Cleanup of Clandestine Methamphetamine Labs
Guidance Document

Colorado Department
of Public Health
and Environment

Hazardous Materials and Waste Management Division
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Note: The following guidance has not yet been updated to reflect the changes in regulation. However, much of the information is still useful and relevant. Please use this document in conjunction with the regulations.

Purpose of this Guidance

This is intended as general guidance for homeowners, landlords, tenants, hotel/motel owners and others to assist in cleaning up former methamphetamine production sites. This guidance is not meant to modify or replace local requirements or guidance. In the event of a conflict between this guidance and local requirements, the local requirements take precedence. This guidance seeks to provide advice in cleaning up contamination most frequently associated with methamphetamine production and does not address every possible situation. If a situation is not described in the guidance or clarification is desired, please contact your local health, zoning or building department or the Hazardous Materials and Waste Management Division.

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CLEANUP OF CLANDESTINE METHAMPHETAMINE LABS

INTRODUCTION

Clandestine methamphetamine (meth) laboratories have been a growing problem throughout Colorado and across the United States. In Colorado alone, the number of meth lab seizures reported by the Colorado Bureau of Investigation has increased dramatically over the past three years: 150 in 1999, 264 in 2000, and 452 in 2001.

Typically after a lab is discovered by law enforcement, the bulk of any lab-related debris, such as chemicals and containers, is removed. However, contamination may be left on surfaces and in absorbent materials (carpets, furniture), sinks, drains and ventilation systems. Though often found in small amounts, meth lab contaminants may pose health threats to persons exposed to them. Table 1 provides a list of chemicals commonly associated with meth labs in Colorado, their health effects, and occupational exposure limits.

In response to increased concerns over the contamination left behind at meth labs, the Colorado Department of Public Health and Environment (the Department) has put together the following guidance to assist local agencies, property owners, and the general public in addressing contamination at former meth labs.

Chemicals associated with other drug manufacturing methods are not specifically addressed in this document. In addition, as the availability of precursor chemicals is restricted by law enforcement, and as meth manufacturers become more creative, chemicals not listed in Table 1 may be used as alternatives. In all cases, whether dealing with a meth lab or other drug manufacturing, the inventory of chemicals discovered at the site will dictate the precautions taken by the first responders, and the measures necessary for site cleanup. In general, the cleanup procedures discussed in this document should be sufficient to address most chemicals associated with drug lab sites; however, the presence of exotic chemicals should be discussed with the Department and the local regulatory agency overseeing the cleanup.

ENFORCEMENT OPTIONS

There is no current state statute that specifically authorizes state or local agencies to require the decontamination of the interior of private properties contaminated by clandestine meth lab activities. However, certain authorities exist in nuisance statutes, regulations and ordinances and in various codes commonly adopted by local government agencies that may be used in appropriate circumstances to require cleanup. The Department has broad environmental protection authorities to require cleanup of contamination in outdoor areas, in appropriate circumstances, under water quality, solid waste and/or hazardous waste statutes and regulations.

Local Health Authorities

Some local agencies require clean up actions using the statutory authority to address nuisances found in Part 5, 6 and 7 of Article 1 Title 25 of the Colorado Revised Statutes. This empowers local boards of health to abate public health nuisances. Local agencies may want to evaluate whether such authorities exist in their jurisdiction. Another nuisance statute that may be useful is Part 3 of Article 13, Title 16 of the Colorado Revised Statutes, which deals with Abatement of Public Nuisance.

Section 16-13-303 includes a specific provision classifying buildings, vehicles and real property that are used in connection with crimes related to illegal drugs as Class 1 public nuisances.

Some local health departments rely on building departments to initiate and require the clean up of the property and to not allow re-occupancy until local “clean up standards” are met as determined by the health officer. Whether this is possible in your area depends on what has been adopted into local ordinances. As an example refer to the Uniform Building Code or the Uniform Housing Code (Chapter 10, Substandard Buildings). Other codes that may be useful include the Uniform Code for the Abatement of Dangerous Buildings (Section 302, Item 15), International Building Code (Section 115), or the International Property Maintenance Code (Section 109). Some local health departments assist building departments by determining when unacceptably unhealthy conditions exist for the structure to be considered unsuitable for human habitation and in determining when these conditions are sufficiently reduced.

Solid Waste Statutes

There are several sections in the solid waste statute where public nuisance or nuisance conditions are referenced. However, in the context they are used it appears to be a difficult leap to meth lab enforcement.

A more universal section is 30-20-110(j) of the minimum standards. Section 30-20-110(j) reads: "Such minimum standards shall require the reporting, documentation, or remediation of spills at illegal disposal sites, abandoned disposal sites, or contaminated sites". This section has been used to require cleanup of petroleum and antifreeze spills and could be used to respond to meth lab sites.

PRELIMINARY SITE ASSESSMENT

Prior to beginning cleanup of a former meth lab, a preliminary assessment should be conducted to determine what chemicals are involved, the manufacturing method, and whether the property is fit or unfit for use as is. There are many meth "recipes" and manufacturing methods. Identifying the chemicals used and the drugs being made at the laboratory will help to determine what kind of chemical sampling may be necessary. The drug lab seizure report and the hazardous material transportation manifest will contain invaluable historical and drug manufacturing method information. From this information, a lab site chemical inventory can be developed. The chemical inventory will help to identify potential chemical hazards and the manufacturing method used.

The preliminary assessment should be reviewed by the local health department, or other oversight agency, to evaluate the potential contamination and health risk. The oversight agency will determine whether the property is fit or unfit for use, and whether cleanup or decontamination is necessary. In some areas, this determination may be made by the local building department or other local agency with authority to designate a property as fit or unfit for use. If it is determined that cleanup is necessary, the property owner may wish to contact their insurance company to determine whether property or homeowner’s insurance can be used to cover cleanup costs.

Methods of Manufacturing

The manufacture of meth is fairly simple. Generally, meth is made by using a “recipe” obtained from acquaintances, publications or other sources. The person manufacturing the drug literally “cooks” the ingredients. Hence these people are called “cooks.” Though there are a number of methods used to produce this drug, the two most common methods currently found in Colorado include the Red Phosphorus and Birch methods. Both use ephedrine or pseudoephedrine as a primary ingredient. These chemicals are present in many common over-the-counter cold and asthma medications.

Red Phosphorus Method

The Red Phosphorus Method is also called “Red P,” “HI” Method, or the Red, White and Blue Method. Chemicals commonly associated with this method include hydriodic acid (HI), hydrochloric (muratic) acid, sulfuric acid, sodium hydroxide (lye), sodium chloride (salt), red phosphorus, iodine, isopropyl alcohol, ethyl alcohol (ethanol), methyl alcohol (methanol), hydrogen peroxide, naphtha (Coleman fuel), charcoal lighter fluid (mineral spirits, petroleum distillate), acetone, benzene, toluene, ethyl ether (starting fluid), freon, hydrogen chloride gas, and chloroform. Other chemicals that may be used include acetic acid, methyl-ethyl-ketone (MEK), and hypophosphorus acid. Wastes generated during manufacturing include potentially flammable extraction process sludges, phosphine gas, hydriodic acid, hydrogen chloride gas, phosphoric acid, and yellow or white phosphorus.

Birch Method

The Birch Method is also called the “Ammonia” or “Nazi” Method. Chemicals associated with this method include anhydrous ammonia, lithium metal, sodium metal, isopropyl alcohol, ethyl alcohol (ethanol), methyl alcohol (methanol), hydrogen chloride gas, hydrochloric (muratic) acid, sulfuric acid, sodium chloride (salt), toluene, naphtha, freon, ethyl ether, chloroform, and methyl-ethyl-ketone (MEK). Wastes generated include potentially flammable extraction process sludges and hydrogen chloride gas.

