The Emerging Threat of Chemical Suicides

Shelley DuTeaux, PhD MPH
California Air Resources Board
Office of Emergency Response
What is a Chemical Suicide?

- New suicide technique
  - publicized on the Internet
- Uses a mixture of easily-obtained compounds
  - makeshift confined space
  - evolve gases at extremely toxic and/or explosive concentrations
- Most US cases involve young adults creating hydrogen sulfide (H$_2$S) in vehicles
Potential Dangers

- Creates an inhalation and dermal hazard to bystanders or those alerting the EMS system.
- First responders maybe unaware of the potential danger.
- Surrounding neighborhoods may be affected, potentially evacuated until the scene is stabilized and decontaminated.
Prevalence

- Japan first reported a trend of poisonous gas suicides
  - 208 people took their lives by mixing household chemicals in 3 month period in 2008
- First US incident in 2008 (Pasadena, CA)
  - cases since reported in Idaho, Utah, Texas, Georgia, North Carolina, South Carolina, Florida, Connecticut, Washington, California
- Number of incidents will likely rise as more individuals learn about the process

Recent Incident

19-year old victim at Cal Poly – San Luis Obispo
Friday, March 16, 2012

Photo Credit: San Luis Obispo Tribune
19-year-old Cal Poly freshman found dead in a car filled with poisonous gas in campus parking lot, Friday, March 16th - - the last day of winter quarter exams

At about 3pm, a construction worker going to his vehicle saw a handmade sign in a car window warning people to stay away because of deadly gas

When the worker peered inside he saw someone unresponsive and called University police

“We backed up from that point with the hazardous gases that may be present with the owner and the signs,” University Police Department (UPD) Chief Bill Watton said on scene.

- - Photo and quote: San Luis Obispo Tribune
Recent Incident, *continued*

- City Fire, County Environmental Health, and County HazMat
  
  • confirmed the presence of H$_2$S
  
  • spent hours removing gas from the vehicle

- Parking lot and adjacent streets closed for several hours

- Students were told about the potential for hazardous chemicals and that they could not have access to their cars

*Photo credit: CalPoly SLO Daily Mustang*
Chemical Threat

CaS + 2 HCl $\rightarrow$ CaCl$_2$ + H$_2$S

- Reaction of metal sulfide with strong acid evolves hydrogen sulfide gas
- Most popular metal sulfide is calcium polysulfide, an active ingredient in “lime sulfur” herbicides (28-30 % by weight)
- Popular sources of acids are toilet bowl cleaners (7-20% HCl)
### Acid Sources

<table>
<thead>
<tr>
<th>Chemical Product</th>
<th>Acidity/ingredient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toilet Bowl Cleaner</td>
<td>(9.5-25% HCl)</td>
</tr>
<tr>
<td>Germicidal Acid Bowl Cleaner</td>
<td>(20.5% phosphoric acid)</td>
</tr>
<tr>
<td>Shower, Tub, and Tile Cleaner</td>
<td>(7% urea-mono HCl acid)</td>
</tr>
<tr>
<td>Tile, stone, concrete cleaner</td>
<td>(1-30% HCl)</td>
</tr>
<tr>
<td>Pool cleaners</td>
<td>(muriatic acid, ~17% HCl)</td>
</tr>
</tbody>
</table>

### Sulfur Sources

<table>
<thead>
<tr>
<th>Chemical Product</th>
<th>Concentration/ingredient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artist oil paints</td>
<td>(0–15% Zn sulfide)</td>
</tr>
<tr>
<td>Dandruff shampoos</td>
<td>(1.0% Se sulfide)</td>
</tr>
<tr>
<td>Pesticides</td>
<td>(5–30% Ca polysulfides)</td>
</tr>
<tr>
<td>Spackling paste</td>
<td>(1–2% Zn sulfide)</td>
</tr>
<tr>
<td>Some latex paints</td>
<td>(6.6% Zn sulfide)</td>
</tr>
<tr>
<td>Garden fungicides, lime sulfur</td>
<td>(5-90% sulfur)</td>
</tr>
</tbody>
</table>
Effects of $\text{H}_2\text{S}$ Exposure

