



DEPARTMENT OF ENVIRONMENT & CONSERVATION

**Reasonable, Appropriate, Protective (RAP)
Cleanup Response and Documentation Guidance for Properties Quarantined
Because of Clandestine Methamphetamine Laboratory (CML) Activities**

(Interim Final Guidance, June 1, 2006)

Pursuant to TCA 68-212 Part 5.

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I. Acknowledgements

This guidance is a distillation and incorporation of cleanup methods and procedures used in other states affected by clandestine methamphetamine production (Washington, Colorado, Minnesota, and others). A special acknowledgement and thanks to John Martyny and the researchers at the National Jewish Medical and Research Center for their research into the understanding as to how contaminants originate and migrate from the ‘methamphetamine cooking’ process. Lastly, KCI - *The Anti-Meth Site*, (formerly the Koch Crime Institute) deserves much praise for identifying and promoting meaningful strategies in crime reduction and prevention, KCI was a pivotal resource for this guidance.

II. Introduction

The Tennessee General Assembly passed P. Ch. 855 of the Acts of 2004 (subsequently codified into TCA 68-212-500's) addressing clandestine methamphetamine labs. The Tennessee Department of Environment and Conservation (TDEC) then promulgated Rule 1200-1-19 providing the standard of cleanliness and the process for professionals dealing with these sites to be placed on the lists maintained by TDEC.

TDEC maintains lists of cleanup contractors certified to clean properties affected by the manufacture of methamphetamine and persons qualified to do testing and certify cleanups such as a Certified Industrial Hygienist (CIH) or other TDEC certified CML Hygienist.

This guidance is designed to assist property owners on the appropriate steps necessary to remove a quarantine order because of the presence of hazardous substances and/or waste associated with the criminal production of methamphetamine, its reagents, or its precursors. This guidance also assists the CIH or other such persons or entities as listed by the Commissioner (*Cleanup Contractors and CML Hygienists*) to evaluate an appropriate cleanup response through examples of degrees of clandestine methamphetamine production and associated activities.

The Primary Goals of a RAP Cleanup Response are:

- **Achieve Overall Contaminant Mass Reduction.**
- **Thoroughly Document the Cleanup Response.**
- **Achieve a level of cleanliness that is protective of human health so a property is deemed “Safe for Human Use”.**

In order to achieve these goals, it is important for the property owner, CML Hygienist and CML Contractor to understand all residual health hazards posed as a result of this criminal activity. In addition, they must be able to accurately assess the hazards, identify the appropriate cleanup procedures, and adequately photograph and document the cleanup response. Upon completion of the cleanup, the CIH or CML hygienist must present the property owner a copy of the documentation package of the cleanup and a Certificate of Fitness stating that the property is now “Safe for Human Use” with respect to methamphetamine related contaminants. If additional criminal or environmental support is required, the Cleanup Contractor must know when, where, and how to contact appropriate agencies.

III. Principle Threat Waste and Contaminants of Concern encountered at CML

Residual methamphetamine and associated hazardous waste are released during the methamphetamine manufacturing process. Airborne contaminants are absorbed into rugs, furniture, drapes, walls and other absorbing surfaces. Airborne contaminants also enter and contaminate the heating, ventilation, and air conditioning (HVAC) system. Spills are common and affect floors, walls, appliances, and other surfaces. Hazardous waste is frequently dumped into sinks, toilets, and bathtubs. This leaves contamination in the waste water system. Law enforcement and health agencies have found that levels of iodine, phosphine, and hydrochloric acid are likely to exceed current occupational standards during a cook using the red phosphorous method. Hydrochloric acid levels were especially high during the final "acidification stage," often exceeding the NIOSH "Immediately Dangerous to Life and Health" (IDLH) level. Large amounts of methamphetamine are also released into the air and deposited on most items and on horizontal and vertical surfaces throughout the building. ‘Cooking’ can release as much as 5,500 micrograms of methamphetamine per cubic meter into the air, and deposit as much as 16,000 micrograms per 100 square centimeters onto surfaces. Concentrations of iodine gas (a common byproduct of methamphetamine production) of less than one part per million can cause severe respiratory distress. Iodine can be spilled or adsorbed to surfaces where it can sublime to air. The IDLH for iodine in air is 2 parts per million. The anhydrous ammonia (NAZI) method also shares many of these contaminants. With this base insight into the potential hazards associated with the clandestine methamphetamine laboratory process, it is clear that both residual methamphetamine and hazardous waste generated during the manufacturing process pose a threat to human health, and render the property ‘Unsafe for Human Use’.

The Principal Threat Waste (PTW) and Contaminants of Concern (COC) resulting from the manufacturing process may be in the form of corrosive waste sludge and /or as residues of a variety of volatile organic compounds (VOCs), metals, acids and bases. Some of the chemicals used in the process include but are not limited to hydriodic acid, hydrochloric acid, sulfuric acid, sodium hydroxide, red phosphorus, hydrogen peroxide, naphtha, Freon, chloroform, acetone, benzene, toluene, ethyl ether, acetic acid, methyl-ethyl-ketone, hypophosphorus acid, yellow phosphorus, anhydrous ammonia, lithium, sodium, isopropyl alcohol, ethyl alcohol, and methanol. The residual COC and PTW may be contained in or on absorbent materials, ceiling tiles, walls, floors, counter-tops, appliances, children toys, linen, drapes, furniture, mattresses, clothing, soil, waste water systems, HVAC systems, range vent hoods, etc. For more information on the hazards associated with the chemicals see Appendix A.

Albeit rare, it is possible that bulk chemicals, reagents, and methamphetamine oil could remain on the property. In most cases law enforcement agencies and their contractors remove bulk chemicals, paraphernalia, and manufacturing related items. However, if suspicious items are discovered, a hazardous materials specialist should remove them and properly dispose of them. Things as simple as a garbage bag full of containers or a bucket of cat litter may contain deadly amounts of toxic vapors, and the vapors may be released when the items are disturbed. A garbage bag of containers with methamphetamine related residues could easily contain enough phosphine gas to cause permanent pulmonary damage with a single exposure. Consult law enforcement before proceeding to ensure these items are not important evidence.

