Full Report

Regional Incident Survey Team (RIST) Report

Eastern-0903-Other

Regional Incident Survey Teams (RIST)

RISTs gather information for the National Hazardous Materials Fusion Center. RISTs are composed of individuals from around the country who are skilled and experienced in hazardous materials (hazmat) response or experienced in the hazmat industry. RIST members are part of a team invited by a local jurisdiction or state authority to conduct a survey of an incident response of interest and record information from the responder's perspective. In no case is the data intended to be used to criticize or condemn response actions, but rather to share lessons learned and smart practices with other emergency responders who may face a similar response.

Incident Type

Chemical suicide, multiple response locations

Container

Small metal container

Hazardous Material

Aluminum phosphide, UN 1397

Initial Dispatch Information

Incident time: 1117

Location: hotel

- 9-1-1 call from front desk of hotel; second party call of possible overdose of pills; ambulance needed at 1117 hours.

- Dispatch notes "Not a lot of information."

Initial dispatch: emergency medical services (EMS), fire first responder and law enforcement

Initial Incident Size Up

- The first arriving units found a male in obvious medical distress inside the hotel being attended to by other guests and hotel staff; no one had direct knowledge of the patient.

- EMS crew and law enforcement personnel entered the patient's room in an attempt to find more information about the patient.

- Crews entering the room observed substantial amounts of powder.

Crews identified a small metal tin as the source of the white powder, secured the tin in a plastic bag and transported the container with the patient to the hospital.

- Weather conditions:
    - temperature—18°C (64°F)
    - dew point—4°C (39°F)
    - humidity—39 percent
    - wind—WSW at 16 km/h (10 mph)
    - no clouds or precipitation

Incident Response

At 1117 hours emergency responders were sent to a local upscale chain hotel for an overdose of pills. The 9-1-1 call was placed by hotel employees after receiving a call from a hotel guest who had found another guest in distress in a public hallway. Emergency crews arrived on the scene within four minutes and began treating a critically ill, semiconscious adult male patient.

As EMS crews treated the patient, law enforcement personnel and first responders entered the patient's hotel room seeking more information about what the patient may have ingested. Inside the room emergency responders observed a powdery substance covering the desk and counter. The identity of this substance was unclear, but responders were able to locate a tin that appeared to be the source of the powder. Responders placed the tin in a plastic bag and transported it to the hospital with the patient at 1142 hours, 20 minutes after arrival on scene. It is part of local response protocols to bring the pill or chemical bottle to the hospital with the patient when dealing with attempted suicides or accidental poisonings, as the bottle or container may assist doctors and poison control in developing treatment plans for the patient.

Transport time to the hospital was nine minutes. During that time the hospital was consulted and given a patient report. The patient was delivered to the critical care bed in the emergency room, allowing doctors to have all the tools needed in case resuscitation became necessary. Hospital personnel began treating the patient's symptoms and consulted the local poison control center. A doctor in the emergency room, familiar with suicide techniques using poisonous chemicals in his native country of India, recognized this may be a similar type of case and as a result raised awareness of the possible hazards to the emergency department (ED) staff. One of the treatments given to the patient was large doses of charcoal to absorb the poison.

The ambulance cleared the response at 1314 hours and returned to quarters.

At 1407 hours the emergency room called 9-1-1 and asked that the hazardous materials team be sent to the hospital because they had a patient who has ingested a poison that the call-taker entered into the Computer Aided Dispatch (CAD) system as "aluminum phosphate." The hospital caller also stated that the "patient is giving off gas" and that they "also have a container in the room that is giving off gas."

At 1409 hours a standard hazardous materials investigation response consisting of a hazmat unit, engine, truck, battalion fire chief (incident commander), EMS chief (as safety officer), and a basic-life-support (BLS) ambulance was dispatched.

The battalion chief and first engine arrived on scene simultaneously within minutes of dispatch. The battalion chief established incident command and placed his vehicle in a position to observe both exterior entrances to the emergency room. The crew of the first engine donned structural firefighting gear with self contained breathing apparatus (SCBA) and made contact with ED staff who advised:

- They were treating a patient who had taken pills and was experiencing breathing problems;
- That the pills taken by the patient are commonly used for suicide in India and very lethal;
- That they believed fumes were coming from a plastic container in the patient's room; and
- That the main concern of the hospital staff was to determine if there was a problem that places staff and other patients at risk.

The first engine advised command of this information and relayed that the potential exposure problem was somewhat contained within a single treatment room within the emergency department. The incident commander (IC) relayed this information including the chemical name "aluminum phosphate" to the incoming hazardous materials unit (HMU).

