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TO: Heads of Fire Departments

FROM: Stephen D. Coan
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DATE: June 1, 2011

SUBJECT: **Chemical Suicide**

This memo (originally issued in July 2010, is being reissued in light of the recent incidents of chemical suicide throughout the Commonwealth)

Suicide by toxic gas has become an increasingly common method for ending one's life and poses **immediate and serious danger to first responders**. The primary product in this emerging trend for suicide has been Hydrogen Sulfide, produced from readily available household products. The trend originated in Japan and has become more widespread, presumably, through the proliferation of information via Internet "suicide bulletin boards." This method of suicide is becoming common in the United States with recent incidents throughout the country including two in New York State and one episode reported to have occurred in a Massachusetts community on board a ship.

Responders should be aware that these situations commonly occur in vehicles, residential bathrooms and other small confined spaces, where a small amount of gas can quickly reach lethal concentrations. Early reports from Japan, as well as reports of such suicide acts in the United States, have taken place in motor vehicles with clearly posted warnings to responders. More recently, Japan has seen episodes of Hydrogen Sulfide suicide in buildings. While vehicle executed suicide poses limited risk to the public, such actions taken in buildings, offer greater risks to the public and first responders. Dispatchers and call takers should warn callers not to approach or enter vehicles, rooms or apartments where chemical suicide may have been attempted.

Indicators of a Chemical Suicide

- Individuals who initiate chemical suicide may, or may not, place warning signs on doors or windows to indicate the presence of deadly gas inside the space. Signs may not be easily detected, or understood, by other people – including responders! Signs may be hidden or obscured by condensation, frost, snow or vapors produced by the reaction. Interview anyone who may have approached the scene to learn what they saw or smelled. A "rotten egg" smell would indicate hydrogen sulfide; an almond odor is typical of cyanide compounds.

- Look for indications that a chemical reaction has been initiated. Typically you will find containers of household chemicals and pails, buckets, pots or other containers where chemicals could have been mixed. There is a possibility that improvised "containers", such as a sink or the glove box of an automobile, could be used to mix the chemicals. If you can clearly see that there are no chemical containers and mixing containers present anywhere in the space it is probably not a chemical suicide.

- Written warning – Including signs as described above or suicide notes that may detail the intended method.

- Suicide in a small space – such as a car, bathroom, closet, trailer

- Sealed environment – A suicide room or car may be sealed up with plastic, duct tape or weather striping.

- Precursor Chemicals – Acids (organic (fruit juice) or inorganic (muriatic)), sulfur based products such as rust and lime remover, Zinc Sulfate, certain pesticides.

About Hydrogen Sulfide (H_2S)

Hydrogen Sulfide gas has been a long known toxic gas, being the principal culprit of "sour gas" wells. Hydrogen Sulfide is also a principal concern in confined space rescue. The gas is produced for suicide purposes by mixing a sulfur containing product, such as detergent, certain pesticides or cleaners with an acid, such a Muriatic (Hydrochloric) acid, or Zinc lime cleaner and acid, or even aluminum sulfide in water. The presence of these materials near a reported suicide, or other response where the welfare of a reported unseen person or unconscious person should raise consciousness and caution.

Hydrogen Sulfide is a colorless gas with an odor resembling rotten eggs or sewer gas. It may occur naturally or in industrial or waste management settings from the decomposition of organic materials. Encountering very high levels or prolonged low-level exposure will desensitize workers to its odor. Hydrogen sulfide has an Immediately Dangerous to Life and Health (IDLH) level of 100 parts-per-million (PPM), a level easily achieved in a closed vehicle with small quantities of precursor chemicals.

Hydrogen Sulfide carries an NFPA 704 Health Risk rating of 4. The primary hazards of Hydrogen Sulfide are respiratory. Though some skin and eye contact hazards exist, skin hazards are largely associated with contact of Hydrogen Sulfide in its liquefied compressed gas state, causing frostbite[1]. Respiratory hazards are extensive, including at various levels of exposure: irritation, cough, lack of sense of smell, sensitivity to light, changes in blood pressure, nausea, vomiting, difficulty breathing, headache, drowsiness, disorientation, hallucinations, pain in extremities, tremors, visual disturbances, suffocation, pulmonary congestion, coma, death[2].

