ENVIRONMENTAL HEALTH AND SAFETY
STANDARD OPERATING PROCEDURES

SOP No.24.01.99.W1.48AR WTAMU Chemical Inventory
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Environmental Health and Safety at WTAMU is composed of two distinct but integrated environmental safety departments that report to the Vice President of Research and Compliance. Academic and Research Environmental Health and Safety (AR-EHS) is responsible for research and academic related compliance, which includes laboratory and academic research and the associated compliance committees. Fire and Life Safety (FLS-EHS) is responsible for fire related compliance and conducts fire and life safety inspections of campus buildings and assists with the testing all fire detection and suppression systems.

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PURPOSE: Chemical Inventory

In order to comply with numerous regulatory requirements, including the Hazard Communication Regulation – CFR 1910.1200 (Haz Com), West Texas A & M University (WTAMU) produces an annual chemical inventory identifying the location (building and room) and quantity of all institutional research hazardous materials. An on-line inventory software system, BioRaft *ChemTracker*, is used to support chemical tracking in the fulfillment of all regulatory requirements. Hazard Communication Regulation – CFR 1910.1200 (HazCom) was created to ensure that the hazards of chemicals produced or imported are evaluated, and that appropriate hazard information is transmitted to employers and employees. Other chemical regulations and guidelines, that require chemical reporting and inventory include:

- Environmental Protection Agency (EPA) – Emergency Planning and Community Right-to-Know Act (EPCRA) hazardous chemical storage reporting
- Department of Homeland Security (DHS) – Chemicals of Interest (COI)
- Centers for Disease Control and Prevention (CDC) – Select agents and toxins
- Drug Enforcement Agency (DEA) and Bureau of Narcotics and Dangerous Drugs (BNDD) – Controlled Substances and List I & II regulated chemicals
- International Building Code - Flammable material and other storage limits
- Local Fire Department Requirements – Flammable material storage limits
- Veterans Administration (VA) – mandated inventory reconciliation every 6 months for VA funded researchers

A system for maintaining an accurate inventory of laboratory or facility chemicals is essential for compliance with local and state regulations and any building codes that apply. Additionally, performing annual chemical inventory updates does the following:

- ensures that chemicals are stored according to compatibility tables,
- eliminates unneeded or outdated chemicals,
- increases ability to locate and share chemicals in emergency situations,

- updates the hazard warning signage on the laboratory door,
- promotes more efficient use of laboratory space,
- checks expiration dates of peroxide formers,
- ensures integrity of shelving and storage cabinets,
- encourages laboratory supervisors to make “executive decisions” about discarding dusty bottles of chemicals,
- repairs/replaces torn or missing labels and broken caps on bottles,
- ensures compliance with all federal, state, and local record-keeping regulations,
- promotes good relations and a sense of trust with the community and the emergency responders,
- reduces the risk of exposure to hazardous materials and ensures a clean and healthful laboratory environment,
- may reduce costs by making staff aware of chemicals available within the organization.

Every laboratory should maintain an up-to-date chemical inventory in their SDS binder. Environmental Health and Safety (EHS) will deliver an up-to–date inventory listing after a laboratory inventory has been completed. A physical chemical inventory should be performed at least annually, or as requested by the Principal Investigator of the laboratory (PI), Department Head, Dean, or Vice President for Research and Compliance.

INVENTORY REQUIREMENTS:

Each research laboratory or facility at WTAMU will work in conjunction with EHS and the PI/subject matter expert to inventory all items listed in the "items required to be inventoried" below.

All hazardous and non-hazardous chemicals must be procured through the EHS Office (See SOP No. 24.01.01.W1.31AR WTAMU Chemical Procurement Procedure). Upon receipt of the chemical, EHS will enter the chemicals into BioRaft ChemTracker according to the designated laboratory or facility. The chemical will then be delivered to the appropriate laboratory or facility and the associated SDS added to the SDS laboratory binder.

On an annual basis, EHS verifies that the items in BioRaft ChemTracker match what is currently found in the lab and other storage areas, such as: common areas, refrigerators/cold rooms, and freezers. However, there are other materials which are highly regulated and may require more frequent inventory updates. These materials are items of interest to federal and local agencies, such as Department of Homeland Security (See DHS Chemicals of Interest List (Appendix A), Centers for Disease Control and Prevention, Local Fire Department, etc. and are more controlled to prevent the following:

- Release: quantities of toxic, flammable, or explosive chemicals that have the potential to create significant adverse consequences for human life or health if intentionally or unintentionally released, detonated, or involved in a fire.
- Theft or diversion: materials that have the potential, if stolen or diverted, to be abused or used as weapons, which can ultimately lead to significant adverse consequences for human life or health.
- Sabotage or contamination: chemicals that, if mixed with other readily available materials, have the potential to create significant adverse consequences for human health or life.

ITEMS REQUIRED TO BE INVENTORIED

Any, but not limited to, chemical containers that have a manufacture's label which denotes physical or health hazards, or whose SDS denotes hazards, are to be included in the inventory. In general, laboratory chemicals (hazardous & non-hazardous) and reagents are inventoried even if the hazard is considered low. Chemicals received from chemical manufacturers such as Sigma-Aldrich, Fluka, Alfa Aesar, Fisher Scientific, Mallinckrodt Baker, Acros, Bio-Rad, Qiagen, Invitrogen, etc., will be included in the lab inventory. The list below provides some examples of common materials that need to be inventoried.