The IC established a unified command and requested that the hospital provide a representative at the command post. The local sheriff's department had a representative at the command post by 1410 hours.

At 1425 the HMU arrived on the scene and met with the IC to relay the chemical hazards of aluminum phosphate. At this time it was discovered that the actual chemical involved was aluminum phosphide. The HMU quickly reassessed the chemical hazard using Standard Operating Procedures and forms. Resources used in assessing the hazard included the National Fire Protection Association (NFPA) 704 Guide, *Emergency Response Guidebook* (ERG), *National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards*, and *Chemical Hazards Response Information System* (CHRIS) manual. This chemical posed a much higher risk than the originally reported chemical, and this information was reported to the IC.

The IC set his incident priorities as isolating the problem within the ED, assuring the safety of patients currently in the emergency rooms, and preventing further exposure to the facility. While accomplishing these objectives the IC continued to discuss patient resuscitation options with the ED staff. At 1436 hours, with information from the hazardous materials team, hospital staff, police, and the initial assessment from the first engine, the IC determined that the situation was contained to the ED and recommended evacuation of patients from, and closure of the department.

The hospital staff refused the recommendation to close and evacuate. The hospital proposed an alternative which was to move the patient across the treatment area to an isolation room within the ED. After conferring with building engineers who advised they could isolate the airflow in the room the patient was in, the IC declined to support moving the patient. The hospital staff never evacuated the emergency room, but the IC did succeed in closing the ED to ambulance arrivals for one hour by working with the county dispatch center.

At 1447 hours the patient went into cardiac arrest, and despite resuscitation efforts by ED staff, was pronounced dead about 20 minutes later. During resuscitation efforts, the patient vomited a charcoal solution which was accompanied by a fishy odor, and one hospital staff member complained of dizziness.

To support the incident objectives, the IC directed the hazmat team to make an entry into the ED and perform air monitoring. At 1525 hours an entry team, wearing structural firefighting personal protective equipment (PPE) and SCBA, using a four-gas meter, photo ionization detector (PID), and explosive meters entered the ED and found:

- Oxygen (O_2) concentration of 21.3 percent
- PID reading of 0.2 parts per million (ppm)
- Hydrogen Sulfide (H_2S) meter reading of zero ppm
- Carbon Monoxide (CO) meter reading of zero ppm
- Lower Explosive Limit (LEL) reading of zero percent

Their entry and collection of samples lasted approximately 20 minutes. Entry team members proceeded through technical decontamination as they exited the ED. Upon completion, the entry members received a medical assessment.

At 1616 hours unified command returned the ED to the control of the hospital. The ED had been surveyed and found to be safe. The deceased patient and his belongings were now evidence and in cooperation with the police and in consultation with the medical examiner, were to be stored in the hospital morgue overnight. The medical examiner would pick up the victim the next morning and take him to the regional office for an autopsy.

Unified command remained in effect and was joined by members of county emergency management. As the IC became aware of the original incident at the hotel and obtained information that the victim lived in the community, he adjusted the incident priorities to ensure that each known area the victim had been was assessed for potential hazards and other victims.

At 1551 hours the HMU returned to the hotel with the sheriff's office. Over the next hour the HMU performed a hazmat entry and conducted air monitoring. The environment was assessed to be safe, although powder was observed in the room. The room was sealed for evidence and later turned back to the property owner for clean up.

Later in the evening the HMU crew performed their third entry of the day to assess the victim's home. This assessment revealed no hazards and the house was left with law enforcement.

The next morning the hospital morgue contacted the HMU directly and asked them to come to the hospital to determine if the "deceased from yesterday is safe to move." The HMU had been informally briefed by the off-going shift about the previous day's events and the chemical involved. The HMU officer, being familiar with the hazards, requested and received permission through the chain of command to go to the hospital and assist the coroner and hospital staff.

At 1303 hours a hazmat investigation assignment was again dispatched to the hospital, this time to the loading dock/morgue area. Units began arriving on the scene by 1403 hours and unified command was established by the battalion chief on the "delta" side of the facility.

At unified command an action plan was developed that involved sending the HMU into the morgue to monitor the air conditions, attempt to determine if the victim was off-gassing hazardous substances, and remove the evidence bag from the body storage bag. The coroner's assistant who was picking up the body would not accept the body if the evidence bag was inside the body bag.

Using Standard Operating Procedures the HMU team assessed the potential hazards from the chemical and prepared an entry team. The HMU officer decided on a liquid splash-protective (Level B) entry and to perform air monitoring using a four-gas PID, gamma radiation monitor and a Draeger CMS™ with a phosphine chip.

