

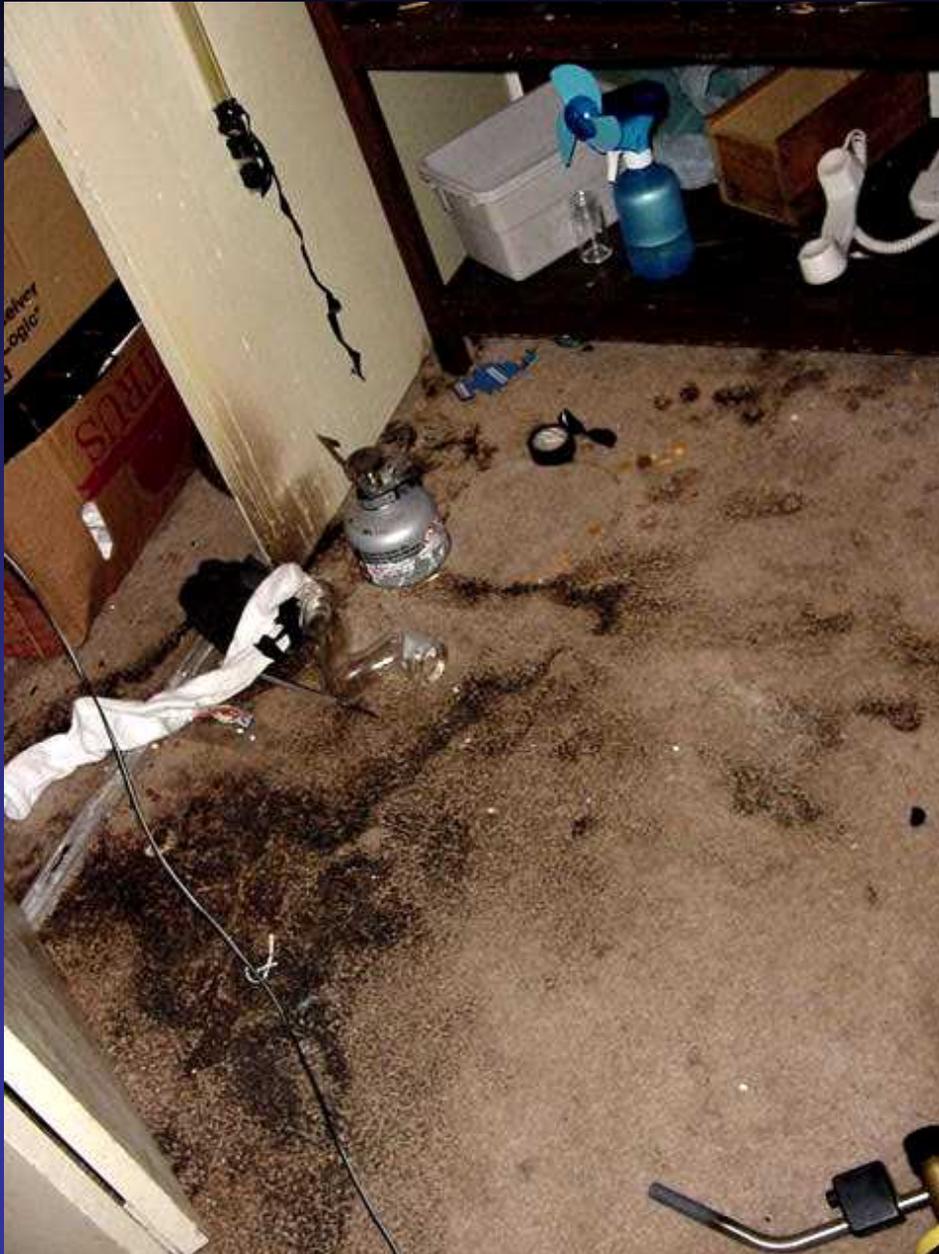
Chemical Exposures Associated with Methamphetamine Labs

by

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What is a Meth Lab?



