HAZMAT HQ
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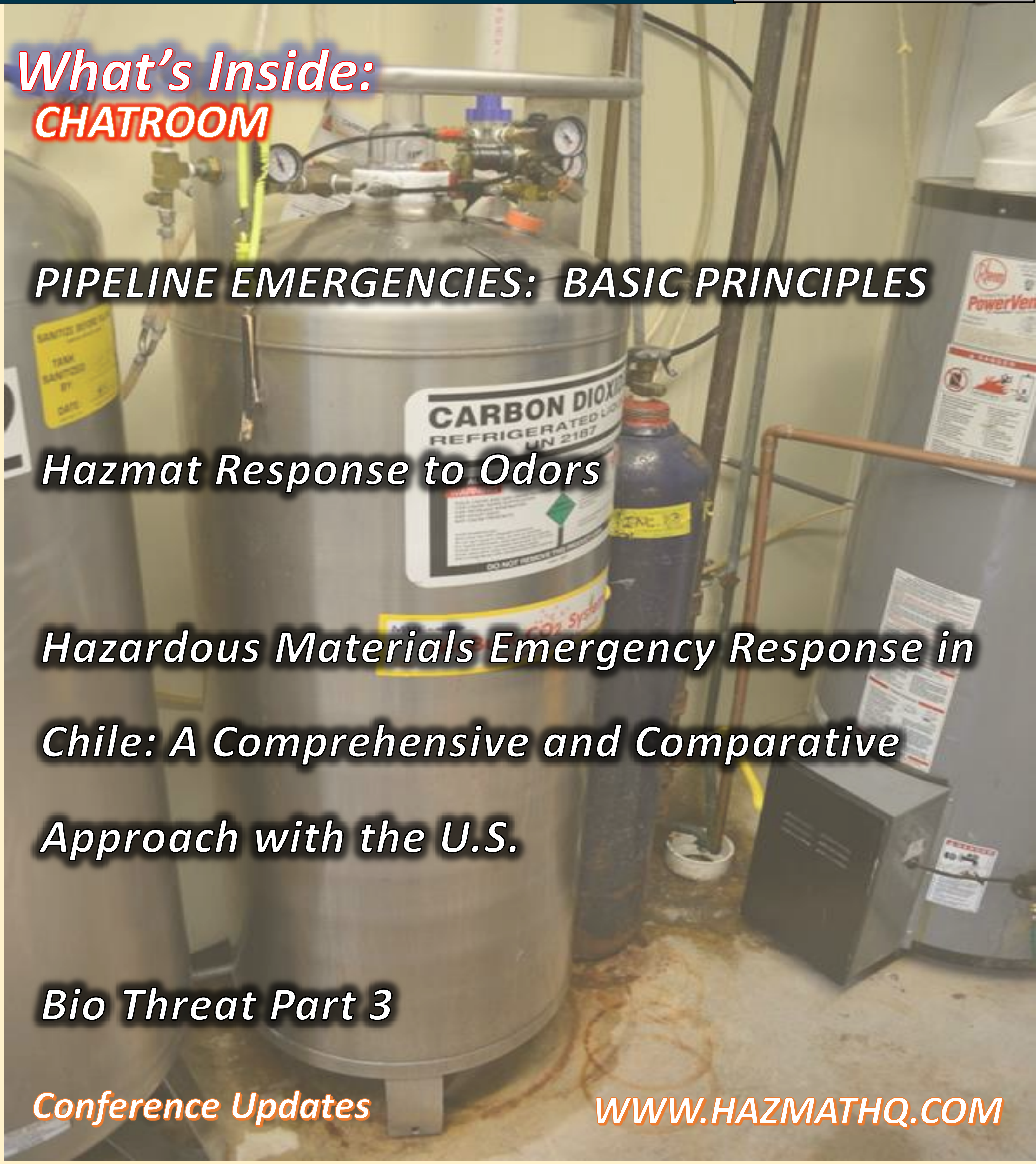

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CHATROOM – Around the U.S.

Here are five notable hazmat incidents from the last month, along with the lessons learned from each:

1. Chemical Fire in Akron, Ohio (September 2024)

A fire at the SMB Products plant in Akron resulted in the evacuation of 10,000 residents. The fire involved chemicals such as methanol and xylene, creating toxic smoke and explosion risks. Emergency services, although well-equipped, struggled due to the scope of the fire, eventually running out of chemicals to suppress it.

Lessons Learned:

- Evacuations need to be ordered promptly. A two-hour delay exposed residents to hazardous fumes.

- Firefighters and hazmat responders should have a greater supply of suppressive chemicals and be ready for prolonged incidents.

- Community preparedness is critical; many families were unprepared for a chemical emergency.

2. Sodium Hydrosulfite Drum Reaction in Florida (September 2024)

A warehouse in Pasco County experienced a dangerous reaction in a drum containing sodium hydrosulfite. Due to moisture entering the drum, an exothermic reaction caused the chemical to overheat, threatening an explosion. The presence of nearby acetylene and hydrogen cylinders added to the complexity.

Lessons Learned:

- Using drones with thermal imaging can help monitor high-risk situations without endangering personnel.

- Continuous wind direction monitoring is vital in hazardous chemical releases.

- Research teams should directly interview facility owners and witnesses to gather crucial chemical information.

3. Butane Tanker Fire in Houston, Texas (August 2024)

A butane tanker exploded on a highway, causing a large-scale evacuation and road closure. Firefighters had to apply specialized foam to suppress the blaze. Fortunately, no one was seriously injured.

Lessons Learned:

- Foam suppression resources need to be on hand for dealing with flammable liquid fires.

- Effective evacuation plans prevented civilian casualties, underscoring the need for community-wide drills and hazmat awareness.

- Understanding the flammability of transported chemicals is crucial for responder readiness.

