Guidelines for Hazardous Waste Management In the Forensic Biology Section

Background

The State Crime Laboratory, a division of the North Carolina Department of Justice must comply with regulatory programs established by the U.S. Environmental Protection Agency (EPA) and the NC Department of Environment and Natural Resources (NCDENR). One such program is the Resource Conservation and Recovery Act (RCRA). The RCRA establishes a "cradle-to-grave" management system for hazardous waste and applies to all State Crime Laboratory personnel who use chemicals and generate hazardous waste in the laboratory. The objective of this hazardous waste management system is to ensure that hazardous waste is handled in a manner that protects human health and the environment. Under EPA regulations, hazardous waste is regulated 1) as soon as it is generated – the point that a chemical or material becomes a waste, 2) during transport and handling, and 3) through treatment, storage, or disposal.

Hazardous waste generated by the Forensic Biology Section includes laboratory wastes (chemicals and solvents) as identified in the attached disposal guide. As a hazardous waste generator, Forensic Biology Section personnel assume a number of responsibilities. The purpose of this guide is to assist Forensic Biology Section personnel with hazardous waste regulatory requirements ensuring that Federal and State requirements are satisfied. The guide is divided in separate categories for each type of laboratory process conducted by the Forensic Biology Section. By following this guide, Forensic Biology Section personnel should find it easier to manage the day-to-day compliance with the applicable hazardous waste regulations. Individuals with questions concerning waste disposal procedures should contact their Section Safety Officer or the Crime Laboratory Safety Coordinator.

Types of Hazardous Wastes

RCRA defines a hazardous waste as a solid waste that because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause or significantly contribute to an increase in serious; irreversible; or incapacitating, reversible illnesses or pose a substantial present or potential hazard to human health, safety, or welfare to the environment when improperly treated, stored, transported, used, or disposed of or otherwise managed.

Listed Wastes:
By definition, EPA determined that some specific wastes are hazardous. These wastes are incorporated into lists published by the Agency. These lists are organized into three categories:

1. *The F-list* (non-specific source wastes). Because the processes producing these wastes can occur in different sectors of industry, the F-listed wastes are known as wastes from non-specific sources. Wastes included on the F-list can be found in the regulations at 40 CFR §261.31.

Examples: spent halogenated (such as methylene chloride and chlorobenzene) and non-halogenated solvents (such as xylene, pyridine, acetone and methanol).

2. *The K-list* (source-specific wastes). This list includes certain wastes from specific industries, such as petroleum refining or pesticide manufacturing. Wastes included on the K-list can be found in the regulations at 40 CFR §261.32.

Examples: not applicable to the Crime Laboratory.

3. *The P-list* and *the U-list* (discarded commercial chemical products). These lists include specific commercial chemical products in an unused form. Wastes included on the P- and U-lists can be found in the regulations at 40 CFR §261.33.

Examples: P-listed (potassium and sodium cyanides, sodium azide) and U-listed (xylene, tetrahydrofuran, acrylamide, methanol).

Characteristic Wastes:
A solid waste can also be considered a hazardous waste if it exhibits one or more of the hazardous waste characteristics (termed a **characteristic** waste): ignitability, corrosively, reactivity, or toxicity.

1. Ignitability (EPA Code D001):
A solid waste that has any of the following properties displays the characteristic of ignitability and is considered a hazardous waste:
•A liquid, other than an aqueous solution containing less than 24 percent alcohol by volume, with a flash point below 60°C (140°F);
•A non-liquid, capable under standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes, and when ignited burns so vigorously and persistently that it creates a hazard;
•An ignitable compressed gas, which includes gases that form flammable mixtures at a concentration of 13 percent or less in air; or
•An oxidizer, such as permanganate, inorganic peroxide, or nitrate that readily stimulates combustion of organic materials.

2. Corrosively (EPA Code D002):
A solid waste that has any of the following properties displays the characteristic of corrosively and is considered a hazardous waste:

•Is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5, using EPA-specified or approved test methods; or
•Is a liquid and corrodes steel (SAE 1020) at a rate greater than 6.35 mm (0.25 inch) per year at a test temperature of 55°C (130°F).

