## *CHEMICALS USED IN METHAMPHETAMINE MANUFACTURE*

### *Properties of Chemicals Used*

Most of the chemicals associated with producing meth can be grouped into the following distinct categories with similar toxic and physical properties:

1) solvents;
2) metals and salts; and
3) strong acids or bases.

Regardless of the production method (there are several methods used to produce meth), chemicals in each of these groups are used. The routes of exposure and possible health effects of these chemicals and those that have unique hazards are summarized in Tables1-3 below.

Those chemicals classified as solvents or corrosives (strong acids or bases) may exist as gases or liquids and thereby produce the greatest risk for inhalation (breathing) exposure. In contrast, chemicals that are solid or relatively non-volatile (don't easily become gasses) present little inhalation risk unless environmental factors, such as air movement, fire, explosion, etc., cause the chemical to be present in the air as dust or vapors. Solid substances in the form of fine powders are easily inhaled.

### *Tables*

**TABLE 1: CHEMICAL TOXICITY AND ROUTES OF EXPOSURE**
(Skin and Respiratory)
CORROSIVES AND IRRITANTS

**TABLE 2: CHEMICAL TOXICITY AND ROUTES OF EXPOSURE**
(Skin and Respiratory)
SOLVENTS

**TABLE 3: CHEMICAL TOXICITY AND ROUTES OF EXPOSURE**
(Skin and Respiratory)
METAL/SALTS

**TABLE 1**

## CHEMICAL TOXICITY AND ROUTES OF EXPOSURE
## (Skin and Respiratory)

## CORROSIVES AND IRRITANTS

| Substance | Form | Exposure |
|---|---|---|
| Acetic Acid | Liquid | Skin, Eyes, Inhalation |
| Acetic Anhydride | Liquid | Skin, Eyes, Inhalation |
| Ammonia | Gas, Liquid | Skin, Eyes, Inhalation |
| Benzyl Chloride | Liquid | Skin, Eyes, Inhalation |
| Hydroiodic Acid | Liquid | Skin, Eyes, Inhalation |
| Methylamine | Gas, Liquid, Solid | Skin, Eyes, Inhalation |
| Perchloric Acid | Liquid | Skin, Eyes, Inhalation |
| Phosphine | Gas | Eyes, Inhalation |
| Sodium Metal | Solid | Skin, Eyes |
| Sodium Hydroxide | Liquid, Solid | Skin, Eyes |
| Thionyl Chloride | Liquid | Skin, Eyes, Inhalation |

**Health Effects:** Vapors of volatile corrosives may cause eye irritation, lacrimation (shedding tears), redness/inflammation, and corneal injury. Inhalation may cause mucous membranes irritation in the nose and throat, and lung irritation resulting in cough, chest pain, and shortness of breath. Accumulation of fluids and bleeding in the lungs may occur in severe cases. High concentrations of vapor may cause skin irritation. Additional symptoms of vapor inhalation may include headache, nausea, dizziness, and anxiety. Direct contact with corrosives may result in severe eye or skin burns.

## TABLE 2

## CHEMICAL TOXICITY AND ROUTES OF EXPOSURE
## (Skin and Respiratory)

## SOLVENTS

| Substance | Form | Exposure |
|---|---|---|
| Acetone | Liquid | Skin, Eyes, Inhalation |
| Benzene | Liquid | Skin, Eyes, Inhalation |
| Benzyl Chloride | Liquid | Skin, Eyes, Inhalation |
| Chloroform | Liquid | Skin, Eyes, Inhalation |
| Ethanol | Liquid | Skin, Eyes, Inhalation |
| Ethyl Ether | Liquid | Skin, Eyes, Inhalation |
| Freon | Liquid | Skin, Eyes, Inhalation |
| Hexane | Liquid | Skin, Eyes, Inhalation |
| Isopropanol | Liquid | Skin, Eyes, Inhalation |
| Methanol | Liquid | Skin, Eyes, Inhalation |
| Petroleum Ether | Liquid | Skin, Eyes, Inhalation |
| Pyridine | Liquid | Skin, Eyes, Inhalation |

**Health Effects:** Inhaling vapors at low concentrations may result in mild eye, nose, and throat irritation. Symptoms of intoxication (drowsiness and lack of coordination) or loss of consciousness may occur at high concentrations. Liver and kidney impairment may also occur at high doses.

