency management to conduct a new one.

Locally Maintained Accident Report Histories

Some jurisdictions may maintain histories of previous hazardous materials transportation incidents. Discuss such histories with local emergency management and local fire departments. Alternately, the PHMSA maintains a database of past reports. However, that information is problematic due to its self-reported nature.[30] However, the PHMSA database may assist in identifying locations where hazardous materials facilities generate hazardous materials transportation activity not covered in Tier-II facility reports. Districts should collaborate with experts and local emergency management agencies or their LEPC when evaluating such reports.

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[27] Available at: Texas Commission on Environmental Quality. "Petroleum Storage Tanks (PST) Viewer." https://www.tceq.texas.gov/gis/petroleum-storage-tanks-pst-viewer.
[28] Available at: Texas Railroad Commission. "Public GIS Viewer." https://www.rrc.texas.gov/resource-center/research/gis-viewer/.
[29] See: Texas Division of Emergency Management. "Technological Hazards." https://tdem.texas.gov/technological-hazards/#1565810893006-1337138d-8b19.
[30] See: Pipeline and Hazardous Materials Safety Administration. "Incident Statistics." https://www.phmsa.dot.gov/hazmat-program-management-data-and-statistics/data-operations/incident-statistics.

Petroleum Storage Tanks Viewer and Public GIS Viewer

In Texas, TCEQ licenses and inspects petroleum-product underground storage tanks (USTs). Many of these tanks are at filling stations or vehicle yards. Locating such tanks using the TCEQ PST Viewer is relatively easy. This tool can assist districts in identifying routes with likely Class 3 flammable hazards from fuel trucks transiting local roads to and from such locations to deliver fuel. Instructions for using the TCEQ PST Viewer appear later in this appendix.

Unfortunately, there is no easy access viewer of aboveground bulk storage tanks in Texas. Active oil wells and industrial facilities may possess such tanks on-site that, while registered, licensed, or inspected, may not require reporting to local authorities or appear in databases accessible to the public. In particular, oil and gas activity generates hazardous materials roadway traffic associated with such tanks, both permanent and temporary, at wellheads and drilling sites.

The Texas Railroad Commission Public GIS Viewer can aid districts in locating active wells, pipelines, and other facilities regulated by the Texas Railroad Commission. However, the viewer and the data it provides are complex. The viewer includes historical data and no-longer-active plugged wells that can make hazard identification difficult. Consequently, the information provided by the Texas Railroad Commission is challenging to interpret for untrained or unfamiliar users. Districts may wish to consult with community experts or local planning departments to aid in interpreting such information. Such an examination can yield clues about oil- and gas-associated hazardous materials roadway traffic despite the difficulty.

Map Surveys

The simplest and quickest way to evaluate hazmat transportation locations is through a basic map survey. The drawback is that it relies on limited data and the judgment of the person doing the survey. Still, for some districts, it will be the primary means by which they evaluate their hazardous materials transportation hazard exposure. Generally speaking, major highways (interstates and U.S. highways) have more commercial and hazmat vehicles than state highways and farm-to-market roads, which have more traffic than local roads. However, this can vary widely by location. Even local roadways in some industrial areas have significant hazmat commercial traffic, as can county and farm-to-market roads in oil field areas. Roadway hazardous materials transportation can occur on any road, even roadways designated as no-hazmat routes.

The best way to do a map survey of roadway hazards is to integrate it into your evaluation of known fixed-hazmat sites. Use tools like the TCEQ PST Viewer to identify underground storage tanks that generate Class 3 flammable traffic and the locations of Tier II facilities in relation to major roadways. More advanced viewers like the Texas Railroad Commission Public GIS Viewer can provide clues about oil and gas activity. Once you know places where hazardous materials traffic travels to and from, you can trace the likely routes vehicles will take to and from those sites to major roadways.

If there are **filling stations** on the same street as a school in an urban area, Class 3 flammable liquid fuel trucks likely pass the school to and from those stations.