4. Railcar Chlorine Leak in Baton Rouge, Louisiana (August 2024)

A train derailment caused a chlorine gas release in a densely populated area. Emergency services swiftly evacuated over 2,000 people while containing the spill. There were reports of respiratory distress among nearby residents, but no fatalities occurred.

Lessons Learned:

- Rapid deployment of detection equipment is key to assessing the spread of airborne chemicals.

- Community notification systems must be swift and reliable to facilitate timely evacuations.

- Special protective equipment for both responders and residents can reduce the impact of toxic gas releases.

5. Industrial Acid Spill in Sacramento, California (September 2024)

A sulfuric acid spill at a chemical manufacturing plant forced a shelter-in-place order for nearby businesses. The acid was contained using absorbents, and decontamination procedures were conducted for those exposed to the fumes.

Lessons Learned:

- Immediate isolation of spills can prevent the spread of hazardous substances.

- Proper personal protective equipment (PPE) and decontamination resources are essential for minimizing health risks.

- Communication with nearby facilities is necessary for managing shelter-in-place protocols.

Each of these incidents reinforces the importance of preparedness, proper resource allocation, and swift response to minimize harm during hazardous material emergencies.


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PIPELINE EMERGENCIES: BASIC PRINCIPLES

By: Gregory G. Noll, CSP, CEM

Pipelines and piping systems are the safest and second largest hazmat transportation mode within the United States. While emergency responders are familiar with pipeline systems used for both intrastate and interstate transportation, pipelines are also used for transporting products between industrial facilities, transferring raw materials and finished products within oil, chemical and petrochemical facilities, and delivering liquid and gas fuels directly to the consumer.

From a design and construction viewpoint, all piping systems are based upon the following basic principles:

1. *A material is inserted or injected into a pipe.*

Although slurries may be transported in a pipeline, liquid and gas products are most common. Depending upon the product, the material may / may not be odorized. For example, natural gas liquids (NGL) in transmission pipelines are often not odorized, while odorant (mercaptan) will be injected at city gates or main line valves where natural gas enters the local distribution system.

2. *The product is moved from an origination point to a pre-specified destination.* The product is physically moved as a result of gravity, the pressure of the product, energy created through the use of pumps or compressor stations, or a combination of all of the above. In addition, various valves and manifolds may be used to control and direct the flow of the product.

3. *The product is ultimately removed from the pipeline at its destination point.* Depending upon

the type of pipeline and the location, the product may be transferred to another mode of transportation (e.g., marine, rail, highway), placed into a container for storage (e.g., tank, underground cavern, etc.), or used such as a fuel at an electric generation station.

Pipeline systems can be categorized into (1) gathering systems as found in both gas or liquid exploration and production operations, (2) transmission pipelines which are the "interstate highways" of the pipeline transportation systems, and (3) distribution systems which deliver the product to the end user. Distribution systems are managed by local distribution companies (LDC) for the movement of natural gas from the transmission system to the consumer.

Pipelines often cross over or under roads, waterways, and railroads. At each of these crossover locations, a marker should identify the pipeline right-of-way. Although its format and design may vary, pipeline markers are required to provide three critical information points: (1) the pipeline contents (e.g., natural gas, propane, refined products, etc.), (2) the pipeline operator, and (3) an emergency telephone number.

Keep in mind that multiple pipelines can be located in a common pipeline right-of-way, and there should be a separate pipeline marker for each pipeline. Pipeline markers will identify the approximate – not the exact – location of the pipeline within the right-of-way. While new pipeline construction will have a burial depth of at least 3 feet, the depth of established pipelines can vary depending upon factors such as erosion and the use of directional drilling.

The pipeline emergency telephone number goes to a pipeline control center (PCC), where an operator monitors pipeline operations and can initiate emergency shutdown procedures. It should be stressed that even when a ruptured pipeline is immediately shut down, product backflow may continue for several hours depending upon valve locations and topography until the product drains to the point of release.

Most gas pipelines are dedicated to one product (e.g., natural gas, butadiene, anhydrous ammonia). However, liquid petroleum transmission pipelines may carry several different petroleum products simultaneously, including refined products and natural gas liquids. Pipeline personnel normally refer to product flows in terms of "barrels" rather than gallons (*Note:* 1 barrel equals 42 gallons).

For liquid petroleum pipelines, there is usually no physical separator (e.g., sphere or pig) between different products. Rather, the products are allowed to “co-mingle.” This interface can range from a few barrels to several hundred, depending on the pipeline size and products involved. Verification of the shipment arrival is made by examining a sample of the incoming batch for color, appearance, and/or chemical characteristics.

Product flows through many transmission pipeline systems are monitored through a computerized pipeline SCADA System (Supervisory Control and Data Acquisition System). The exact injection date and time of the particular product into the pipeline is noted and its delivery date/time is projected. As the product gets close to its destination, a sensor in the line signals the arrival of the shipment. The SCADA System provides pipeline personnel with the ability to monitor pipeline flows and pressures (i.e., mass balance) and initiate emergency shutdown procedures in the event of a pipeline release.

What emergency responders should know about pipelines:

1. *The location of pipelines in your response area*. The National Pipeline Mapping System (https://www.npms.phmsa.dot.gov) is an excellent open-source tool for initially learning about certain types of liquid and gas transmission pipelines in a selected county. There is a Public Map Viewer which allows the general public to view maps of transmission pipelines and LNG plants. and a First Responder Map Viewer which is more refined information but requires PHMSA permission for access.
2. *The operator of the pipeline and their emergency contact numbers*.
3. *Product(s)being transported by the pipeline*.
4. *The shut-off valve locations, including pump stations*. This can help emergency responders to

determine how quickly the release can be isolated and will include both motor operated valves that can be controlled from the PCC, and manual valves that must be isolated by pipeline personnel. The spacing of valves and pump stations will vary depending upon the topography. Remember—emergency responders should NEVER attempt to isolate any pipeline valves on transmission or distribution pipelines unless under the direction of pipeline operations personnel.