- DHS Chemicals of Interest* (Appendix A or https://www.dhs.gov/xlibrary/assets/chemsec_appendixa-chemicalofinterestlist.pdf)
- DEA scheduled materials, to include those materials acquired from the Division of Comparative Medicine (DCM)* (Appendix B or http://www.deadiversion.usdoj.gov/schedules/index.html)
- Select agents that are classified as biological toxins*
- All flammable solvents*, to include primary & secondary chemical containers that are brought into the lab from another location (e.g.)
- 10 gallon carboy of ethanol that is filled from a primary 55 gallon drum and brought into the laboratory.Materials that are transferred or inherited from another lab
- All organic solvents, including liquid scintillation counting cocktail
- Other research drugs and therapeutics
- All chemicals/reagents regardless of hazard class, laboratory personnel will need to adjust the levels of non-hazardous chemicals/reagents to reflect the amount commonly stored in the room)

- Shock sensitive and potentially explosive mixtures produced by the lab must be inventoried (e.g. Bouin's stain made from saturated picric acid solution or serial dilution of ether mixtures).

For further guidance in peroxide forming materials and shock sensitive materials, see the sections of this standard operating procedure listed below.

1) Reactive or explosive materials requiring special attention (Page 10)

2) Guidelines for Safe Handling and Disposal of Peroxide Forming (Page 10)

- Lecture cylinders, small compressed gas cylinders or small propane cylinders
- Corrosive cleaning agents (e.g. strong base/acid solutions, RNASE away, Chromerge, etc.)
- Materials used for maintenance, repair, or cleaning (e.g. bleach, mineral spirits, oils, lubricants and greases including vacuum pump fluid)
- Photographic Chemicals
- Activated charcoal
- Chemical kits**
- Dyes and stains
- Biological material (e.g.)
- plant or animal tissue, blood or blood products
- reproducing biological organisms, bacteria, viruses, fungi or yeast
- Enzymes, antibodies, proteins, peptides, nucleic acids
- Conjugated antibodies and proteins

** Chemicals contained in a kit are usually not individually inventoried. They can be inventoried under the kit name.

ITEMS NOT REQUIRED TO BE INVENTORIED:

Even though some items may not be entered into the inventory, the user is still responsible to obtain a current SDS for the product. The list below provides some examples of common materials that do not need to be inventoried.

- Any secondary chemical container that is produced in the lab from a primary chemical container(s) that is already inventoried (e.g.)

    - 1N NaOH that is made from a commercially available 10N NaOH solution or solid NaOH.
    - Squirt bottles and spray bottle
    - Conical and "Falcon" tubes with chemicals or samples in them
- Tissue culture media or other growth media
- Buffer solutions for pH probes
- Non-chemical diagnostic materials that contain a film on any surface (e.g. 96-well plate)
- Chemical spill kits
- First aid kit (may include calcium gluconate as a first aid for hydrofluoric acid burns)
- Food or food additives (unless it will be used for R&D or operational purposes)
- Office Supplies (appropriate quantities for office administrative purposes)
- Non-Hazardous metals such as foils, bars, and rods
- Test strips (pH, peroxide, water hardness, iron, phosphate, etc.)

Note: Each PI or designated person(s) will be responsible for the proper hazard determination for all mixtures that are commonly made and used in the research lab. For hazard classification guidance concerning mixtures and solutions, the Hazard Communication Standard (29 CFR 1910.1200) states that a mixture (or solution) will be considered as having the same health hazards as the components that comprise ≥1% of the mixture (≥0.1% for known carcinogens in the mixture). If the PI or designated person(s) is not comfortable with making hazard determinations or is unsure about the hazard classification of a particular solution, they should consult with EHS.

ACQUISITION OF CHEMICALS

1. The purchase, transfer or use of any chemical that is not on the existing inventory for the laboratory must have prior approval from the Principal Investigator (PI) prior to purchase or use.

2. Before a hazardous material is used, information on proper handling, storage, and disposal, will be made available to those who have potential exposure by the PI or assigned laboratory personnel. A safety data sheet (SDS) formally known as a material safety data sheet (MSDS) is available for all hazardous materials purchased.

Chemical Research Laboratory Inventory at WTAMU is maintained by EHS. Please review the SOP No. 24.01.01.W1.31AR WTAMU Chemical Procurement Procedure The inventory is maintained by the following process:

- All hazardous and non-hazardous research chemicals are procured through EHS. Please see the Chemical Procurement Procedure at http://www.wtamu.edu/chem-procedure and the online submission form at http://www.wtamu.edu/chem-order. To maintain the chemical inventory, EHS should be contacted as chemicals are moved to or from laboratories or facilities. Contact EHS for assistance: 651-2270 or ar-ehs@wtamu.edu.

- Upon arrival to campus, all hazardous and non-hazardous research chemical purchases are delivered to EHS. In addition, EHS identifies, and inventories packages containing research chemicals delivered to the University at Central Receiving on a daily basis.

- Upon delivery, EHS adds the associated chemical to the chemical inventory using the software product, BioRaft ChemTracker. EHS delivers the chemical to the appropriate laboratory, along with the associated SDS sheet, which EHS adds to the laboratory SDS folder.

- Annual chemical inventories of each lab are also conducted by EHS; EHS uses a barcode system to help facilitate laboratory chemical tracking. All research and teaching laboratories that use or store chemicals are included in the annual inventory. All chemicals inventoried by EHS have a unique bar code number sticker placed on the container to facilitate tracking. (For more information, see the section within this SOP on Chemical inventory handling.)

- A barcode inventory form is located in each lab to help maintain an accurate chemical inventory. Laboratory personnel can remove the chemical inventory barcode sticker from empty chemical containers and place the associated barcode sticker onto the chemical inventory barcode form -- before placing the empty container into the appropriate waste bin. Or, EHS can be contacted (ext. 2270) to pick up the empty chemical containers and will remove the item from the laboratory chemical inventory. EHS collects empty chemical containers and the barcode form on a monthly basis (see Appendix D).

NON-COMPLIANCE OF ACQUISITION OF CHEMICALS

EHS receives all chemical packages from Central Receiving. If procurement has been placed without going through EHS then EHS will contact the PI to remind them of the procedure. The reminder will also include a memo if procurement is made without following procedure then EHS will contact the PI and could request additional training through the Purchasing office. If a second occurrence happens then EHS will contact the PI, department head, dean, and Vice President of Research and Compliance and request suspension of Procard privileges for 30 days. If a third occurrence happens then EHS will request Purchasing to cancel Procard permanently.

