School Science Class Chemical Incidents

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The Problem

- A science demonstration that went bad in a Minnesota school in December has drawn national attention to the fact that there is little official oversight of experiments in classroom labs.
- No government agencies track all injuries in school laboratories.
- In MN, as in many states, there are no state codes for classroom science demonstrations.
The Agency for Toxic Substances and Disease Registry (ATSDR) has been conducting state-based chemical incident surveillance since 1990. Data are used for outreach and intervention to reduce public health consequences.

In a previous analysis* for the period 2002—2007, approximately 1% (n=423) of the 43,766 reported incidents occurred in elementary and secondary schools in the 15 states.

- Mercury was the most common hazardous substance released (29%); only 2% of mercury-related incidents caused an injury.
- Hydrochloric acid, commonly found in chemistry classrooms, resulted in a significant rate of injury (58%).

*Centers for Disease Control and Prevention. Hazardous Chemical Incidents in Schools --- United States, 2002—2007. MMWR, November 7, 2008 / 57(44);1197-1200
METHODS
Analysis of Science Class Incidents

- Used data from ATSDR surveillance programs
  - Hazardous Substances Emergency Events Surveillance (HSEES) 2002-2009
  - National Toxic Substance Incidents Program (NTSIP) 2010
- Selected incidents with the SIC and NAICS codes for K-12 schools (n=607)
- Reviewed the comments field for descriptions indicating a science class
  - Included the words “science” or “laboratory”
  - Indicated a thermometer was dropped in a classroom or by a teacher,
  - Made some judgment calls based on the comments and/or chemicals
  - If no comments, incident was not included (n=68)
RESULTS
Data 2002-2010 Overview

- **165 lab incidents**
  - 91 involved mercury
  - 79 involved an evacuation
    - Mean length 38.5 hours, maximum 58 days
  - 152 were primarily caused by human error
  - Equipment failure (n=38) and improper mixing (n=8) contributed to many incidents.

- **150 victims in lab incidents**
# School Science Class Incidents and Victims by Year

<table>
<thead>
<tr>
<th>Year - No. of states</th>
<th>Lab Incidents</th>
<th>Lab Victims</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002-15</td>
<td>16</td>
<td>17</td>
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<tr>
<td>2003-15</td>
<td>19</td>
<td>41</td>
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<tr>
<td>2004-13</td>
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<td>2008-13</td>
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<tr>
<td>Jan-June 2009-13</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>July-Dec 2009- 6*</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>2010-7</td>
<td>6</td>
<td>9</td>
</tr>
</tbody>
</table>

*13 states funded by HSEES through June 2009, then 6 states funded by NTSIP July through December.
Injuries/Symptoms*

- Respiratory irritation (n=63)
- Skin irritation (n=37)
- Burns (n=36)
- Headache (n=16)
- Eye irritation (n=12)
- Dizziness/CNS (n=7)
- Trauma (n=6)
- Short of breath (n=4)
- Gastrointestinal symptoms (n=1)
- Other (n=3)

*Individuals may have multiple symptoms.
Treatment of Victims

- Treated at hospital/not admitted (n=72)
- Treated on scene (first aid) (n=28)
- Observation at hospital, no treatment (n=16)
- Injury reported by official (n=12)
- Treated at hospital (admitted) (n=10)
- Seen by private physician within 24-hours (n=10)
- Missing info (n=2)
Top* Chemicals by Number of Incidents

- Mercury (n=91)
- Hydrochloric acid (n=10)
- Reaction (n=6)
- Mixture (n=6)
- Formaldehyde (n=4)
- Sulfuric acid (n=3)
- Ammonia (n=3)
- Sodium hydroxide (n=3)

*Chemicals involved in 3 or more incidents
Top* Chemicals by Number of Victims

- Reactions (n=26)
- Nitrous oxide (n=20)
- Hydrochloric acid (n=16)
- Mixtures (n=15)
- Floor cleaner not specified (n=10)
- Solvent (n=9)
- Methyl alcohol (n=9)
- Alkaline hydroxides (n=5)
- Flammable metal powders (n=5)

*Chemicals with 5 or more victims.
Example Scenarios

- 2005 Michigan – Students found mercury in an unmarked bottle and dropped it on the floor and kicked it up and down the hallways. The school was closed for 2 weeks while it was decontaminated.

- 2008 Colorado - A teacher ignited a fire while using a mixture of calcium, potassium permanganate and sodium metal during an experiment causing a release of vapors into the air. Several teachers and a student were taken to the hospital for treatment.
DISCUSSION
Science class chemical incidents can cause injury and school disruption.

These events may be preventable though proper training and supervision, given that most were caused by human error.

Because many of the school lab incidents involved mercury, particularly in measuring devices (thermometers/barometers), incidents can be greatly reduced through replacing them with mercury free instruments.
Not much ATSDR outreach has been directed at other school lab safety issues. EPA has some voluntary programs.

The regulations that do exist to protect children from chemical exposures [e.g. Occupational Safety and Health Administration (OSHA) or voluntary guidelines] are not consistently applied or enforced.
Limitations

- The data reported in this presentation is not representative of the entire US.
- Variations in state reporting procedures mean that ascertainment of school based incidents may not be as thorough in all participating states.
- The lack of comments for some incidents hindered our ability to identify all lab incidents in this dataset.
ATSDR Outreach

- Little government oversight of chemicals in schools
- Children are vulnerable to effects of chemicals
- ATSDR has chosen to focus on those chemical exposure incidents in schools for which successful interventions have been and developed and implemented
  - Mercury
  - Pesticides
  - Cleaning chemicals
  - Science labs
Next Steps

- Assemble workgroup to develop a white paper with evidence-based recommendations for effective policies and voluntary activities to reduce school chemical incidents, including in the science class
- Circulate the document to state lawmakers with the assistance of national organizations (i.e. National Conference of State Legislatures)
- Follow and report on adoption and effectiveness of best practices
For more information or to be part of the white paper please contact

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