Other Methods

Other methods to manufacture meth include the amalgam method, which primarily uses phenyl-2-propanone (P2P) and methylamine. Mercuric chloride, aluminum, hydrochloric acid, isopropyl alcohol, methanol, ethanol, acetone, benzene, chloroform and ether are also associated with this manufacturing method.

Areas of Contamination

Potential areas of contamination can be divided into primary and secondary areas. Typical primary areas of contamination include:

- **Processing or "cooking" areas:** Gross contamination in these areas may be caused by spills, boil-overs, explosions, or by chemical fumes and gases created during the heating and distilling portions of the "cooking" process. Indoor areas affected may include floors, walls, ceilings, used glassware and containers, working surfaces, furniture, carpeting, draperies and other textile products, plumbing fixtures and drains, or heating and air-conditioning vents. Outdoor cooking areas could involve picnic tables, camping stoves, or other outdoor areas where cooking could occur.

- **Disposal areas:** Indoor areas include sinks, toilets, bathtubs, plumbing traps and floor drains, vents, vent fans and chimney flues. Outdoor areas may include soil, surface water, groundwater, dumpsters, sewer or storm systems, septic systems and cesspools.

- **Storage areas:** Contamination may be caused by leaks, spills or open containers.

Secondary areas of contamination may include:

- Locations where contamination has migrated, such as hallways or high-traffic areas.

- Common areas in multiple dwelling structures and adjacent apartments or rooms may also be contaminated, including contamination of floors, walls, ceilings, furniture, carpeting, light fixtures, blinds, draperies and other textile products.

- Common ventilation or plumbing systems in hotels and multiple dwellings.

CLEANUP PROCEDURES FOR STRUCTURES

The removal of lab chemicals and equipment must be conducted by properly trained and equipped law enforcement and/or a hazardous materials (hazmat) cleanup team. After a site has been secured and no longer subject to criminal investigation, appropriately trained and equipped personnel should be hired to cleanup any remaining contaminated materials. If suspicious containers or lab equipment are found on a property, untrained personnel should leave the area and contact the local fire department or law enforcement agency.

Since there is no statutory authority for the Department to establish uniform cleanup standards for the interior of private properties, site-specific cleanup requirements should be developed in consultation with the local health department (refer to the Post Cleanup Assessment for Structures and Re-occupancy of Structures sections, following). In rare cases of severe contamination, effective cleanup may only be accomplished by demolition of the contaminated structure. In most situations, cleanup/decontamination will involve one or more of the following measures. Appropriate personal protective equipment (PPE) must be worn at all times during the cleanup.

Airing-Out

When solvents and other chemicals that may have soaked into the walls or furnishings are slowly volatilizing indoors, proper ventilation may safely reduce contamination and decrease odors. Venting should be conducted for several days before cleanup begins to allow volatile compounds to be dispersed, and good ventilation should be maintained during all phases of the cleanup. Care must be taken to ensure that vented contaminants are exhausted to the outdoors and not to the air intakes of adjacent structures. Windows should be opened and exhaust fans set up to circulate air out of the structure. During this time, the property should remain off limits unless it is absolutely necessary to make short visits to the property. In some cases it may be beneficial to raise the indoor air temperature to approximately 85° Fahrenheit for 48 to 72 hours to enhance volatilization. This should be done only after an initial period of venting, and after all bulk chemicals have been removed from the property. Monitoring of the indoor atmosphere should be conducted to ensure that vapor levels do not approach a level that would pose an explosion hazard (lower explosive limit).

After clean up, the property should be aired out for three to five days. Then the property should be checked for re-staining or odors, either of which would indicate that the initial cleaning was not successful and that more extensive steps should be taken.

Gross Cleanup

Cleanup and decontamination should be completed under the direction of trained personnel. Residual powders and liquids should be tested to determine their corrosivity, toxicity, and flammability. In cases where acids or bases are known to be sources of contamination, the potential for harmful effects may be reduced or removed through neutralization. Acids may be neutralized with solutions of sodium bicarbonate (baking soda), and bases may be neutralized by using weakly acidic solutions of vinegar or acetic acid in water. Solids should be scooped up and packaged for disposal. Liquids can be absorbed with clay (kitty litter or floor sweep) or other non-reactive material and packaged for disposal. If the property is on a septic tank system, the tank liquid should be tested to determine if it contains meth lab related chemicals. If meth lab chemicals are present, the contents of the tank should be disposed of as either a solid or hazardous waste, based on the results of analysis. Analysis of the septic tank contents should be based on chemicals determined to be part of the lab site chemical inventory (developed as part of the preliminary assessment).

During the meth cooking process, vapors are given off that can spread and be absorbed by nearby materials. Spilled chemicals, supplies and equipment can further contaminate non-lab items. It is a good idea to remove items that are visibly contaminated or have odors.

Removal

Visibly contaminated (etched or stained) sinks, bathtubs, and toilets are difficult to clean and may need to be removed and replaced. Absorbent materials, such as carpeting, drapes, furnishings, wallpaper, clothing, etc., can absorb vapors and may collect dust and powder from the chemicals involved in the manufacturing process. Some absorbent materials can be safely washed or cleaned by other methods if they exhibit little to no odor or staining, but many stained materials or those with odors will have to be disposed of in a solid waste landfill, with prior approval according to the type and degree of contamination. Generally, cleaning costs for these items exceed replacement costs. Prior to transporting waste to a landfill, the facility should be notified that the waste stream is from a former meth lab so that the landfill can take the proper measure to handle it appropriately.

Detergent-Water Washing

Some nonporous and semi-porous surfaces (such as floors, counters, tiles, walls and ceilings) can hold contamination from the meth cooking process, especially in those areas where the cooking and preparation were performed. Cleaning these areas is very important as people may come in frequent contact with these surfaces through skin contact, food preparation, etc. If a surface has visible contamination or staining, complete removal and replacement of that surface section is recommended. This could include removal and replacement of wallboard, floor coverings and counters. If this is not possible, intensive cleaning with a detergent-water solution or steam cleaning is recommended. Methanol and isopropyl alcohol may also be used, but should only be used in a well-ventilated area, and with appropriate PPE. Used wash water should be tested and disposed of properly. Analysis should be based on chemicals determined to be part of the lab site chemical inventory (developed as part of the preliminary assessment). With approval from the local publicly owned treatment works (POTW), it may be possible to discharge the wash water into the sanitary sewer.

Cleaning of porous materials that are not discarded will usually consist of vacuuming using a machine equipped with a HEPA filtration system, followed by hot water detergent scrubbing. Non-washable materials, such as lined curtains, that are not heavily contaminated can be steam-cleaned. In cases of mild to moderate contamination, pre-testing should not be necessary, if the cleanup protocol includes through detergent cleaning. If property owners wish to avoid cleaning or disposal of goods, pre-testing will generally be required. Depending on the material, a sample of fabric may need to be collected for laboratory analysis.

Ventilation System

Ventilation systems tend to collect fumes and dust and redistribute them throughout a structure. The vents, ductwork, filters and even the walls and ceilings near ventilation ducts can become contaminated. All air filters in the system should be replaced, vents should be removed and cleaned, the system's ductwork should be cleaned, and surfaces near inlets and outlets should be cleaned.

In motels, apartments, row-houses or other multiple-family dwellings, a ventilation system may serve more than one unit or structure. These connections must be considered when evaluating cleanup and testing procedures. One strategy is to take samples from adjacent or connected areas/rooms/units, working outward from the lab site until samples show low levels or no contamination.