REMOVING CHEMICALS FROM LABORATORY

EHS will conduct an annual physical chemical inspection and will work with the PI to determine if chemicals are expired, unwanted, or unused. An electronic inventory may be sent to the PI for review. EHS will work with the PI to schedule removal of expired, unwanted, or unused chemicals. If the PI seeks to keep expired, non-hazardous chemicals, the PI may fill out the nonhazardous expired chemical exemption form (see SOP section: Expired Non-Hazardous Chemicals).

EXPIRED NON-HAZARDOUS CHEMICALS

Chemicals are classified as hazardous or non-hazardous and each type of chemical is associated with an expiration date and/or safety hazard by the chemical manufacture for one of three reasons:

a) Safety/Hazard – some chemicals, e.g., peroxide formers, become unstable with age and, thus, an expiration date is assigned by the manufacturer becomes critical to safely managing these materials in storage. Note: Expiration dates can also be assigned by the User as related to when the container was first opened as is the case for organic peroxides.

b) Quality Assurance/QA – manufacturers will assign expiration dates as a part of a QA program to ensure that the product performs as designed, i.e., "within spec's".

c) Combination – the manufacturer assigned expiration date may cover both of the above examples.

EHS understands the research and cost implications associated with chemicals and that a non hazardous chemical may be usable beyond the expiration date. To continue to use a non-hazardous chemical in a laboratory environment, the PI should complete the non-hazardous chemical expired exemption request form (Appendix E). This form is completed for each chemical and is approved by the PI, Department Head, Dean, and EHS. It is requested that the form be submitted within four weeks of the original notification to the PI. If a request is not received, EHS will follow-up with the PI and schedule a time to remove and dispose of the expired chemical.

Upon receipt of the expired nonhazardous chemical form, EHS will review the SDS to make certain the chemical complies with associated regulations and is classified in the general storage group. Upon approval, the expired, non-hazardous chemicals will not be removed from the laboratory until the date the PI has requested on the exception form.

IACUC Note: However, with regard to any research involving vertebrate animals, all chemicals (hazardous/non-hazardous) must be current and nonexpired.

CHEMICAL HANDLING

Important information about handling chemicals can be found in the SDS. A comprehensive file of MSDSs/SDSs must be kept in the laboratory. Trained laboratory personnel should always: a) read and heed the label and the SDS before using a chemical for the first time, b) understand and appropriately utilize the personal protection equipment (PPE) that must be worn when handling the chemical; c) ensure that ventilation is adequate for the chemical's usage in the laboratory, and d) understand and enforce the institutional Chemical Hygiene Plan (See SOP No. 24.01.01. W1.33AR WTAMU Chemical Hygiene Plan), and all associated safe laboratory practices, so that appropriate actions are taken in the event of a chemical spill, fire, or explosion.

REACTIVE OR EXPLOSIVE MATERIALS REQUIRING SPECIAL ATTENTION

An explosion occurs when a material undergoes a rapid reaction that results in a violent release of energy. Such reactions can happen spontaneously or be initiated and can produce pressures, gases, and fumes that are hazardous. Highly reactive and explosive materials used in the laboratory require appropriate procedures. In this section of the SOP, techniques for identifying and handling potentially explosive materials are discussed.

REACTIVE OR EXPLOSIVE COMPOUNDS

Occasionally, it is necessary to handle materials that are known to be explosive or that may contain explosive impurities such as peroxides. Because mechanical shock, elevated temperature, or chemical action might result in explosion with forces that release large volumes of gases, heat, and often toxic vapors, such reactive or explosive compounds must be treated with special care.

The proper handling of highly energetic substances without injury demands attention to the most minute details. The unusual nature of work involving such substances requires special safety measures and handling techniques that must be understood thoroughly and followed by all persons involved. The practices listed in this section are a guide for use in any laboratory operation that might include explosive materials in the chemical inventory. However, additional information should be sought from the SDS.

Work with explosive (or potentially explosive) materials generally requires the use of special protective apparel (e.g., face shields, gloves, and laboratory coats) and protective devices such as explosion shields, barriers, or even enclosed barricades or an isolated room with a blowout roof or window.

PARTICULARY HAZARDOUS SUBSTANCES

A list of Particularly Hazardous Substances (PHS's) is provided to help you comply with the Hazardous Chemicals in Laboratory Standard (Code of Federal Regulations, Title 29, and Part 1910.1450). These chemicals may present extreme risk potential to laboratory workers if not handled appropriately; therefore, these substances may require additional control measures when used. It is important to note that the list should not be considered "all inclusive". Many other chemicals that are not listed may also possess extremely hazardous properties. Laboratory PI's are responsible for assessing the hazards of chemical materials that they may use or synthesize, and to take appropriate steps to implement safety controls.

Hazardous Chemicals in Laboratories Standard (29 CFR 1910.1450) defines *Particularly Hazardous Substances* (PHSs) as including the following categories of chemicals:

Select carcinogens are those that are listed by OSHA, the International Agency for Research on Cancer (IARC), or the National Toxicology Program (NTP) as known or suspected human carcinogens. Complete lists of these compounds can be found at:

- The OSHA website
- The National Toxicology Program Annual Report on Human Carcinogens
- The International Agency for Research on Cancer Monographs

Reproductive toxins are chemicals that may adversely affect male and female reproductive health and/or the developing fetus. Resources for information about reproductive toxins (Repro Tox, Repro Text, Teris, etc.) can be found through Micromedex.