Freon is generally not poisonous, but if spilled onto the skin it may result in freezing injury to the skin.

## TABLE 3

## CHEMICAL TOXICITY AND ROUTES OF EXPOSURE
## (Skin and Respiratory)

## METAL/SALTS

| Substance | Form | Exposure |
|---|---|---|
| Aluminum | Solid | Skin, Eyes |
| Iodine | Solid | Skin, Eyes |
| Lead Acetate | Solid | Skin, Eyes |
| Lithium Aluminum Hydride | Solid | Skin, Eyes |
| Magnesium | Solid | Skin, Eyes |
| Mercuric Chloride | Solid | Skin, Eyes |
| Palladium | Solid | Skin, Eyes |
| Potassium Metal | Solid in Kerosene | Skin, Eyes |
| Red Phosphorous | Solid | Skin, Eyes |
| Sodium Acetate | Solid | Skin, Eyes |
| Sodium Hydroxide | Solid | Skin, Eyes |
| Sodium Metal | Solid in Kerosene | Skin, Eyes |

**Health Effects:** Most metals and salts are stable solids with minimal potential for exposure unless ingested or unless the material is present in the air as dust, vapor (at normal temperatures), or fumes (if heated). Sodium and potassium metal and sodium hydroxide are extremely corrosive in the presence of moisture. Lithium aluminum hydride is extremely reactive (fire and explosion hazard).

## *Impacts of These Chemicals on Human Health*

Several chemicals involved in methamphetamine production present a danger of injury from fire or explosion. In addition, at a lab site there are possible risks of exposure to infectious disease in the event of skin puncture by drug paraphernalia (needles). There is a risk of injury or toxicity from chemical exposure depending on the toxic properties of the chemicals present and their quantity, form, concentration, and the duration and route of exposure. The body may absorb chemicals or local injury may occur by one or more of the following routes of exposure:

1. Inhalation (breathing)
2. Skin exposure (direct skin contact)
3. Ingestion (swallowed)
4. Injection (introduced via skin puncture with a needle, broken glass, etc.)

Inhalation and/or skin exposure are the most likely routes of exposure for people exposed to labs. Ingestion is possible if people eat, drink, or smoke in contaminated areas, or fail to wash contamination from skin and clothing. The drug user-chemist has the additional potential of toxicity from all routes of exposure; i.e., ingestion and injection of drugs, spilling chemicals onto the skin, and inhaling vapors. Others, including children, who enter or live in labs may accidentally ingest chemicals, in addition to risking potential skin or inhalation exposure.

Inhalation or skin exposure may result in local injury from corrosive substances, and may include symptoms such as shortness of breath, cough, chest pain, or skin burns. Many solvents are well absorbed from the lungs into the body and, if the dose is sufficient, may result in symptoms of intoxication - dizziness, lack of coordination, nausea, etc. The skin, to a lesser extent, absorbs some solvents if chemicals have direct contact. Ingesting chemicals runs the greatest risk of toxicity, however, except in the event of a suicide attempt or a child accidentally ingesting these chemicals, toxicity by ingestion is the least likely route of exposure.

## *Exposure Risks*

The risk of human exposure to chemicals varies considerably depending on the lab process, quantity and form of chemicals, and other exposure factors. Also, a lab that is actively producing drugs presents a much greater potential hazard than a building that formerly housed a lab.