5. *Emergency response measures* based upon the type of scenario (i.e., leak, puncture or rupture), the product involved (liquid vs. gas), fire vs. no fire scenario, and the type of pipeline (i.e., gathering, transmission or distribution system).

How would you recognize a pipeline release? Indicators of a pipeline incident can vary based upon the types of products being transported and the size and nature of the release, but can include:

- Discolored or abnormally dry soil or vegetation
- Continuous bubbling in wet or flooded areas
- Oily sheen on water surfaces
- Noise or sounds ranging from a quiet hissing to a loud roar.
- Vapor fog or blowing dirt around a pipeline area
- Frozen ground in warm weather

Emergency response personnel should NEVER attempt to isolate any pipeline valves on transmission or distribution pipelines unless under the direction of pipeline operations personnel. Operation of pipeline valves and systems must be under the full command and direction of the pipeline operator. Failure to do so may create a hydraulic hammer similar to water hammer and create additional problems far worse than the original event.

For More Information. In addition to information provided by the pipeline operator, responders may reference the *Pipeline Emergencies* (3rd edition) textbook and related Internet-based training curriculum at http://www.pipelineemergencies.com for additional information. The curriculum is a result of a cooperative agreement between the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) and the National Association of State Fire Marshals (NASFM) - see http://pipelineemergencies.com.

Addition al reference sources include the *Pipeline Emergency Response Guidelines* (2023 edition) published by the Pipeline Association for Public Awareness. See https://training.pipelineawareness.org.

Figure 1 - Pipeline markers must provide the pipeline contents, the pipeline operator, and an emergency telephone number.

Figure 2 - Breach of an LPG pipeline.

Figure 3 - Emergency responders should NEVER attempt to isolate any pipeline valves on

transmission or distribution pipelines unless under the direction of pipeline operations personnel.

Gregory Noll is a senior partner with Hildebrand and Noll Associates, a consulting firm specializing in emergency planning, response, and incident management issues. Greg also serves as the Program Manager for the South Central PA Regional Task

Force, one of nine regional task forces established throughout Pennsylvania, as well as the Hazmat / WMD Manager for the PA Task Force-1 federal urban search and rescue unit. A member of the U.S. Air Force Reserve with over 29 years of service, Greg has served as a subject matter expert for various DoD hazardous materials and counter-terrorism response training programs.

Greg has 41 years of experience in the fire service and emergency response community, and is the co-author of nine textbooks on hazardous materials emergency response and management topics. In 2010, he received the William Patterson Lifetime Achievement Award from the California hazardous materials emergency response community for his significant contributions to the hazardous materials emergency response and training communities, and in 2011 was the recipient of the John M. Eversole Lifetime Achievement Award by the International Association of Fire Chiefs (IAFC) for his leadership and contributions to further and enhance the hazardous materials emergency response profession. He currently serves as Chairperson - NFPA technical Committee on Hazardous Materials / WMD Response Personnel (NFPA 472) and as State/Local Co-Chair for the InterAgency Board (IAB) Training and Exercise SubGroup.