Chemicals having high acute toxicity are those that have oral, inhalation, or dermal LD_{50} and LC_{50} values below specified thresholds (see below) listed in the OSHA Hazard Communication Standard (29 CFR 1910.1200). Oral exposures are not considered a high risk in labs so chemicals toxic only by the oral route are not included on the PHS list. The toxicity thresholds are as follows:

- Dermal LD_{50} (albino rabbits) ≤ 200 mg/kg
- Inhalation LC_{50} (albino rats) ≤ 200 ppm vapor or gas or ≤2 mg/l dust or fume

Reactive chemicals include explosives, flammable solids, peroxide formers, oxidizers, and compounds that are reactive with air or water.

STORAGE GROUPS

To lessen risk of exposure to hazardous chemicals, trained laboratory personnel should separate and store all chemicals according to hazard category and compatibility. In the event of an accident involving a broken container or a chemical spill, incompatible chemicals that are stored in close proximity can mix to produce fires, hazardous fumes, and explosions. Laboratory personnel should read the SDS and heed the precautions regarding the storage requirements of the chemicals in the laboratory. A detailed chemical compatibility table is Appendix F.

To avoid accidents, all chemical containers must be properly labeled with the full chemical name, not abbreviations, using a permanent marker. All transfer vessels should have the following label information:

- chemical name,
- hazard warnings,
- name of manufacturer,
- name of researcher in charge, and
- date of transfer to the vessel.

Incoming chemical shipments should be dated promptly upon receipt and chemical stock should be rotated to ensure use of older chemicals. It is good practice to date peroxide formers upon receipt and date again when the container is opened so that the user can dispose of the material according to the recommendations on the SDS. Peroxide formers should be stored away from heat and light in sealed airtight containers with tight fitting, nonmetal lids. Test regularly for peroxides and discard the material prior to the expiration date.

When storing chemicals on open shelves, always use sturdy shelves that are secured to the wall and contain ¾-in. lips. Please also comply with the following:

- Do not store liquid chemicals higher than 5 ft. on open shelves.
- Do not store chemicals within 18 in. of sprinkler heads in the laboratory.

- Do not store chemicals in the laboratory chemical hood, on the floor, in the aisles, in hallways, in areas of egress, or on the benchtop.
- Store chemicals away from heat and direct sunlight.

Secondary containment devices (i.e., chemical-resistant trays) may be utilized where appropriate.

Only laboratory-grade explosion-proof refrigerators and freezers should be used to store properly sealed and labeled chemicals that require cool storage in the laboratory. Laboratory personnel should periodically clean and defrost refrigerators and freezers to ensure maximum efficiency. Domestic refrigerators and freezers should not be used to store chemicals; they possess ignition sources and can cause dangerous and costly laboratory fires and explosions. Do not store food or beverages in the laboratory refrigerator.

Azos, Peroxides, and Peroxidizables

Organic azo compounds and peroxides are common reagents that often are used as free radical sources and oxidants. They are generally low-power explosives that are sensitive to shock, sparks, or other accidental ignition. They are far more shock sensitive than most primary explosives such as TNT. Inventories of these chemicals should be limited and subject to routine inspection. Many require refrigerated storage. Liquids or solutions of these compounds should not be cooled to the point at which the material freezes or crystallizes from solution, however, because this significantly increases the risk of explosion. Refrigerators and freezers storing such compounds should have a backup power supply in the event of electricity loss. Users should be familiar with the hazards of these materials and trained in their proper handling.

Certain common laboratory chemicals form peroxides on exposure to oxygen in air (see Tables below: Classes of Chemicals). Over time, some chemicals continue to build peroxides to potentially dangerous levels, whereas others accumulate a relatively low equilibrium concentration of peroxide, which becomes dangerous only after being concentrated by evaporation or distillation. (See SOP section below: Organic Peroxides.)

The peroxide becomes concentrated because it is less volatile than the parent chemical. A related class of compounds includes inhibitor-free monomers prone to free radical polymerization that on exposure to air can form peroxides or other free radical sources capable of initiating violent polymerization. Note that care must be taken when storing and using these monomers most of the inhibitors used to stabilize these compounds require the presence of oxygen to function properly, as described below. Always refer to the SDS and supplier instructions for proper use and storage of polymerizable monomers.

Essentially all compounds containing C—H bonds pose the risk of peroxide formation if contaminated with various radical initiators, photosensitizers, or catalysts. For instance, secondary alcohols such as isopropanol form peroxides when exposed to normal fluorescent lighting and contaminated with photosensitizers, such as benzophenone. Acetaldehyde, under normal conditions, autoxidizes to form acetic acid. Although this autoxidation proceeds through a peroxy acid intermediate, the steady-state concentrations of that intermediate are extremely low and pose no hazard. However, in the presence of catalysts (Co^{2+}) and under the proper conditions of ultraviolet light, temperature, and oxygen concentration, high concentrations of an explosive peroxide can be formed. The chemicals described in the Tables below represent only those materials that form peroxides in the absence of such contaminants or otherwise atypical circumstances.

Although not a requirement, it is prudent to discard old samples of organic compounds of unknown origin or history, or those prone to peroxidation if contaminated; secondary alcohols are a specific example.

Table 1: Classes of Chemicals That Can Form Peroxides

Class A: Chemicals that form explosive levels of peroxides without concentration

Isopropyl ether Butadiene
Chlorobutadiene (chloroprene) Potassium amide
Potassium metal
Sodium amide (sodamide)
Tetrafluoroethylene Divinyl acetylene
Vinylidene chloride

Class B: These chemicals are a peroxide hazard on concentration (distillation/evaporation). A test for peroxide should be performed if concentration is intended or suspected.

Acetal
Cumene
Cyclohexene
Cyclooctene
Cyclopentene
Diaacetylene
Dicyclopentadiene
Diethylene glycol dimethyl ether (diglyme)
Diethyl ether
Dioxane (*p*-dioxane)
Ethylene glycol dimethyl ether (glyme)
Furan
Methyl acetylene
Methyl cyclopentane
Methyl-isobutyl ketone
Tetrahydrofuran
Tetrahydronaphthalene
Vinyl ethers

Class C: Unsaturated monomers that may autopolymerize as a result of peroxide accumulation if inhibitors have been removed or are depleted

Acrylic acid
Butadiene
Chlorotrifluoroethylene
Ethyl acrylate
Methyl methacrylate
Styrene
Vinyl acetate
Vinyl chloride
Vinyl pyridine

*These lists are illustrative, not comprehensive. SOURCES: Jackson et al. (1970) and Kelly (1996).