Hydrogen Sulfide carries a high flammability risk, also rated at 4 on the NFPA 704 diamond. Hydrogen Sulfide has a lower explosive limit (LEL) of 4% (40,000 ppm) and an upper explosive limit (UEL) of 44%[3]. The flammability poses risk to responders in the use of rescue tools to gain entry and where used in buildings or used in vehicles when the ignition and/or accessory switch may have been left on. One law enforcement bulletin on the subject raises concern on a larger scale, surmising that Hydrogen Sulfide may be generated as a booby trap against police entry teams when flash-bang devices are deployed. While many scenarios can be hypothesized, the flammability and thereby explosive potential should be clearly considered to be as high of a risk as that of toxicity. Initial size-up of a suicide or attempted suicide by H_2S should clearly and specifically identify ignition sources and provide protection against ignition.

Examples of household products used to produce H_2S are shown in the following table[4]

Acid Sources	Sulfur Sources
Lysol® Ready –to-Use disinfectant (4%-8% citric and hydroxyacetic acid)	Artist oil paints (up to 15% zinc sulfide)
Lysol® Toilet Bowl Cleaner (9.5% HCl)	Dandruff shampoos (1% selenium sulfide)
Sno Bol ®Toilet cleaner (15% HCl)	Pesticides (5%-30% calcium polysulfides)
The Works ® Toilet Bowl Cleaner (15%-20% HCl)	Spackling paste (1%-2% zinc sulfide)
Blu-Lite ® Germicidal Acid Bowl Cleaner (20.5% phosphoric acid)	Some latex paints (6.6% zinc sulfide)
Kaboom ® Shower, Tub and Tile Cleaner (5%-7% urea-monohydrochloric acid)	Garden Fungicides (5%-90% sulfur)
Tile & Stone cleaners (1%-30% HCl)	

[1] Source CDC, NIOSH Pocket Guide to Chemical Hazards, 1995 edition
[2] Source Hydrogen Sulfide Material Safety Data Sheet, Matheson Tri-Gas, via internet
[3] [3] Source CDC, NIOSH Pocket Guide to Chemical Hazards, 1995 edition
[4] Source New York State Office of Homeland Security, Advisory, 26 September 2008

Hydrogen Sulfide will not dissipate quickly after ventilation unless it is forced out of its containment. It has a Relative Gas Density (relative to air) of 1.19, meaning it is close in density to air and not prone to move much without air exchange. However, it will dissipate quickly in open air and if there is no further production as it has a vapor pressure of 13376 mm/hg, about 2 times that of ammonia or chlorine.

Approach and Detection

Caution should also be taken to avoid assuming that every chemical suicide is from Hydrogen Sulfide. Some chemical suicides have occurred using other chemicals, including **Hydrogen Cyanide**. Suicide by Hydrogen Cyanide has been seen in relatively recent history in Massachusetts and in Arizona.

Recommendations for respiratory protection in the emergency or IDLH environment are for self-contained breathing apparatus (SCBA) or supplied air systems[5] [6]. The chemical protective clothing (CPC) requirements for Hydrogen Sulfide, in this setting, are not specifically addressed under exposure guidance. Published guidance for this product recommends chemical protective clothing, but cites the risk as frostbite. As previously stated, this risk is associated with the industrial transportation and use of Hydrogen Sulfide as a compressed liquefied agent. However, this recommendation would tend to prevent a rapid rescue in structural fire fighting ensemble with SCBA.

In cases where the act of attempted suicide was witnessed and 911 called immediately, this lack of guidance may tend to inhibit or prevent a rescue and possible opportunity to save the victim. Accordingly, we have asked the Hazardous Materials Committee of the International Association of Fire Chiefs to investigate the CPC requirements and to put forth recommendations based upon such investigation. Other sources[7] state that chemical protective clothing is unnecessary, as H_2S is not absorbed through the skin. This is consistent with guidance regarding H_2S encountered in the confined space environment and would support rescue from chemical suicide where H_2S is known to be the product used, in structural firefighting ensemble with SCBA.