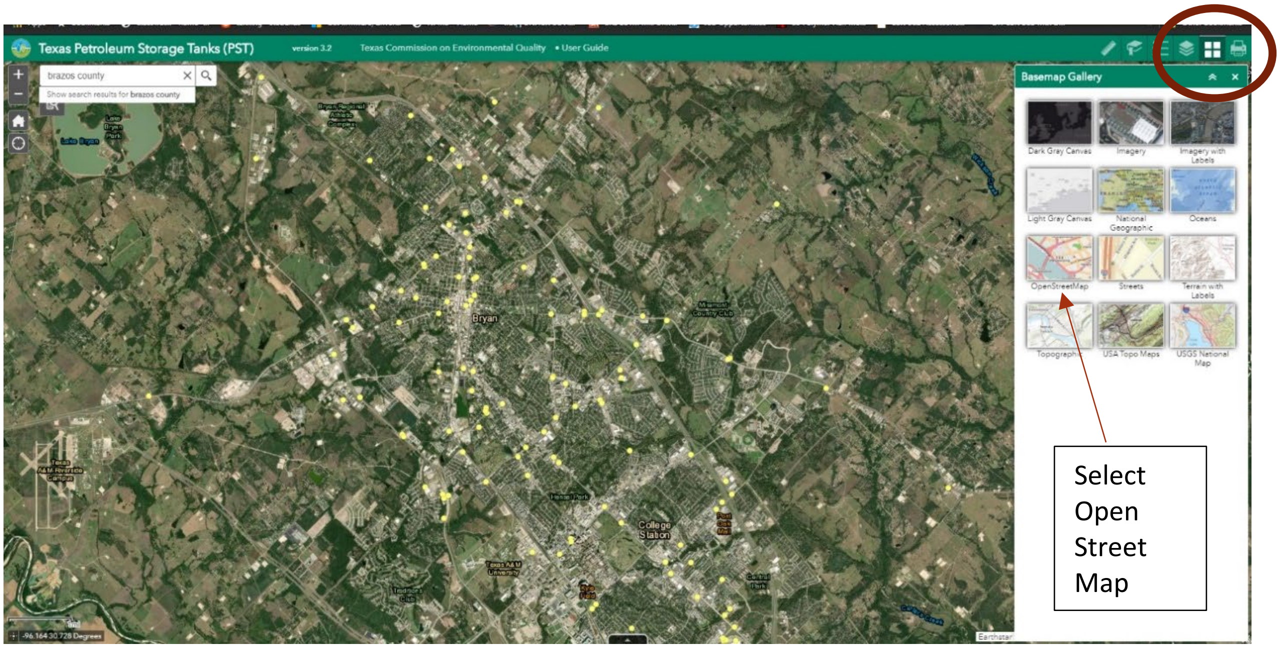
For example, if you know there are filling stations on the same street as a school in an urban area on both sides of the school, Class 3 fuel trucks likely pass the school to and from those stations. Their delivery schedule depends on the filling station. For example, a small, isolated filling station might take fuel delivery irregularly, weekly, or monthly. In contrast, a large, busy convenience center near a significant roadway like an interstate might take delivery of fuel once a day or even more than once a day. The TCEQ PST Viewer will also show USTs at UPS or FedEx centers that maintain vehicle fleets. The bus company or the school-district-owned bus yard will likely also have such a tank and appear in the viewer. These facilities, because of fleet fuel consumption, have large USTs but also require regular re-supply. An example appears in the following instructions.

Instructions for the TCEQ PST Viewer

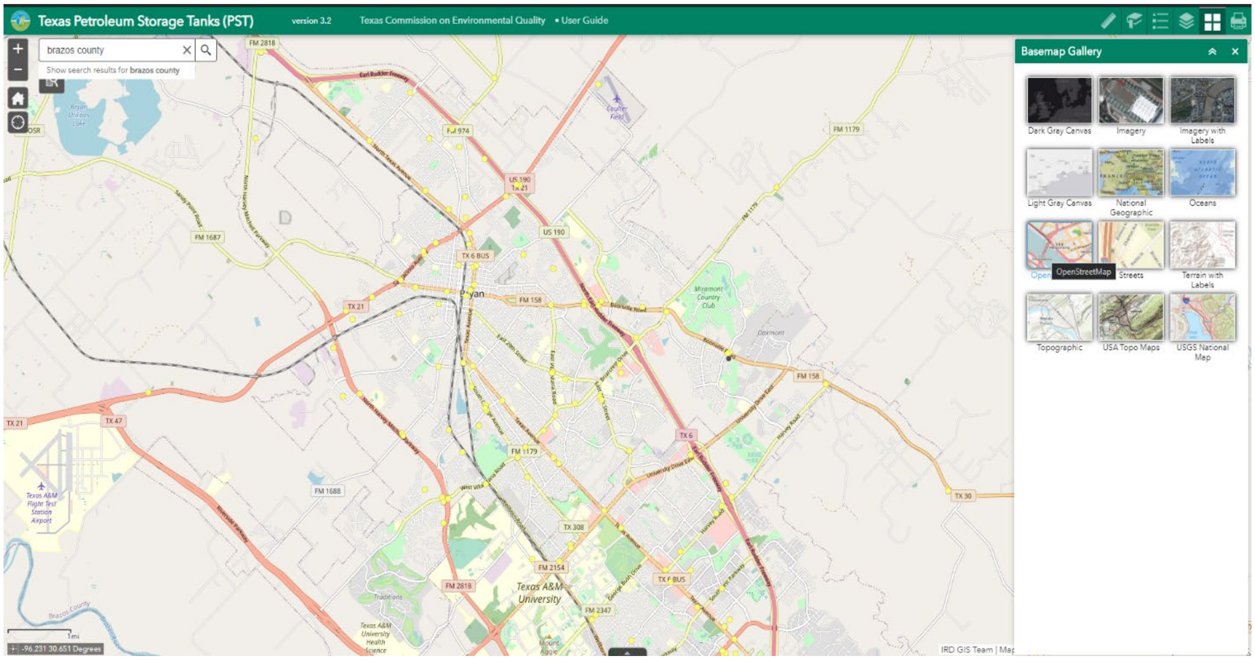
The TCEQ PST Viewer is online at https://www.tceq.texas.gov/gis/petroleum-storage-tanks-pst-viewer. The website also includes a user guide and information on the data the viewer contains. The following are instructions to use the viewer:

1. To open the viewer, click on the large blue button labeled “Petroleum Storage Tanks Viewer.”
2. The viewer opens in a new window, showing a map of Texas with many yellow dots on it. In the top left corner of the viewer is a search bar. Here you can enter an address, county, or city, and the map will zoom in to that location. You can also zoom in manually using the + and – buttons or your mouse wheel.