The Project

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Red P Cooks



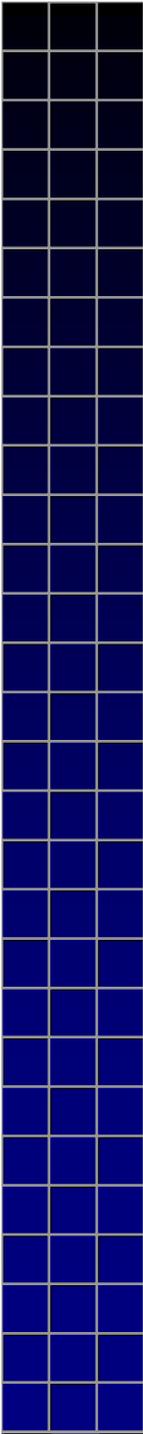
Anhydrous Ammonia Cooks



Hypophosphorous Cooks







Results of Exposure Study

Phosphine

- Symptoms
 - Severe pulmonary irritant
 - Nausea, vomiting, diarrhea, chest tightness, cough, headache, may be caused by exposures as low as 10 ppm
 - Pulmonary edema has caused death.
 - Implicated in deaths at Meth Labs.
 - Current Exposure Standards
 - TLV = 0.3 ppm
 - STEL = 1 ppm
 - IDLH = 50 ppm
 - Invisible with slight fish or garlic odor.
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Phosphine Exposure Levels

- In Red "P" and Hypophosphorous cooks.
 - Ranges from ND to 3.5 ppm (**10 x the TLV of 0.3 ppm**)
 - In the area of the cook in a home it averaged 0.94 ppm.
 - Phosphine may be present in the "death bag" at high concentrations.
 - The cook temperature and water content may have a significant effect on the amounts of phosphine generated.
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Iodine

- Iodine – Airborne
 - Irritant of the eyes, mucous membranes, and skin.
 - May cause chest tightness and difficulty breathing.
 - Levels of 1.63 ppm will cause eye irritation in all exposed within 5 minutes.
 - Skin rash due to hypersensitivity can occur.
 - Current Exposure Standards
 - TLV = 0.1 ppm Ceiling
 - IDLH = 2 ppm
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Iodine Exposure Levels

- Measured Exposure Range.
 - 0.23 ppm – 3.7 ppm (almost 2x the IDLH)
 - Levels measured in the house cook.
 - Cook area = 0.16 ppm
 - Down the hall = 0.04 ppm
 - Levels measured in the hotel cook
 - 0.001 ppm – 0.05 ppm
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Solvents

- Many different types of solvents can be used.
 - Symptoms will depend upon solvent type.
 - Irritation, pulmonary edema, peripheral neuropathy, liver damage.
 - Explosion hazard may be a major concern.
 - Current exposure levels depend on the individual solvent.
 - n-Hexane = 50 ppm
 - Chloroform = 10 ppm
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Hydrochloric Acid

- Symptoms – Airborne
 - Upper respiratory tract irritation – cough, burning throat, choking, burning eyes, chest pain.
 - Acute symptoms may occur as low as 5 ppm.
 - Skin contact may cause burns and ulceration.
 - Current Exposure Levels
 - TLV = 2 ppm Ceiling
 - IDLH = 50 ppm
 - Colorless gas with pungent odor.
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Hydrogen Chloride Exposure Levels

- Average exposures during entire cook period.
 - 0.3 – 2.3 ppm (slightly above the 2 ppm TLV)
 - Average exposure during salting out.
 - 3.8 – 7.2 ppm (> 3 x the TLV)
 - Peak concentrations during salting out.
 - 60 ppm – 155 ppm (> 3 x the IDLH)
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Anhydrous Ammonia

- Symptoms

- Severe irritant of the eyes, respiratory tract, and skin.
- After 70 ppm, most individuals will report irritation.
- Levels over 2500 may cause corneal irritation, bronchospasm, chest pain, and pulmonary edema. Bronchitis and pneumonia may also occur.
- Tolerance may be acquired.

- Current Exposure Standards

- TLV = 25 ppm
 - STEL = 35 ppm
 - IDLH = 300 ppm
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Anhydrous Ammonia Levels

- All meters overloaded
 - Highest reading 3000 ppm (**10 x the IDLH**)
 - Drager tube readings 500 ppm to 2000 ppm
 - Cook exposures range from 130 ppm to 370 ppm (**10 x the STEL**)
 - Exposures at the cook were 190 ppm and 410 ppm for a 2 hour period
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Methamphetamine

- Symptoms

- Very little known regarding low level chronic exposures.
- Irritation of the skin, eyes, mucous membranes, and upper respiratory tract.
- High levels may cause dizziness, headache, metallic taste, insomnia, high or low blood pressure, etc.
- Chronic exposures may cause irritability, personality changes, anxiety, hallucinations, psychotic behavior.
- Smaller infants, altered behavior patterns, lower IQ scores, teratogenic affects, cerebral hemorrhage.