One of the more significant hazards when decontaminating a methamphetamine lab can be hypodermic needles. Users who inject methamphetamine are much more likely than the average population to have hepatitis or HIV/AIDS. Methamphetamine labs are frequently strewn with copious amounts trash that can hide carelessly discarded hypodermic needles. Needles have been found in many unlikely places such as in furniture, mixed in other garbage, on the floor or intentionally hidden in unexpected places for concealment. While HIV virus is unlikely to survive in an old hypodermic needle for more than a day, hepatitis pathogens can survive for a week or more. Because of the ease with which these items can puncture personal protective equipment (PPE), extra caution should be taken when a hypodermic user's lab is being decontaminated. Tough, puncture resistant boots and over-gloves are appropriate in these situations.

IV. Worker safety

The residual chemicals and contents can easily injure an individual cleaning a former CML. TDEC highly recommends that only trained professionals perform cleanups. The physical and chemical hazards are sometimes hidden. Chemicals present in CML residues are sometimes incompatible with chemicals used in cleaning. Appropriate training and protective equipment are extremely important for the safety of cleanup workers. Applicable OSHA rules (<http://www.osha.gov/>) apply to these cleanup responses for workers and Supervisors. Discipline in the use of protective equipment and adherence to safety procedures is also important. The work involved in a CML cleanup can be hot and tiring creating the temptation to remove equipment and cut corners on safety. Please see the TDEC website for training opportunities. <http://www.state.tn.us/environment/dor/meth/>

V. Fate and Transport of COC and PTW

When a methamphetamine lab is in operation, hazardous chemicals are usually released. These releases can range from vapors seeping through walls and being pulled through ductwork, to spills soaking into porous materials, or disposal activities of waste materials inside and outside of the structure.

The acid vapors, solvents, methamphetamine, drug byproducts and other vapors can redeposit on and in insulation, wallboard, carpet, ductwork, furniture, appliances or almost any other surface. Once re-deposited, the residues can be tracked out the door on shoes or clothing. Some of the chemicals can volatilize once again when humidity and temperature conditions change. Depending upon concentration, this could possibly cause an inhalation or flammable hazard. In addition, vapors containing methamphetamine, its byproducts, volatile organic compounds (VOC), metals, acids, and bases will generally travel together within a dwelling.

After adequate ventilation of contaminated areas, most solvent vapors will not pose an immediate threat to human health. Solvents tend to evaporate easily and dissipate when ventilated. For most of these solvents, the physical law of conservation of mass requires a substantial spill or continuing source for them to maintain a toxic concentration over a long period of time. Similarly, phosphine gas, a highly toxic byproduct of the Red-P manufacturing process, is a concern during and shortly after the actual 'cook'. However, since it is so reactive and dissipates rapidly it is not likely to have a long residence time when the structure is ventilated adequately.

Spills are very common in methamphetamine labs. Solvents, red phosphorous, iodine and other chemicals can leave hazardous vapors or residues on either hard or porous surfaces. Those on porous surfaces can have considerable residence

times. Like residues from vapors, the residues from spills can be tracked from place to place on shoes, clothing, toys, and other items of people present during cooking or cleanup. Spills may also be a persistent source of volatile chemicals. Spill areas should be targeted for removal or thorough cleaning.

A primary route of disposal for principle threat waste is the waste water system. Sinks and toilets provide a tempting route of disposal for the large amounts of byproducts (hazardous waste sludge) that result from drug production. The sludge in turn frequently clogs p-traps and toilets making the waste water system inoperable, and possibly contaminating the septic field depending on degree of drug production. Fortunately, many of the microorganisms in a septic system can break down the hazardous chemicals. If, on the other hand, the amount of drug production is great or the lab has been operating for months to years, extreme pH conditions or large amounts of solvent may overwhelm it which will require the system to be remediated by informed professionals. Municipal sewer systems can take these by-products miles from the clandestine lab. Fortunately, this transport action within a municipal sewer system has a tendency to dilute the problem, so for many cases a simple notice of the problem to the sewer authority may be a sufficient remedial action. See Appendix C.

Another key transport mechanism in methamphetamine labs is the heating, ventilation and cooling (HVAC) system. Intakes from the HVAC or other air duct systems can pull in hazardous vapors and redistribute them to every room attached to the system. Residues can accumulate in the ductwork, filter and blower mechanism (typically at low temperature and low air movement) and then off-gas later (typically at high temperature and high movement). Depending on the tier level of the response, a cleaning / removal of the ductwork and blowers may be appropriate, and air filters should be replaced during any methamphetamine lab remediation.

Below are examples of chemicals that may be encountered, the transport mechanisms, location of contaminants, and its persistence on the quarantined property.

- **Anhydrous Ammonia** - tends to evaporate - does not tend to leave a residue - easily removed by ventilation
- **Phosphine gas** - always in gaseous form - reacts with other chemicals in the environment and degrades rapidly - dissipates with ventilation
- **Methamphetamine** - vaporizes during production and deposits as residue - resides as residue on surfaces - may be persistent on surfaces
- **Acids** - released as vapor during production or as a spill - deposited as residue - reside on surfaces until wetted - long residence time
- **Solvents** - released as vapor during production or spilled - absorb into porous surfaces and evaporate over time - persistence is related to spill volume, the extent of perfusion into porous materials, and environmental conditions
- **Red Phosphorous** - released as spill - resides as residue - indefinitely
- **Iodine** - released as spill - resides as residue - indefinitely - may sublime into iodine gas, a toxic respiratory irritant
- **Lead** - released as vapor or as spill - resides as residue or dust - infinite residence
- **Mercury** - released as vapor or as spill - resides as metallic residue or as a gas - indefinite residence time.
- **Lithium** - released as spill or battery pieces - resides in spill residue or black, metallic, ribbon-like chunks - infinite residence
- **Alkalis (Lye)** - released as spill, resides as residue or dried spill, indefinite residence
- **Alcohols (methanol)** - released as spill - absorb into porous surfaces and evaporate over time - persistence is related to spill volume, the extent of perfusion into porous materials, and environmental conditions

VI. Standards of Cleanliness

Rule 1200-1-19 provides the following standards of cleanliness for sites used to manufacture methamphetamine:

- **Methamphetamine:** Shall not exceed 0.1 micrograms /100 square centimeters
- **Volatile Organic Chemicals (VOC):** Shall not exceed 1 part per million (ppm) total hydrocarbons and VOCs in air under normal inhabitable ventilation conditions.
- **Mercury*:** Shall not exceed 50 nano grams per cubic meter of air under normal inhabitable ventilation conditions.
- **Lead*:** Shall not exceed 40 micro grams per square foot

* - *If it is determined that the Amalgam (P2P) process was not used, then these standards do not apply.*

VII. Analytical Methodology

The current EPA SW-846 analytical methods used to detect methamphetamine is 8270C-Modified. For lead the method is 6020. Portable analyzers with gold film absorption systems are available for mercury vapor detection. TDEC recognizes that science and technology are constantly refining analytical procedures and instrumentation. Therefore, any proven and defensible analytical methodology / technology that has a detection level lower than the 'Standards of Cleanliness' numbers can be employed. These alternate analytical methods must be thoroughly documented to ensure that data results are defensible. A photo-ionization detector (PID) can be used for VOC determinations. The correct lamps must be used and the instrument calibrated prior to screening of the VOC. The calibration of the instrument must be documented.