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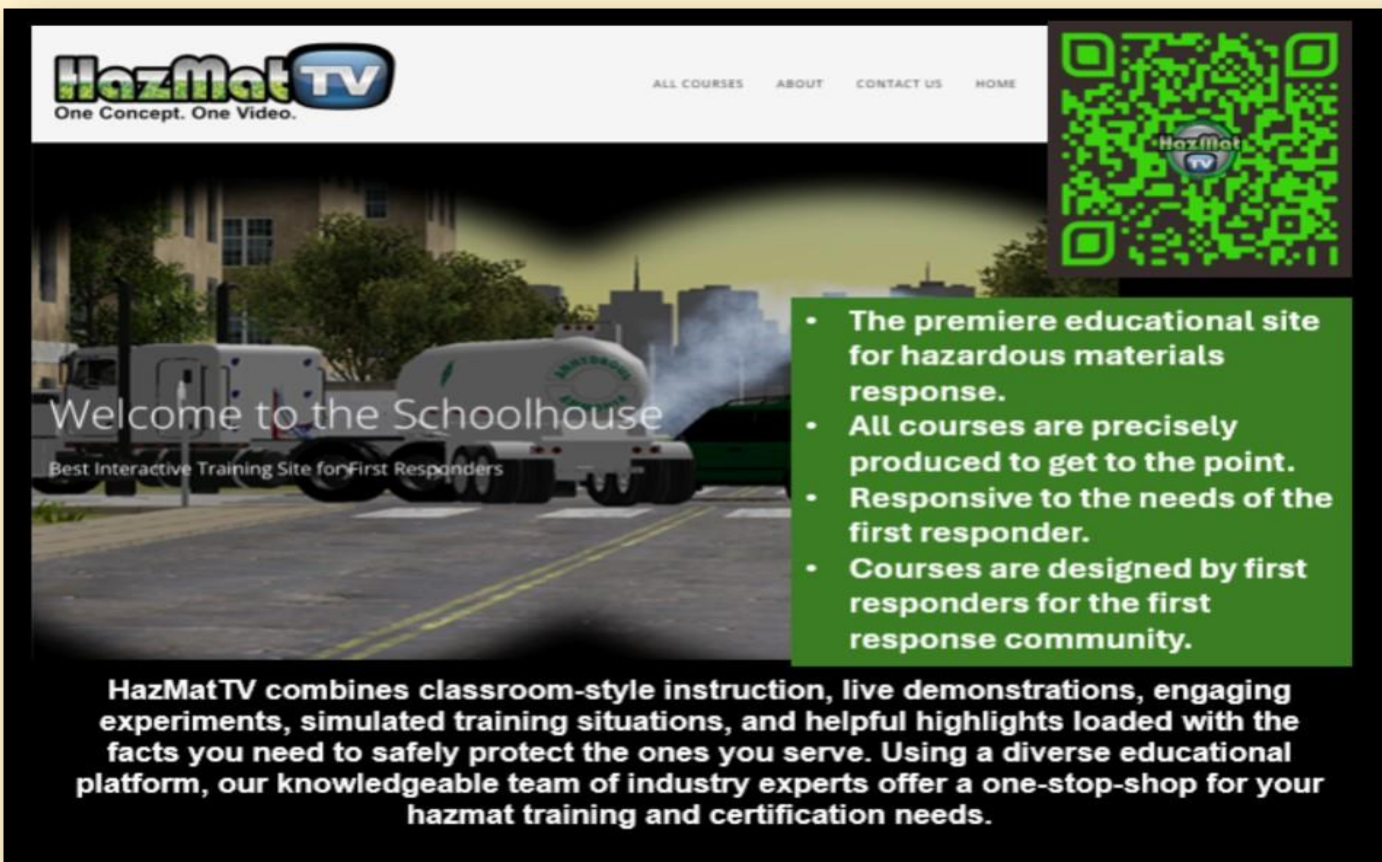
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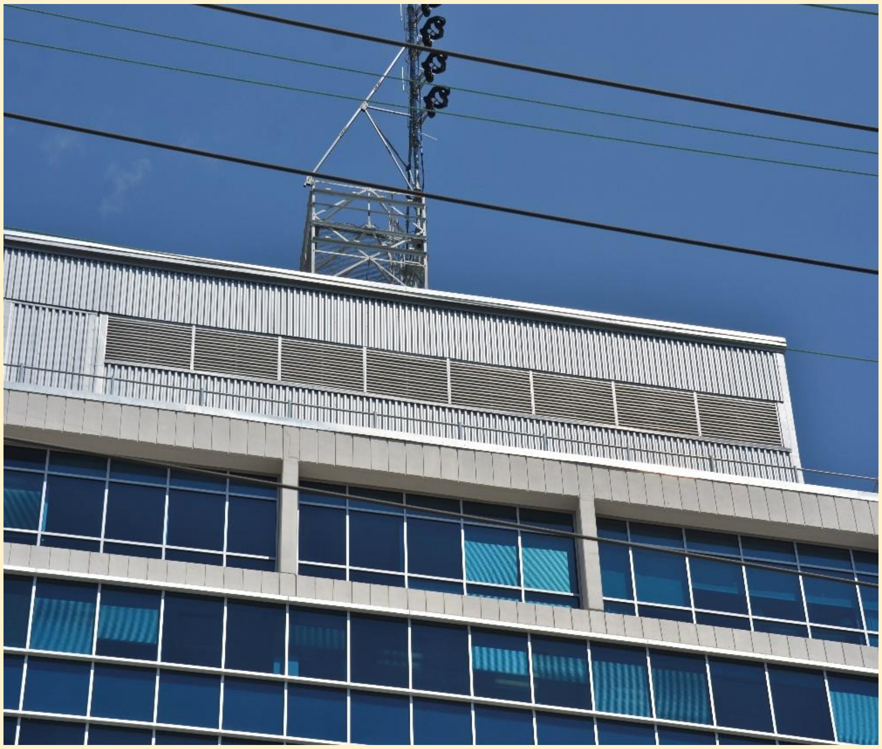
Hazmat Response to Odors

By Chris Hawley

Investigating an odor that may irritate building occupants poses significant challenges. Even a small amount of the offending material can cause issues, and it might not always align with the building's typical use. For instance, one evening, a hazardous materials team was called to a high-rise office building due to a chemical odor. Several individuals experienced headaches and other minor symptoms. Despite no unusual chemicals being present in the offices, the team followed their investigation protocol and discovered alcohol in the air throughout the entire building. Unable to locate an internal source, they extended their search outside and found that alcohol vapor from a nearby flavoring production facility had entered through the fresh air intake system. This incident underscores the importance of considering both internal and external sources when investigating such problems.



Alcohol vapor from an unrelated release was pulled into the fresh air intakes of this highrise.

While Hazmat responses to odors are unique, they fall within the capabilities of well-trained teams equipped with proper education and tools. It's crucial also to consider potential terrorist attacks involving WMD materials. By following the recommendations outlined here, Hazmat teams can discern whether an issue is accidental or intentional.

The key takeaway is to think beyond conventional response methods: use standard Hazmat tools creatively, adhere to guidelines where applicable, but most importantly—trust your instincts during investigations.

The investigation of Hazmat odors is typically linked to activities carried out by the occupants, often resulting from some type of chemical activity. This would be considered an acute issue. If there are individuals experiencing serious illness or injuries, it is considered a chemical release. A situation where there may be slight irritation due to an odor is still chemically related but is more of a chronic issue. Situations where there is long-term illness or irritation are considered chronic and are probably related to a low-level chemical issue or more like a true odor investigation. The building can be a potential source of illness, but it is usually related to the heating, ventilation, and air-conditioning (HVAC) system. The occupants may bring chemicals, such as mace or pepper spray, into the building, causing problems. Additionally, the occupants may inadvertently mix some cleaning chemicals, which could also cause problems. Even without mixing cleaning materials, their use may cause issues. External factors and neighboring facilities can also be contributing factors related to several issues. When responding to an odor investigation, it's important to consider the quality of indoor air. Take, for example, the bunk area in a fire station. Two key factors affecting indoor air quality are temperature and humidity levels. Even a slight deviation in these factors can impact all the responders in the fire station. An inefficient HVAC system may not effectively remove irritating odors. Monitoring the level of carbon dioxide (CO_2) inside the building compared to outside can provide insights into the HVAC system's efficiency and air exchange. While there are no fixed rules for indoor air quality, it's typical to find slightly higher CO_2 levels indoors, generally 200–400 ppm more than outdoors. A difference of more than 700 ppm may indicate a problem. A common incident is the release of CO_2 from large containers of CO_2 found in many restaurants, convenience stores and even residences.