The entry was performed at 1510 hours and concluded at 1530 hours. The readings found during the entry indicated that there were no hazards present. The evidence bag was removed from the body bag and turned over to the hospital for disposal.

At 1551 hours the incident was terminated by command. The victim was taken to the regional morgue by the assistant coroner and the hospital returned to normal operations.

Lessons Learned/Smart Practices

This incident was handled by a department that strives for excellence and has dedicated considerable resources to preparing for hazardous materials emergencies. They have established a hazardous materials response team and developed operating procedures to support that team. As evidenced by the considerable documentation associated with this incident, it is clear that this investment paid off by protecting the community from further harm and not causing injury to responders.

This incident presented challenges for the incident commander and hazardous materials teams in a number of areas. These areas include:

- hazard risk assessment
- detection challenges
- operation of unified command
- chemical identification (hazardous materials information)

Additionally, this incident brought to light a trend for all responders to consider. When is an attempted suicide or accidental poisoning no longer an incident handled primarily by emergency medical specialists but a hazardous materials incident managed under a different set of laws and standards? The use of hazardous chemicals in suicides appears to be increasing worldwide including the United States (Vernon, 2009). There have been a number of Department of Homeland Security (DHS) and local intelligence information products distributed on this very subject. These products define the chemicals used and their risk to responders and others.

Hazard and Risk Assessment

Many substances that exhibit flammable properties are also toxic. We can protect ourselves from toxic hazards through the application of engineering controls (ventilation, isolation); administrative procedures (not walking in the puddle, avoiding contact with the contaminants, proper training); and personal protective equipment (from boots and gloves to SCBA and vapor protective (Level A) ensembles).

Emergency responders often focus primarily on the flammable properties of a material and do not fully consider its toxic effects. A thorough examination of both hazards is necessary to provide a complete risk assessment of the situation at hand.

Aluminum phosphide is listed in the *Emergency Response Guidebook (ERG)*. The *ERG* returns two entries when the material name "aluminum phosphide" is entered as the chemical of concern and both are highlighted in green, alerting the responder to the fact that the chemical is a toxic inhalation hazard (TIH) or water reactive chemical.

The entries in the ERG are as follows:

- Aluminum Phosphide – Guide 139, ID 1397
- Aluminum Phosphide pesticide – Guide 157, ID 3048

In the *ERG*, under the heading of "Potential Hazards," the section "Fire or Explosion" or the section "Health**"** will appear first, depending on the primary hazards of substance. In this case, the following information can be found for aluminum phosphide:

- guide 139 is for substances – water reactive (emitting flammable and toxic gases) and lists fire/explosion as the primary hazard.

- guide 157 is for toxic and/or corrosive (non-combustible / water–sensitive) and lists health as the primary hazard.

So, a first responder using the *ERG* for the initial size-up may be presented with a confusing situation. In this case, it is assumed that the *ERG* is making a distinction between 100% straight aluminum phosphide and aluminum phosphide present in smaller percentages in pesticides. This distinction would not be easily recognizable to a first responder with only basic training in hazardous materials recognition and response and could lead to confusion. However, the *ERG* would still provide the responder with the information that the chemical is a TIH or water reactive chemical.

Detection Challenges

The question is "how can phospine be detected?" Some multi-gas meters have the capacity for such a toxic gas sensor. It is, however, highly unlikely to find many response units that have this capability, unless they are geared toward specific industrial applications. Conventional thinking might suggest that a decline in the oxygen level indicates presence of contaminants. Indeed, reduction of oxygen concentration is a reason for concern. After all, if oxygen is being displaced, so is nitrogen. And since atmospheric air is composed of approximately one part oxygen and four parts nitrogen, every percentage point of oxygen reduction might suggest the presence of 50,000 ppm of some contaminant (1 percent = 10,000 ppm.) Oxygen concentration should not be used as a definitive measure of the presence of toxic gases or vapors. This scenario demonstrates that the toxic gas levels would be extremely high before they produced a noticeable change in oxygen concentration. However, responders must be aware that even small changes in the percentage of oxygen can be due to the presence of toxic gases displacing air. Similarly, a combustible gas indicator (CGI) or LEL sensor is not designed to detect gases or vapors that present toxic hazards.

Photo Ionization Detectors (PID) are widely used to detect presence of volatile organic compounds (VOC) and can do so in the scale of parts per million. The term *volatility* refers to the property of a liquid to readily change to the gaseous state. Organic compounds are those compounds that have carbon molecules in their makeup. PIDs, however, may detect some inorganic compounds as well, and phosphine is one of them. Most manufacturers provide technical data sheets with listings of the compounds their equipment can detect. They also provide correction factors that allow the user to more accurately quantify the toxic gas. Having those charts readily available may prove to be an indispensable resource when trying to measure a known toxin and having them laminated and readily available at the incident will be useful.