Encapsulation or Sealing

Interior surfaces (e.g., walls, wood flooring, ceilings, and paneling) should be painted with an oil-based paint, epoxy, or other material suitable to create a physical barrier capable of preventing contact with, or volatilization of contaminants. Complete coverage may require more than one coat. The painted areas should be monitored and the barrier maintained to assure that the contamination is contained. If staining, odors or discoloration appear after the coating dries, further cleaning or removal and replacement of the surface may be necessary.

Plumbing

Waste products generated during meth manufacturing are often dumped down sinks, drains and toilets. These waste products can collect in drains, traps and septic tanks, and can give off fumes. If staining is noted around sinks, toilets or tubs, or if a strong chemical odor is coming from household plumbing, the local POTW should be advised that chemicals associated with meth production might have been disposed of down the sanitary sewer. Do not conduct any invasive measures to eliminate the odors. If air reactive chemicals (such as phosphorus or lithium metal) are present, exposure of these chemicals to air may result in ignition. The plumbing system should be flushed with generous amounts of water to reduce the concentration of residual chemicals. If contamination of a septic tank or leach field is suspected, contact the local health department or environmental health service to determine if the local Individual Sewage Disposal System Regulations address such an issue.

Personal Belongings

If residence of the structure need to remove personal items, they should do so only after the items have been properly decontaminated. As with household items, personal items that are visibly stained are hard to clean and may need to be discarded. Items such as clothing, that are not visibly stained, can be laundered one or more times to remove any residual chemicals. Non-porous and semi-porous items should be decontaminated using a detergent- water wash, or similar cleaning method, as described above.

POST CLEANUP ASSESSMENT FOR STRUCTURES

Cleanup and sampling of former meth labs should be conducted under the supervision of a properly qualified person such as a Certified Industrial Hygienist. Decisions regarding the sampling plan can be made based on the preliminary assessment information, chemicals used and duration of lab operation, the apparent extent and severity of contamination, and professional judgment. Variations of the cleanup and testing process may include:

- Sampling alone may be necessary when pre-cleaning samples indicate low levels or no contamination in some areas.

- In areas of moderate to heavy contamination, cleanup may be carried out without previous sampling if post-cleanup sampling will be conducted.

- In areas of obviously mild contamination, cleanup may be done without post-cleanup sampling, based on best judgment and adjacent sampling results.

- Pre- and post-cleanup testing should be done if drug manufacture methods are suspected to have included the use of mercury (typically mercuric chloride) or lead (typically lead acetate).

After complete cleanup, small amounts of residual chemicals may remain. Post-cleanup sampling should be conducted after residual cleanup and/or the encapsulant has cured. This assessment should include sampling for meth residues on surfaces using a wipe sample. Wipe samples of hard surfaces will indicate levels of contamination on those surfaces and may also be the best indicator of the contamination in adjacent fabrics and other soft furnishings. The procedure for collecting a wipe sample is included as Attachment 1. This procedure is in accordance with the OSHA Technical Manual (http://www.osha.gov/dts/osta/otm/otm_ii/otm_ii_2.html - 3).

If the amalgam (P2P) method was used, testing should also include airborne mercury and lead, and surface sampling for lead. Risk-based exposure limits for lead and mercury are provided in Table 2. Bear in mind that the possibility of obtaining false positives for lead and mercury exists because these materials used to be commonly added to paints. Homes built before 1978 may test positive for lead and homes built before 1990 may test positive for mercury.

In cases of moderate to heavy contamination, indoor air should be field screened, before and after cleaning, for volatile organic compounds (VOCs) with a photo ionization detector (PID), flame ionization detector (FID) or similar instrument to determine that the lab has been cleaned to reasonable background levels (concentration similar to ambient outdoor air). Field screening will provide information regarding the concentration of total VOCs in the structure, which is important for monitoring exposures for worker protection. Field screening may also provide information regarding the severity of contamination and the areas to focus cleanup efforts. If there is sufficient concern about residual vapor concentrations after cleanup, indoor air may be tested to determine the concentrations of specific chemicals. In most cases, indoor air testing may not be necessary as long as an adequate cleanup has been performed. Due to the possibility of detecting background levels of commonly used household chemicals, the presence of residual meth lab related chemicals may be hard to distinguish.

Because of the potential problem of background interference, and the relatively high cost associated with collecting and analyzing indoor air samples, the use of indoor air concentrations may not be the most practical way to evaluate the effectiveness of a cleanup. Sampling surfaces for meth may be a more practical tool to gage the effectiveness of cleanup.

If indoor air sampling is conducted, it should be performed by an environmental professional, familiar with indoor air sampling techniques, that is capable of interpreting the data and evaluating the potential for background interference. Prior to collecting an indoor air sample for VOCs, the indoor air temperature should be maintained at 70 degrees Fahrenheit or above for a minimum of 24 hours. Indoor air should be sampled for chemicals determined to be part of the lab site chemical inventory (developed as part of the preliminary assessment) and in consultation with the local health department, or other oversight agency. Sampling and testing should be performed using recognized standards and written procedures designed to ensure accuracy, reproducibility, and relevance to onsite contamination.

Written documentation showing that the cleanup has been completed should be submitted to the local health department, or other agency overseeing the cleanup. The final report should summarize the work performed, present data collected during the post-cleanup assessment, and be signed by a Certified Industrial Hygienist, or other qualified environmental professional. The local health department, or other oversight agency, may review the report and determine whether the property is suitable for re-occupancy.

RE-OCCUPANCY OF STRUCTURES

In order to determine acceptable risk-based concentrations for meth lab related chemicals, the Department reviewed human exposure reference values for chemicals commonly associated with meth production. This evaluation included acute (based on high-level, short term exposures), and chronic (based on low-level, long-term exposures) minimum risk levels. Acute minimum risk levels may be useful for evaluating high-level exposures, such as those associated with the meth cooking process or direct exposure to meth related chemicals prior to gross cleanup (as described previously). Chronic minimum risk levels may be appropriate for evaluating long-term exposure to residual levels of meth related chemicals, after gross cleanup has been conducted. Therefore, chronic minimum risk levels were used to develop proposed exposure limits for residual meth lab related chemicals, as shown in Table 2. The evaluation process used to develop the proposed exposure limits is described in Attachment 2. Acute exposure limits from the NIOSH Pocket Guide are provided in Table 1 for select meth lab related chemicals.

Several other states have established cleanup standards specifically for the residue of meth. After communicating with some of these state health departments, it was learned that these levels are not health-based. The meth cleanup levels are based on what is believed to be conservative and protective, while at the same time achievable by clean-up contractors. Currently, there is not sufficient information available regarding the effects of long-term exposure to low concentrations of meth to adequately evaluate chronic minimum risk levels. Therefore, the Department is unable to provide a health-based exposure limit for meth at this time.

As discussed previously, there are difficulties related to testing and evaluating the concentrations of meth related chemicals in indoor air. Therefore, the use of meth testing to evaluate the effectiveness of cleanup may be more practical than the use of indoor air concentrations of other associated chemicals. In order to provide a practical measurement to determine the adequacy of cleanup, the Department evaluated the cleanup standards used by several other states. The cleanup levels for meth range from 5 ug/ft^2 to 0.5 ug/ft^2. Based upon limited information now available, the 0.5 ug/ft^2 standard appears to be the most conservative approach. In addition, the cleanup process necessary to reduce the levels of meth to 0.5 ug/ft^2 should also be capable of reducing the concentrations of other meth related chemicals to acceptable levels. Testing for a limited suite of chemicals may be appropriate for "piece labs" that produce only pre-cursors or do limited production steps, since meth may not be present at these labs.

If the P2P method was used, testing should also include lead and mercury. Other compounds may also be tested for, as deemed necessary based on the preliminary assessment.