This is a large liquid CO_2 dewar that can release a large amount of CO_2 within a building. Note there is a cylinder of gaseous CO_2 next to the dewar which is used as a backup supply.

This is a home CO_2 setup that has a small cylinder as the supply.

There are four basic causes of acute odor investigations. The four are related to cleaning chemicals, mace or pepper spray, HVAC systems, and building chemicals. Most of the incidents will fit into one or more of these causes. One item to always remember is that even though you may not be able to identify a specific cause, you will be able to identify what is not the cause.

The use of cleaning chemicals can result in the release of chlorine, ammonia, and acid gases, which are common sources of problems. Detecting mace and pepper spray can be challenging as these chemicals are difficult to detect without advanced detection devices. The Proengin AP4C is capable of detecting pepper spray and will indicate its presence on the nitrogen channel. Furthermore, the AP4C can detect a wide range of chemicals present in the air. The ChemproX features a trend analysis that can help pinpoint the source of the issue and identify potential materials in the air. Additionally, the high-pressure mass spectrometer (MS) known as MX908 can detect pepper spray in both trace and aerosol modes. Another useful device is the Gas

Chromatograph/Mass Spectrometer (GC/MS). To determine the use of mace or pepper spray, swab tests can be conducted on clothes or carpet, and the samples can be analyzed using the MS or GC/MS. It's advisable to identify the most affected individuals, seal their clothes in a bag, heat the bag, and then collect an air sample for analysis using the detection devices.

The AP4C device which can be used for odor investigations. The initial monitoring should be done with the HVAC system shut down. After sampling the building or if you suspect that the HVAC is the source of the problem, have air monitors in place and then turn the system back on. Pay particular attention to the discharge vents and the return air vents.

The PPB photoionization detector will pick up hot spots for odors and is an essential tool for odor response. The PPB PID will also let you know something is in the air that probably shouldn't be. A standard photoionization detector will not pick these levels up unless they are at higher amounts. Another detection device that is useful is a Metal Oxide Sensor (MOS) that is found in leak detector-style devices or can be used as an LEL sensor. This sensor has low sensitivity in the low PPM range but has an advantage over the PID as it can detect more chemicals in the air. The PID predominantly detects organic items, while the MOS can detect both organics and inorganics. There are two Fourier Transform Infrared (FTIR) devices that can assist with these types of incidents. The XplorIR is a handheld device that can detect many of the possible airborne target materials. The ThreatID is another FTIR device that has a gas sampling device that can capture a sample and analyze it. The Proegin AP4C, ChemproX, and MX908 all have libraries that can detect many of the target materials. One of the challenges when using these devices is that the threshold of detection is at or near the IDLH levels. This would be a large quantity in a building and would cause a human reaction in many cases. Colorimetric tubes can get well below the IDLH levels by increasing the tube's sensitivity and should be considered.

The XplorIR which can detect a large number of chemicals and can be useful in odor investigations.

The initial monitoring should be done with the HVAC system shut down. After sampling the building or if you suspect that the HVAC is the source of the problem, have air monitors in place and then turn the system back on. Pay particular attention to the discharge vents and the return air vents.

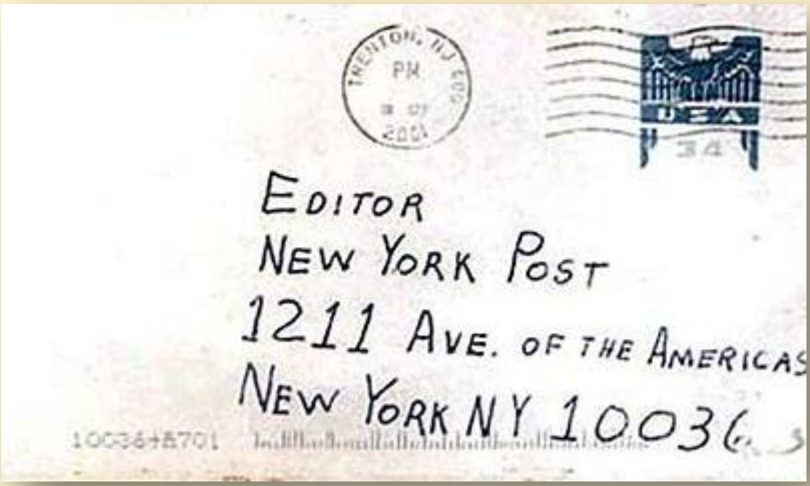
The response to an odor investigation can be very frustrating, but at the same time, it can be very rewarding, especially when you successfully identify a cause. When you solve a mystery, the occupants are happy, the building owner is happy, and the Hazmat team looks good to the community. If you sample and did not find anything that does not mean that it was a false call. It means there are three possibilities: Either you did not have a detection device for the material present, or the level of contaminant is below the minimum detection limit for your detection devices. The last possibility is that the building was ventilated before the arrival of the detection devices and the material is no longer present. When you are done and did not find anything, you can be assured nothing present is an acute risk to the occupants or nothing present is immediately dangerous to their life or health. It does not mean that there is not a chronic or long-term hazard present. There are times when you know a material is present, but you are unable to detect it. In these cases, refer the building manager to an indoor air quality specialist. The standard line is “We tested for the following items . . . and we did not find any detectable levels. Based on these results we did not find any acute or immediately life-threatening levels. We did not nor could we rule out long-term chronic issues, as that is beyond our capabilities.” Next month we will discuss some case studies where these tactics were utilized.