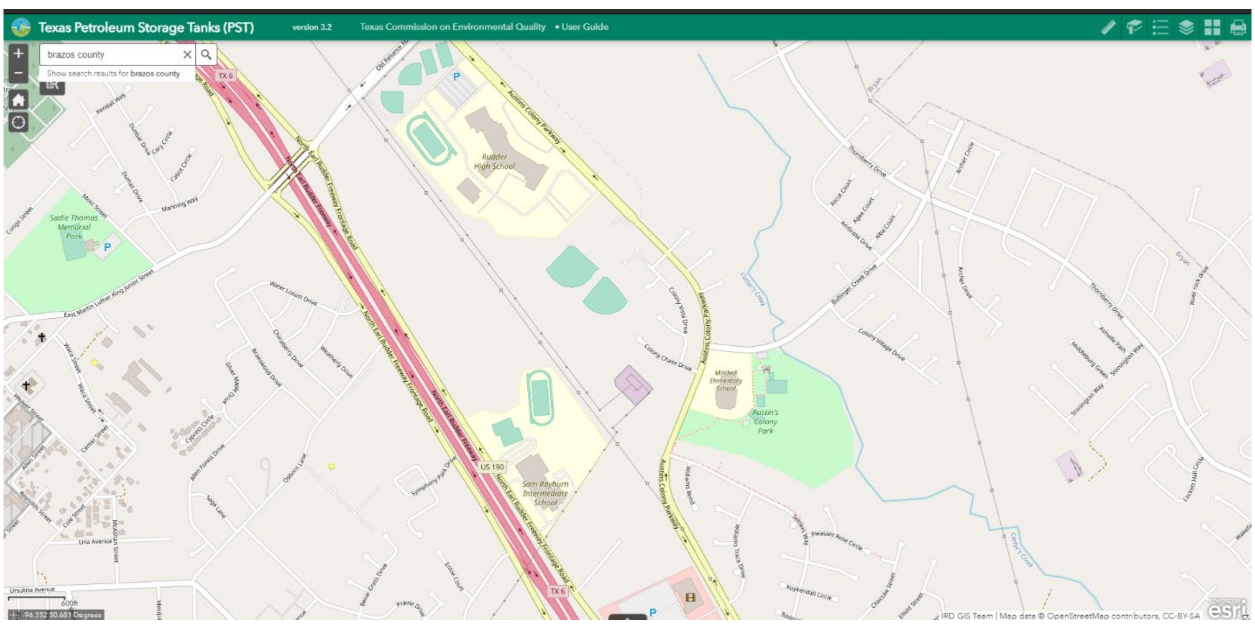
3. The viewer opens to a default satellite view. This view makes the yellow dots noting the location of licensed USTs more visible. However, it is difficult to find schools and other locations without reference labels of streets and other identifying information. To change this, you will need to change the base map. Do this by clicking on the four-square icon in the top right-hand corner of the screen, shown in the following screenshot, which opens the menu that lets you select a different base map. Click on the one labeled "Open Street Map" for the most information, shown in the following screenshot. You can always change the base map to a different view by clicking this menu.



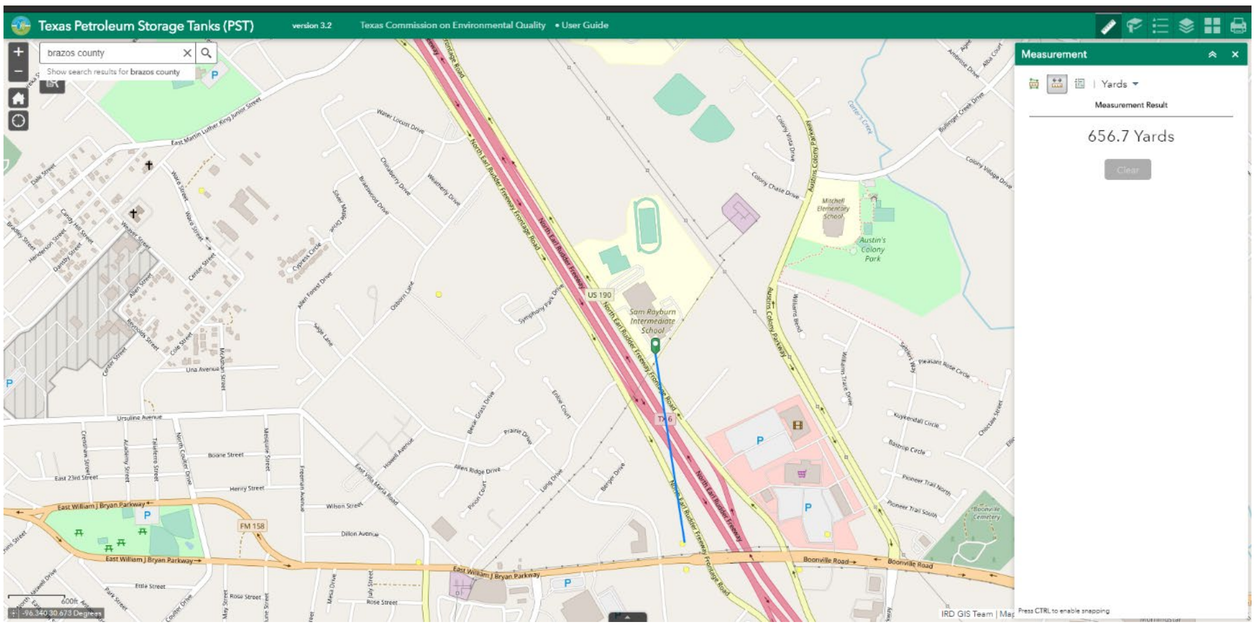
4. Clicking on Street Map will open a view that looks like this:



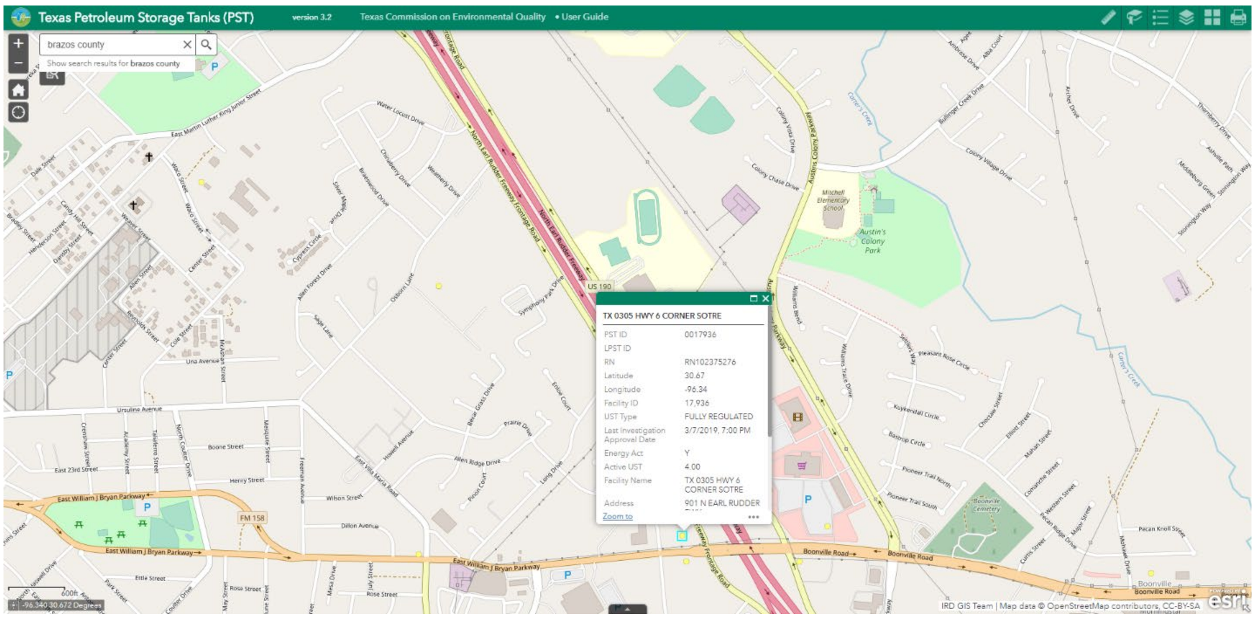
5. From here, you can locate your schools, either by searching for them in the search bar in the top left or zooming in.

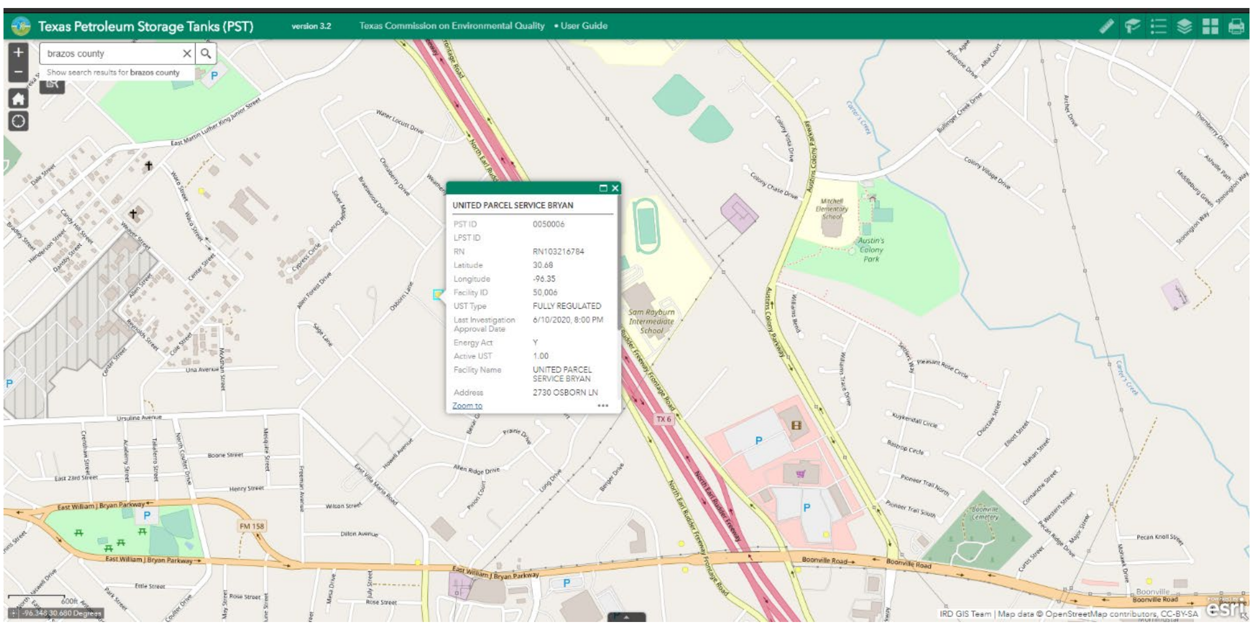


6. While a few UST sites are visible in the closer-in view, if we zoom out a little, we see many more within 1,000 to 1,500 yards of this complex of three schools, which border a major roadway. Click the small ruler in the top right corner and select the “Distance” tool to measure distances. Change the measurement to yards. Using this tool, you can see that several of these stations are within 1,000 yards of property lines, while others are further distant, about 1,500 or more yards.