Table 2: Types of Compounds Known to Autoxidize to Form Peroxides

- Ethers containing primary and secondary alkyl groups (never distill an ether before it has been shown to be free of peroxide)
- Compounds containing benzylic hydrogens
- Compounds containing allylic hydrogens (C=C—CH) containing a tertiary C—H group (e.g., decalin and 2,5-dimethylhexane

- Compounds containing conjugated, polyunsaturated alkenes and alkynes (e.g., 1,3-butadiene, vinyl acetylene)
- Compounds containing secondary or tertiary C—H groups adjacent to an amide (e.g., 1-methyl-2-pyrrolidinone)

Class A compounds are especially dangerous when and present difficulties for disposal. Their use should be avoided if at all possible. A common substitute is a sulfuric acid–peroxydisulfate solution, and commercial cleaning solutions that contain no chromium are readily available. Confusion about appropriate cleaning bath solutions has led to explosions due to mixing of incompatible chemicals such as potassium permanganate with sulfuric acid or nitric acid with alcohols. For information about how to clean glassware appropriately, consider contacting the manufacturer of the equipment.

Organic Peroxides

Organic peroxides are a special class of compounds with unusually low stability that makes them among the most hazardous substances commonly handled in laboratories, especially as initiators for free-radical reactions. Although they are low-power explosives, they are hazardous because of their extreme sensitivity to shock, sparks, and other forms of accidental detonation.

Many peroxides that are used routinely in laboratories are far more sensitive to shock than most primary explosives (e.g., TNT), although many have been stabilized by the addition of compounds that inhibit reaction. Nevertheless, even low rates of decomposition may automatically accelerate and cause a violent explosion, especially in bulk quantities of peroxides (e.g., benzoyl peroxide). These compounds are sensitive to heat, friction, impact, and light, as well as to strong oxidizing and reducing agents. All organic peroxides are highly flammable, and fires involving bulk quantities of peroxides should be approached with extreme caution. Precautions for handling peroxides include the following:

- Limit the quantity of peroxide to the minimum amount required.
- Do not return unused peroxide to the container.
- Clean up all spills immediately. Solutions of per- oxides can be absorbed on vermiculite or other absorbing material and disposed of harmlessly according to institutional procedures.
- Reduce the sensitivity of most peroxides to shock and heat by dilution with inert solvents, such as aliphatic hydrocarbons. However, do not use aromatics (such as toluene), which are known to induce the decomposition of diacyl peroxides.
- Do not use solutions of peroxides in volatile sol- vents under conditions in which the solvent might vaporize because this will increase the peroxide concentration in the solution.
- Do not use metal spatulas to handle peroxides because contamination by metals can lead to explosive decomposition. Magnetic stirring bars can unintentionally introduce iron,

which can initiate an explosive reaction of peroxides. Ceramic, Teflon, or wooden spatulas and stirring blades may be used if it is known that the material is not shock sensitive.

- Do not permit open flames and other sources of heat near peroxides. It is important to label areas that contain peroxides so that this hazard is evident.
- Avoid friction, grinding, and all forms of impact near peroxides, especially solid peroxides. Glass containers that have screw-cap lids or glass stoppers should not be used. Polyethylene bottles that have screw-cap lids may be used.
- To minimize the rate of decomposition, store per- oxides at the lowest possible temperature consistent with their solubility or freezing point. Do not store liquid peroxides or solutions at or lower than the temperature at which the peroxide freezes or precipitates because peroxides in these forms are extremely sensitive to shock and heat.

Peroxidizable Compounds

Certain common laboratory chemicals form peroxides on exposure to oxygen in air. Over time, some chemicals continue to build peroxides to potentially dangerous levels, whereas others accumulate a relatively low equilibrium concentration of peroxide, which becomes dangerous only after being concentrated by evaporation or distillation. The peroxide becomes concentrated because it is less volatile than the parent chemical.

Excluding oxygen by storing potential peroxide formers under an inert atmosphere (N2 or argon) greatly increases their safe storage lifetime. Purchasing the chemical stored under nitrogen in septum-capped bottles is also possible. In some cases, stabilizers or inhibitors (free-radical scavengers that terminate the chain reaction) are added to the liquid to extend its storage lifetime. Because distillation of the stabilized liquid removes the stabilizer, the distillate must be stored with care and monitored for peroxide formation. Furthermore, high-performance liquid chromatography–grade solvents generally contain no stabilizer, and the same considerations apply to their handling.

- If a container of Class B and C peroxidizables is past its expiration date, and there is a risk that peroxides may be present, open it with caution and dispose of it according to institutional procedures. **If a container of a Class A peroxidizable is past its expiration date, or if the presence of peroxides is suspected or proven, do not attempt to open the container.** Because of their explosivity, these compounds can be deadly when peroxidized, and the act of unscrewing a cap or dropping a bottle can be enough to trigger an explosion. Such containers should only be handled by experts. Contact your organization's safety personnel for assistance.
- Test for the presence of peroxides if there is a reasonable likelihood of their presence and the expiration date has not passed

Peroxide Detection Tests

Warning: Do not test Class A peroxidizables suspected of or known to contain peroxides. Contact EHS for further information and instruction.

The following tests detect most (but not all) peroxy compounds, including all hydroperoxides:

- Peroxide test strips, which turn to an indicative color in the presence of peroxides, are available commercially. Note that these strips must be air dried until the solvent evaporates and exposed to moisture for proper indication and quantification.