CLEANUP PROCEDURES FOR SOIL, GROUNDWATER AND SURFACE WATER

If areas of potential outdoor contamination are identified or suspected, further investigation of outdoor contamination may be necessary. Small areas of outdoor contamination may be dealt with by removal or treatment of contaminated soils or water (i.e., small areas of ponded water). Contaminated soil or water removed from the site must be characterized to determine if it contains a characteristic or listed hazardous waste, and must be disposed at an appropriately licensed solid or hazardous waste disposal facility. Analysis should be based on the lab site chemical inventory and manufacturing method used. If large areas of soil, surface water or groundwater contamination are present, characterization and cleanup of these areas should be conducted by a professional environmental contractor, in consultation with the Department's Hazardous Materials and Waste Management Division. In general, characterization and remediation of soil, surface water or groundwater impacts would include the following:

Source Identification

It is important to tie site characterization to the chemical storage and waste disposal information gathered on the site to ensure that assessment efforts look for potential contaminants in the places they are likely to be. This type of information can be gathered from observations made by law enforcement or hazmat personnel, or by conducting a site tour to note the property's condition, looking for evidence of contamination such as stained soil or stressed (dead or dying) vegetation.

It is important to evaluate both natural features and manmade structures, such as drainage systems, local topography, utilities, surface water bodies, easements and locations of buildings, because these features can influence the migration of contaminants and restrict access to portions of the site during remedial efforts. This information is used in conjunction with information regarding the subsurface characteristics at the site to evaluate contaminant migration pathways.

The amount of information that may need to be gathered will depend largely upon the characteristics of the release and the local hydrogeology. Relatively immobile contaminants (such as metals) that may have been released onto the ground surface will require considerably less subsurface data collection than a release involving relatively mobile contaminants (such as solvents). The subsurface characteristics will need to be defined to the degree necessary to provide a clear understanding of potential migration pathways for the purpose of defining the extent of contamination.

Sampling And Analytical Methods

All samples must be collected using professionally accepted equipment and methods. These are described in either ASTM Phase II environmental site assessment documents or EPA site investigation guidance documents. All samples must be prepared and analyzed in strict accordance with the methods described in EPA's "Test Methods for Evaluating Solid Waste (SW- 846)" or other method approved by the Hazardous Materials and Waste Management Division. The SW-846 Manual is available online at http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm. In a limited number of instances, the Division has established alternate procedures that vary from those set forth in SW-846 (e.g., sample preservation and analysis of indoor air samples).

Remediation

The results of the site characterization effort and the desired cleanup goals will define the level of remediation that may be required. Outdoor contamination may be dealt with using one or more of the following measures: 1) waste removal, 2) site controls (e.g., fencing), 3) drainage control, 4) monitoring, and 5) removal or treatment of contaminated soil or water (i.e., surface water or groundwater).

Soil Cleanup Levels

The Hazardous Material and Waste Management Division has established soil cleanup levels for a limited number of chemical compounds associated with meth labs, as provided in Table 3. For compounds that do not have established cleanup levels, a property owner may propose the use of an appropriate cleanup level for soil, using either background concentration, the method detection limit, or a risk-based concentration calculated in accordance with the Division's "Proposed Soil Remediation Objectives Policy Document."

Groundwater Cleanup Levels

Cleanup standards for groundwater may be found in Water Quality Control Commission's Regulation No. 41 "The Basic Standards for Ground Water." A list of State groundwater standards for select compounds associated with meth labs is provided in Table 3.

For those contaminants for which State standards have not been established, the facility may chose to:

- Use EPA's Clean Water Act maximum contaminant levels (MCL) or maximum contaminant level goals (MCLG),
- Calculate a health-based drinking water standard using an MCL-equivalent methodology, or
- Calculate a health-based standard using the Water Quality Control Commission's policy 96-2 "Human Health-Based Water Quality Criteria and Standards".

Surface Water Cleanup Levels

In the event that activities have resulted in the contamination of surface water, the remediation goal should be the most stringent of one of the following cleanup levels:

- The appropriate surface water standard, as established by the Department's Water Quality Control Division, for that surface water body. This applies only to those surface water bodies, primarily rivers and interconnected ponds and lakes, for which water quality standards have been established.

- A health-based concentration that is protective of human health using a drinking water exposure scenario (unrestricted use designation).

- A concentration that is protective of aquatic life or other wildlife found in the area.

CONTACTS FOR ADDITIONAL INFORMATION

To report a known or suspected meth lab, contact your local law enforcement agency or drug task force.

For general questions regarding meth lab cleanup, call the Hazardous Materials and Waste Management Division's Customer Technical Assistance line at 303-692-3320 or toll-free at 1-888-569-1831 ext 3320. This number should also be called if you suspect that there may be potential environmental contamination from a meth lab (i.e., disposal to surface waters or dumped on the ground).

Suspected disposal down the sanitary sewer should be reported to the local wastewater treatment authority. The public works department or other city offices can assist in determining how to contact the local wastewater treatment authority.

For questions regarding health effects of meth lab-related chemicals or by-products, please contact the Department's Disease Control and Environmental Epidemiology Division at 303-692-2700.

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TABLES

Table 1
Chemical Exposure Limits for Select Chemicals
Associated with Clandestine Methamphetamine Labs

Chemical	Occupational Exposure Limits	Health Effects
Acetone CAS: 67-64-1 DOT: 1090, 127	OSHA: 1000 ppm (2400 mg/m^3) TWA NIOSH: 250 ppm (590 mg/m^3) TWA IDLH: 2500 ppm ATSDR MRL: 13 ppm (inhalation)	vapor irritant to eyes and mucous membranes, skin irritant
Acetic Acid CAS: 64-19-17 DOT: 2790, 153 (10-80% acid) 2789, 132 (>80%)	OSHA: 10 ppm (25 mg/m^3) TWA NIOSH: 10 ppm TWA, 15 ppm (37 mg/m^3) STEL IDLH: 50 ppm	irritate or burn skin, eyes and respiratory system, hyperkeratosis, pharyngeal edema, chronic bronchitis
Alcohol (Isopropyl) CAS: 67-63-0 DOT: 1219, 129	OSHA: 400 ppm (980 mg/m^3) TWA NIOSH: 400 ppm TWA, 500 ppm (1225 mg/m^3) STEL IDLH: 500 ppm	vapor irritant to eyes and respiratory system, high concentrations may be anesthetic
Aluminum CAS: DOT:	OSHA: 15 mg/m^3 (particulates) NIOSH: 10 mg/m^3	irritation to eye, skin and respiratory system
Ammonia (Anhydrous) CAS: 7664-41-7 DOT: 1005, 125 (anhydrous) 2672, 154 (10-35%) 2073, 125 (35-50%) 1005, 125 (>50%)	OSHA: 50 ppm (35 mg/m^3) TWA NIOSH: 25 ppm (18 mg/m^3) TWA, 35 ppm (27 mg/m^3) STEL IDLH: 300 ppm ATSDR MRL: 0.3 ppm (inhalation)	irritate or burn skin, eyes and respiratory system; contact with liquid causes caustic burns and frostbite; death due to inflammation of larynx
Benzene CAS: 71-43-2 DOT: 1114, 130	OSHA: 1 ppm (3 mg/m^3) TWA, 5 ppm (16 mg/m^3) STEL NIOSH: 0.1 ppm TWA, 1 ppm STEL IDLH: 500 ppm ATSDR MRL: 0.004 ppm (inhalation)	eye and respiratory irritant, dizziness, excitation, flushing, weakness, headache, loss of breath, chest constriction, nausea, coma, death
Chloroform CAS: 67-66-3 DOT 1888, 151	OSHA: 50 ppm (240 mg/kg^3) Ceiling NIOSH: 10ppm (49 mg/kg^3) Ceiling, 2ppm (9.78 mg/kg^3) STEL IDLH: 500 ppm ATSDR MRL: 0.02 ppm (inhalation)	headache, dizziness, nausea, drunkenness, narcosis