7. Clicking on the yellow dots noting the location of licensed USTs provides additional information. In this case, the majority are filling stations. Across the highway, a UPS distribution facility has a UST for its fleet of vehicles. Using this information, you can predict a high level of Class 3 flammable liquid traffic, primarily gasoline and diesel fuel, along both the freeway and at the exits north and south of the schools visible in this example. Much of this will pass relatively close to the visible schools, well within the 800-meter isolation zone for a large Class 3 flammable spill involving fire.

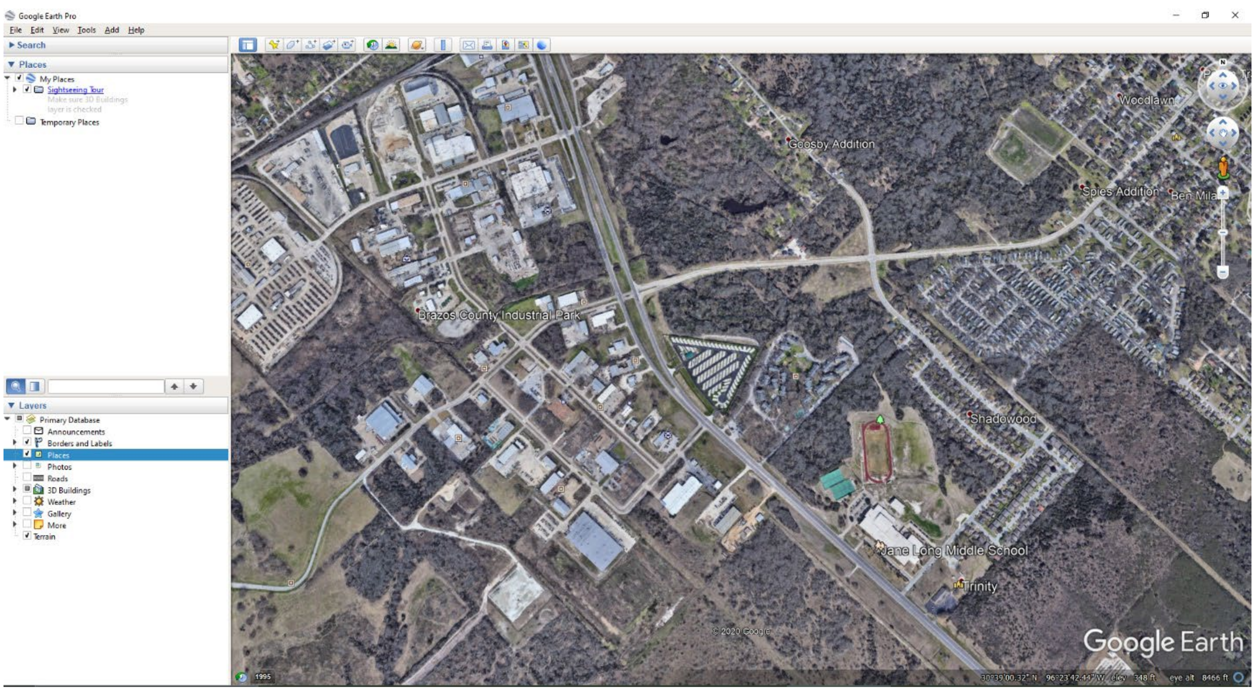




Instructions for Google Earth for General Map Surveys

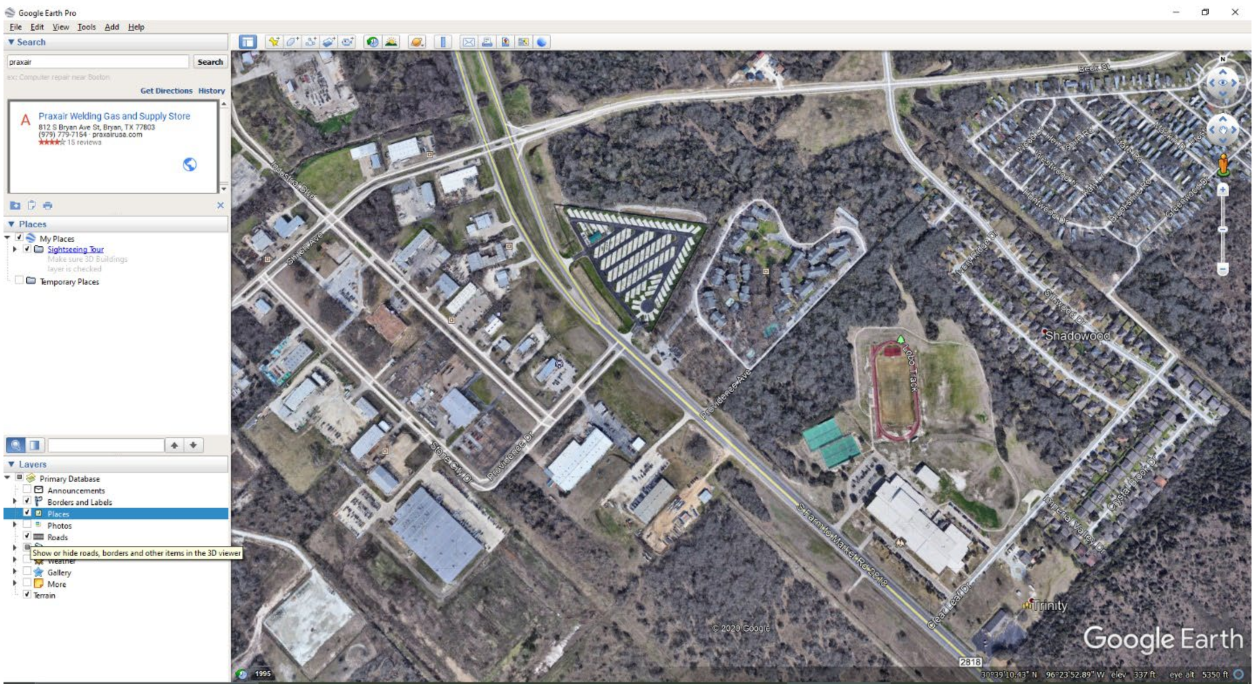
Google Earth contains valuable information for map surveys to determine roads that hazardous materials traffic may transit. Additionally, importing KML files of Tier II facilities provided by an LEPC or local emergency management will show the locations of such facilities. It is possible to identify possible routes without such information, as shown in the following example. As with other methods, it is best to conduct such surveys in collaboration with local responders, emergency management, and the LEPC, all of which can provide additional information and insight regarding identified hazards and routing.