Less technical methods are also useful. Normal visual acuity can be used for determining if items are stained or discolored. Spray starch or sometimes water can highlight iodine residues. Intermediate range, non-bleeding, color indexed pH indicator strips can be used to ascertain if acid / alkali residues are present. The pH of surfaces should generally be between 6 and 8 if little or no acids or bases are present or if a cleanup has been effective.

VIII. Sampling Strategy and Methodology

It is TDEC's position that it is much more cost effective for the property owner and the Cleanup Contractor to make the assumption that residual contamination is present when a 'methamphetamine cook' has occurred, than to spend money to prove contamination is not present/dangerous via pre-sampling determinations. Money spent on pre-sampling events and evaluation is usually better spent towards the cleanup action and replacement of furnishings. With the exception of screening samples (e.g. - VOCs in air, pH of surfaces, drug detection sprays or spray starch for iodine detection) used to direct cleaning actions, sample collection should be performed after the cleanup action is completed. This type of sampling is called confirmatory. It confirms that the cleanup response addressed all contamination sources. Confirmatory sampling is preferred because this type of sampling is the most cost effective and defensible. When a cleanup action is implemented correctly, all contaminated surfaces should be removed, washed and/or sealed to prevent risk of exposure. Confirmatory sampling will determine if the cleanup action was successful.

Confirmatory air samples must be acquired under normal HVAC operations from locations that exhibited the highest screening detections. Surface samples must be taken from surface areas that were not replaced and must target areas that exhibited the highest screening values or visual contamination noted during the inspection. The number of confirmatory samples to determine compliance is left to the 'Best Professional Judgment' of the CIH employed to certify the living space as 'Safe for Human Use'. The rationale for the number of samples taken and their location should be included in the final report. Procedures for collecting wipe samples are given in Appendix D.

IX. Recommended Methamphetamine Cleanup Resources

To assist property owners and Cleanup Contractors in furthering their understanding of potential hazards associated with these Clandestine Methamphetamine Laboratories, the following URLs are provided as additional resources. TDEC's strongly suggests that property owners and Cleanup Contractors review these resources before undertaking cleanup responses.

KCI, *The Anti-Meth Site*

http://www.kci.org/meth_info/links.htm

National Jewish Medical and Research Center

<http://nationaljewish.org/>

Keyword: methamphetamine

Washington State Department of Health

<http://www.doh.wa.gov/ehp/ts/CDL/default.htm>

Colorado Department of Health and Environment

<http://www.cdphe.state.co.us/hm/methlab.pdf>

<http://www.cdphe.state.co.us/hm/methlabfactsheet.pdf>

Minnesota Department of Health

<http://www.health.state.mn.us>

Keyword: methamphetamine

X. Tiered Response Scenarios for RAP Cleanups

In surveying the types of crime scenes encountered by law enforcement, TDEC has noted that affected properties fall into 4 degrees, or tiers of criminal methamphetamine production. The degree of methamphetamine production directly influences the degree of potential contamination that may be encountered at one of these quarantined properties. In turn, the degree of potential contamination will directly affect the amount of sampling, removals, and cleanup procedures necessary to return the property to its appropriate reuse. Thus releasing the property from quarantine.

The following tiered response scenarios provide examples for reasonable, appropriate and protective cleanups of properties that have been quarantined as a result of the presence and or potential release of hazardous substances used in the criminal production of methamphetamine. Prior to any cleanup action the following activities must have occurred:

- **All criminal investigations of the Crime Scene are completed and permission to enter property from the designated Chief Law Enforcement Officer (CLEO) has been secured.**
- **All lab process related chemicals, waste, and paraphernalia have been removed and documented by law enforcement and their response contractors. See attachment B.**
- **A Certified Industrial Hygienists (CIH) and other such person or entity as listed by the Commissioner has been contracted.**
- **The initial assessment and inspection of the quarantined property by the Cleanup Contractor has been performed, appropriate PPE for cleanup workers has been selected, and the Hazard Assessment and Scope of Work for the appropriate Tiered Response is completed and communicated to cleanup workers.**

Tier 1 Response - (*Motel/Hotel 'transient-cook' scenario with anhydrous ammonia*)

Crime scene evidence suggests that the manufacturing process was initiated. Limited amounts of reagents or precursors are present and open. It is uncertain a 'cook' was completed, or 1 to 2 low-yield* Nazi 'cooks' were completed, minor spill and staining may be observed. An example of when this Tier designation would be appropriate would be where a short-term guest began the manufacturing process in a hotel, motel, State and Federal park cabin, or in a relatives' / friends' residence over the weekend.

At a minimum a typical cleanup would involve the following:

- **If suspicious items (containers with residues, tubing, odd containers of kitty litter or paraphernalia) are discovered that are apparently related to methamphetamine production, contact law enforcement immediately. If law enforcement personnel do not remove them, these items should be removed by a hazardous materials specialist and properly disposed. Also, law enforcement officials will likely be interested in any firearms encountered during cleanup. Call law enforcement for advice before touching firearms.**