Ether (Ethyl Ether) CAS: 60-29-7 DOT: 1155, 127	OSHA: 400 ppm (1200 mg/m^3) TWA NIOSH: 400 ppm TWA (under evaluation) IDLH: 1900 ppm (10% LEL)	eye and skin irritant, headache, nausea, loss of consciousness
Ethanol (Ethyl Alcohol)CAS: 64-17-5DOT: 1170, 127	OSHA: 1000 ppm (1900 mg/kg^3) TWANIOSH: 1000 ppm TWAIDLH: 3300 ppm (10% LEL)	eye nose and throat irritant, headache, drowsiness, liquid causes intoxication
Ethyl Acetate CAS: 141-78-6 DOT: 1173, 129	OSHA: 400 ppm (1400 mg/m^3) TWA NIOSH: 400 ppm TWA IDLH: 2000 ppm (10% LEL)	eye and respiratory irritant, headache, dizziness, nausea, weakness, loss of consciousness
Formic Acid CAS: 64-18-6 DOT: 1779, 153	OSHA: 5 ppm (9 mg/kg^3) TWA NIOSH: 5 ppm	vapor: nausea, vomiting; liquid: skin and eye burns
Freon CAS: varies (several types) DOT: varies	OSHA: varies NIOSH: varies	vapor: greater than 10% in air may cause narcosis; liquid may cause frostbite.
Hydriodic Acid (Hydrogen Iodide) CAS: 10034-85-2 DOT: 1787, 154	OSHA: NA NIOSH: NA	skin, nose and throat irritant; skin and eye burns; coughing, shortness of breath
Hydrochloric (Muriatic) Acid (Hydrogen Chloride Gas) CAS: 7647-01-0 DOT: 1789, 157 (solution) 1050, 125 (anhydrous)	OSHA: 5 ppm (7 mg/m^3) Ceiling NIOSH: 5 ppm Ceiling IDLH: 50 ppm	skin, nose and throat irritant; skin and eye burns
Hydrogen Peroxide CAS: 7722-84-1 DOT: 2984, 146 (8-20%) 2014, 140 (20-60%) 2015, 143 (>60%)	OSHA: 1ppm (1.4mg/kg^3) TWA NIOSH: 1 ppm IDLH: 75 ppm	skin, nose and throat irritant; skin and eye burns
Hypophosphorus Acid CAS: 6303-21-5 DOT: 154, 3264	OSHA: NA NIOSH: NA	severe skin, eye, and respiratory tract irritation or burns
Iodine (Crystals) CAS: 7553-56-2 DOT: NA	OSHA: 0.1 ppm (1 mg/kg^3) Ceiling NIOSH: 0.1 ppm IDLH: 2 ppm	eye, nose and skin irritant; lacrimation, chest tightness, skin burns, rash, cutaneous hypersensitivity
Lithium Metal CAS: 7439-93-2 DOT: 1415, 138	OSHA: NA NIOSH: NA	severe skin and eye irritation or burns, lung irritant, coughing, shortness of breath

Methanol (Methyl Alcohol) CAS: 67-56-1 DOT: 1230, 131	OSHA: 200 (260 mg/kg^3)ppm NIOSH: 200 ppm, 250 ppm (325 mg/m^3) STEL IDLH: 6,000 ppm	eye, nose and throat irritant, dizziness, headache, difficulty breathing, liver damage, teratogen
Methylamine CAS: 74-89-5 DOT: 1061, 118 (anhydrous) 1235, 132 (aqueous)	OSHA: 10 ppm (12 mg/m^3) TWA NIOSH: IDLH: 100 ppm	seizures, eye, nose and throat irritant, skin and eye burns
Methyl Ethyl Ketone (2-Butanone) CAS: 78-93-3 DOT: 1193, 127; 1232, 127	OSHA: 200 ppm (590 mg/m3) NIOSH: 200 ppm (590 mg/m3) ST 300 ppm (885 mg/m3) Other: 3000 ppm	Irritation of eyes, skin, nose; headache; dizziness; vomiting; dermatitis
Methylene Chloride CAS: 75-09-02 DOT: 1593, 160	OSHA: 25 ppm (87 mg/m^3) TWA, 125 ppm (435 mg/m^3) STEL NIOSH: under revision IDLH: 2300 ppm ATSDR MRL: 0.3 ppm (inhalation)	eye, nose and throat irritant, pulmonary edema, headache, nausea, fatigue
Naphtha (petroleum distillates) CAS: 8002-05-9 DOT: 1255, 128	OSHA: 500 ppm (2000 mg/m^3) TWA NIOSH: 350 mg/m^3 TWA, 1800 mg/m^3 Ceiling IDLH: 1100 ppm	Irritation of eyes, nose, throat; dizziness, drowsiness, headache, nausea; dry cracked skin; chemical pneumonitis
Phosphine Gas CAS: 7803-51-2 DOT: 2199, 119	OSHA: 0.3 ppm (0.4 mg/m^3) TWA NIOSH: 0.3 ppm TWA, 1 ppm (1 mg/m^3) STEL IDLH: 50 ppm	Nausea, vomiting, abdominal pain, diarrhea; thirst; chest tightness, dyspnea (breathing difficulty); muscle pain, chills; stupor or syncope; pulmonary edema; liquid: frostbite
Phosphoric Acid CAS: 7664-38-2 DOT: 1805, 154	OSHA: 1 mg/m^3 TWA NIOSH: 1 mg/m^3 TWA, 3 mg/m^3 STEL IDLH: 1000 mg/m^3	eyes, skin and upper respiratory system irritant; eye, skin, burns; dermatitis
Phosphorus Pentachloride CAS: 10026-13-8 DOT: 1806, 137	OSHA: 1mg/m^3 TWA NIOSH: 1 mg/m^3 TWA IDLH: 70 mg/m^3	high irritant to skin, eyes & mucous membrane
Phosphorus (Yellow) CAS: 7728-14-0 DOT: 1381, 136	OSHA: 0.1mg/m^3 NIOSH: 1mg/m^3 IDLH: 5 mg/m^3 ATSDR MRL: 0.02 mg/m^3 (inhalation)	high irritant to skin, eyes & mucous membrane, abdominal pain, nausea, jaundice; anemia
Phosphorus (Red) CAS: NA DOT: NA	OSHA: NA NIOSH: NA	slight ingestive hazard

Sodium Dichromate CAS: 10588-01-9 DOT: 1479, 140	OSHA: 0.01 mg/m^3 TWA (as CrO_3) NIOSH: 0.001 mg/m^3 TWA (as Cr) IDLH: 15 mg/m3 (as Cr^{+6})	respiratory irritation from inhalation of dust or mist; ingestion: vomiting, diarrhea; irritant to eyes and skin
Sodium Hydroxide (Lye, Caustic Soda) CAS: 1310-73-2 DOT: 1823, 154 (dry, solid) 1824, 154 (solution)	OSHA: 2 mg/m^3 TWA NIOSH: 2 mg/m^3 Ceiling IDLH: 10 mg/m^3	irritation or damage to respiratory system; irritation or burn to skin; contact causes severe damage to eyes
Sodium Metal CAS: 7440-23-5 DOT: 1428, 138	OSHA: NA NIOSH: NA	highly caustic to skin, forms caustic solution in water, strong oxidizer
Sulfuric Acid CAS: 7664-93-9 DOT: 1830, 137 1831, 137 (fuming) 1832, 137 (spent)	OSHA: 1mg/m^3 TWA, 3 mg/m^3 STEL NIOSH: 1 mg/m^3 TWA IDLH: 15mg/m^3	skin, nose and throat irritant; skin and eye burns; pulmonary edema, bronchitis; emphysema; conjunctivitis
Toluene CAS: 108-88-3 DOT: 1294, 130	OSHA: 200ppm TWA, 300ppm Ceiling, 500ppm 10-min max NIOSH: 100ppm (375 mg/m^3) TWA, 150 ppm (560 mg/m^3) STEL ATSDR MRL: 0.4 ppm (inhalation)	eye, nose and throat irritant, weakness, exhaustion, euphoria, dizziness, headache; dilated pupils, anxiety, muscle fatigue, insomnia