1. After opening Google Earth Pro, zoom in to a school, as shown in the example:

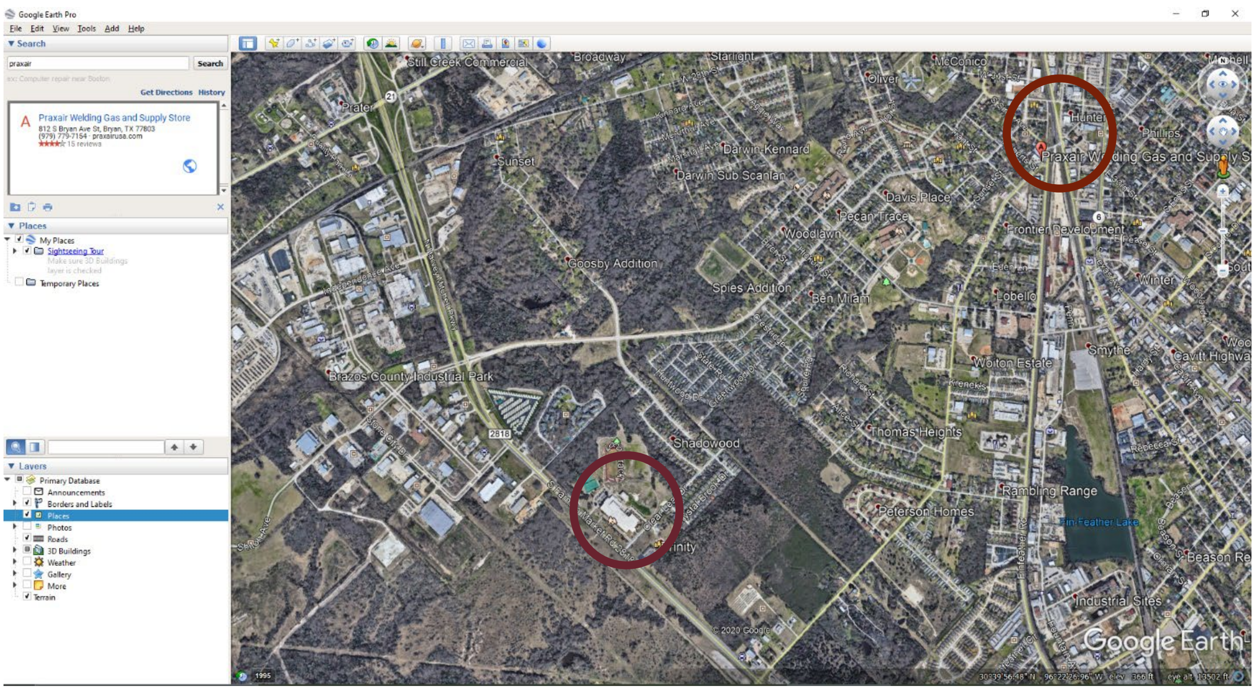


2. Without any further analysis, we can see that this school is near an industrial park. Such sites are likely to generate hazardous-materials-related traffic even if they do not have Tier II facilities.

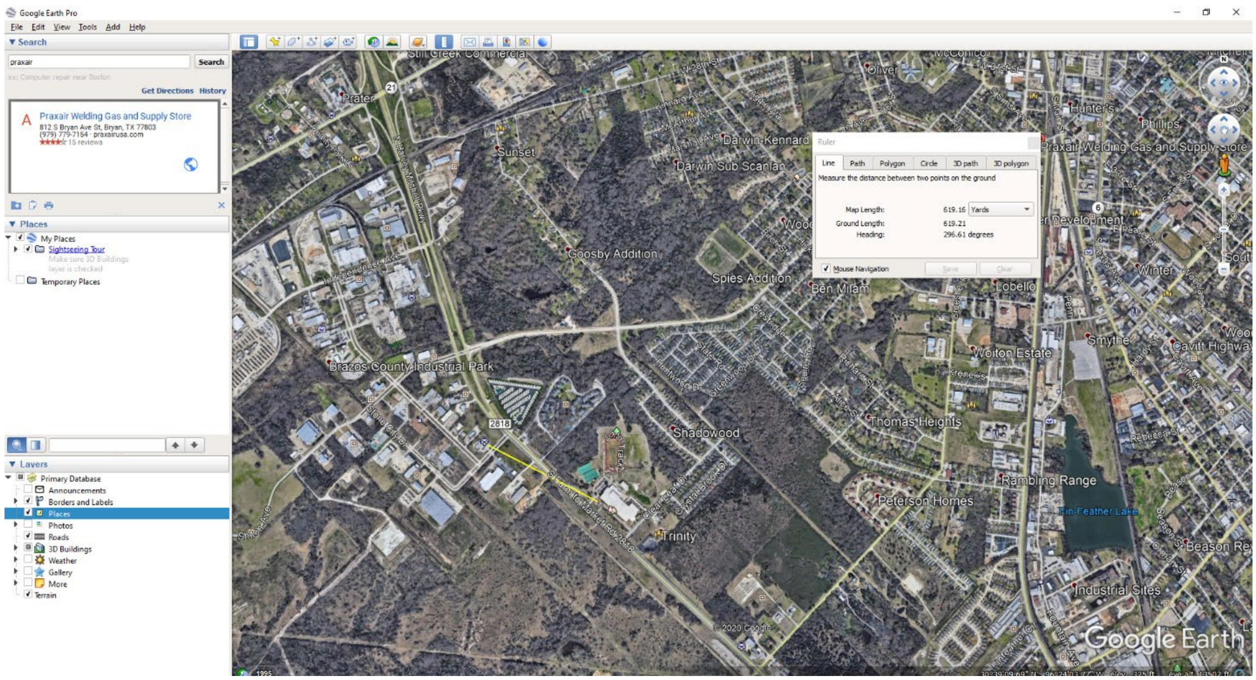
3. Turning on the roads in the menu on the bottom left of the map viewer identifies the visible roads.