- Document and photograph the cleanup action.
- Prior to the cleanup response, remove all ancillary volatile and semi-volatile chemical sources that may be located on the premise not associated with the lab process. (*Examples of VOC sources include: automotive gas, propane, automotive cleaners, aerosols, dry cleaned clothing, etc. If this task is not performed, then false positive for VOC air samples may occur.*)
- Heat and ventilate premise for 72 hours prior to cleanup. The goal of ventilating the property is to achieve non-detects prior to the cleanup response. Once non-detects are achieved, then there is no need for further confirmatory air monitoring after the cleanup is completed.
- If a minor spill is noted during the assessment (*e.g. If a can of solvent leaked on counter top or floor.*), then the Cleanup Contractor should target that area for an appropriate and thorough cleaning or removal.
- Screen air for VOCs. Representative air samples must be acquired while normal, inhabitable HVAC ventilation is occurring and target areas of spills for cleaning..
- The level of OSHA certification for cleanup workers and choice of PPE is a judgment call for the Cleanup Contractor and his/her employees to make.
- Using appropriate PPE, the cleanup workers shall thoroughly clean all hard surfaces with appropriate cleansers. Commercially shampoo rugs, steam clean mattress and cloth furniture, and have bed linens and drapes commercially laundered. Secure cleaning receipts for documentation purposes. Have cleanup workers sign off on cleanup checklist that work was performed.
- Collect any clothing or items left behind by the clandestine lab operator or their family and render unserviceable*, and discard them. This step must be photo documented. Because these articles of clothing and toys have the potential to be heavily contaminated with COC they are not to have the potential to be reused. Please remember the old saying; “One man’s trash is another man’s treasure.”
- Where practicable, carefully segregate any hypodermic needles or other sharps. A container made of puncture resistant plastic is recommended here.
- Since removal and replacement of appliances is not anticipated, wash and clean all appliances thoroughly.
- Particular interest should be taken for both cleaning and testing on surfaces that tend to collect dust such as range hoods, ceiling fans, windowsills, etc.
- Where appropriate, test pH with pH paper strips (pH range of 6 to 8 is acceptable), use spray starch (iodine indicator) or photo-ionization detector (VOC) to target areas of potential concern.
- After completion of cleanup, acquire confirmatory samples to determine if site meets Standard of Cleanliness.
- Prepare documentation and certify that property is ‘Safe for Human Use’ The documentation package shall include all reports noted in “*Documentation Requirements:*”
- In cases where police have found a methamphetamine lab but preliminary samples come back as non-detect (with appropriate detection limits), the structure should still be given at least a Tier 1 cleanup response to address probable contaminants other than methamphetamine before release.

* - Render unserviceable – TDEC views this term to mean that items must be destroyed to such a degree that it can no longer be used for its intended purpose. For example: toys or clothing must be cut or broken into pieces. Appliances must be cut in half or otherwise damaged beyond repair. Prior to rendering refrigeration units unserviceable, Freon must be removed by a licensed technician. Carpet must be cut into small pieces. Contact TN Division of Air Pollution Control for guidance before burning anything.

Tier 2 Response - (*Motel/Hotel 'transient-cook' scenario with moderate activity or red phosphorous methods.*)

Crime scene evidence suggests that a limited amount of methamphetamine, reagents, or precursors were produced over a relative short period of time, a week or so. One or two 'Red-P' or 3 to 4 'Nazi' low-yield 'cooks'. Spills and stains may be observed. An example of when this Tier designation would be appropriate would be where a guest(s) in a hotel, motel, State and Federal park cabin, or in a relatives' / friends' residence stayed less than 2 weeks.

At a minimum a typical cleanup would involve the following:

- **If suspicious items (containers with residues, tubing, kitty litter or paraphernalia) are discovered that are apparently related to methamphetamine production, contact law enforcement immediately. If law enforcement personnel do not remove them, these items should be removed by a hazardous materials specialist and properly disposed. Also, law enforcement officials will likely be interested in any firearms encountered during cleanup. Call law enforcement for advice before touching firearms.**
- Where applicable/appropriate, follow all cleaning procedures described in Tier 1.
- This Tier differs from Tier 1 Responses in that additional affected fixtures and materials may need to be removed, rendered unserviceable, and disposed of appropriately.
- Alternatively heat and ventilate property for a minimum of 8 days, or until non-detects are achieved via air monitoring. Remember to remove all potential VOC sources on the property.
- Trained technicians shall perform removals, render items unserviceable, and dispose of items appropriately.
- If appliances and fixtures are stained and contaminated to the point that successful cleaning is in doubt, then render appliances and fixtures unserviceable and remove.
- Absorbent surfaces (e.g. drop ceilings surrounding and proximal to 'cook', mattresses, pillows, carpets, and clothing) shall be rendered unserviceable and removed.
- All potential process-related stained surfaces and items shall be rendered unserviceable and removed.
- Where appropriate, the removed items are to be documented and manifested to Special Waste landfill facilities.
- All non-stained hard surfaced are to be washed with appropriate cleaners.
- Where appropriate, all washed hard surfaces are to be painted or sealed.
- All other absorbent surfaces (e.g. – linens, drapes) are to be commercially cleaned twice.
- Cloth furniture is to be commercially steam cleaned twice.
- Replace air filters in HVAC, and commercially clean ventilation duct works.
- After completion of cleanup, acquire confirmatory samples to determine if site meets Standard of Cleanliness.

Tier 3 Response - (*Rental or Residential Property 'entrenched cook' scenario.*)

Crime scene evidence suggests that numerous Red-P and/or Nazi 'cooks', or precursors and reagent production have occurred periodically over an extended period of time, many weeks to several months. Chemical spills, staining, and burn pits are often observed at these locations. An example of when this Tier designation would be appropriate would be homes and rental property where owners or tenants manufacture methamphetamine periodically. This tier designation should be considered the default Tier designation for homes and rental property with re-occurring 'cooks'. This Tier designation may also be appropriate for hotels / motels with a history of multiple or re-occurring clandestine methamphetamine lab seizures.

At a minimum a typical cleanup would involve the following:

- **If suspicious items (containers with residues, tubing, kitty litter or paraphernalia) are discovered that are apparently related to methamphetamine production, contact law enforcement immediately. If law enforcement personnel do not remove them, these items should be removed by a hazardous materials specialist and properly disposed. Also, law enforcement officials will likely be interested in any firearms encountered during cleanup. Call law enforcement for advice before touching firearms.**
- Where applicable, follow all cleaning responses in Tier 1 and 2. (Be advised that contact with residual hazardous substances or waste is possible.)
- Alternatively heat and ventilate property for a minimum of 2 weeks, or until non-detects are achieved via air monitoring. Remember to remove all potential VOC sources on the property.
- Remove all porous and absorbent materials and render unserviceable.
- Remove all stained materials and render unserviceable.
- Remove all affected appliances and fixtures and render unserviceable.