- Current Standards

- None
 - Therapeutic dose = 5 mg (2 to 3 x per day)
 - Surface contamination = 0.1 – 0.5 ug/100 cm²
 - No Effect Level Unknown
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Methamphetamine Levels on Surfaces

- Ranged from non-detect to 16,000 ug/100cm².
 - Levels inside microwaves were high.
 - Levels on air returns were elevated suggesting airborne quantities.
 - Levels on flat surfaces in the lab area were very high.
 - Levels exceeding the standard were found in every verified lab.
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Airborne Methamphetamine using Red P Method



4200 $\mu\text{g}/\text{m}^3$

To

5500 $\mu\text{g}/\text{m}^3$

Methamphetamine Surface Levels After One Cook

- Vertical Surfaces
 - 36 inches from Cook – 130 ug/100 cm²
 - 88 inches from Cook – 120 ug/100 cm²
 - 146 inches from Cook – 30 ug/100 cm²
 - 200 inches from Cook – 11.6 ug/100 cm²
 - Hallway 216 inches from Cook – 8 ug/100 cm²
 - Clothing Contamination
 - 1 ug/sample to 580 ug/sample
 - Highest during salting out
 - Higher in Red P Methodology
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What About After the Cook?



Exposures 24 hours After a Cook

- Airborne Methamphetamine
 - During the Cook – 520 – 780 ug/m³
 - Walking Around – 70 – 117 ug/m³
 - Mild Activity – 106 – 170 ug/m³
 - Heavy Activity – 100 – 210 ug/m³
 - Meth in Carpet Dust
 - 59 ug/m² – 270 ug/m²
 - Other Compounds
 - Iodine and HCl becomes airborne next day
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Symptoms Among Responders



Health Effects

<i>Grouped health effect</i>	Ever had effect (n=93)	Symptomatic & sought medical treatment
Headache	56 (60%)	5 (9%)
Sore throat	42 (45%)	4 (10%)
Respiratory	41 (44%)	6 (15%)
Skin	38 (41%)	7 (18%)
CNS	29 (31%)	3 (10%)
Eye	28 (30%)	3 (11%)
Cardiovascular	14 (15%)	3 (21%)
Gastrointestinal	11 (12%)	0 (0%)

Exposure Conclusions

- Exposures to iodine, phosphine, anhydrous ammonia, and hydrochloric acid may exceed occupational standards.
 - Hydrochloric acid, Iodine, and anhydrous ammonia may exceed IDLH Levels.
 - Significant amounts of airborne methamphetamine are released during the cook and deposited on both horizontal and vertical surfaces.
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Conclusions (cont)

- Entering the cook area will contaminate clothing with methamphetamine and other chemicals.
 - The entire area of the home is contaminated by the generated compounds.
 - A significant number of responders report symptoms after laboratory entry.
 - A number of responders have had symptoms that required a physician visit.
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How can I Protect Myself?

- Wear the appropriate personal protective equipment.
 - Initial entry – SCBA, Protective Clothing (fire and chemical), Gloves, Boots.
 - After stabilization – Air purifying Respirators may be OK.
 - Assume that everything in the building is contaminated.
 - Establish good decon procedures.
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Decontamination



How much contamination During a Single Cook?

- Red "P" Cook Meth Contamination
 - Cooking Phase – ND
 - Filtering Phase – ND – 580 ug/sample
 - Salting Out – ND – 10.3 ug/sample
 - Anhydrous Ammonia Meth Contamination
 - All phases – ND – 58 ug/sample
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Entry Only Contamination: 24 hours After Cook

- All individuals that entered the home came out with measurable contamination.
 - Foot Contamination
 - 0.78 – 49 ug/wipe
 - Hand Contamination
 - 29 - 56 ug/wipe
 - Neck
 - All positive but most below 1.0 ug
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Lab Bust Contamination

- Suspects
 - 0.9 ug/wipe to 17.4 ug/wipe
 - Hands, clothing, etc.
 - Children
 - 0.2 ug/wipe to 1.18 ug/wipe
 - Pets
 - 1.89 ug/wipe (fur)
 - Law Enforcement Officers
 - 0.5 – 0.93 ug/wipe
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What Does This Mean?