4. Several of the facilities in the park have additional identification information visible in the viewer if selected. Using that information and basic internet searches, we can identify some of the businesses. In this example, we can determine that the industrial park includes several beverage distributors, body shops, and metal fabrication shops. Distributors use large quantities of carbon dioxide, while body shops and metal fabricators use welding gases. Both generate associated hazmat traffic along the major roadways shown passing near the school. We can expand this basic search further. For example, searching for welding supply yields a Praxair welding gas distributor to the northeast of this view. Tracing routes from there to the industrial park provides clues about where this traffic might occur.



5. Using the measurement tool, we can measure the distances to some of these businesses and the roadways, as we did for railroads.



APPENDIX D—ASSESS HAZARDS FROM INDUSTRIAL, STORAGE, OIL/GAS, AND OTHER HAZARDOUS MATERIALS

Assessing facility hazards is a complicated task. If possible, district officials should work with local emergency management and response experts to assess proximity and the type of facility hazards to district properties. LEPCs and local emergency management and responders have access to electronic versions of reports and software tools like CAMEO that make the hazard assessment process more accessible and comprehensive. This appendix provides a simplified version that allows districts to identify facility hazards based on available information without much external assistance. It is not a comprehensive evaluation capable of identifying all potential hazardous materials facility hazards in the vicinity of schools. Consult local emergency management, the LEPC, fire departments, and facility operators for more comprehensive information about facility hazards.

Sources of Information

School districts have two primary sources of information about hazardous materials facilities in the vicinity of their schools and district property:

- LEPCs.
- TCEQ.

LEPCs

LEPCs, mandated by the EPCRA, maintain reports from local facilities subject to regulation under the act. These reports, known as Tier II reports, provide emergency planners and the public information about hazardous chemicals present above specific quantities in their communities.

The EPCRA regulations do not cover all chemicals, only a specific set of especially hazardous substances stored, used, or produced above specific quantities in a set period. In Texas, the Tier II reports also cover ammonium nitrate facilities (these do not fall under federal regulations). For communities where the LEPC is inactive, the county judge or county emergency management organization should have Tier II information and provide it on request. Under EPCRA, the LEPC must provide the information. Where LEPCs are inactive, the county judge or local emergency manager usually acts in the place of the LEPC. Alternatively, you can ask your local fire department.

TCEQ

The second source of information is the TCEQ Open Data Access portal map of PST Viewer. This system is online and allows districts and the public to locate PSTs licensed and inspected by TCEQ. This tool allows districts to quickly locate USTs for petroleum-based products in the vicinity of schools, including filling stations likely to generate Class 3 hazardous materials shipments of fuel on adjacent roadways. Storage tanks within 800 meters (1/2 mile) of schools may pose fire/explosive threats to school property in an incident involving fire.

Tier II Reports

Figure 2: Many types of facilities manufacture, store, or use hazardous materials. Your LEPC and Fire Department can help you identify which facilities are near your district properties. (Source: Shutterstock)

Tier II reports can seem like complicated documents. Depending on the community, different rules regarding access and distribution also apply. Fortunately, to plan for school districts, basic information will suffice in most cases. Such information appears at the beginning of Tier II reports. If you are collaborating with a community LEPC or emergency manager, they can extract the information for you.

Specifically, the assessment should account for the Tier II facilities in the area covered by the district. For some districts, this may involve coordination with multiple LEPCs and their communities. Local emergency management can obtain electronic access to Tier II reports to import the data into the CAMEO suite of tools. Districts using CAMEO or collaborating with community partners to use CAMEO will find the process significantly simplified.

The specific Tier II information needed to conduct a basic assessment of hazard locations is as follows:

- Name and address of the facility and its reported latitude and longitude.
- Emergency contact/24-hour telephone number.
- The North American Industry Classification System (NAICS) number of the company (an identifier of the type of business).
- Is the “Yes” block checked for the company requiring chemical accident prevention under Section 112(r) of the Clean Air Act (40 CFR part 68, Risk Management Program)?

The remainder of Tier II reports contains a list of chemicals and related information. This section requires some level of knowledge and training to assess appropriately. The following is only a general guide for minimum hazard assessments. For a more comprehensive analysis, seek expert assistance.