CAS = Chemical Abstracts Service number
DOT = Department of Transportation ID and Guide numbers
NA = not available
TWA = time weighted average
STEL = short term exposure limit
IDLH = immediately dangerous to life and health
ATSDR = Agency for Toxic Substances and Disease Registry
MRL= minimal risk level
LEL = lower explosive limit
ppm = parts per million
mg/m^3 = milligrams per cubic meter

Source: NIOSH Pocket Guide to Chemical Hazards: http://www.cdc.gov/niosh/npg/npg.html
ATSDR MRLs: http://www.atsdr.cdc.gov/mrls.html

Table 2
Recommended Indoor Air Exposure Limits for Selected Chemical Compounds Associated with Clandestine Methamphetamine Laboratories

Compound	CDPHE Risk-Based Concentration [a]
acetone	0.15 ppm (0.35 mg/m^3)
ammonia	0.14 ppm (0.1 mg/m^3)
ammonium hydroxide	0.025 ppm (0.036 mg/m^3)
benzene	0.00009 ppm (0.0003 mg/m^3)
chloroform	0.00002 ppm (0.00009 mg/m^3)
ethyl ether	0.23 ppm (0.7 mg/m^3)
ethanol	1 ppm (1.9 mg/m^3)
formic acid	0.005 ppm (0.009 mg/m^3)
glacial acetic acid	0.01 ppm (0.025 mg/m^3)
hydrochloric acid	0.013 ppm (0.02 mg/m^3)
iodine	0.0001 ppm (0.001 mg/m^3)
methanol	0.2 ppm (0.26 mg/m^3)
methylene chloride	0.0014 ppm (0.0047 mg/m^3)
methyl amine	0.01 ppm (0.012 mg/m^3)
methyl ethyl ketone	0.34 ppm (1 mg/m^3)
naphtha	0.1 ppm (0.35 mg/m^3)
nitroethane	0.1 ppm (0.31 mg/m^3)
petroleum spirit	0.1 ppm (0.35 mg/m^3)
phosphoric acid	0.0025 ppm (0.01 mg/m^3)
potassium chromate	0.0000001 ppm (0.000001 mg/m^3)
potassium dichromate	0.000004 ppm (0.00005 mg/m^3)
sodium chromate	0.000008 ppm (0.00005 mg/m^3)
sodium dichromate	0.0047 ppm (0.05 mg/m^3)
sodium hydroxide	0.0012 ppm (0.002 mg/m^3)
sulfuric acid	0.0003 ppm (0.001 mg/m^3)
toluene	0.11 ppm (0.4 mg/m^3)
lead [b]	0.0002 ppm (0.0015 mg/m^3)
lead [b] (wipe sample)	40 ug/ft^2
mercury [b]	0.000037 ppm (0.0003 mg/m^3)

a. Assumes exposure 24 hours/day, 350 days/year, for 30 years; 1x10^{-6} risk and HI$\leq$1; mg/m^3 concentrations.

b. Associated with amalgam (P2P) method only.

c. Not detectable in sample of porous material.

Table 3
Soil Remediation Objectives and Groundwater Standards for Selected Chemical Compounds Associated with Clandestine Methamphetamine Laboratories

Compound	**Soil Remediation Objective**	**Groundwater Cleanup Standard**	**Soil Concentration Protective of Groundwater** [c]
acetone	1000 mg/kg	-	2.9 mg/kg
benzene	0.84 mg/kg	5.0 ug/l	0.17 mg/kg
chloroform	0.30 mg/kg	6.0 ug/l	1.89 mg/kg
formic acid	pH > 2	pH 6.5-8.5	-
glacial acetic acid	pH > 2	pH 6.5-8.5	-
hydrochloric acid	pH > 2	pH 6.5-8.5	-
methyl ethyl ketone	1000 mg/kg	-	18.30 mg/kg
methylene chloride	11.5 mg/kg	4.7 ug/l	0.06 mg/kg
phosphoric acid	pH > 2	pH 6.5-8.5	-
sulfuric acid	pH > 2	pH 6.5-8.5	-
toluene	1000 mg/kg	1000 ug/l	85 mg/kg
lead [a]	400 mg/kg	50 ug/l	22 mg/kg
mercury (elemental) [a]	1.1 mg/kg	2 ug/l	0.88 mg/kg
mercury (ionic compounds[b]) [a]	23 mg/kg	2 ug/l	0.88 mg/kg

a. Associated with amalgam (P2P) method only.
b. Ionic mercury compounds such as $HgCl_2$.
c. Applies if impacted soil is near or in contact with groundwater or surface water.

ATTACHMENT 1

WIPE SAMPLE COLLECTION PROCEDURE

COLLECTION OF NON-POROUS SURFACE SAMPLES (WIPE SAMPLES)

To determine the extent of contamination on non-porous surfaces (tile, linoleum and formica), a technique known as “wipe” sampling is used. On porous areas, such as carpet or drapes, this sampling technique is only satisfactory for a qualitative (absence or presence) identification of the chemical.

Paper filters are generally used for collection of metals. Mixed cellulose ester filter discs (AA filters) or smear tabs, or their equivalent, are most often recommended. Polyvinyl chloride filters are available for substances that are unstable on paper-type filters. Squares of a gauze material may be used for many organic substances, and have the advantage of being more durable than filter media, especially when wiping rough surfaces. They may be used dry, or wetted with water or solvent to enhance collection efficiency.

The following procedure is recommended for collecting wipe samples:

1. If multiple samples are to be taken at the worksite, prepare a rough sketch of the area to be wipe sampled.

2. A new set of clean, impervious gloves should be used for each sample to avoid contamination of the filter by previous samples (and the possibility of false positives) and to prevent contact with the substance.

3. Withdraw the filter from the vial with your fingers or clean tweezers. If a damp wipe sample is desired, moisten the filter with distilled water (lead samples) or other solvent (methanol for meth samples) as recommended.

4. Depending on the purpose of the sample, it may be useful to determine the concentration of contamination (e.g., in micrograms of agent per area). For these samples, it is necessary to record the area of the surface wiped (e.g., 1 ft^2). This would normally not be necessary for samples taken to simply show the presence of the contaminant.

5. Firm pressure should be applied when wiping.

6. Start at the outside edge and progress toward the center of the surface area by wiping in concentric squares of decreasing size.

7. Without allowing the filter to come into contact with any other surface, fold the filter with the exposed side in. If possible, use the same filter to repeat the sampling of the same area, then fold it over again. Place the filter in a sample vial, cap and number it, and note the number at the sample location on the sketch. Include notes with the sketch giving any further description of the sample.

8. At least one blank filter treated in the same fashion, but without wiping, should be submitted for each sampled area.

ATTACHMENT 2

MEMORANDUM
ON
PROPOSED EXPOSURE LIMITS

Colorado Department of Public Health and Environment
Disease Control and Environmental Epidemiology Division

Proposed Exposure Limits for Methamphetamine Lab Cleanups

August 1, 2002

This attachment describes human exposure reference values for chemicals associated with methamphetamine production. Table 1 provides definitions of each type of reference value. Table 2 lists reference values available or derived from EPA, ATSDR and NIOSH sources. Included in Table 2 are acute minimum risk levels, which may be useful for evaluating high-level exposures, but are not appropriate post-cleanup criteria.