Chris Hawley has 34 years of firefighting experience, from small municipalities to large metropolitan areas. 29 years of experience in hazardous materials and weapons of mass destruction (WMD) response Has provided training and consulting throughout the United States. Through the Defense Threat Reduction Agency (DTRA) International counterproliferation Program (ICP) which is a partnership with the FBI and CBP has lead training and exercises in almost 40 countries worldwide. Conference Chair of the IAFC Hazardous Materials Response Teams conference for more than 20 years. This conference is the largest hazardous response conference worldwide. Serves on the National Fire Protection Association (NFPA) Hazardous Materials Committee for NFPA 472, 1072 and 475. These are international standards for hazardous materials response and training. Author of more than 9 textbooks, primarily focused on hazardous materials/WMD and Special Operations. Contributed to and coauthored several other textbooks in the same field. Co-Author of Incident Management for IT Operations. Author of numerous magazine and web based articles. Serves as a subject matter expert on hazardous materials/WMD response and planning concerns.

The Biological Weapon Threat- (Part 3) Recognizing the problem

By Kevin Ryan

Welcome to Part III of the series on the Biological Weapons Threat. Part I looked some history surrounding the threat while Part II covered recognizing a biological weapons attack. September 2001 presented a new threat that had to be learned from the ground up. Very little knowledge in the emergency response world focused on these types of threats. New



techniques, equipment, methods and training had to be developed to respond to these “white powders”. We are seeing the same evolution with the battery problems responders are currently experiencing. The BCFD (Baltimore City FD) was no different. The white powder protocol developed has

morphed into the current suspicious substance procedure. The procedure has been adapted in the last 21 years to reflect suspicious packages as well as being applied to fentanyl responses. Changing the name to the Suspicious Substance procedure may be one of the more significant changes. Using the title white powder promoted tunnel vision. Responders always expected to see a white powder when using the procedure. In reality, the product could be tinted brown or have other characteristics. The procedure has proven itself on multiple occasions with positive results when applied correctly. Law Enforcement agencies in the City (including federal) are familiar with the procedure knowing it produces viable and actionable results. The procedure consists of (4) parts including:

- Investigation Checklist
- Risk Assessment
- Entry Procedure
- State Lab Screening form

Let’s look at what the 4 parts provide to the procedure.

1. **Investigation checklist-** The checklist gives the Incident Commander (IC) a general strategic approach to handle the incident. Basic hazmat strategy is a big part of the checklist. Establishing unified command, establish control zones, use the risk assessment questionnaire to categorize the incident and provide for interviewing exposed or contaminated victims.
2. **Risk Assessment Questionnaire-** The questionnaire allows for a thorough size up of the incident. Basic incident information can be documented including date, IC, incident # and member completing. A section for location determines the occupancy and what kind of business it is.

The package or envelope can be assessed by interviewing the person receiving. The who, what, when and where of the package\envelope is determined through these questions. The most important section is the exposure or interview of exposed victims. The best information can be gained by speaking directly to anyone who opened or saw the package before it being isolated.

3. **Entry Procedure-** The heart of a suspicious substance investigation comes from the entry procedure. The sampling of the product, threat assessment and incident credibility are major factors in determining our course of action. The BCFD samples for public safety only. We will not sample for evidence or any LE investigative aspect. Our

primary goal is protection of the public. The mission stops at that point for us once the determination is made as to whether it's a threat or not. Two major components to this is PPE required and detection equipment needed. A CBRN rated attire is utilized including the mask and cartridge. SCBA is not used unless a specific circumstance arises that requires it. The entry procedure is intended for solids, liquids and settled products. Unopened packages or items suspected as explosives must be screened and cleared by a bomb squad before our investigation continues. Equipment used for testing can be as basic as a protein check such as the HazChem kit or as advanced as a Razor PCR 10 pouch. Testing of product is considered destructive or non-destructive depending on the method used. The entry team must leave enough product for a lab to be able to evaluate the sample. A method to bag the sample and then decon for transport is described as well.

4. **State Lab Screening Form-** Once a sample is collected to be sent to the State Lab, the screening form must accompany the sample. The form simply allows documentation of what was done by the entry team and who transported the sample to the lab. Samples sent to the lab must have a highly credible threat verified by our procedure.

As I stated earlier, the process has evolved in the last 21 years. The last class I took on emerging threats is looking at PBA's (pharmaceutical based agents) or toxins such as ricin or abrin. Our procedure can be adapted to these by using IR, Raman and adding a fentanyl specific test kit (we have already been using opiod screening kits). There is much more room for expansion in our process as new threats emerge. The one common thread that allows this procedure to be effective is knowing our partner agencies. Maintaining relationships with LE agencies and the State Lab allow us to make this effective. Our partner agencies know exactly what we are capable of when we deal with this type of incident.

Part III has covered our response profile for targeted sampling of suspicious substances. Part IV will highlight a BCFD response where outside the box thinking utilizing our procedure gave us the answers we needed. More information on our response profile can be obtained by emailing me at kevin.ryan@baltimorecity.gov.

Kevin Ryan leads the Baltimore City FD Hazmat Operations Office. A 31-year veteran of the fire service with 26 years of experience in the world of hazmat response. He is a Level III instructor and adjunct at the BCFD Fire Academy.

Hazardous Materials Emergency Response in Chile: A Comprehensive and Comparative Approach with the U.S.

By Raúl Espinoza
Founder & CEO HAZFIRE Consultants
Hazmat Specialist

Introduction

The hazardous materials (Hazmat) emergency response in Chile has significantly evolved over the past decades, driven by the need to manage complex incidents arising from the handling and transportation of chemicals in key industrial sectors. From mining in the north, agriculture, and viticulture in the central region, to aquaculture in the south, the intensive use of chemicals necessitates a robust system for preventing and responding to accidents involving these materials. This article explores the application of the Multi-Institutional Emergency Operations Manual (ABC Manual) in Chile, analyzing the challenges in Hazmat response compared to the U.S. system, with a particular focus on structural, technological, and operational differences.