- Add 1 to 3 mL of the liquid to be tested to an equal volume of acetic acid, add a few drops of 5% aqueous potassium iodide solution, and shake. The appearance of a yellow to brown color indicates the presence of peroxides. Alternatively, addition of 1 mL of a freshly prepared 10% solution of potassium iodide to 10 mL of an organic liquid in a 25-mL glass cylinder produces a yellow color if peroxides are present.

- Add 0.5 mL of the liquid to be tested to a mixture of 1 mL of 10% aqueous potassium iodide solution and 0.5 mL of dilute hydrochloric acid to which has been added a few drops of starch solution just prior to the test. The appearance of a blue or blue-black color within 1 minute indicates the presence of peroxides.

None of these tests should be applied to materials (such as metallic potassium) that may be contaminated with inorganic peroxides.

Disposal of Peroxides

Check with state and federal environmental agencies before attempting to treat any chemical for the purpose of disposal without a permit. Pure peroxides should never be disposed of directly but must be diluted before disposal. Small quantities (□25 g) of peroxides are generally disposed of by dilution with water to a concentration of 2% or less, after which the solution is transferred to a polyethylene bottle containing an aqueous solution of a reducing agent, such as ferrous sulfate or sodium bisulfite. The material can then be handled as a waste chemical; however, it must not be mixed with other chemicals for disposal. Spilled peroxides should be absorbed on vermiculite or other absorbent as quickly as possible. The vermiculite–peroxide mixture can be burned directly or may be stirred with a suitable solvent to form a slurry that can be handled according to institutional procedures. Organic peroxides should never be flushed down the drain.

Large quantities (>25 g) of peroxides require special handling and should only be disposed of by an expert or a bomb squad. Each case should be considered separately, and handling, storage, and disposal procedures should be determined by the physical and chemical properties of the particular peroxide [see also Hamstead (1964)].

Peroxidized solvents such as tetrahydrofuran (THF), diethyl ether, and 1,4-dioxane may be disposed of in the same manner as the nonautoxidized solvent. Care should be taken to ensure that the peroxidized solvent is not allowed to evaporate and thus concentrate the peroxide during handling and transport.

NON RESEARCH CHEMICAL INVENTORY

The SSC Service Solutions is contracted by WTAMU and The Texas A&M University System to operate operations of the grounds, custodial services, and building maintenance at WTAMU. SSC is responsible for maintaining their own environmental health and safety programs and standard operating procedures. As such, SSC is not included in any of the compliance standard operating procedures at WTAMU. Chemicals that may be in usage in other WTAMU areas, outside the SSC, will maintain a chemical inventory through BioRaft ChemTracker – and will be facilitated by EHS. These areas include the EHS, Fire and Life Safety, the lock shop, and the University Police Department.

TRAINING

West Texas A & M University Environmental Health and Safety will follow the Texas A & M University System Policy 33.05.02 Required Employee Training. Staff and faculty whose required training is delinquent more than 90 days will have their internet access terminated until all trainings are completed. Only Blackboard and Single Sign-on will be accessible. Internet access will be restored once training has been completed. Student workers whose required training is delinquent more than 90 days will need to be terminated by their manager through Student Employment.

RECORD RETENTION – No official state records may be destroyed without permission from the Texas State Library as outlined in Texas Government Code, Section 441.187 and 13 Texas Administrative Code, Title 13, Part 1, Chapter 6, Subchapter A, Rule 6.7. The Texas State Library certifies Agency retention schedules as a means of granting permission to destroy official state records.

West Texas A & M University Records Retention Schedule is certified by the Texas State Library and Archives Commission. West Texas A & M University Environmental Health and Safety will follow Texas A & M University Records Retention Schedule as stated in the Standard Operating Procedure 61.99.01.W0.01 Records Management. All official state records (paper, microform, electronic, or any other media) must be retained for the minimum period designated.

REFERENCES AND RELATED MATERIALS

Related Statutes, Policies, or Requirements

Environmental Protection Agency (EPA) – Emergency Planning and Community Right-to-Know Act (EPCRA) hazardous chemical storage reporting

Department of Homeland Security (DHS) – Chemicals of Interest (COI)

Centers for Disease Control and Prevention (CDC) – Select agents and toxins

Drug Enforcement Agency (DEA) and Bureau of Narcotics and Dangerous Drugs (BNDD) – Controlled Substances and List I & II regulated chemicals

International Building Code - Flammable material and other storage limits

Local Fire Department Requirements – Flammable material storage limits

Veterans Administration (VA) – mandated inventory reconciliation every 6 months for VA funded researchers

Prudent Practices in a Laboratory, 11th edition

Contact Office

WTAMU Environmental Health and Safety

806-651-2270

Appendix A

How Chemicals of Interest Was Developed

The Department of Homeland Security developed a chemicals of interest list *(PDF, 16 pages - 2 MB)* (Appendix A) *(PDF, 41 pages - 2.12 MB)* that includes chemicals that present one or more security issues.

Note:

On November 20, 2007 the Department of Homeland Security published the final Appendix A in the Federal Register. With the publication of a final Appendix A, all provisions of 6 CFR Part 27, including § 27.210(a)(1)(i), are operative and in effect.

The deadline in the Chemical Facilities Anti-Terrorism Standard (CFATS) interim final rule for submission of "Top Screens" required by 6 CFR § 27.210(a)(1)(i) will be 60 calendar days from the date of publication of Appendix A in the Federal Register.

In developing the list, the Department looked to existing expert sources of information including other federal regulations related to chemicals. Among the other sources that the Department referenced in part are the following:

- Chemicals covered under the Environmental Protection Agency's Risk Management Program;
- Chemicals included in the Chemical Weapons Convention;
- Hazardous materials, such as gases that are poisonous by inhalation; and
- Explosives regulated by the Department of Transportation.