The information in Tables 1 and 2 was used to generate proposed CDPHE exposure limits, which are listed in Table 3. Table 3 also lists the source or method from which the reference value is obtained.

Lastly, Table 4 shows a comparison of the proposed CDPHE limits with values currently available from the Kansas Department of Health and Environment and the EPA (Indoor Air Guidelines).

The proposed CDPHE exposure limits were selected from the available reference values or modified reference values based on the reliability of the source, or method of modification. The first level of preference is given to values obtained from EPA's Integrated Risk Information System (IRIS). For the three compounds that are known or probable human carcinogens, the reference value given in Table 3 is the 30-year exposure concentration calculated for an added lifetime cancer risk of 1 in 1,000,000.

For noncarcinogens, the preferred reference value is an IRIS reference concentration (RfC). For chemicals that do not have an IRIS RfC, the second level of preference may be an ATSDR minimum risk level for chronic inhalation exposure. The only chemical for which this was an option is acetone. The database, from which the MRL was estimated, is quite limited. Alternatively, the extrapolated RfD method (see below) was selected for acetone.

The third level of preference is a method that applies an IRIS oral reference dose (RfD) to the inhalation pathway. This method converts dose from (mg/kg/day) to an exposure concentration (mg/m^3). This conversion is commonly used by EPA Region 9 to convert RfDs to exposure concentration screening values, when only an RfD is available.

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This method, however, has limitations, e.g., it may not account for portal-of-entry effects, and route-specific absorption, distribution and metabolism. These limitations cast doubt on method validity. Therefore, use of the derived reference values should be limited to risk screening.

The least desirable reference values presented in Table 3 are those based on modified occupational exposure limits. Although such values may be the least acceptable, this method does provide a referent concentration when one is required and a more acceptable value is not available.

Some states have set reference levels for methamphetamine residues after the clean up of a contaminated area. After communicating with some of these state health departments, it was learned that these levels are not a health-based standard. The methamphetamine levels are based on what is believed to be conservative and protective, while at the same time achievable by clean-up contractors. Therefore, a methamphetamine reference level cannot be recommended at this time.

Table 1. Definitions of reference values

Reference Dose (RfD)	The Oral Reference Dose for chronic noncarcinogenic health effects of a compound is based on the assumption that thresholds exist for certain toxic effects. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of harmful effects during a lifetime. RfDs are obtained from the EPA Integrated Risk Information System (IRIS).
Inhalation Reference Concentration (RfC)	The Inhalation Reference Concentration for chronic noncarcinogenic health effects of a compound is analogous to the oral RfD and is likewise based on the assumption that thresholds exist for certain toxic effects. The RfC considers toxic effects for both the respiratory system (portal-of-entry) and for effects peripheral to the respiratory system (extrarespiratory effects). In general, the RfC is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily inhalation exposure of the human population (including sensitive subgroups) that is likely to be without an appreciable risk of harmful effects during a lifetime. RfCs are obtained from the EPA Integrated Risk Information System (IRIS).

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Table 1. Definitions of reference values (cont.)

References doses extrapolated to the inhalation pathway	For chemicals that do not have an IRIS RfC, a less desirable option is to convert an IRIS oral reference doses (RfDs) for inhalation exposure. This method converts dose from (mg/kg/day) to an exposure concentration (mg/m^3) by multiplying the RfD of a chemical by 70 kg body weight and dividing by 20 m^3/day. This method, however, has important limitations.
ATSDR Minimal Risk Level (MRL), Acute and Chronic	The Agency for Toxic Substances and Disease Registry Minimal Risk Level (MRL) is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure. Acute MRL values are for exposure up to 14 days, while Chronic MRL values are for exposure of one year to a lifetime. MRLs are intended to serve as screening levels. MRLs are not intended to define clean up or action levels.
NIOSH Recommended Exposure Limits (REL)	The National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limits (REL) are the recommended maximum exposure level of a compound that a worker should be exposed to, in order to avoid adverse health effects. RELs are time-weighted average concentrations for up to a 10-hour workday during a 40-hour workweek.
Long-term Effects Screening Levels (ESLs)	The Texas Natural Resource Conservation Commission developed Long-term Effects Screening Levels (ESLs), by dividing NIOSH RELs by one thousand. This calculation was done to obtain long-term non-occupational (i.e. household) referent concentrations. ESLs are used to evaluate the potential for effects to occur as a result of exposure to concentrations of constituents in the air. ESLs are based on data concerning health effects, odor nuisance potential, effects with respect to vegetation, and corrosion effects. They are not ambient air standards. If predicted or measured airborne levels of a constituent do not exceed the screening levels, adverse health or welfare effects would not be expected to result. If ambient levels of constituents in air exceed the screening levels, this does not necessarily indicate a health hazard exists.

Table 2. Reference Values Available or Derived from EPA, ATSDR or NIOSH Sources.

Compound	EPA IRIS RfC	Extrapolated RfD	Cancer Risk 1x10-6*	ATSDR MRL Acute Inh.	ATSDR MRL Chronic Inh.	Effects Screening Level Modified NIOSH REL
acetone	~	0.35 mg/m³	~	26 ppm	13 ppm	0.25 ppm (0.59 mg/m³)
ammonia	0.1 mg/m³	~	~	0.5 ppm	0.3 ppm	~
ammonium hydroxide	~	~	~	~	~	0.025 ppm
benzene	~	~	0.0003 mg/m³	0.05 ppm	0.004 ppm	~
chloroform	~	~	0.00009 mg/m³	0.1 ppm	0.02 ppm	~
ethyl ether	~	0.7 mg/m³	~	~	~	0.4 ppm (1.2 mg/m³)
ethanol	~	~	~	~	~	1 ppm (1.9 mg/m³)
formic acid	~	~	~	~	~	0.005 ppm (0.009 mg/m³)
glacial acetic acid (acetic acid)	~	~	~	~	~	0.01 ppm (0.025 mg/m³)
hydrochloric acid	0.02 mg/m³	~	~	~	~	~
iodine	~	~	~	~	~	0.0001 ppm (0.001 mg/m³)
lithium metal	~	~	~	~	~	NL
methanol	~	~	~	~	~	0.2 ppm (0.26 mg/m³)
methylene chloride	~	1.75 mg/m³	0.0047 mg/m³	0.6 ppm	0.3 ppm	~
methyl amine	~	~	~	~	~	0.01 ppm (0.012 mg/m³)
methyl ethyl ketone	1 mg/m³	~	~	~	~	~
naphtha	~	~	~	~	~	0.1 ppm (0.35 mg/m³)
nitroethane	~	~	~	~	~	0.1 ppm (0.31 mg/m³)
petroleum spirit	~	~	~	~	~	0.1 ppm (0.35 mg/m³)
phosphoric acid	0.01 mg/m³	~	~	~	~	~
potassium chromate	~	~	~	~	~	0.000001 mg/m³
potassium dichromate	~	~	~	~	~	0.00005 mg/m³
potassium permanganate	~	~	~	~	~	NL
red phosphorus	~	~	~	~	~	NL
sodium chromate	~	~	~	~	~	0.00005 mg/m³
sodium dichromate	~	~	~	~	~	0.05 mg/m³
sodium hydroxide	~	~	~	~	~	0.002 mg/m³
sodium metal	~	~	~	~	~	NL
sulfuric acid	~	~	~	~	~	0.001 mg/m³
toluene	0.4 mg/m³	~	~	1 ppm	0.08 ppm	~
methamphetamine	~	~	~	~	~	~
total VOCs	~	~	~	~	~	~
lead	0.0015 mg/m³ (H)	~	~	~	~	~
mercury	0.0003 mg/m³	~	~	~	~	~

(H) Health Effects Assessment Summary Tables (HEAST), prepared by the EPA, can be used in the absence of a RfC.