- If there is a septic system, sample for methamphetamine by-products (volatile organics). If present, pump septic system and dispose of septage at a treatment works or hazardous waste facility as concentrations warrant (See Appendix C: Lessons Learned).
- Clean or remove grossly contaminated sub-floor or other framing materials prior to reconstruction. **Do not remove any structural members of the building that would compromise structural integrity.** In such cases, clean as well as possible.
- All surfaces, not replaced, must meet Standard of Cleanliness after cleanup.
- Removed items are to be documented and manifested to Special Waste facilities.
- If hazardous waste is present, then it must be manifested to Hazardous Waste facilities.

Tier 4 Response – *(The ‘mass-production cook /drugs-for-profit’ lab scenario.)*

Crime scene evidence suggests that this lab is capable of producing large quantities (multiple pounds) of methamphetamine, reagents, or precursors during a manufacturing event. Examples of when this Tier designation is appropriate would be homes, rental properties, commercial buildings, and/or farms where large capacity methamphetamine labs or supporting precursor / reagent labs are located. A principle-determining factor for this tier selection is evidence of potentially severe environmental effects because of large quantities of drummed and / or buried waste discovered on the property. Law enforcement agencies must consult with TDEC prior to making this Cleanup Tier Recommendation.

At a minimum a typical cleanup would involve the following:

Please note that prior to any cleanup response for a Tier 4 scenario, when it is determined that hazardous substances or waste are present in such quantities that a regulatory oversight may be required under TDEC Hazardous Waste Rules, coordination with TDEC for the appropriate oversight of hazardous waste characterization, disposal, and cleanup activities is necessary prior to any cleanup response. TDEC does not foresee Tier 4 Responses being very common, but recognizes that the possibility exists.

XI. How to get started with a RAP Response:

1. When should the RAP response for quarantined properties begin? When the criminal investigation authorities have decided that the crime scene is no longer necessary for evidence collection, and approval to enter the quarantined property has been secured in writing from the designated CLEO by the property owner.
2. Property owners should contact a Cleanup Contractor within 60 days of the property being released for cleanup.
3. The Cleanup Contractor shall secure as much information as possible from law enforcement. (Law Enforcement / First Responder Crime Scene Report).
4. After reviewing the information from law enforcement, the Cleanup contractor will inspect the quarantined property, assess all potential hazards and assign the appropriate Tiered RAP Cleanup Response (if the Tier is not assigned by law enforcement) to the quarantined property. Justification for the Tier assignment must be supplied.
5. The Cleanup Contractor will develop an appropriate Scope of Work (SOW) for cleanup activities based on the Tier Response. During this step appropriate PPE for the protection of the cleanup workers will be assigned. This step is very important because it is the cleanup workers that will have the greatest potential to be exposed to PTW and COC at these properties.
6. The Cleanup Contractor shall verify and document that all cleanup work was performed according to the SOW. If removal and disposal of contaminated media requiring Special Waste or Hazardous Waste manifesting is necessary, then this activity must be approved by the appropriate regulatory agency, and documented in a Transportation and Disposal Plan.

XII. Disposal of Methamphetamine Wastes

Demolition wastes from methamphetamine sites such as carpets, furniture, trash and other items should be hauled to a Class 1 Landfill. A list is available on the TDEC Methamphetamine Cleanup website along with a copy of the Blanket Special Waste Approval for such CML wastes.

<http://www.state.tn.us/environment/dor/pdf/BlanketWasteApproval.pdf>

XIII. Open Burning

CML wastes should not be burned. Burning releases toxic substances into the atmosphere. Tennessee has a general prohibition against open burning (see Air Pollution Control regulations 1200-3-4). The open burning of wastes from a CML property is prohibited under this rule. The open burning of such wastes could result in a substantial fine or other penalty. <http://tennessee.gov/environment/apc>

XIV. Documentation Requirements

1. After the cleanup response is completed, the Cleanup Contractor or CML Hygienist shall submit a written report along with before-and-after photo documentation of all cleanup activities. This report will also include the SOW for the appropriate Tier Designation along with the justification why this response was chosen, any information from law enforcement, site sketches, photos, and manifests, etc. In addition, if a removal activity occurred during the cleanup response the Transportation and Disposal Plan must be included. Be advised, when it comes to the defensibility of any documentation package of this type, photograph and document the activities adequately.
2. In addition to the above report and supporting documentation, the CML Hygienist or CIH shall submit a Certificate of Fitness certifying that the quarantined property has been cleaned up and that all risks and hazards resulting from criminal methamphetamine production have been abated, and that the property is 'Safe for Human Use' with respect to the methamphetamine laboratory contaminants. This letter is to be attached to the front of the document package and must be prepared by a certified industrial hygienist or TDEC certified CML Hygienist.
3. The property owners are to keep a certified copy of this documentation for a minimum of 5 years or for future property transfers.

Appendix A. Chemicals and Hazards associated with Methamphetamine Production.

Typical Chemicals Found in Lab Sites	Common Legitimate Uses	Poison	Flammable	Toxic Vapors	Explosive	Corrosive	Skin Absorption	Common Health Hazards
Acetone	Fingernail polish remover, solvents	X	X	X			X	Reproductive Disorders
Methanol	Brake cleaner fluid, fuel	X	X	X			X	Blindness, eye damage
Ammonia	Disinfectants	X		X		X	X	Blistering, lung damage
Benzene	Dye, varnishes, lacquers	X	X	X	X	X	X	Carcinogen, Leukemia
Ether	Starters fluid, anesthetic	X	X		X			Respiratory
Freon	Refrigerant, propellants	X		X		X		Frostbite, Lung damage
Hydriodic Acid	Driveway cleaner	X		X		X	X	Burns, Thyroid damage
Hydrochloric Acid (Hcl gas)	Iron ore processing, mining	X		X		X	X	Respiratory, Liver damage
Iodine Crystals	Antiseptic, Catalyst	X	X		X	X		Birth defects, Kidney failure

Appendix A. (Continued)

Chemicals and Hazards associated with Methamphetamine Production.

Typical Chemicals Found in Lab Sites	Common Legitimate Uses	Poison	Flammable	Toxic Vapors	Explosive	Corrosive	Skin Absorption	Common Health Hazards
Lithium Metal	Lithium batteries	X				X	X	Burns, Pulmonary edema
Muriatic Acid	Swimming pool cleaners	X		X		X		Burns Toxic vapors
Phosphine Gas	Pesticides	X		X			X	Respiratory failure
Pseudophedrine	Cold medicines	X						Abuse: Health damage
Red Phosphorus	Matches, fireworks	X	X	X	X			Unstable, flammable
Sodium Hydroxide	Drain cleaners, lye	X		X		X	X	Burns, skin ulcers
Sulfuric Acid	Battery acid	X		X		X	X	Burns, thyroid damage
Toluene	Paint thinners, solvents	X	X	X	X		X	Fetal damage, pneumonia
Liquid Lab Waste	None	X	X	X	X	X	X	Unknown long term effects

This information was obtained from the Division of Environmental Health, Office of Environmental Health and Safety, Washington State. <http://www.doh.wa.gov/ehp/ts/CDL/methhazards.htm>

Appendix B: TDEC Cleanup Response Tier Selection Criteria

(This is the decision tree law enforcement officials use to recommend a cleanup tier.)

