Environmental Hazards in Clandestine Labs
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Objectives
- Describe the chemical and environmental hazards surrounding clandestine lab operations and exposures
- Understand the potential health effects of clandestine lab chemical hazards
- Be familiar with possible lung injuries and appropriate respiratory protection
Basic Hazard Types

- Chemical
  - Hazardous chemicals
  - Uncontrolled reactions
  - Spills

- Environmental
  - Suspects, bullets
  - Explosions and Fires
  - Booby Traps and IEDs
  - Ambient Oxygen Concentration
  - Heat Stress
  - Waste Dumping Pits
  - Rerouting of Electricity

Probably Not Wired To Code
Burns

“Fires at covert improvised laboratories used to produce illicit methamphetamine are producing a new type of burn patient.”

-AP Photo Caption

Burns

Methamphetamine Laboratory Explosions: A New and Emerging Burn Injury

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The proliferation of clandestine methamphetamine laboratories results in a wave of new burn patients. Aided by the triage of burn injuries associated with laboratory accidents, we undertook an analysis to characterize these injuries. Fifteen consecutive patients were enrolled and reviewed by age, gender, and IBH burn units. The cases were classified into four groups: Methamphetamine Laboratory Explosions, Methamphetamine Production, Methamphetamine Use, and Methamphetamine Laboratory Access.

The incidence of laboratory injuries sustaining 22.5% or higher inflicted and emergency treatment was significantly higher for methamphetamine laboratory injuries than for the laboratory access group. There was a higher incidence of triage burn trauma with higher incidence of burn injuries than expected.

The majority of burn injuries occurred in the hands and forearms, and minimal or no differences between the two groups.

Meth lab injury is singular and may not meet criteria for recovery as in other conditions. This study has implications for understanding methamphetamine laboratory injuries and improving burn care.

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Precursor Chemicals

- Highly toxic, corrosive, and/or flammable
- Many restricted by OSHA regulations requiring hazardous materials teams to clean up sites
- Five pounds of toxic waste are generated for every pound of methamphetamine produced.
- Commonly disposed of in backyards, dumpsters, storm drains, parks or along roadsides and farm fields.

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Chemicals

- **Precursors**
  - phenyl-2-propanone
  - ephedrine
  - pseudoephedrine
- **Reagents (catalysts & caustics)**
  - mercuric chloride
  - sodium acetate
  - hydrogen sulfide
  - hydriodic acid (HI)
  - iodine
  - red phosphorus
  - sodium hydroxide
- **Catalysts**
  - sodium acetate
  - freon
- **Solvents**
  - methanol
  - diethyl ether
  - freon
- **Caustics**
  - hydrochloric acid
  - phosphoric acid
  - sodium hydroxide

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On-Site Chemicals

- Depends on methods being used
- Quantities vary based on size and activity of lab
Chemicals
- Over 350 chemicals have been associated with meth labs
- 50 – 60 chemicals are commonly found
- By volume/quantity
  - Solvents: Most
  - Caustics
  - Precursors
  - Catalysts: Least

Solvents
- Solvents are the most commonly encountered class of chemicals and the most common dermally-absorbed class of chemicals
- Leading cause of fires and explosions at clandestine labs.

Meth Lab Waste
Shake and Bake

- Little more than a 2-liter soda bottle filled with the toxic ingredients.
- The waste and debris cannot be dumped in a regular landfill, only in specially approved waste sites.

Shake and Bake

Also known as the "one-pot" approach that uses less pseudoephedrine.
It also yields meth in minutes rather than hours, and it's cheaper and easier to conceal.
Meth cooks can carry all the ingredients in a backpack.

What risks do meth labs pose to human health and the environment?
Cooks

- Cooking meth poses a high danger of explosion because of volatile, unstable compounds are mixed, usually without the proper safety equipment.

Clinical effects from exposure to chemicals (cooks or waste)

- Exposure can lead to chemical burns, shortness of breath, damage to the central nervous system, headaches, vomiting, confusion, and, in some cases, death.