Even though phosphine has a very low LEL, it presents toxic hazards at significantly lower concentrations. A quick glance through the *NIOSH Pocket Guide to Chemical Hazards* would yield similar results for most chemicals that are both toxic and flammable. The above example by no means attempts to undermine the risks presented by flammable substances. It is an effort to reveal toxicity hazards that are often overlooked when dealing with flammable hazardous materials.

Detection challenges need to be considered when a hazmat team is called upon to make the determination of safe or unsafe. In this case study, the hazmat team was required to make this determination several times:

- Day 1 – initial response of HMU to ED
- Day 1 – HMU performs assessment of the hotel with the sheriff's office
- Day 1 – HMU performs assessment of patient's home
- Day 2 – HMU returns to the ED to determine if the "deceased from yesterday is safe to move."

On Day 1, the responders made the determination of safe or unsafe using just a four-gas meter or a four-gas meter in combination with a PID. On Day 2, the HMU also used a Draeger CMS™ with a phosphine chip.

The Draeger™ system has a detection limit of 20 ppm for phosphine vapor. The detection limit is the lowest quantity of the substance that can be measured by the system. The *NIOSH Pocket Guide to Chemical Hazards* lists an eight-hour time-weighted average (TWA) for phosphine of 0.3 ppm, a Short Term Exposure Limit (STEL) of one ppm, and an Immediately Dangerous to Life and Health (IDLH) of 50 ppm. So, in the case of phosphine, the detection limit for the measurement instrument is higher than the health-based exposure limits. When this condition exists, the contaminant level may exceed the health-based limits but not be high enough to be detected by the measurement instrument. Responders must be thoroughly aware of the limitations of their measurement instruments and these limitations must be considered during the risk assessment carried out to determine if the area can be declared safe. All responders must remember that instruments do not make decisions: they only provide information to responders that they can use in their decision-making.

Unified Command

Unified command is one way to carry out command in which responding agencies and/or jurisdictions with responsibility for the incident share Incident Management.

A unified command may be needed for incidents involving:

- multiple jurisdictions,
- a single jurisdiction with multiple agencies sharing responsibility, or
- multiple jurisdictions with multi-agency involvement.

If a unified command is needed, incident commanders representing agencies or jurisdictions that share responsibility for the incident usually manage the response from a single incident command post. unified command allows agencies with different legal, geographic, and functional authorities and responsibilities to work together effectively without affecting individual agency authority, responsibility, or accountability. Under unified command, a single, coordinated incident action plan will direct all activities. The incident commanders will supervise a single command and general staff organization and speak with one voice.

The incident commander during the second phase of this incident (when the hazardous materials team was called to the emergency room) identified the need for unified command and established unified command at his response vehicle. Initial members of the unified command were the incident commander, representing the fire department (first responder, EMS, and hazmat), sheriff's department, and the hospital.

The IC also served as the operations section chief. Initial meetings of the unified command presented challenges for the IC because the hospital representative did not have the same incident management priorities as the fire and sheriff's representatives. Additionally, the hospital representative didn't maintain a constant presence at the command post which limited the ability of the unified command to discuss and agree to incident management objectives.

As the incident continued, the local emergency management agency reported to the scene and was included in the unified command.

In this incident the hospital had different assumptions about the hazards involved in the incident than did the responders; the hospital also functioned under different priorities. This is exactly the type of situation unified command is designed to manage, but in order for it to function properly it must have dedicated partners from all parties.

There were two weaknesses in the implementation of the unified command that can be improved in future incidents. The first is that all parties in unified command need to be there, although this is not always a viable option the IC must make a concerted effort to bring agency representatives together. With the hospital representative coming and going from the command post he/she missed important opportunities to describe the the hospital's priorities and needs to the incident commander so that those they could be included in the incident action plan.

The second weakness was that a lack of resources forced the IC to also serve in the role of operations section chief. In this case that meant that the IC was directly supervising hazardous materials entry operations while also trying to determine the operational needs of the hospital and communicating potential hazardous situations to other responders. This created a situation where the IC was in charge of fire service operations, but only nominally in charge of the entire incident. The IC must realize when this situation occurs, and use his role as the IC to work the unified command process, allowing for the allocation of the operations section chief position to another officer and permitting the IC to focus on the incident commander's role.

