

CHEMICAL HAZARDS RELATED TO CLANDESTINE DRUG LABORATORIES

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Abstract

The number of clandestine drug laboratories in the United States and Europe has increased as a result of the rising popularity of drugs such as gammahydroxybutyrate (GI-IB), 3,4-methylenedioxyamphetamine (Ecstasy), and other methamphetamines; as well as a shift from complex manufacturing procedures involving several highly explosive, flammable, and toxic industrial precursor chemicals to simpler "cold cook" methods involving ammonia and common household acids, caustics, and chlorinated hydrocarbon solvents.

Although fires and explosions at clandestine drug laboratories continue to result in injuries and fatalities, injuries from corrosive and caustic chemicals are increasing due to the shift to "cold cook" methods for manufacturing methamphetamines and from caustic impurities in GI-IB. These laboratories pose health hazards for police, firefighters, and the public. Establishing a register of contaminated locations and exposed individuals may provide more objective information about long-term health and environmental hazards posed by the laboratories.

Introduction

Illicit drug use in the United States reached a high of 12.9 million persons in 1979, decreased through the 1980s to a low of 12 million in 1992, and increased in the late 1990s to 13.6 million. [1] The increase is due largely to the popularity of four clandestine drugs: methamphetamines; 3,4-methylenedioxymethamphetamine (commonly known as MDMA, or Ecstasy); flunitrazepam (marketed under the brand name "Rohypnol"); and gammahydroxybutyrate ("GI-IB"). Incidents of Ecstasy abuse have increased 800 percent over the past five years, and seizures of Ecstasy pills shipped to the United States from Europe increased from 300,000 pills in 1993 to 3.5 million pills in the first two months of 2000 alone. [2,3] Illicit drug use has been associated with several social problems in the United States, including violent crime and child abuse.

Several European countries have experienced increases in illicit drug manufacturing activity. Diversion of industrial chemicals for production of illegal drugs remains a serious problem in the Czech and Slovak republics, Germany, the Netherlands, Poland, and Russia. [4] Illegal methamphetamine manufacturing is extensive in these countries. Ecstasy is produced in clandestine laboratories for consumption in Europe, and for distribution to the United States. [2,4,5]

Clandestine drug laboratory issues shared by European countries and the United States include production of GI-IB and methamphetamines for local consumption, and production of Ecstasy in Europe for local consumption and for distribution to the United States.

Methods

With the exception of marijuana, chemical precursors are required to manufacture illicit drugs. In the past, regulatory controls on industrial chemical precursors in the United States and some European countries were effective in curbing diversion of these chemicals to clandestine laboratories. [3] The advent of simple methamphetamine production methods has allowed clandestine drug manufacturers to circumvent diversion controls, and has resulted in a dramatic increase in the number of clandestine laboratories in the United States. [6] In addition, the Internet has allowed clandestine methamphetamine manufacturers in Europe and North America to exchange information on production methods. [7]

Methamphetamines

Methamphetamines can be smoked, inhaled, injected, or ingested; resulting in increased heart rate, blood pressure, body temperature, and rate of breathing. Side effects include increased violent behavior, nervousness, irritability, paranoia, and severe depression upon withdrawal. In the past, methamphetamine production involved the use of several highly flammable and toxic industrial chemicals, including cyanide compounds, mercury, and ether. [8] Many of these substances were subsequently placed on a list of watched chemicals by the U.S. Drug Enforcement Administration. [9] As a result, methamphetamine manufacturers developed alternative methods using common household chemicals. Yields are low, but these methods are popular because the precursor chemicals are accessible in communities in the United States.

Currently, one of the most popular methods of clandestine methamphetamine production is the ephedrine reduction method. [10] Ephedrine is separated from other ingredients in nutritional supplements, cold medicines, and herbal pills by boiling the pills in hydroiodic acid and red phosphorus. Iodine is obtained from pet stores, and the red phosphorus is obtained from match book striking pads. After boiling, the iodine and red phosphorus are filtered out, and the ephedrine is converted to methamphetamine using sodium hydroxide (drain opener lye), hydrochloric acid or hydrogen sulfide, and a hydrocarbon solvent (toluene or camping stove fuel). Byproducts are poured down the drains of apartments and homes where the laboratories are located, resulting in serious chemical and thermal burn hazards for law enforcement officers, maintenance and cleanup personnel, and future residents.