- Anyone entering or taken from the lab area will be contaminated with low levels of methamphetamine.
 - In some cases, these levels may not be high.
 - The potential for high contamination levels does exist.
 - Accidents, fires, entry during the cook, etc.
 - Contamination may involve more than meth.
 - There is no adequate method for direct detection at this time.
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Decontamination Questions?

- Who?
 - Children, suspects, pets, responders, inadvertent exposures, evidence.
 - Where?
 - On scene, hospital, fire station, group home, etc.
 - How?
 - Wet decon, dry decon, clothing removal and replacement, clothing cover and transport.
 - How should contaminated clothing be handled?
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Decontamination

- Thought out in advance.
 - Hospital decon should be planned.
 - What will happen to clothing?
 - What about evidence shipment?
 - Child protocols
 - Involve the least contact possible.
 - Hospital, ambulance, vehicles
 - Confine exposures to one area.
 - EMERGENCIES
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Water and Detergent Decontamination

- Current data limitations
 - Only participant decontamination was tested.
 - Only smooth surfaces have been tested.
 - Methamphetamine results only
 - Decontamination results
 - Pre-decon levels - 5.8 – 26 ug/100 cm²
 - Post-decon levels - < 0.11 ug/100 cm²
 - Most samples have been <0.3 ug/100 cm²
 - On porous surfaces even methanol does not extract all methamphetamine.
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Water Decon Concerns

- Porous surfaces generally do not decontaminate well.
 - Carpeting, drywall, etc.
 - Suspects have not been tested.
 - Clothing has not been tested
 - Methamphetamine may be removed easier than other compounds.
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Chemical Residual Removal From Children

- Suggested guidelines from the Medical and Scientific Committee of the National Alliance for DEC.
 - Only Type I Meth Labs
 - Three Situations
 - Emergencies
 - Children with observed chemical contamination.
 - Children without observed chemical contamination.
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Emergencies

- Any Child in medical distress, or involved in fire, explosion, etc.
 - Basic life support **MUST** take preference over decontamination.
 - Transport ASAP
 - Decontaminate as soon as possible but **do not** delay transportation.
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Significant Chemical Exposure

- Conditions – chemical smell, wet clothes, visible chemical on clothes, etc.
 - If possible in a **non-threatening manner**, discard clothes at the scene and provide a warm shower with soap.
 - If not possible at scene, discard clothing and dress in clean clothes for transport to shower area.
 - Preferred – Shower at scene
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No Observed Chemical Exposure

- Condition – No sign of obvious chemical exposure (odor, liquids, etc).
 - Child will not likely present a significant danger.
 - Public Health considerations.
 - Monitoring considerations.
 - Communities should develop a protocol.
 - Based on capabilities of community.
 - Based on what is best for the children.
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Protocol Suggestions

- Clothes worn in lab should be removed as soon as is safe.
 - Shower should be provided when:
 - Safe and trauma-free shower can be provided.
 - Shower should be with warm water.
 - Clothes worn at the scene should be kept by responsible agency or discarded.
 - Shower may be conducted at: on scene, at hospital, at fire station, by local protocol
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Remediation

- Many states have enacted remediation guidelines.
 - General requirements:
 - Removal of porous surfaces
 - Cleaning of smooth surfaces
 - Removal of carpeting
 - Removal of contaminated material
 - Remediation testing
 - Concerns
 - Septic Systems, household items, surrounding soil
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Current Guidelines

<i>State</i>	<i>Specified Value</i>	<i>Unified Value</i>
Alaska	0.1 ug/100 cm ²	0.1 ug/100 cm ²
Arizona	0.1 ug/100 cm ²	0.1 ug/100 cm ²
Arkansas	0.5 ug/ft ²	0.05 ug/100 cm ²
Colorado	0.5 ug/ft ²	0.05 ug/100 cm ²
Minnesota	<1ug/ft ²	<0.1 ug/100 cm ²
Oregon	0.5 ug/ft ²	0.05 ug/100 cm ²
Tennessee	0.1 ug/100 cm ²	0.1 ug/100 cm ²
Washington	0.1 ug/100 cm ²	0.1 ug/100 cm ²

Dose Estimates vrs. Exposure

Basis for Dose	Calc. Dose (mg/kg-day)
Infant exposed to 0.1 ug/100 cm ²	0.00008
Infant exposed to 0.5 ug/100 cm ²	0.0004
RfD – Prenatal Development	0.005
RfD – Neurotoxicity Endpoints	0.007
Illicit usage - 150 mg for Adult	2.14
Infant exposed to 499 ug/100 cm²	0.41