3. Reactivity (EPA Code D003):
A solid waste that has any of the following properties displays the characteristic of reactivity and is considered a hazardous waste:
•Is normally unstable and readily undergoes violent change without detonation;
•Reacts violently with water;
•Forms potentially explosive mixtures with water;
•When mixed with water, generates toxic gases, vapors, or fumes in a quantity sufficient to present a danger
•Is a cyanide or sulfide bearing waste that generates toxic gases, vapors, or fumes at a pH between 2 and 12.5;
•Is capable of detonation or explosive reaction when subject to a strong initiating source or if heated in confinement;
•Is readily capable of detonation, explosive decomposition, or reaction at standard temperature and pressure; or
•Is an explosive.

4. Toxicity (EPA Series D):
Materials that fail the test because of the presence of certain heavy metals or organic constituents above regulated levels.

Hazardous Waste Management Procedures:

1. It is the responsibility of each Forensic Biology Section employee to properly dispose of all used and unused chemicals and solutions used in the examination of biological evidence in the laboratory. .

2. Laboratory sink drains are not to be used for the disposal of hazardous materials and other chemical waste, except as specifically identified in this guide.

3. Every attempt should be made to separate hazardous waste from bio-hazardous waste. If this is not possible, it is possible to dispose of hazardous waste in biohazard waste containers.

4. Concentrated acids and bases cannot be flushed down the laboratory drain at any time unless previously neutralized. However, solutions which have a pH between 3 and 12, and do not contain any known hazardous or toxic materials or otherwise meet the definition of a characteristic waste, the solution may be disposed of by flushing down the laboratory drain.

Working solutions of acids may be neutralized by the addition of dilute base, such as sodium hydroxide, while working solutions of bases may be neutralized by the addition of dilute acid, such as hydrochloric acid. The pH of a solution may be determined using a calibrated pH meter or suitable litmus paper.

5. Generally, empty bottles or containers are not considered hazardous waste. These containers may be rinsed in the sink to remove any remaining residue, the labels removed or defaced, and the bottles disposed of in an appropriate trash container. Containerized liquids will never be disposed of in the general laboratory trash.

6. Empty containers of acutely hazardous material (for example, cyanide), referred to as a P-listed material by the EPA, must be triple-rinsed and the rinsate collected and disposed of as hazardous waste. After the container has been triple rinsed and the labels removed or defaced, they may be disposed of directly into an appropriate trash container.

7. Empty bottles containing residues of flammable solvents, such as methanol, that are hazardous only on the basis of their flammable characteristic, may be rinsed out and the rinsate discharged down the laboratory drain. This disposal is permitted only if, during the rinsing process, the flammable is diluted with sufficient water to eliminate the flammable characteristic prior to disposal.

8. The contents of each waste container will be clearly identified. The waste container must be kept closed at all times, except when adding waste. Waste containers are to be filled to ¾ capacity to prevent the buildup of excessive vapor pressure and to allow adequate room for expansion. When the waste container is filled to ¾ capacity, it is to be taken to the Section's Hazardous Waste Storage Room.

9. The appropriate personal protective equipment (i.e., gloves, chemical splash goggles) is to be used and skin contact is to be avoided when working with chemicals. Whenever possible, all processes are to be performed in a chemical fume hood.

Disposal Guide for Forensic Biology Reagents

REAGENT	RCRA HW CODE	DISPOSAL PROCEDURE
Phenol/Chloroform/Isoamyl Alcohol (PCI) Solution - PCI Extraction tubes - Pipet tips used to dispense PCI	U188 D022 U044	Do not dispose of used or unused PCI down the laboratory drain or in regular trash. PCI extraction tubes, and PCI contaminated media, such as pipet tips used to dispense PCI, must be placed in the biohazard trash. Hazardous waste regulations require that all PCI placed in a disposal container must be securely capped to prevent spillage of the contents.
Ammonium Acetate (7M) Hydrochloric acid (HCl) Phenolphthalin - Stock solution, pH14 - Working solution, pH 14 Phosphoric acid RBS-35 ($NaClO$/ $NaCO_3$/ $K_4P_2O_7$/ $C_6H_5SO_3H$) Sodium Hydroxide Pellets (NaOH) Sodium Hydroxide Solutions 10N, 4M, 0.2M	D002	Dispose of as a corrosive hazardous waste. Do not place in laboratory trash for disposal. Unwanted or discarded pellets or solutions must be handled as a HW and returned to the HW storage room for proper disposal. Corrosive solutions, although regulated, may be poured down the drain for disposal if, prior to disposal, the pH is adjusted to between 3 and 12. Check pH with litmus paper or pH meter prior to disposal and adjust pH as necessary. Flush with water. Rinse empty containers and discard in an appropriate trash container.
Acetic acid	D001 D002	Dispose of as a corrosive flammable hazardous waste. Do not place in laboratory trash for disposal. Unwanted or discarded pellets or solutions must be handled as a HW and returned to the HW storage room for proper disposal. Corrosive solutions, although regulated, may be poured down the drain for disposal if, prior to disposal, the pH is adjusted to between 3 and 12. Check pH with litmus paper or pH meter prior to disposal and adjust pH as necessary. Flush with water. Rinse empty containers and discard in an appropriate trash container.