- Colorless gas, heavier than air, with strong odor of rotten eggs detectable as low as 0.5 ppb
- Inhalation of high concentrations of can produce extremely rapid unconsciousness and death
Effects of H$_2$S Exposure, continued

- CNS injury is immediate and significant
- A few breaths at high concentrations can cause immediate loss of consciousness, coma, respiratory paralysis, seizures, death
- Death often results from respiratory arrest
- Toxic mechanism: Inhibition of cytochrome oxidase resulting in a lack of O$_2$ utilization
H₂S Concentrations of Note

IDLH
= 100 ppm

Max 1hr conc without serious effects
= 170 to 300 ppm

May be dangerous in 30-60 min
= 500 to 700 ppm

Rapid unconsciousness, cessation of respiration, and death
= 700 to 1000 ppm

Unconsciousness, cessation of respiration, and death in a few minutes
= 1000 to 2000 ppm
Closed vehicle experiment

- Reaction of 1qt (28%) lime sulfur and 1qt (20%) HCl
- Driver's breathing zone peak concentration = 8000 ppm within 2 mins
- H$_2$S concentration avg = 6000 ppm/10 min
- Within 3 min of opening car doors vehicle concentrations dropped to < 5 ppm

H_2S not the only threat

The following chemicals have been reported in other chemical-assisted suicides:

- ammonium hydroxide
- aluminum sulfide
- calcium hypochlorite
- calcium sulfide
- germanium oxide
- hydrochloric acid
- potassium ferrocyanide
- sodium hypochlorite
- sulfur
- sulfuric acid
- trichloroethylene

Recent case of victim swallowing malathion:

- After arrival in ambulance, fumes pouring out of man prompted hospital officials to move him out of ER (temporarily shut down)
- Three paramedics treated for exposure to chemical fumes from victim
- Workers decontaminated the ambulance and ER equipment (gurneys, privacy screens)
- Surfaces and ambient air tested before return to service
Responder and Community Impacts

- CDC reported injuries to four responding law enforcement officers
- None wore personal protective equipment; however, two had HazMat training
- Four recent events resulted in evacuation orders affecting 85 persons; 32 persons were decontaminated
Preventing Further Injury

- Situational awareness starts with the initial call to EMS/dispatcher
  - Windshield survey of scene
  - Odd odor, color, vapors?
  - Posted warning signs?
  - Unresponsive person?
  - Taped windows, doors, vents?
  - Mixing bucket, empty containers?

- Warn law enforcement or first on-scene *before arrival or action*
Protective Steps

1. Establish zones of control and evacuation/shelter-in-place orders

2. Proper personnel protective equipment (SCBA, Level A/B) before breaching “enclosed space”

3. Decrease toxic/explosive concentrations
   - Some toxic gases form explosive mixtures with air
   - Ventilate source after analysis of potential hazards
   - Water spray can reduce vapors or divert a plume drift

4. Air monitoring until scene is rendered safe
Protective Steps, continued

5. Victim transport – Decontamination prior to leaving
   - Potential for victim and clothing to ‘off-gas’ trapped vapors
   - EMS and hospital must be notified in advance in order to avoid contamination of personnel/equipment

6. Decontamination
   - Responders, entry teams
   - Vehicle prior to transport/impounding
   - Surrounding scene; control and isolate run-off; collect contaminated soils
Potential Criminal Uses

Zinc or Aluminum phosphide:

- Highly toxic, low cost rodenticide, pellets
- Upon exposure to moisture liberates phosphine gas (garlic smell)
- Suicide cases have contaminated ER/EMS
- Potential chemical threat
  - Release/ ‘off gas’ in enclosed space
  - Respiratory toxicity
  - Potential for widespread contamination, chaos

Resources

ATSDR, Medical Management Guideline for Hydrogen Sulfide

NIOSH documentation for Immediately Dangerous to Life or Health (IDLH) Concentrations – Hydrogen Sulfide
www.cdc.gov/niosh/idlh/7783064.HTML

Central Florida Hazardous Materials Fusion Center

National Hazardous Materials Fusion Center
www.hazmatfc.com/incidentreports/statstrends/Pages/Home.aspx

Suicide Prevention Resource Center
www.sprc.org

Shelley DuTeaux
sduteaux@arb.ca.gov
916.324.1149