

Toxicity Levels in a Manufacturing Environment

by

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Project Sponsors

- Colorado Department of Public Safety
 - U.S. Dept. of Justice
 - Colorado Methamphetamine Program
 - National Institutes of Occupational Safety and Health (NIOSH)
 - North Metro Drug Task Force
 - Tri-County Health Department
 - National Jewish Medical and Research Center
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Project Purpose

- To determine the actual exposures associated with the investigation of clandestine methamphetamine labs.
 - To determine the potential health effects to first responders.
 - To suggest PPE for first responders.
 - To suggest medical monitoring for first responders.
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Added Benefit

- To determine the potential exposures to children associated with methamphetamine labs.



What We Did

- Went into methamphetamine laboratories with the NMTF and conducted air sampling.
 - GC/MS Scans (hydrocarbon unknowns)
 - Acids
 - Phosphine
 - Iodine
 - Wipes for methamphetamine and precursors
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MSA

MSA Chem-Tape
MSA Chem-Tape
MSA Chem-Tape
MSA Chem-Tape

MSA
Breath
R-30

MSA



Pre-Sampling at Colorado Springs Police Department





power on heater on
Electromantle

SPECTRUM
HT105 500 ml
Hypophosphorous Acid
50% (w/v) Solution
CAUTION: For manufacturing or laboratory use only. Hazardous and corrosive. See Safety Data Sheet (SDS) for more information. For chemical emergencies, call 1-800-424-9300.
CORROSIVE

50% Hypo

Meth Lab Responses

- Responded to 14 clandestine laboratories.
 - 2 Hotel Rooms
 - 4 Homes
 - 1 Apartment
 - 6 Trailers
 - 1 Vehicle
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NMTF Cook at a Home









Definitions

- Threshold Level Value (TLV)
 - 8 hour time-weighted average (TWA)
 - Occupational exposures only
 - Guideline ONLY
 - Ceiling Value
 - A concentration that should not be exceeded during any part of the working exposure.
 - Short Term Exposure Limit (STEL)
 - Not to be exceeded for a 15 minute TWA
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Pre-Sampling Findings

- Hydrochloric Acid
 - Current TLV = 2ppm Ceiling
 - Lab Range = 0.3 – 2.3 ppm
 - Phosphine
 - Current TLV = 0.3 ppm, 1ppm STEL
 - Lab Range = 0.3 ppm – 3.5 ppm
 - Iodine
 - Current TLV = 0.1 ppm Ceiling
 - Lab Range = 0.23 ppm – 3.7 ppm
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Pre-Sampling Findings (cont)

- GC/MS Findings
 - Methyl Chloride
 - Chloroform
 - Heptane
 - Methanol
 - Pentane
 - Methyl Iodide
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Pre-Sampling Findings (cont)

- Methamphetamine Levels (wipes)
 - Background levels were present within the lab hoods.
 - Current allowable levels = 0.5 ug/100 cm² to 0.1 ug/100 cm²
 - Range in Hoods = 0.78 ug/100 cm² to 16 ug/100 cm²
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Pre-Sampling Conclusions

- Exposures to hydrochloric acid may be at or above the current occupational standard.
 - Phosphine exposures may exceed the current STEL by as much as three times.
 - Iodine may exceed the current occupational standard by 30 fold.
 - Methamphetamine levels may significantly exceed standards.
 - Numerous volatile hydrocarbons may be released.
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Field Study Findings

- None of the labs that we entered were in production.
 - Chemicals present in most of the labs were minimal.
 - Children were associated with several labs.
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Chemical Exposures

- Hydrochloric Acid – No elevated levels were found.
 - Phosphine – Phosphine may have been elevated at one site (0.25 ppm?).
 - Iodine – Low levels were found at 2 labs (0.002 ppm)
 - Low level solvents were found in some labs.
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Methamphetamine Exposures

- 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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Surface Methamphetamine Levels

Location	ug/100cm²
Night Stand	2800
Ceiling Fan	2500
Microwave	2400
Bath Exhaust Grill	1600
Microwave	1700
Hotel Table	920
Kitchen Stove	790
Floor	520
Return Air Vent	450
Livingroom Table	430