Chemical Industry in Chile and its Relationship with Hazmat Emergencies

Chile is a major importer of a wide variety of chemicals essential to its economy, with usage varying by geographical region. In the north, the mining industry uses explosives and chemicals in processes such as leaching and solvent extraction to obtain high-value minerals. In the central region, agrochemicals are fundamental for the cultivation and protection of agricultural products, while in the south, aquaculture requires disinfectants, anti-fouling agents, and other compounds. Given this diversity of chemicals, hazard classification is essential to protect transporters, handlers, and emergency teams in the event of an incident.

The 1995 Incident: A Turning Point in Hazmat Response in Chile

A key milestone in the evolution of chemical emergency response in Chile was the 1995 fire at a chemical plant, which underscored the need to improve the country's capabilities in managing Hazmat incidents. Since then, Chilean firefighters have received training abroad and acquired specialized equipment to more effectively handle such emergencies. Today, approximately 90 Hazmat units are distributed across the country, equipped to respond with a high level of technical training, ensuring a rapid and coordinated response.

On December 17, 1995, as the workday was beginning in Lo Espejo and across the entire Metropolitan Region, a fire broke out at the company Mathiesen Molypac, located at 02360 Lo Sierra Street, Metropolitan Region of Chile.

The National Operations System, managed by the National Firefighters' Board through the Hazmat Operational Working Group (GTO), has advanced in standardizing the response through a voluntary certification process. This process allows for the identification, accreditation, and registration of Hazmat teams that offer a uniform response, with the ability to coordinate both among themselves and with the National Firefighters' Operations System (SNO). This is crucial in addressing hazardous material incidents that exceed the local response capacity of individual fire departments and in specific situations that require intervention by accredited Hazmat teams, ensuring more efficient resource management and community protection.

Response Structure in Chile According to the ABC Manual

The ABC Manual, regulated by Exempt Decree No. 50, coordinates multi-institutional emergency response, including Hazmat incidents. Chilean Firefighters, SAMU, and Carabineros collaborate under specific procedures to delineate safety zones and manage Hazmat incidents. Safety zones are divided into red, orange, and green areas, with firefighters responsible for establishing perimeters and conducting containment and risk mitigation operations.

A notable feature of the response in Chile is the flexibility in on-site decision-making, allowing for rapid adaptation to changing circumstances. However, this flexibility can present coordination challenges, especially in large-scale emergencies or those involving multiple agencies.

Comparison with the U.S. Hazmat Response System

In the United States, Hazmat emergency response is governed by the National Incident Management System (NIMS), which includes the Incident Command System (ICS). This system establishes a clear hierarchy in the chain of command and is used uniformly at all levels of government and in the private sector. In contrast, the Chilean system is more flexible, which allows for greater adaptability but may result in a lack of uniformity in protocol implementation.

One of the main differences between Chile and the U.S. lies in the use of advanced technology.

In the United States, geolocation and interoperable communication tools are widely integrated into response processes, facilitating real-time coordination between agencies. In Chile, although the ABC Manual recognizes the importance of georeferencing, its implementation remains a challenge, particularly in rural areas with limited infrastructure.

Operational Challenges in Hazmat Response in Chile

Chile's geographical context presents unique challenges for Hazmat emergency management. The country's length and diverse topography make access to affected areas difficult. Unlike the U.S., where transportation networks are more developed, in Chile, routes can be inadequate for the rapid transit of emergency teams, especially in mining or rural areas.

Another challenge is the availability of trained personnel. While Chilean firefighters have made progress in training their personnel, there is still a considerable reliance on volunteers, many of whom are concentrated in urban areas. Industries in remote areas, such as mining, have created their own emergency brigades, leading to variability in levels of preparedness and equipment.

Private Sector and Chemical Emergency Response

As Chile's industrial sector grows, so does the need for internal emergency response brigades within companies handling hazardous materials. These brigades, particularly in sectors such as mining, forestry, and chemicals, are the first line of defense during the initial moments of an incident. In remote areas, the private sector also provides external brigades, staffed by volunteer or former firefighters who bring their experience to emergency management.

Lessons Learned and Future Improvements

Chile has made considerable progress in its ability to respond to hazardous materials emergencies. Coordination between major emergency institutions has been key to ensuring an effective response. However, continued investment in technological modernization, particularly in communication and geolocation areas, is needed to improve coordination and reduce response times.

The standardization of procedures at the national level and ongoing training are areas with room for improvement. Regular drills and voluntary certification programs, promoted by the National Firefighters' Board, are steps in the right direction but must be complemented by greater integration of the private sector and the use of advanced technologies.

Conclusion

Hazardous materials emergency response in Chile has reached a significant level of maturity through the identification, accreditation, and registration of Hazmat teams that provide standardized responses, with the ability to coordinate both among themselves and with the National Firefighters' Operations System (SNO). This is critical for handling hazardous materials incidents that exceed the local response capacity of individual fire departments, as well as specific situations that require intervention by accredited Hazmat teams. Moreover, the integration of the Incident Command System (ICS) by the National Disaster Risk Management Committee (COGRID) as a management tool for response institutions has been a significant advancement.

However, the country continues to face challenges, particularly in terms of technology, especially in communication and geolocation areas, which are key to improving coordination and reducing response times.

Raúl Espinoza more than 28 years of experience in specialized consulting, covering planning, preparedness, prevention, mitigation and response to

emergencies in multimodal transport and sectors such as mining, steel, petrochemicals and gas.