The recommended TDEC Cleanup Response Tier for a property is based on probable or documented criminal activity as noted in the EPIC Report and from crime scene information available to law enforcement officers. It should be noted that subsequent assessments and testing of a quarantined property by a TDEC Certified CML Cleanup Contractor, CML Hygienist, or a Certified Industrial Hygienist may result in a finding that an alternate cleanup response Tier be more appropriate. The cleanup contractor must document any variance from the initial recommended Tier Recommendation and the hygienist of record must concur.

Is this property eligible for quarantine?

Is there evidence of the **manufacture** of methamphetamine?*

Yes: Go to Tier 1 - Selection criteria.

No: **STOP, DO NOT Quarantine this property.**

Note: P2P/Methylamine and / or reagent labs default to Tier 3 Recommendation.

Tier 1 - Selection criteria: (Most applicable to locations where the criminal does not reside or work.)

- 1) Is lab capacity greater than 2 ounces per manufacturing event?
Unknown: Go to Tier 2 - Selection Criteria
Yes: Go to Tier 3 - Selection Criteria.
No: Continue with next Tier 1 questions.
- 2) Did suspects likely manufacture methamphetamine, its reagents, or precursors for more than 3 days but less than two weeks at this location?
Unknown: Go to Tier 3 - Selection Criteria
Yes: Go to Tier 2 - Selection Criteria
No: Continue with next Tier 1 question.
- 3) Are the chemicals found consistent with a phosphorous/iodine (Red-P, Hypophosphoric, Hydroiodic) type methamphetamine or reagent lab?
Unknown: Go to Tier 3 - Selection Criteria
Yes: Go to Tier 2 - Selection Criteria
No: **STOP - A Tier 1 Cleanup Response is recommended for this property.**

Tier 2 - Selection criteria: (Most applicable to locations where the criminal does not reside or work.)

- 4) Is lab capacity greater than 2 ounces per manufacturing event?
Unknown: Go to Tier 3 - Selection Criteria
Yes: Go to Tier 3 - Selection Criteria.
No: Continue with next Tier 2 questions.
- 5) Did suspects likely manufacture more than two weeks at this location?
Unknown: Go to Tier 3 - Selection Criteria
Yes: Go to Tier 3 - Selection Criteria
No: **STOP - A Tier 2 Cleanup Response is recommended for this property.**

Tier 3 - Selection criteria: (Most common to locations where criminal resides or works.)

- 6) Is lab capacity greater than 1 pound per manufacturing event?
Unknown: Go to Tier 4 - Selection Criteria
Yes: Go to Tier 4 - Selection Criteria.
No: **STOP - A Tier 3 Cleanup Response is recommended for this property.**

Tier 4: Selection criteria: (Potential for severe environmental effects.)

Law enforcement agencies must consult with TDEC officials prior to making this Cleanup Response Tier recommendation.

Pursuant to T.C.A. 68-212-Part 5, TDEC - Division of Remediation is tasked with regulatory responsibilities for cleanups at clandestine methamphetamine labs. Please contact the Division of Remediation Central Office at (615) 532-0900 for assistance for this tier recommendation. TDEC-DoR business hours are typically Monday through Friday 8:00 to 4:30 Central time.

*** Be advised that the presence of residues methamphetamine on surfaces alone is not sufficient evidence to prove that the manufacture of methamphetamine occurred. It must be in combination with other lab items or paraphernalia. Evidence of manufacture of methamphetamine can be as simple as the presence of ground tablets, consolidated containers of tincture of iodine, phosphorus stained coffee filters, or non-neutral pH (<6 or >8) present on walls and furniture. These items will, of course, be components of a weight of evidence that manufacturing has occurred. A lab seizure is sufficient evidence to quarantine property.**

Appendix C: Lessons Learned

1. Flexible duct

Flexible ductwork in most cases cannot be economically cleaned. This type of ductwork has a tendency to roll with the turning motion of a cleaning brush. It frequently has a porous inner surface. Water injected into such an environment as inside flexible ductwork would likely lead to mold growth and other problems. In most cases it is recommended that this type of ductwork be removed and replaced with new ductwork once cleaning is sufficiently complete.

2. Paneling

In most cases, wood paneling should be considered an absorbent material.

3. Cleaning the Floor First and Last

The floor of a property affected by methamphetamine production can have heavy concentrations of methamphetamine. Household dust collects methamphetamine residues and deposits them onto the floor as the dust settles out of the air. It has been the experience of some that a ceiling to floor cleaning can give poor results because of recontamination from the floor in the final phase of cleanup. A preliminary washing of the floors can cut the heavy concentrations and reduce the amount of chemicals available to re-contaminate surfaces as the floor is cleaned on the final wash. The cleaning of ceilings and walls working downward would, of course, follow the initial floor cleaning and the floor would be cleaned again as each room is completed and exited.

4. Never dry vacuum.

Dry vacuuming should be avoided at methamphetamine-contaminated sites. Dust particles pulled from surfaces can frequently pass through the vacuum and be redistributed throughout the structure. When these redistributed particles settle, they can re-contaminate cleaned surfaces. Ductwork vacuums should be vented to the outside air when possible.

5. Septic tanks

Septic tanks are frequently used to dispose of waste liquids from methamphetamine production. However, when a septic system is heavily used to dispose methamphetamine wastes, problems with pH, sludge buildup, and bacterial die-off can occur. TDEC recommends that septic systems where methamphetamine waste disposal has occurred regularly (heavy Tier 3 or greater) be tested (Toxicity Characteristic Leaching Procedure - TCLP) and pumped. It is important to remember that testing results should be known **BEFORE the tank is pumped**. If characteristics of the septage are such that it cannot be disposed at a local treatment works, other disposal plans must be made.