Ecstasy

Ecstasy is a stimulant and a mild hallucinogen. Ecstasy produces rapid heart beat, high blood pressure, faintness, muscle cramping, panic attacks, seizures, nausea, hallucinations, chills, sweating, tremors, and blurred vision. It has been implicated in deaths from heat stroke and heart failure. Ecstasy consumed in Europe and North America is produced in clandestine drug laboratories in Europe. One of the most common clandestine synthesis methods for Ecstasy involves distillation of sassafras oil to obtain safrole. [7,10] The safrole is then processed with other precursors (acetone, benzene, diethyl ether, formic acid, hydrogen peroxide, methanol, N-methylformamide, and sulfuric acid) to produce Ecstasy. Precursors for this method include several explosive, flammable, toxic, and corrosive materials. As with clandestine manufacture of methamphetamines, by-products and waste materials are disposed of improperly by pouring them down drains, or by dumping onto the ground. In addition, vapors emitted by several steps in the process pose inhalation hazards to occupants and neighbors, especially children.

Flunitrazepam

Rohypnol is the trade mark for flunitrazepam manufactured by Hoffman-LaRoche in Europe. Flunitrazepam is a benzodiazepine, used in Europe to treat insomnia and as a pre-anesthetic. Flunitrazepam causes partial amnesia, and has been associated with several cases of sexual assault in the United States. Flunitrazepam is manufactured legally in over 50 countries, but not in the United States. Flunitrazepam illegally imported into the United States currently comes from pills diverted from legal pharmaceutical plants. Clandestine manufacturing hazards are minimal at this time; therefore, flunitrazepam will not be discussed further.

GHB

Gammahydroxybutyrate, or GHB, is manufactured in the United States and Europe from common household chemicals in drain openers and floor strippers. [11] GHB is a central nervous system depressant and hallucinogen. It has been used by bodybuilders as a muscular growth stimulant. Consumption of alcohol with GHB results in a strong potentiating effect. [12] GHB has been associated with several deaths related to the potentiating effects of alcohol or corrosive contaminants in drugs produced in clandestine laboratories. GHB has also been associated with several cases of sexual assault. Precursors include ethyl alcohol, gamma butyrolactone, potassium hydroxide, and sodium hydroxide. Fires have resulted from heating solutions containing ethyl alcohol in clandestine GHB laboratories.

Analyses of Residual Vapors at an Inactive Methamphetamine Laboratory

In March 2000, the author conducted vapor monitoring at a clandestine methamphetamine laboratory located in an apartment in Florida, at the request of the U.S. Drug Enforcement Administration. Residents of the apartment building and the apartment property owner were concerned about public health hazards posed by residual contaminants from the laboratory. Residents included a two-year old child who lived in the apartment immediately above the clandestine laboratory.

The laboratory was developed to produce small quantities of methamphetamines using the ephedrine reduction method, and is therefore typical of thousands of such laboratories that have been seized by the U.S. Drug Enforcement Administration across the United States. The laboratory had been inactive for several weeks before it was discovered. A list of seized chemicals included acetone, camping stove fuel, hydrochloric acid, iodine tablets, and toluene. [13]

Protective clothing and equipment during sampling included inner rubber gloves; acid-resistant outer gloves, coveralls, and boots; and a full-face air-purifying respirator with organic vapor/acid mist cartridges.

Air samples were collected from the interior of the apartment and from drains leading from sinks using a Mine Safety Appliances "Kwik Pump" and colorimetric detector tubes for acetone, gasoline/petroleum hydrocarbons, hydrochloric acid, and hydrogen sulfide.

Results

Upon entering the apartment, several stains and burns were visible on carpets. Liquid splash markings were visible on walls. The door to the rear bedroom apartment contained holes indicating that it had been nailed shut. Paper towels were pinned to the gap between the bedroom door and the carpet to reduce dispersion of vapors. A fiberglass bathtub in a bathroom adjoining the bedroom contained extensive pitting and scarring from disposal of corrosive liquids.

No air contaminants were detected in the rooms of the apartment. Vapor samples from the J-trap in the drain in the kitchen sink were also negative for precursor chemicals. However, the drain beyond the J-trap in the bathroom sink contained a powerful “rotten egg” odor indicating the presence of hydrogen sulfide. Hydrogen sulfide was detected at 6 parts per million. The author accidentally splashed some of the liquid from the bathroom sink drain on his wrist while removing protective gloves after the samples were collected. The liquid produced immediate irritation and resulted in second degree burns on the skin.