Ethanol Isopropyl alcohol	D001	Dispose of as a flammable hazardous waste. For large amounts, seal the bottle and dispose of as a HW. For small amounts, open the container and place in an active fume hood. Allow the residual liquid to dry. Then rinse empty reagent bottles to remove residue, remove or deface label and place in a container designated for trash or glass disposal.
Methanol	U154 F003	Methanol that has been used is classified as F003 and can be disposed of by flushing the solution down the sink with water. Rinse empty reagent bottles to remove residue, remove or deface label, and place in a container designed for glass disposal. Any UNUSED methanol is classified as U154 and must not be disposed of down the laboratory drain or in regular trash. Unwanted or discarded solutions must be handled as a HW and returned to the HW storage room for proper disposal. Containers must be rinsed thoroughly, but can then be discarded in a trash or glass receptacle.
Butane	F003	Liquids that have been used are classified as F003 and can be disposed of as a flammable hazardous waste. Triple-rinse empty containers unless pressurized and dispose of the liquid rinse as a HW. The container may then be placed in an appropriate trash container. Label residues or liquid as hazardous waste – Do not pour down drain or place in regular trash. The liquid is an ignitable flammable and should be discarded as a HW. Return to the HW storage room for proper disposal. Do not reuse containers.
Picric acid	F003 D002	Dispose as a flammable hazardous waste. Irritant. Keep solution wet; do not allow to dry out since it has explosive characteristics. Unwanted or discarded solutions or residues must be handled as a HW and returned to the HW storage room for proper disposal.

Pyridine	D001 D038 F005 U196	Pyridine and any solid wastes (such as microscope slides) containing pyridine or its reagents (Takayama), must be managed and disposed of as a hazardous waste. Rinse empty containers three times and collect the rinse as a hazardous waste. Then, dispose of the container in an appropriate trash or glass receptacle. Collect unused Takayama reagent and used microscope slides in separate containers. Label containers as hazardous waste – Do not pour down drain or place in regular trash.
Acetone	U002 F003	Acetone that has been used is classified as F003 and can be disposed of by flushing the solution down the sink with water. Rinse empty reagent bottles to remove residue, remove or deface label, and place in a container designed for glass disposal. Any UNUSED acetone is classified as U002 and must not be disposed of down the laboratory drain or in regular trash. Unwanted or discarded solutions must be handled as a HW and returned to the HW storage room for proper disposal. Containers must be rinsed thoroughly, but can then be discarded in a trash or glass receptacle.
Toluene (Permount)	F005 U220	Toluene that has been used is classified as F005 and can be disposed of as a flammable hazardous waste. Triple-rinse empty containers and dispose of the liquid rinse as a HW. The container may then be placed in an appropriate trash container. Label residues or liquid as hazardous waste – Do not pour down drain or place in regular trash. Any UNUSED toluene is classified as U220 and is a toxic flammable substance. It must not be disposed of down the laboratory drain or in regular trash. Unwanted or discarded solutions must be handled as a HW and returned to the HW storage room for proper disposal. Do not attempt to clean or reuse containers.