The Department of Homeland Security has identified three security issues related to chemicals:

- **Release**—Toxic, flammable, or explosive chemicals or materials that, if released from a facility, have the potential for significant adverse consequences for human life or health.
- **Theft or Diversion**—Chemicals or materials that, if stolen or diverted, have the potential to be misused as weapons or easily converted into weapons using simple chemistry, equipment or techniques, in order to create significant adverse consequences for human life or health.
- **Sabotage or Contamination** —Chemicals or materials that, if mixed with readily available materials, have the potential to create significant adverse consequences for human life or health.

The following are two additional security issues being considered at this time. The Department of Homeland Security will use the Top Screen process to identify the chemicals associated with these security issues as well as to determine their potential future inclusion in Appendix A and/or coverage under Chemical Facility Anti-Terrorism Standards.

- **Critical to Government Mission**—Chemicals or facilities the loss of which could create significant adverse consequences for national security or the ability of the government to deliver essential services and

- **Critical to National Economy** —Chemicals or facilities the loss of which could create significant adverse consequences for the national or regional economy.

The Department continues to assess available information about chemicals critical to government mission and the economy. The Department will use the information it collects through the Top Screen process to identify facilities responsible for economically critical and mission-critical chemicals.

Last Published Date: July 27, 2012

Appendix B

List of Controlled Substances Disclaimer

Section 812 of the Controlled Substances Act (21 U.S.C. §801 et seq.) (CSA) lists substances which were controlled in 1970 when the law was enacted. Since then, approximately 160 substances have been added, removed, or transferred from one schedule to another. The current official list of controlled substances can be found in section 1308 of the most recent issue of Title 21 Code of Federal Regulations (CFR) Part 1300 to end (21 CFR §1308) and the final rules which were published in the Federal Register subsequent to the issuance of the CFR.

This list describes the basic or parent chemical and do not describe the salts, isomers and salts of isomers, esters, ethers and derivatives which may be controlled substances. **These lists are intended as general references and are not comprehensive listings of all controlled substances.** Please note that a substance need not be listed as a controlled substance to be treated as a Schedule I substance for criminal prosecution. A controlled substance analogue is a substance which is intended for human consumption and is structurally or pharmacologically substantially similar to or is represented as being similar to a Schedule I or Schedule II substance and is not an approved medication in the United States. (See 21 U.S.C. §802(32)(A) for the definition of a controlled substance analogue and 21 U.S.C. §813 for the schedule.)

Defined Abbreviations

2C-B	4-Bromo-2,5-dimethoxyphenethylamine
2C-T-7	2,5-Dimethoxy-4(n)-propylthiophenethylamine
BZP	N-Benzylpiperazine
DMT	Dimethyltryptamine
DOM	4-Methyl-2,5-dimethoxyamphetamine
GBL	Gamma butyrolactone
GHB	Gamma hydroxybutyric acid, gamma hydroxybutyrate, 4-hydroxybutanoic acid, sodium oxybate
LAAM	Levo-alphacetylmethadol
LSD	Lysergic acid diethylamide, lysergide
MDA	3,4-Methylenedioxyamphetamine
MDE	3,4-Methylenedioxy-N-ethylamphetamine
MDMA	3,4-Methylenedioxymethamphetamine
MPPP	1-Methyl-4-phenyl-4-propionoxypiperidine
P2P	Phenyl-2-propanone, phenylacetone
PCC	1-Piperidinocyclohexanecarbonitrile
PCE	N-Ethyl-1-phenylcyclohexylamine
PCH	1-Phenylcyclohexylamine
PCP	1-(1-Phenylcyclohexyl)piperidine, phencyclidine
PEPAP	1-(2-Phenylethyl)-4-phenyl-4-acetoxypiperidine
PHP	1-(1-Phenylcyclohexyl)pyrrolidine

SPA	(-)-1-Dimethylamino-1,2-diphenylethane
TCP	1-[1-(2-Thienyl)cyclohexyl]piperidine
TCPy	1-[1-(2-Thienyl)cyclohexyl]pyrrolidine
THC	Tetrahydrocannabinols
THG	Tetrahydrogestrinone

Definition of Controlled Substance Schedules

Drugs and other substances that are considered controlled substances under the Controlled Substances Act (CSA) are divided into five schedules. An updated and complete list of the schedules is published annually in Title 21 Code of Federal Regulations (C.F.R.) §§ 1308.11 through 1308.15. Substances are placed in their respective schedules based on whether they have a currently accepted medical use in treatment in the United States, their relative abuse potential, and likelihood of causing dependence when abused. Some examples of the drugs in each schedule are listed below.

Schedule I Controlled Substances

Substances in this schedule have no currently accepted medical use in the United States, a lack of accepted safety for use under medical supervision, and a high potential for abuse.

Some examples of substances listed in Schedule I are: heroin, lysergic acid diethylamide (LSD), marijuana (cannabis), peyote, methaqualone, and 3,4-methylenedioxymethamphetamine ("Ecstasy").

Schedule II/IIN Controlled Substances (2/2N)

Substances in this schedule have a high potential for abuse which may lead to severe psychological or physical dependence.

Examples of Schedule II narcotics include: hydromorphone (Dilaudid®), methadone (Dolophine®), meperidine (Demerol®), oxycodone (OxyContin®, Percocet®), and fentanyl (Sublimaze®, Duragesic®). Other Schedule II narcotics include: morphine, opium, and codeine.

Examples of Schedule IIN stimulants include: amphetamine (Dexedrine®, Adderall®), methamphetamine (Desoxyn®), and methylphenidate (Ritalin®).

Other Schedule II substances include: amobarbital, glutethimide, and pentobarbital.

Schedule III/IIIN Controlled Substances (3/3N)

Substances in this schedule have a potential for abuse less than substances in Schedules I or II and abuse may lead to moderate or low physical dependence or high psychological dependence.

Examples of Schedule III narcotics include: combination products containing less than 15 milligrams of hydrocodone per dosage unit (Vicodin®), products containing not more than 90 milligrams of codeine per dosage unit (Tylenol with Codeine®), and buprenorphine (Suboxone®).