Test Cook

- To determine the exposure levels during a cook.
 - To determine the spread of exposures through a typical home.
 - To determine the personal exposures to the cook
 - To determine the exposures to bystanders (Children)
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Test Cook Chemical Findings

- Phosphine Levels (TLV = 0.3 ppm)
 - At the cook area – 0.94 ppm
 - Cook's Exposure – 0.14 ppm
 - Down the hall – 0.26 ppm
 - Iodine Levels (TLV = 0.1 ppm)
 - At the cook area – 0.16 ppm
 - Cook's Exposure – 0.04 ppm
 - Down the hall – 0.04 ppm
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Chemical Findings (cont)

- Hydrochloric Acid (2.0 ppm)
 - At the cook area - 1.9 ppm
 - Cook's Exposure – 0.08 ppm
 - Down the hall – 0.02 ppm
 - Acidification stage – 3.8 ppm
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Real-Time Samples

- Phosphine
 - Vicinity of Red P cook – High of 2.6 – 2.9 ppm
 - Vicinity of Hypo Cook – High of 0.85 ppm
 - 1 room away from Hypo cook – High of 0.4 ppm.
 - 2 rooms away from Hypo Cook – High of 0.55 ppm
 - Hydrochloric Acid
 - Acidification phase – 60 ppm to 155 ppm
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GC/MS Results

- Acetone
 - Pentane
 - Hexane
 - Methylcyclopentane
 - Aliphatic hydrocarbons –C7 & C8
 - Toluene
 - Benzyl Chloride
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Methamphetamine Surface Levels

- Horizontal Surfaces
 - 6 inches from cook – 87 ug/100 cm²
 - 72 inches from cook – 28 ug/100 cm²
 - Vertical Surfaces
 - 63 inches from cook – 20 ug/100 cm²
 - 113 inches from cook – 10 ug/100 cm²
 - Clothing
 - ND to 18 ug/wipe
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Test Cook Conclusions

- Exposures to iodine, phosphine, and hydrochloric acid can exceed occupational standards.
 - Significant amounts of airborne methamphetamine are released during the cook and deposit on both horizontal and vertical surfaces.
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Test Cook Conclusions (cont)

- Entering the cook area may contaminate clothing with methamphetamine and other chemicals.
 - The entire area of the home is contaminated by the generated compounds.
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Implications to Children Associated with Methamphetamine Labs

- All children will be exposed to methamphetamine.
 - Touch
 - Food
 - Airborne
 - Ingestion
 - Children may be exposed to levels of iodine, acid, and phosphine that exceed occupational standards.
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Chemical Levels

Compound	TLV	Lab Pre-test	NMTF Cook	Realtime Cook (MAX)
Hydrochloric Acid	2 ppm Ceiling	0.3 ppm – 2.3 ppm	0.02 ppm – 3.8 ppm	155 ppm
Phosphine	1 ppm STEL	0.3 ppm – 3.5 ppm	0.14 ppm – 0.9 ppm	2.9 ppm
Iodine	.1 ppm Ceiling	0.2 ppm – 3.7 ppm	0.04 ppm – 0.2 ppm	ND



NOV

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White portable heater

Red fire extinguisher

Black stereo system

Pioneer DEH-P6500 car stereo box

Cardboard box with white rope

dorf

Potential Symptoms

- Hydrochloric Acid – Airborne
 - Upper respiratory tract irritation – cough, burning throat, choking, burning eyes.
 - Acute symptoms may occur as low as 5 ppm.
 - Iodine – Airborne
 - Irritant of the eyes, mucous membranes, and skin.
 - Levels of 1.63 ppm will cause eye irritation in all exposed within 5 minutes.
 - Skin rash due to hypersensitivity can occur.
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Symptoms (cont)

- Phosphine
 - 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.
 - Solvents
 - Irritation, pulmonary edema, peripheral neuropathy, liver damage.
 - Methamphetamine
 - Unknown
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What Next?

- Project continuation
 - More data on cooking exposures.
 - Rating sheet to suggest exposures to medical care givers.
 - Education of medical, law enforcement, and emergency services providers in Colorado.
 - Child Follow-up
 - Identify children that have been exposed to meth labs.
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- Establish a protocol for the evaluation of the physical and mental well-being of these children.
 - Better, less invasive methods.
 - Track the children over time to determine long-term health effects.
 - Evaluate and improve medical protocols.
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