- Using the address and latitude/longitude information provided in Tier II reports, identify schools near Tier II facilities using Google Earth.
  - Emergency managers, LEPCs, and some fire departments can export Tier II information electronically into a spreadsheet. The latitude and longitude provided are simple to convert to a KML file you can import into Google Earth (search for solutions on the internet). Your LEPC/local emergency management might also provide you with a ready-made KML file on request.
  - Alternately, if you have a limited number of Tier II facilities, you can find them one by one on Google Earth.

    - Either way, if using Google Earth, the process is the same as used for railroads to measure distances to schools (see Appendix A).

- If the Tier II report does not identify a business type, use the reported NAICS number to identify the type of facility for each business (use https://www.naics.com/search/ to identify codes).
    - Business types may provide clues about the facility's hazards and aid in identifying ammonium nitrate facilities or other facilities with particular risks.
- The highest-hazard facilities reporting Tier II information will have "Yes" checked for "RMP," noting that the facility is subject to the RMP requirements under "Chemical Accident Prevention," Section 112(r) of the Clean Air Act (40 CFR part 68, Risk Management Program). These facilities must create special plans and procedures to reduce accident risks and coordinate plans and exercises with local agencies and responders.

Finally, look at the list of reported chemicals:

- Does the list include ammonium nitrate or other fertilizer products? These facilities may pose significant explosive hazards in the event of a fire.[31]
- Are any of the facilities subject to the Risk Management Program (RMP) or use extremely harazdous substances? If so, they manufacture, store, use, or process chemicals of elevated concern.
- Consult with experts, like the LEPC, on the risks of other chemicals listed.

School districts should seek outside assistance from the LEPC, fire department, or other experts to conduct a more in-depth assessment of facility hazards and their proximity to district properties.

[31] Texas required certain facilities to report fertilizers like ammonium nitrate via the Tier II reporting system following the 2013 disaster in West, Texas. This requirement applies only in Texas. Chemical reporting requirements for Tier II reports is otherwise governed by federal regulation under EPCRA (part of the Superfund Amendments and Reauthorization Act or SARA).

APPENDIX E—CLASSIFYING AND IDENTIFYING HAZARDOUS MATERIALS

Classes

Due to the extensive number of potentially hazardous and dangerous substances, DOT regulations establish various classification methods for hazardous materials, which form the underlying basis for the information in the *ERG*. One of the more common methods of hazmat classification is by hazard class. The hazard classes correspond to standardized placards or warning labels when shipping the materials or found on material containers. The nine hazard classes, with several divisions under some of the classes, are:

- Class 1—explosives:
  - Division 1.1—explosives that have a mass explosion hazard.
  - Division 1.2—explosives that have a projection hazard but not a mass explosion hazard.
  - Division 1.3—explosives with a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.
  - Division 1.4—explosives that present no significant hazard.
  - Division 1.5—very insensitive explosives that have a mass explosion hazard.
  - Division 1.6—extremely insensitive articles that do not have a mass explosion hazard.
- Class 2—gases:
  - Division 2.1—flammable gases.
  - Division 2.2—nonflammable, non-toxic* gases.
  - Division 2.3—toxic* gases.
- Class 3—flammable liquids (and combustible liquids [U.S.]).
- Class 4—flammable solids; substances liable to spontaneous combustion; substances that, on contact with water, emit flammable gases:
  - Division 4.1—flammable solids, self-reactive substances, and solid desensitized explosives.
  - Division 4.2—substances liable to spontaneous combustion.
  - Division 4.3—substances that, in contact with water, emit flammable gases.
- Class 5—oxidizing substances and organic peroxides:
  - Division 5.1—oxidizing substances.
  - Division 5.2—organic peroxides.
- Class 6—toxic* substances and infectious substances:
  - Division 6.1—toxic* substances.
  - Division 6.2—infectious substances.
- Class 7—radioactive materials.

- Class 8—corrosive substances.
- Class 9—miscellaneous hazardous materials/dangerous goods and articles.

* The word *toxic* is synonymous with the words *poison* and *poisonous*.

UN/NA Identifier

In addition to belonging to one or more of the hazard classes, hazardous materials also have United Nations or North American Identification Numbers (UN/NA ID). These numbers appear either as part of the hazard class placard or separately on an orange rectangular sticker or sign affixed to the truck, railcar, or other containers during shipping (Figure 7). The PHMSA *ERG* explains these markings, shows examples and explains how to use them and other markings/information. The *ERG* also explains how to use the guidebook in its first 27 pages. Users should read and familiarize themselves with the *ERG* and those pages before using the guidebook in an emergency.

Figure 3. Class 3 Flammable Liquid Hazard Placard Showing UNID 1993 (for Various Flammable Liquids).

CAS Registry Number

Most chemical substances described in the open scientific literature have a Chemical Abstracts Service (CAS) registry number. The CAS number appears on shipping documents and SDS. Several databases also contain CAS numbers, including the CAMEO chemicals database.[32] For example, the insecticide parathion has a CAS number of 56-38-2. If known, CAS numbers can help locate the SDS. Simply enter “CAS” followed by the number in a search engine, and in most cases, the top results will include the relevant SDS. The U.S. National Library of Medicine, part of the National Institutes of Health, also maintains the ChemIDplus database that allows searches of chemicals by name or number.[33]

32 See: National Oceanic and Atmospheric Administration. CAMEO Chemicals. https://cameochemicals.noaa.gov/.
33 See: U.S. National Library of Medicine. ChemIDplus Lite. https://chem.nlm.nih.gov/chemidplus/chemidlite.jsp.