Fortunately, a septic tank is an efficient bioreactor capable of handling many of the chemicals involved in the illicit manufacture of methamphetamine. Acids and bases are attenuated or neutralized. Solvents are adsorbed to carbon solids and slowly broken down. Liquid wastes from septic tanks would only be considered hazardous if they were to exhibit characteristics of hazardous waste or contained listed waste. Septage with very high or very low pH or a very high concentration of a solvent with a toxicity characteristic such as benzene would be quite rare. It is even more unlikely that the liquid would exhibit the characteristics of ignitability or reactivity. Because the waste determination would be based on the entire contents of the tank, it is unlikely that the contents would exhibit a hazardous waste characteristic if the volume of methamphetamine waste in the tank were small in comparison to the volume of common household waste.

Be aware of the regulations concerning the transport and disposal of hazardous waste. Contact TDEC Division of Solid Waste Management or the Tennessee Department of Safety if you are unsure of how to proceed. Remember that tying up septic hauler truck until samples are analyzed and disposal decisions are made could be a very expensive proposition.

6. Contamination Mass Reduction

The least contaminated areas of a structure should usually be cleaned first. This limits the amount of contamination carried by workers as they go to different areas. Once cleaned, rooms can be roped off with tape or otherwise marked so that workers do not inadvertently spread contaminants back into cleaned rooms.

7. Encapsulation

One strategy for reducing methamphetamine concentrations on surfaces is to coat them with an encapsulating paint. However, painting does not encapsulate heavy concentrations of methamphetamine. Methamphetamine vapors can slowly

volatilize through the paint. Painting should only be done after surfaces have been washed at least twice. We feel the contaminant mass reduction of two washes should prevent significant risk of seeping through the paint. Any concerns about heavy concentrations inside walls or in attic spaces that could potentially re-contaminate the living space of the dwelling should be addressed before this phase of cleanup.

Indications are that oil-based paints and sealers work better than water-based paints and sealers.

8. Documentation Quality

TDEC does not usually give review or comment on methamphetamine cleanup reports. They are entirely the responsibility of the contractor and hygienist.

Care and diligence should be taken in the documentation of a methamphetamine cleanup. A photographic record of removals and cleaning should depict all of the major cleanup actions. These will help the property owner, contractor, hygienist and others if questions are ever raised about a cleanup. Frequently, cleanups are used as evidence that a family has turned their lives around after children have been removed from the home by court order. These cleanup reports will inevitably be scrutinized by the court and caseworkers. Should a contractor or other person be called into court to testify about cleanup issues, a high quality and detailed cleanup report will be invaluable.

While this guidance is not a point for point regulation, it does represent the best-known strategies for methamphetamine cleanup at a given time. When disputes or questions arise about cleanups, deviations from this guidance should be documented with sound reasoning and logic from the information at hand. If a cleanup report is questioned, it is likely that it will be held against the guidance in a checklist fashion and deviations from it will naturally be questioned heavily.

9. Third party testing

TDEC keeps contact information for hygienists and cleanup contractors in separate lists. The cleanup contractor and hygienist should be hired independent of one another. If a contractor or hygienist hires the counterpart, s/he is likely to hire someone with whom s/he a close professional relationship. Contractors and hygienists will nearly always work together honestly. However, if they are hired separately there is even less likelihood that they could collude to drive up price or cover a poor cleanup. An independent review also has a better appearance if cleanup issues are later questioned. In either case, both the hygienist and contractor will have to work together and communicate to achieve a proper cleanup.

10. Communication with Law Enforcement

It is always a good idea to call the quarantining officer or his/her narcotics office to inform them when people will be in the quarantined property. No one is allowed in a quarantined property without the supervision of law enforcement or a TDEC certified CML contractor or hygienist.

11. Mobile Homes

Occasionally, when a methamphetamine lab is located in a mobile home that is several years old, the cost of decontamination may outweigh the value of the mobile home. In such cases, with contaminated furnishing removed, the mobile home may be hauled intact to a Class 1 landfill and be demolished at the landfill. Prior arrangements must be made with the landfill. Some landfills will not be able to accommodate on-site demolition. The steel framing at the base of the mobile home should be minimally affected and can be recycled. The recycling process will effectively destroy any residues.

Appendix D. - AQUIRING SEMI-POROUS SURFACE WIPE SAMPLES

The sample method used to determine whether or not a structure is sufficiently clean of methamphetamine related contaminants is called surface “wipe” sampling. Please note that all hard surfaces in homes or structures (e.g. ceilings, floor tile, walls, counter tops, shelving, appliances, etc.) should be considered semi-porous with respect to methamphetamine contamination. Porous surfaces such as carpet, drapes, most paneling, clothing, etc. cannot be sampled using this method. Good quality, absorbent wipes should be used when collecting methamphetamine wipe samples, especially when wiping rough surfaces. Wipes must be wetted with a wetting agent to enhance collection efficiency. The current approved wetting agent for collection of methamphetamine samples is methanol.

The following sample acquisition procedure is recommended when collecting wipe samples at former CMLs.:

- 1) Prepare a site sketch of the areas to be sampled, along with the rationale why each sample location was chosen. A log of all activities occurring during the sampling event is also important to record. In addition, a photo log of all sample locations and procedures should be recorded. Make sure photo shows sample location inside the room relative to other items for later identification, not just the sample location by itself with no other items around it. This step is critical as it is one of the primary reference documents that could be challenged in court if a property goes through litigation.
- 2) Position a clean, good quality metal or stiff paper 100 cm² template over the area to be sampled. Lightly mark the surface to be sampled at the corners of the template with a pencil. Remove and wipe template with clean dry wipes prior to repositioning it over the next sample location. Use 2” wide painters tape to outline the 100 cm² area on the surface where the pencil marks were made. Use a permanent marker to label the outlined area at the upper right edge of the 2” wide painters tape with the sample location identifier. Good Quality 100 cm² templates are also acceptable.
- 3) Co-locate moistened intermediate range, non-bleeding, color indexed pH indicator strips near sample areas. It is best to place pH strips to the side of sample areas so it does not interfere with wipe tests. Moisten pH strips with neutral de-ionized water. Apply moist pH paper to surface, allow time for reaction (1 minute) and read pH strip while still moist. Make sure all pH strips remain in the neutral color index before placing them on surfaces. The pH test can be a good indicator of where active cooking may have occurred within a structure. Record the pH reading in field book along with sample location ID number. These pH strips will need to have a minimum sensitivity of 0.3 to 0.5, and be able to measure a pH range of from 2 to 9. Note: Do not drown a surface area with water and then place the pH strip in the puddle. This method will over buffer a surface area and yield an inaccurate reading.
- 4) Prior to taking any 100cm² wipe sample, a new set of clean, impervious protective gloves must be worn to prevent / limit the potential for cross-contamination of a sample from previous sample locations. This step also serves to protect the sampler from exposure to contaminants and wetting agents. Take care that gloves are chosen that are chemically compatible with acids and other suspected chemicals.
- 5) After all sample location preparation has been completed, begin wipe sample acquisition. With a cleaned gloved hand, withdraw wipes from package and place on a clean surface. One wipe is used per each 100cm² location. Fold wipe into ¼ size and moisten the wipe with methanol by pouring it onto the wipe. The wipe should not be dripping with methanol, but moistened sufficiently to collect a representative sample. Wring or squeeze out any excess wetting agent. Under and/or over saturating the wipe with the wetting agent, may prevent a true representative sample from being acquired. Practice this technique.
- 6) Firm pressure should be applied when wiping a surface. With a rolling-up wiping motion, start at an outside upper edge and begin wiping around along and down the edge towards the central portion of the surface area. When done correctly this wiping motion allow you to capture almost ½ the surface area in a single pass. Repeat this motion on the un-wiped portion of the sample area. Fold the wipe over to expose clean inner surface and repeat this process once. Remember this is a wipe sample so do not to use a scrubbing motion on the surface area. Remember to remain inside the outlined 100cm² area. A slight overrun of 100cm² area onto painters tape will not affect sample results. Do not under sample the 100cm² area. This technique needs to be practiced before attempting to acquire samples in the field.
- 7) Without allowing the wipe to come into contact with any other surface, place the wipe into the sample container, cap, properly label it with the location number, and note the number of the sample location on the sketch and on

sample container. Place a legal / custody seal on the sample container. Include notes with the sketch giving any further description of the sample. If this is a composite sample, all wipes for that composite sample must be placed into the same sample container prior to placing legal seal onto container.

- 8) At least one field blank wipe, moistened with solvent, but without wiping, should be submitted for every twenty samples for quality control purposes. Do not note that sample is a field blank on lab submittal sheet.
- 9) Complete chain of custody forms, lab sheets, and field notebook. Pack cooler with sufficient ice to maintain 32°F during shipment. Two large sealable poly bags are sufficient to keep samples cool during transport in small coolers. Double bag ice to prevent leakage during shipment. Sample containers should be wrapped in bubble wrap to prevent breakage during transport. Use bubble wrap or packing peanuts to fill up empty spaces in cooler. Send samples via an overnight shipper.

Appendix E. - Data Usability

1. Data usability and evaluation.

Testing for methamphetamine and determining whether a property is 'safe for human use' requires the use of hard data and simple statistics. Averages of concentration among composite wipe samples must be calculated and compared to standards. Discreet/grab samples of certain areas are also frequently taken.

2. Discreet/grab samples

Discreet samples are those taken of a single area designated with a template and compared to a standard. In a discreet sample only one wipe is used to sample a single 100cm² area and is then analyzed. The results are reported as the amount collected per 100cm².

Discreet samples should be taken of areas of frequent contact such as switch plates, doors, kitchen or bathroom counters or any surface where people are likely to place hands.

3. Composite samples

Composite samples are taken of several areas designated by 100cm² templates and analyzed together to produce a single result. In a composite sample up to four wipes from four different templates can be analyzed together. Each template must be used only once with a separate wipe and set of gloves for each 100cm² area of the composite. When results are reported they are corrected to the total surface area of the entire composite.

As an example, if a room is small then one composite sample may suffice to determine the cleanliness of that room. Four 100-cm² templates could be placed on the walls and floor of the room. Individual wipes for each template would be taken and placed into the same sample container. The lab would extract the methamphetamine from all wipes and report the total extracted. If the lab reported a total 0.2 ug extracted from the four wipes, the corrected result for four 100cm² templates would be 0.05 ug/100cm², a passing result. That room could be considered cleaned. If however, the result was greater than 0.1 ug/100cm², the room would have to be cleaned again.

4. A representative sample

How many samples do I need to adequately address a residence? This is one of the most important questions for a hygienist to answer. A small room (12' x 12') may need only one four-point composite sample. A larger room (14' x 25') may need three four-point composites. Each room usually needs testing. Discreet samples should be taken of anything that seems to have a high probability of contact (i.e. eating areas, food storage areas, or any other area to which people are drawn or exposure is likely)

5. Detection limits

Detection limits should be documented by the analytical lab and provided along with the results. A result of "non-detect" is not acceptable proof of a successful cleanup if detection limits are greater than the standards for cleanup.

6. Calibration

Photo-ionization detectors (PIDs) and other analytical or screening equipment need periodic calibration. This should be done according to the manufacturer's specifications and reported along with any results obtained from that equipment. The expiration dates of any calibration standards such as span gas should be reported as well.

7. Background

In some areas, especially near industrial facilities, there may be a baseline or background of VOC that is greater than the 1 ppm standard. In such areas, document outside air conditions with a properly calibrated instrument. Document areas of the structure being tested where readings for VOC are highest and lowest and what those readings are. Clean any areas that appear to be above background. When household VOC is within 1 ppm of background, the structure is considered cleaned to standard.

Remember also that gasoline and power equipment as well as adhesives, paint, dry-cleaned clothing, 0solvents and other volatile household chemicals should be removed a considerable time before this evaluation because of the probability of them contributing to background VOC.

8. Results vs. Standards

If the concentration of methamphetamine from the wipe samples is less than $0.1 \text{ ug}/100\text{cm}^2$, the standard has been met. If a particular room has a corrected composite sample that is greater than $0.1 \text{ ug}/100\text{cm}^2$, that room will need to be cleaned and retested without testing the rest of the building.

In a composite sample the concentration must be corrected for the surface area of the wipe samples. If a composite sample consists of three wipes taken from three 100cm^2 templates and the result is a total of 0.6 ug of methamphetamine, then the result is $0.2 \text{ ug}/100\text{cm}^2$. Be sure that the analytical lab results are clear, and this point is not confused to accidentally report a sample too high or too low.

9. Chain of Custody and Sample Preservation

Chain of custody, sample temperature, and shipping information are important pieces of documentation. They show that samples were shipped with care and that the proper holding temperatures were maintained during shipment. Results of samples collected without this information become suspect.