Discussion

Hydrogen sulfide is present in most sewage systems in concentrations ranging from 5 parts per million to 6,000 parts per million, with higher concentrations typical of sewage treatment plants or city sewers containing large amounts of human waste. [14,15] The odor threshold for hydrogen sulfide is 0.029 parts per billion. [16] Hydrogen sulfide in confined spaces kills several maintenance workers every year in the United States.

One variant of the ephedrine reduction method for producing methamphetamines is to combine iron sulfide and hydrochloric acid to produce hydrogen sulfide gas. The gas is then bubbled into a suspension of iodine in water to produce hydroiodic acid, a precursor for methamphetamine production. [10] Dumping waste iron sulfide and hydrochloric acid into sewers can increase the risk of hydrogen sulfide poisoning in maintenance workers, particularly when corrosive drain openers contact iron sulfide wastes.

Hydrogen sulfide at 6 parts per million in the bathroom drain J-trap could have been the result of normal sewage gas, or could be the result of dumping iron sulfide down the drain after it was combined with hydrochloric acid to produce hydrogen sulfide gas for production of methamphetamines. Hydrogen sulfide concentrations in concentrations as low as 2 parts per million can trigger asthma attacks in asthmatic maintenance workers and children. [16]

The chemical burns on the author’s skin probably resulted from residual hydrochloric acid contamination from the laboratory. Concentrations 5 to 10 parts per million hydrochloric acid may cause skin irritation. [17] Higher concentrations can lead to chemical burns and pulmonary edema in persons exposed without adequate protective equipment.

The low concentrations of precursor chemicals indicated that the apartment could be renovated by sealing floors and walls with primer paint, replacing the carpets, and flushing the drain lines with water.

Unfortunately, clandestine drug laboratories often cause much greater problems for law enforcement officers, children, property owners, and neighbors; and for consumers of the illegal drugs. Law enforcement officers have been injured from inhalation of precursor chemical vapors when serving warrants or investigating calls about suspicious activities without proper protective clothing and equipment. [18] Extensive contamination at some properties requires tearing out walls and carpets, and disposing of them as hazardous waste; cleaning up contaminated soil and ground water; and replacing corroded or damaged plumbing and septic tanks. [19]

Children are a special group of victims of clandestine drug laboratories. In one case in California, a child burned to death in a trailer fire that started when the mother was cooking methamphetamines in the kitchen. The parents would not allow neighbors to rescue the child for fear that the laboratory might be discovered. [20] In a study of 2,400 children exposed to clandestine drug laboratories in California, many children were found to have bruises, abrasions, and sporadic bald spots on their heads. Approximately 35% tested positive for heavy metals above public health guidelines. [20] A four-year old boy died in Arizona in 1997

from inhalation of vapors from precursor chemicals. [21] Children exposed to chemicals in clandestine drug laboratories may suffer kidney, spleen, and liver damage; frequently exhibit emotional and behavioral problems; lack proper nutrition and health care; and are frequently burned by corrosive and flammable precursor chemicals. [22]

Clandestine drug laboratory fires often force evacuations of entire apartment buildings or residential neighborhoods, due to concerns about inhalation of chemicals in smoke. [23] In addition to hazards from precursor chemicals, toxic gases and vapors in smoke from burning building materials include aldehydes, ammonia, carbon dioxide, carbon monoxide, hydrogen cyanide, hydrogen chloride, nitrogen oxides, and phosgene. [24]

Consumers of illegal drugs from clandestine laboratories are also victims. In addition to Rohypnol, consumers of illegal GHB have been victims of sexual assault. [12] GHB consumers have also been poisoned from caustic contaminants in the product. [25]

Conclusions

News media articles and government reports provide ample evidence that clandestine drug laboratories pose serious health hazards to law enforcement officers, fire fighters, property owners, children, and people “ living adjacent to the laboratories. However, there is no central register in the United States for recording locations where these laboratories have been discovered, and for monitoring the health status of victims. A central register of clandestine drug laboratories and victims could provide a database from which to begin to study the broader impacts of these laboratories.

Croatia maintains a national register of radioactive source materials. That register was quite valuable in retrieving radiation sources lost during the war with Serbia in the 1990s. [26] Perhaps a similar register of clandestine drug laboratories may be useful in protecting Croatia’s valuable karst aquifers, and in preserving the health of the Croatian people.

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