## *Active Labs*

A laboratory that is functioning and supplied with chemicals presents the greatest risk of adverse health effects for occupants and emergency responders. If a building is discovered to be a clandestine drug lab containing chemicals and laboratory hardware, it is considered unsafe for entry except by trained, licensed personnel wearing appropriate personal protective equipment.

Danger of explosion and fire are a serious risk due to large amounts of solvents that may be present upon entering a lab building. A large accidental or deliberate spill of chemicals could result in air concentrations great enough to be lethal or to produce symptoms of illness from inhaling solvents or corrosives. The lab cooking process may generate airborne chemical dusts and vapors, which could result in sufficient exposure to produce illness. Air concentrations of chemicals may vary considerably depending on the lab process and quantity of chemicals present. Another potential serious risk of chemical exposure may occur if occupants set up chemical “booby traps" in an effort to injure or disable potential intruders.

Immediate injury with onset of symptoms from chemical exposure is the most significant health risk related to methamphetamine manufacture. When this occurs it is known as an “*acute exposure*.” (See Tables 1-3 above for routes of exposure and possible health effects.)

## *Former Labs*

After removing illicit laboratory equipment and chemicals, residual amounts of some chemical substances may persist on building surfaces and furnishings prior to cleanup or decontamination. Substances present in the active lab, including gases or volatile solvents, will dissipate rapidly with ventilation unless large amounts of exposed chemicals remain.

Residual solids and liquids in the form of surface residues, spills, etc. will remain in place unless physically removed. Until completely and thoroughly removed, there is a possibility of being exposed to these residuals risking injury. The longer the exposure, the greater the potential for harm. Exposure over an extended period of time (months to years to a lifetime) is known as "*chronic exposure*." Not much is known about the chronic health effects from methamphetamine labs. There is scientific evidence, however, that shows that the chemicals used to manufacture methamphetamine can cause a variety of health effects including cancer, brain/nervous system injury, injury to the liver and kidneys, birth defects, and reproductive disorders. Chemically induced cancers and permanent injury to organ systems are generally associated with continuous or habitual exposure to harmful chemicals over extended periods - years or a lifetime.

If appropriate decontamination procedures are followed, former lab buildings can be re-occupied. Based on the known physical properties of the chemicals associated with methamphetamine production, there is no current scientific evidence to suggest a continuing human health risk after a thorough decontamination.

For exposure limits of individual chemicals typically used in the meth manufacturing process, please refer to the Arizona College of Public Health www.publichealth.arizona.edu/divisions/envirocom/meth_chemicals.htm.

For additional exposure information involving emergency responders visit the National Jewish Research Center's study at www.nationaljewish.org.

## *ENVIRONMENTAL CONCERNS*

It is estimated that 5-7 pounds of chemical waste is produced for each pound of meth manufactured. This waste commonly finds its way into the environment through many different routes. A large percentage of this material is dumped down drains. If a drain is connected to a sanitary sewer it could negatively affect wastewater treatment plants. If it is connected to a septic system, it could cause that system to be ineffective and contaminate soil and ground water. If the material is dumped into a storm sewer, the waste will eventually make its way into lakes, rivers, and streams. This can kill fish, birds, and animals as well as contaminate surface water. If large amounts of waste are buried or dumped they may contaminate wells or groundwater. If the material is burned hazardous byproducts may be released into the air and hazardous residues may collect on the ground.

Meth production also releases toxic gasses, including, but not limited to, hydrochloric acid, hydrogen chloride, phosphine, and ammonia. These gasses are released during the cooking process and can be deadly.

Some meth production requires using explosive materials, some of which may include lithium aluminum hydride, and sodium and potassium metal. Add to these materials the volatile organic compounds (VOCs) such as acetone, ether, and methanol that are frequently present in meth production and a lab becomes potentially explosive.

If you come upon a lab or discover any chemicals that were improperly disposed of, do not touch anything! Call your local police department.

Inquiries to the Drug Lab Cleanup Program should be directed to:

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