Xylene	U239 F003	Xylene that has been used is classified as F003 and can be disposed of by flushing the solution down the sink with water. Rinse empty reagent bottles to remove residue, remove or deface label, and place in a container designed for glass disposal. Any UNUSED xylene is classified as U239 and is a toxic flammable substance. It must not be disposed of down the laboratory drain or in regular trash. Unwanted or discarded solutions must be handled as a HW and returned to the HW storage room for proper disposal. Do not attempt to clean or reuse containers.
All Purpose Cleaner – Correction Enterprises Break-Free CLP DTT EDTA, disodium salt hydrate Glycogen from slipper mussels Guanidinium chloride Hoppe's Nitro Powder Solvent/ Remington Rem Oil Hydrogen peroxide, 30% KimCare Hand Sanitizer Mercon Spray Nuclear Fast Red/ Kernechtrot Stain o-Dianisidine tetrazotized Propane SDS Sodium perborate tetrahydrate Tartrazine WD-40 Zinc chloride	F005	Substances that have been used are classified as F005 and should be disposed of as a flammable hazardous waste. Triple-rinse empty containers unless pressurized and dispose of the liquid rinse as a HW. The container may then be placed in an appropriate trash container. Label residues or liquid as hazardous waste – Do not pour down drain or place in regular trash. The substance is a toxic flammable and should be discarded as a HW. Return to the HW storage room for proper disposal. Do not reuse containers.

10X PCR Buffer, Gene Amp solution 1-Naphthyl phosphate calcium salt trihydrate 3130 POP-4 Polymer Ajax Cleaner with Bleach Boileezers - Aluminum oxide Citric Acid Contrex AP, Decon Powdered Labware Detergent HEPES Hibiclens (Chlorhexidine gluconate) Hydrogen peroxide, 3% Indigocarmine Isoclean Luminol Lysis Buffer N.C.C.E. Cleanser Powder with Bleach pH electrode storage solution pH solution pH 7/ 10 Proteinase K Qiagen MDx Lysis Buffer (Guanidinium chloride) Qiagen MDx Protease (Subtilisin) Qiagen MDx Wash Buffer (Guanidinium chloride) Quantifiler Duo PCR Reaction Mix Ross Storage Solution Sodium acetate Sodium carbonate Sodium phosphate, monobasic	No EPA Regulation/ Mildly Toxic Chemicals	Substance is mildly harmful in water sytems and an irritant. Solutions that have been used should be flushed down the sink with copious water. Rinse empty reagent bottles to remove residue, remove or deface label, and place in a container designed for trash or glass disposal. Any UNUSED solutions are considered toxic. They must not be disposed of down the laboratory drain or in regular trash. Unwanted or discarded solutions must be handled as a HW and returned to the HW storage room for proper disposal. Do not attempt to clean or reuse containers.

20% Sodium dodecyl sulfate (SDS) 2M Sodium Acetate, pH 7.0 3500 Reagents 3700 Running Buffer Allelic Ladders Anode/ Cathode Buffers Anti-p30 Anti-sera BSA(Bovine Serum Albumin) Buffer AVE Buffer AW2 Carrier RNA Citric acid trisodium salt Direct PCR Master Mix DNA 9947A standard DNA Polymerase Hydrogen peroxide, 3% Identifiler and Identifiler Plus - PCR Reaction Mix - Primer - Taq LIZ size standard Matrix Standard DS-33 Quantifiler - DNA Standard - Primer - Reaction Mix		Dispose of solution (s) down laboratory sink unless contaminated– flush with water. Do not place reagent bottles containing chemical residue or liquids in the regular trash. Rinse empty reagent bottles, remove or deface label and place in regular trash. Glass containers should be disposed of in a container designated for that purpose.

RSID - Extraction buffer - Running buffer Stain Extraction Buffer (Tris/EDTA/NaCl/SDS), pH8 TE (Tris/EDTA) TEN (Tris/EDTA/NaCl), pH 8.0 TRIS – 2M Tris Borate EDTA Buffer, 10X		Dispose of solution (s) down laboratory sink – flush with water. Do not place reagent bottles containing chemical residue or liquids in the regular trash. Rinse empty reagent bottles, remove or deface label and place in regular trash. Glass containers should be disposed of in a container designated for that purpose.
Zinc metal HgAbsorb/ Mercury Vapor Adsorbent Rainbow Liquid Deodorant D(+) glucose Anti-H lectin		May be disposed of in the regular trash if not contaminated.
Amphyl Sparkleen/ Alconox Saturated glucose solution Nuclease-Free water		Unused solutions may be disposed of down the laboratory drain if not contaminated.
Solid Waste (such as: pipet tips, test tubes, kim wipes)		Dry waste that are not contained with a recognized hazardous material or waste (blood, poisons, etc.) are not considered hazardous under federal regulations and may be disposed of in the regular trash. Glass should be disposed in a container designated for glass disposal.