NL Occupational exposure limits have not been set.

* These numbers are based on less than lifetime (30 year) exposure, derived from the original lifetime (70 year) exposure values.

Table 3. Proposed CDPHE Exposure Units and Source or Method from which the Reference Value is Obtained.

Compound	Proposed CDPHE reference Value	Source/Method
acetone	0.15 ppm (0.35 mg/m³)	Extrapolated RfD
ammonia	0.14 ppm (0.1 mg/m³)	IRIS RfC
ammonium hydroxide	0.025 ppm (0.036 mg/m³)	NIOSH REL/ESL
benzene	0.00009 ppm (0.0003 mg/m³)	IRIS 1x10-6 cancer risk
chloroform	0.00002 ppm (0.00009 mg/m³)	IRIS 1x10-6 cancer risk
ethyl ether	0.23 ppm (0.7 mg/m³)	Extrapolated RfD
ethanol	1 ppm (1.9 mg/m³)	NIOSH REL/ESL
formic acid	0.005 ppm (0.009 mg/m³)	NIOSH REL/ESL
glacial acetic acid	0.01 ppm (0.025 mg/m³)	NIOSH REL/ESL
hydrochloric acid	0.013 ppm (0.02 mg/m³)	IRIS RfC
iodine	0.0001 ppm (0.001 mg/m³)	NIOSH REL/ESL
lithium metal	-	-
methanol	0.2 ppm (0.26 mg/m³)	NIOSH REL/ESL
methylene chloride	0.0014 ppm (0.0047 mg/m³)	IRIS 1x10-6 cancer risk
methyl amine	0.01 ppm (0.012 mg/m³)	NIOSH REL/ESL
methyl ethyl ketone	0.34 ppm (1 mg/m³)	IRIS RfC
naphtha	0.1 ppm (0.35 mg/m³)	NIOSH REL/ESL
nitroethane	0.1 ppm (0.31 mg/m³)	NIOSH REL/ESL
petroleum spirit	0.1 ppm (0.35 mg/m³)	NIOSH REL/ESL
phosphoric acid	0.0025 ppm (0.01 mg/m³)	IRIS RfC
potassium chromate	0.0000001 ppm (0.000001 mg/m³)	NIOSH REL/ESL
potassium dichromate	0.000004 ppm (0.00005 mg/m³)	NIOSH REL/ESL
potassium permanganate	-	-
red phosphorus	-	-
sodium chromate	0.000008 ppm (0.00005 mg/m³)	NIOSH REL/ESL
sodium dichromate	0.0047 ppm (0.05 mg/m³)	NIOSH REL/ESL
sodium hydroxide	0.0012 ppm (0.002 mg/m³)	NIOSH REL/ESL
sodium metal	-	-
sulfuric acid	0.0003 ppm (0.001 mg/m³)	NIOSH REL/ESL
toluene	0.11 ppm (0.4 mg/m³)	IRIS RfC
methamphetamine	-	-
total VOCs	-	-
lead	0.0002 ppm (0.0015 mg/m³)	H.E.A.S.T.
mercury	0.000037 ppm (0.0003 mg/m³)	IRIS RfC

Table 4. Comparison of Recommended Cleanup Guidelines for Selected Chemical Compounds Associated with Clandestine Methamphetamine Laboratories

Compound	Kansas Cleanup Level [a]	EPA Indoor Air Guidance [b]	CDPHE Risk-Based Concentration [c]
acetone	12 ppm (28.56 mg/m^3)	0.15 ppm (0.35 mg/m^3)	0.15 ppm (0.35 mg/m^3)
ammonia	1.2 ppm (0.84 mg/m^3)	-	0.14 ppm (0.1 mg/m^3)
ammonium hydroxide	ND[e]	-	0.025 ppm (0.036 mg/m^3)
benzene	0.005 ppm (0.016 mg/m^3)	0.0004 ppm (0.0013 mg/m^3)	0.00009 ppm (0.0003 mg/m^3)
chloroform	0.05 ppm (0.24 mg/m^3)	0.000089 ppm (0.00043 mg/m^3)	0.00002 ppm (0.00009 mg/m^3)
ethyl ether	19 ppm (57.57 mg/m^3)	-	0.23 ppm (0.7 mg/m^3)
ethanol	48 ppm (90.72 mg/m^3)	-	1 ppm (1.9 mg/m^3)
formic acid	0.24 ppm (0.45 mg/m3)	-	0.005 ppm (0.009 mg/m^3)
glacial acetic acid	0.48 mg/m^3	-	0.01 ppm (0.025 mg/m^3)
hydrochloric acid	0.013 ppm	-	0.013 ppm (0.02 mg/m^3)
iodine	ND[e]	-	0.0001 ppm (0.001 mg/m^3)
lithium metal	ND[e]	-	-
methanol	9.5 ppm (12.45 mg/m3)	-	0.2 ppm (0.26 mg/m^3)
methylene chloride	1.2 ppm (4.16 mg/m3)	0.0061 ppm (0.021 mg/m^3)	0.0014 ppm (0.0047 mg/m^3)
methyl amine	0.48 ppm (0.61 mg/m3)	-	0.01 ppm (0.012 mg/m^3)
methyl ethyl ketone	-	-	0.34 ppm (1 mg/m^3)
naphtha	16.7 ppm (67.64 mg/m3)	-	0.1 ppm (0.35 mg/m^3)
nitroethane	4.8 ppm (14.74 mg/m3)	-	0.1 ppm (0.31 mg/m^3)
petroleum spirit	16.7 ppm	-	0.1 ppm (0.35 mg/m^3)
phosphoric acid	0.048 mg/m^3	-	0.0025 ppm (0.01 mg/m^3)
potassium chromate	ND[e]	-	0.0000001 ppm (0.000001 mg/m^3)
potassium dichromate	ND[e]	-	0.000004 ppm (0.00005 mg/m^3)
potassium permanganate	ND[e]	-	-
red phosphorus	ND[e]	-	-
sodium chromate	ND[e]	-	0.000008 ppm (0.00005 mg/m^3)
sodium dichromate	ND[e]	-	0.0047 ppm (0.05 mg/m^3)
sodium hydroxide	ND[e]	-	0.0012 ppm (0.002 mg/m^3)
sodium metal	ND[e]	-	-
sulfuric acid	0.048 mg/m^3	-	0.0003 ppm (0.001 mg/m^3)
toluene	2.4 ppm (9.05 mg/m3)	0.11 ppm (0.400 mg/m^3)	0.11 ppm (0.4 mg/m^3)
methamphetamine	-	-	-
total VOCs	-	-	-
lead [d]	-	-	0.0002 ppm (0.0015 mg/m^3)
mercury [d]	-	0.000037 ppm (0.0003 mg/m^3)	0.000037 ppm (0.0003 mg/m^3)

a. Assumes exposure 24 hours a day for one year; mg/m3 concentrations at 25 °C and 1 atmosphere (760 Torr).

b. Assumes exposure 24 hours/day, 350 days/year, for 30 years; 1x10^{-5} risk and HI$\leq$1; mg/m^3 concentrations at 25 °C and 1 atmosphere (760 Torr).

c. Assumes exposure 24 hours/day, 350 days/year, for 30 years; 1x10^{-6} risk and HI$\leq$1; mg/m^3 concentrations.

d. Associated with amalgam (P2P) method only.

e. Not detectable in sample of porous material.