Health Effects

- Most commonly reported adverse effects are headache and airway irritant symptoms
- Most associated with "processing phase"
- 7 to 15 fold risk of becoming ill during a seizure of active lab compared to setup and in-transit

Hazardous Substances Emergency Events Surveillance (HSEES) System

- 66,588 hazmat events from 2001-2008
  - 2373 (3.6%) events involved methamphetamines
    - 541 events resulted in injuries, 902 total victims.
    - 61% of victims were official responders
  - 88.6% occurred in fixed facilities with remainder related to transportation
  - 14.5% meth events required evacuation compared to 6.5% of other causes

Melnikova et al. Public Health Reports. 2011; 126: 116-123
**HSEES System**

- Most common methamphetamine lab toxicants
  - Ammonia
  - Ethyl ether
  - Hydrochloric acid
- Most common methamphetamine lab symptoms
  - Respiratory irritation
  - Headache
- 33.9% treated at hospital & released
- 11.2% admitted, 2.5% deaths

Melnikova et. Al. Public Health Reports. 2011; 126: 116-123

**Waste from meth labs**

- Chemicals that are improperly disposed of can contaminate ground water and wells; kill plants; and harm aquatic life and animals

**Public Health Implications**

- Indiscriminate contamination
- Lack of proper storage
- Eliminated in urine and feces
- Chemical dumping into ground or sewers or septic systems
  - Contamination of surface water, ground water and wells
  - Requires extensive cleanup efforts
**Wastewater and Surface Waters**

- Study to quantify drugs of abuse in different water matrices before water treatment
- Presence of cocaine and amphetamines in influent and effluent samples.
- Cocaine metabolite and MDMA in surface waters
- Nicotine and caffeine found in all samples.

Huerta-Fontela et al. Analytical Chemistry. 2007; 79: 3821-3829

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**Drugs of Abuse and removal by Water Treatment Plant**

- Presence of psychostimulants before and after water treatment was assessed.
- Amphetamine-type stimulants (except MDMA) were completely removed.
- Ozone treatment partially eliminated caffeine.
- Cocaine was fully removed with activated charcoal.
- Reductions of 90% for caffeine and benzoylecgonine and 74% for cotinine were obtained.

Huerta-Fontela et al. Environmental Science and Technology. 2008
Wastewater and Surface Waters

- Review to assess removal of drugs during water treatment
- Amphetamines were not completely removed by were reduced in effluent and was dependent on the technologies used.

Boles and Wells. Journal of Chromatography A. 2010; 1217: 2561-2568

Surface Water Residue

- Presence may have potential implications for human health and wildlife (even with low levels)
- Pharmacologic interactions between drugs of abuse and therapeutic drugs
- Biological effects even at low concentrations

Pomati et al. Chemosphere. 2007; 70: 65-73
**Tap Water**

- 70 samples of drinking water tested for non-controlled and illicit drugs.
- Most frequently detected were caffeine, nicotine, cotinine, cocaine and its metabolites, and methadone and its metabolite.
- Most present in ultratrace levels
- No cannabinoids, LSD, ketamine, fentanyl and PCP were detected.

Boleda et al. Chemosphere. 2011; 84: 1601-1607

**Microbial Degradation**

- Study to look at the impact that microorganisms have on drug (precursors and by-products) degradation.
- Soil microorganisms P2P was rapidly metabolized to many breakdown products.
- Methylamphetamine sulfate remained unchanged.


**Product Contamination - Lead**

- Lead acetate as a P2P reagent
- Using the amalgam method, high levels of lead may be found
- Patients may present with abdominal pain, nausea, weakness, weight loss and anorexia due to lead.
Product Contamination - Mercury

- "Mercury method" uses P2P and methylamine using mercuric chloride
- Inadequate purification has resulted in mercury amounts ranging from 0 – 1300 ppm

Chronic Health Effects

- Little is known
- Animal and human toxicology data
  - May cause cancer, brain damage, liver and kidney problems, and birth defects and reproductive problems.
- No current scientific evidence that human health risk continues once site is properly decontaminated

Rural Environmental Fallout