Unified command is something that must be practiced to be effective. In this case, previous exercises and planning had prepared both responders and hospital staff to deal with an incident outside the hospital or something catastrophic within the hospital. No plans had been developed for a slow developing hazardous materials incident within the hospital. As a result of this planning gap, the hospital was slow to recognize the hazard and did not activate its emergency operations plans. This failure to activate caused untrained and unpracticed members of the hospital staff to be part of unified command.

There were a number of positives from unified command that probably would not have occurred had the incident commander not implemented the process early and included all responsible parties. These positive results included:

- Early contact with the hospital facilities staff who were able to isolate the fumes and keep them from spreading the problem throughout the hospital.
- Control of traffic and access to the hospital by the sheriff's office.
- Identification of other potentially contaminated sites and responders from the original incident. Unified command was able to coordinate a return to the hotel and to the victim's residence to survey them for hazards, and to identify and return the original responders to the scene to check them for exposure and assure their safety.
- Planning for the worst-case scenario, which is evacuation of the hospital.
- Coordination with the medical examiner about the deceased's condition and lack of ongoing hazard. (Unfortunately, this information was not passed on in the coroner's office and resulted in an additional incident the next day.)

To prevent these problems in the future and build on the successes of the incident, the parties involved have met together for an after–action debriefing and are having an ongoing dialogue about how to work together better in unified command. After-action dialogue is a good strategy for any department seeking to improve their unified command functions, bringing the parties together to discuss what the other was thinking and understand where they failed to meet each other's needs. This is the first step in preventing the problem from reoccurring. As always, all of the parties involved felt that more training and opportunities to implement a unified command would improve upon future efforts.

Hazardous Materials Information

Aluminum phosphide

Physical and Chemical Properties of Aluminum Phosiphide	
Appearance	Dark gray or dark yellow
Physical State	Solid, crystals
Molecular Mass	57.96
Chemical Formula	AlP
Specific Gravity	2.85
Reactivity	Strong reactivity to water, reactive to air

The incident surveyed noted an initial discrepancy on the material involved. The first report identified the chemical as *aluminum phosphate*. Later reports contradicted this information and a positive identification of the product by direct examination of the container's label, yielded in *aluminum phosphide*. The similarity in naming of the two products combined with the background noise and interference of radio communications provided all the elements for a misidentification scenario.

Aluminum phosphide presents a significantly higher toxicity hazard than aluminum phosphate. Yet, only a three letter suffix (-*ide* versus -*ate*) separates the two, discrete compounds. Chemical nomenclature is such that even a single letter can make a big difference. It is, therefore, evident that the use of UN/NA numbers for identification and information sharing purposes reduces the risk of an error in misspelling or transmission.

It is a lot easier to read, spell and transmit a four-digit number than a chemical name. The *ERG* is an easy-to-use reference, which can provide not only UN/NA identification numbers, but also crucial information that will allow the first responder to estimate the magnitude of the incident.

Other

Overdose or Hazmat?

One of the recurring questions the interviewers had during the survey was is this incident a poisoning or a hazmat? Is there an overlap between the two?

This event was initially dispatched as an "unknown situation." In the supplemental information, it was noted that a "male subject poss[ibly] OD on pills." The responders who entered the patient's room spoke of powder all over the desk and the floor. This information would be consistent with an overdose, as this would remind most of us of the description we associate with cocaine. However, this particular substance was different. This powder was aluminum phosphide and is used, primarily, to eradicate rats. Because of its use, one may consider this to be a poison. In order to trigger a *hazmat* label, many people would need to hear a hazmat buzzword or phrase. For example, if the initial dispatch had been for a person that had ingested malathion, a different level of response may have been generated. This is because most responders know that malathion is an organophosphate and organophosphates can be used as nerve agents.

The discussion above highlights the situational assessment and risk-based decision-making process that responders need to perform on all emergency scenes, especially routine calls that have the potential to be a hazardous materials incident. So of the chemicals described above (cocaine, aluminum phosphide, and malathion) which one is the poison? Which one is the hazmat? Is there a difference? Situational assessment and risk-based decision making must be practiced to be effective because the overwhelming desire to do good sometimes leads to complacency and increases the chances of overlooking a serious hazard and/or risk.

This jurisdiction did a great job in recovering from what could have been a very bad incident. Due to effective recognition and research, this event which could have affected many more people or closed down an emergency room, was mitigated effectively.

Works Cited

Vernon, A. (2009). *New Hazmat Risk for First Responders Situational Awareness Considerations* (FireWatch Bulletin FW-08-09). Retrieved October 1, 2010, from http://www.fireengineering.com/etc/medialib/new-lib/fireengineering/online-articles/documents/2010/08.Par.79677.File.dat/New%20Hazmat%20Danger%20for%20First%20Responders.pdf