He is a Hazardous Materials specialist certified by the Security Emergency Response Training Center (SERTC) and Transportation Technology Center, Inc. (TTCI) in the United States, and director of the Chemical and Industrial Emergency Response Program at EQUIMISEG, Bogotá, Colombia. Between October 2018 and May 2022, he was Head of Hazmat Operations at Ambipar Response LATAM, leading and coordinating emergency response with hazardous materials in Chile, Peru, Colombia and Uruguay.

In fire protection, he has been a conceptual engineering designer for systems at BHP's Spence mining complex. In addition, it performs NFPA-compliant water-based system inspections and testing in mining and gas facilities.

For 16 years, he was in charge of Industrial Emergency

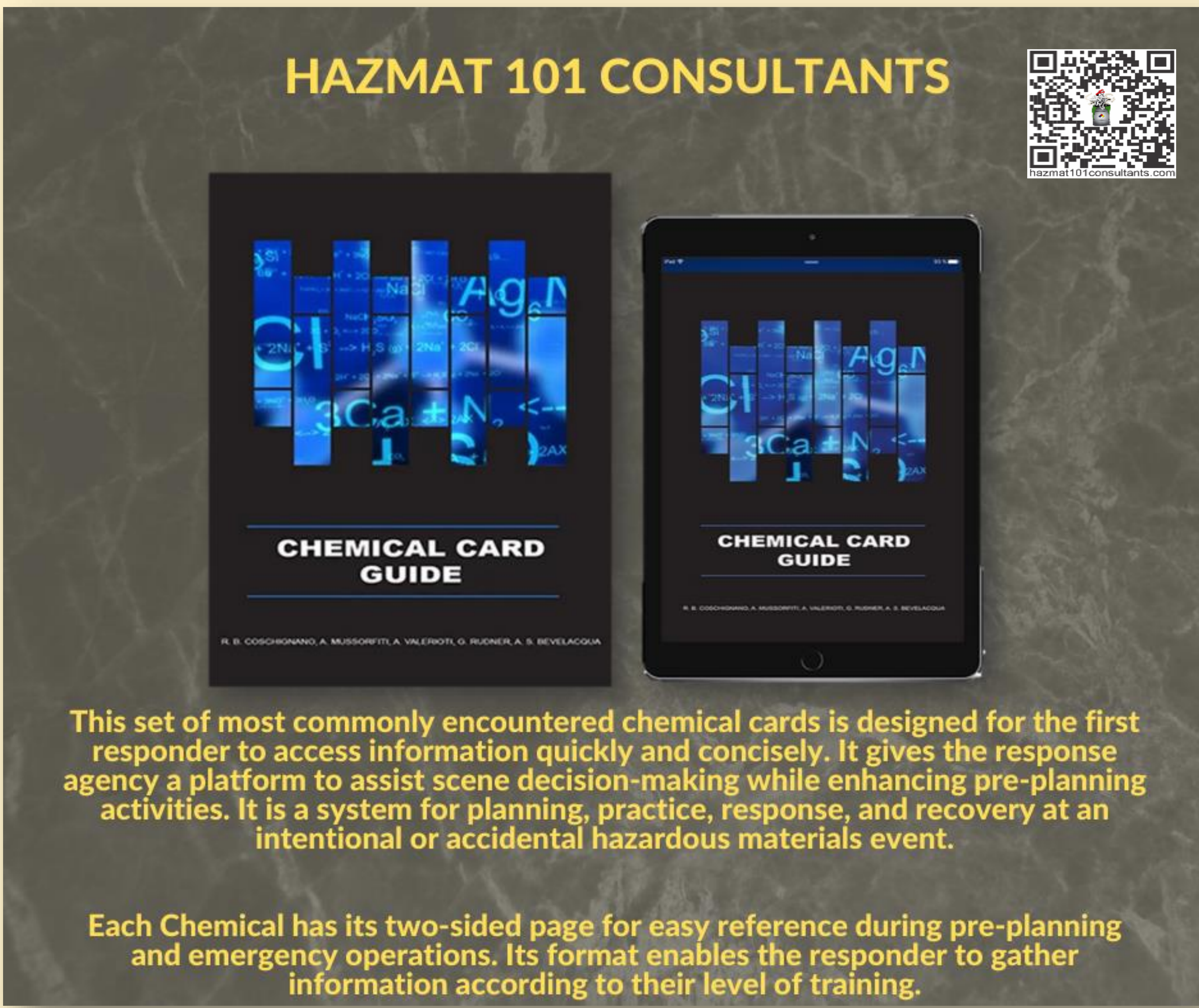
Response at Codelco Chile Ventanas Division, one of the largest and most prominent mining companies in the world. In this role, he accumulated vast experience in industrial emergency management, developing specialized skills and in-depth knowledge of the area.

He is an NFPA 1041 Level I Instructor, certified by Texas A&M University, and holds numerous additional certifications, including NFPA 1041 Level II Instructor by Houston Fire Academy & Fires Foundation and CPI-B Instructor by OFDA-USAID. In addition, he is a Master Instructor Level I from the Northern Alberta Institute of Technology in Canada and leads advanced courses at Texas A&M University. He has designed and implemented emergency response training programs internationally, including Chile, South America, the Caribbean, the United States and Europe.

He is a member of several relevant organizations in the field of security and emergencies, including the International Association of Fire Chiefs and the International

Association of Fire Fighters in the United States,. He is also part of the International Association of Emergency Managers (IAEM) and the State Firefighters & Fire Marshals Association of Texas,

He has made significant contributions to the field of hazmat emergency response, writing numerous technical publications that have been essential for sharing knowledge and best practices.



CONFERENCE DATES

HOTZONE

Oct 17 – 20 2024

Florida Hazmat Symposium

Jan 14 – 17 2025

Oklahoma Hazardous Materials Conference

Mar 5 – 8 2025