Consistently, reports of suicide have been accompanied by clear warnings of the hazard, most specifically warning responders of the danger, the presence of H_2S and the need to call for Hazmat assistance. Confirmation of the presence of H_2S can be made if the precursor chemicals are present and by many responder detection devices. H_2S is a common sensor in "four-gas" meters providing both the level of $H_2S$and the percent of the LEL. Hydrogen Sulfide can be detected with photo-ionization detection (PID) meters with a 10.6 eV, or higher, bulb. Caution should be used in interpretation of the PID

[5] Source CDC, NIOSH Pocket Guide to Chemical Hazards, 1995 edition
[6] Hazmaster G3 Chemical Response Software
[7] New York State Office of Fire Prevention & Control Hazardous Materials/Homeland Security Bureau

results; as such results will report a level of Volatile Organic Compound within its range, but are not specific to Hydrogen Sulfide and may be "seeing" something else.

Proper and safe management of suicide by Hydrogen Sulfide is, as are all emergencies, a matter of the assessment of many factors against plans, training and equipment. As a novel situation, at least thus far in Massachusetts, H_2S presents a series of relatively unknown risks. Communication and awareness of this emerging problem is a first step to meeting that challenge with the best possible results. When in doubt, request assistance from the district Hazmat Response Team.

Volumes of information and news reports of suicide by H_2S reside on the Internet and can be found using search term such as "suicide by Hydrogen Sulfide," or H_2S Suicides. More information will be forwarded through the Department of Fire Services when actionable information becomes available.

(U//FOUO) Potential Use by Terrorists[8]

(U//FOUO) Terrorist training manuals have discussed using Hydrogen Sulfide gas in an attack. DHS/I&A and the JRIC assess that the chemical reactions described in the manuals are viable and would yield hydrogen sulfide, but no information indicates that a terrorist attack is imminent using this chemical

(U//FOUO) The "Mujahideen Poisons Handbook" describes producing hydrogen sulfide gas by reacting sodium sulfide and sulfuric acid.

(U//FOUO) Another terrorist training manual proposes mixing hydrochloric acid and iron sulfide.

(U//FOUO) ***DHS/I&A and the JRIC assess that it would be difficult for terrorists to create fatal concentrations of hydrogen sulfide in large open areas because the gas would dissipate; however terrorists could use it in enclosed spaces to cause disruption and panic, based on the circumstances of non-terrorist-related events.***

[8] ibid

CONSIDERATIONS IN RESCUE AND RECOVERY

- Careful size up of any situation involving an unresponsive person in an enclosed space is critical for responder safety.
- Responders should wear SCBA and turn out gear whenever they are dealing with a suspected chemical suicide.
- Consider wind speed and direction when determining the need to evacuate nearby structures. In an apartment building consideration should be given to evacuating the entire building.
- If chemical containers are present attempt to identify the chemicals from labels on the containers, or a sales receipt. For Hydrogen Sulfide rescue can be made in Fire fighter Protective Ensemble (FFPE).
- The presence of containers of potassium cyanide, or cyanide compounds would indicate a reaction that produces hydrogen cyanide. This is less common than the hydrogen sulfide reaction as the cyanides are not as easily obtained. Rescue CANNOT be made in FFPE
- Air sampling equipment can be used to determine the presence, or absence of hydrogen sulfide or hydrogen cyanide. A small hole may be punched in a car or home window, or a probe, or colorimetric tube inserted in the gap between a door to the room and the floor. A hydrocyanic acid tube will detect hydrogen cyanide. Hydrogen sulfide is heavier than air (VD = 1.19), but hydrogen cyanide is slightly lighter (VD = 0.94) <u>If the vapor in the space cannot be identified, or the presence of hydrogen cyanide is confirmed entry should only be made by individuals protected by fully encapsulated chemical protective clothing (level A). Hydrogen cyanide is Immediately Dangerous to Life and Health at concentrations above 50 parts per million.</u>
- There have been no incidents of fire reported with these incidents and it is believed that concentrations do not typically reach the LEL except at close proximity to the mixing container. Responders should eliminate ignition sources when ever possible.
- The vapors inside the space should be ventilated to the outside. Ensure that no one will be endangered by the vapors before using natural or forced ventilation to air the space out. Anyone who has been exposed to the vapors should be decontaminated with soap and water. Clothing should be removed and double bagged. Contaminated clothing and PPE should be laundered before being reused. The victim should be stripped and decontaminated with soap and water before being transported from the scene. Deceased victims should be covered by a sheet, body bags are not recommended.