Examples of Schedule IIIN non-narcotics include: benzphetamine (Didrex®), phendimetrazine, ketamine, and anabolic steroids such as Depo®-Testosterone.

Schedule IV Controlled Substances

Substances in this schedule have a low potential for abuse relative to substances in Schedule III.

Examples of Schedule IV substances include: alprazolam (Xanax®), carisoprodol (Soma®), clonazepam (Klonopin®), clorazepate (Tranxene®), diazepam (Valium®), lorazepam (Ativan®), midazolam (Versed®), temazepam (Restoril®), and triazolam (Halcion®).

Schedule V Controlled Substances

Substances in this schedule have a low potential for abuse relative to substances listed in Schedule IV and consist primarily of preparations containing limited quantities of certain narcotics.

Examples of Schedule V substances include: cough preparations containing not more than 200 milligrams of codeine per 100 milliliters or per 100 grams (Robitussin AC®, Phenergan with Codeine®), and ezogabine.

Appendix C

Select Agents and Toxins List

The following biological agents and toxins have been determined to have the potential to pose a severe threat to both human and animal health, to plant health, or to animal and plant products. An attenuated strain of a select agent or an inactive form of a select toxin may be excluded from the requirements of the Select Agent Regulations.

HHS AND USDA SELECT AGENTS AND TOXINS
7 CFR Part 331, 9 CFR Part 121, and 42 CFR Part 73

HHS SELECT AGENTS AND TOXINS

Abrin

Botulinum neurotoxins*

Botulinum neurotoxin producing species of *Clostridium**

Conotoxins (Short, paralytic alpha conotoxins containing the following amino acid sequence $X_1CCX_2PACGX_3X_4X_5X_6CX_7$)[1]

Coxiella burnetii

Crimean-Congo haemorrhagic fever virus

Diacetoxyscirpenol

Eastern Equine Encephalitis virus[3]

Ebola virus*

OVERLAP SELECT AGENTS AND TOXINS

Bacillus anthracis *

Bacillus anthracis Pasteur strain

Brucella abortus

Brucella melitensis

Brucella suis

*Burkholderia mallei**

*Burkholderia pseudomallei**

Hendra virus

Nipah virus

Rift Valley fever virus

Venezuelan equine encephalitis virus[3]

*Francisella tularensis**

Lassa fever virus

Lujo virus

USDA SELECT AGENTS AND TOXINS

Marburg virus*

Monkeypox virus[3]

Reconstructed replication competent forms of the 1918 pandemic influenza virus containing any portion of the coding regions of all eight gene segments (Reconstructed 1918 Influenza virus)

Ricin

Rickettsia prowazekii

SARS-associated coronavirus (SARS-CoV)

Saxitoxin

South American Haemorrhagic Fever viruses:

Chapare

Guanarito

Junin

Machupo

Sabia

Staphylococcal enterotoxins A,B,C,D,E subtypes

African horse sickness virus

African swine fever virus

Avian influenza virus[3]

Classical swine fever virus

Foot-and-mouth disease virus*

Goat pox virus

Lumpy skin disease virus

Mycoplasma capricolum[3]

Mycoplasma mycoides[3]

Newcastle disease virus[2,3]

Peste des petits ruminants virus

Rinderpest virus*

Sheep pox virus

Swine vesicular disease virus

USDA PLANT PROTECTION AND QUARANTINE (PPQ)

T-2 toxin

Tetrodotoxin

Tick-borne encephalitis complex (flavi) viruses:

Far Eastern subtype

Siberian subtype

Kyasanur Forest disease virus

Omsk hemorrhagic fever virus

Variola major virus (Smallpox virus)*

Variola minor virus (Alastrim)*

*Yersinia pestis**

SELECT AGENTS AND TOXINS

Peronosclerospora philippinensis (Peronosclerospora sacchari)

Phoma glycinicola (formerly Pyrenochaeta glycines)

Ralstonia solanacearum

Rathayibacter toxicus

Sclerophthora rayssiae

Synchytrium endobioticum

Xanthomonas oryzae

*Denotes Tier 1 Agent

1 C = Cysteine residues are all present as disulfides, with the 1st and 3rd Cysteine, and the 2nd and 4th Cysteine forming specific disulfide bridges; The consensus sequence includes known toxins α-MI and α-GI (shown above) as well as α-GIA, Ac1.1a, α-CnIA, α-CnIB; X1 = any amino acid(s) or Des-X; X2 = Asparagine or Histidine; P = Proline; A = Alanine; G = Glycine; X3 = Arginine or Lysine; X4 = Asparagine, Histidine, Lysine, Arginine, Tyrosine, Phenylalanine or Tryptophan; X5 = Tyrosine, Phenylalanine, or Tryptophan; X6 = Serine, Threonine, Glutamate, Aspartate, Glutamine, or Asparagine; X7 = Any amino acid(s) or Des X and; “Des X” = “an amino acid does not have to be present at this position.” For example if a peptide sequence were XCCHPA then the related peptide CCHPA would be designated as Des-X.
2 A virulent Newcastle disease virus (avian paramyxovirus serotype 2) has an intracerebral pathogenicity index in day-old chicks (Gallus gallus) of 0.7 or greater or has an amino acid sequence at the fusion (F) protein cleavage site that is consistent with virulent strains of Newcastle disease virus. A failure to detect a cleavage site that is consistent with virulent strains does not confirm the absence of a virulent virus.
3 Select agents that meet any of the following criteria are excluded from the requirements of this part: Any low pathogenic strains of avian influenza virus, South American genotype of eastern equine encephalitis virus , west African clade of Monkeypox viruses, any strain of Newcastle disease virus which does not meet the criteria for virulent Newcastle disease virus, all subspecies Mycoplasma capricolum except subspecies capripneumoniae (contagious caprine pleuropneumonia), all subspecies Mycoplasma mycoides except subspecies mycoides small colony (Mmm SC) (contagious bovine pleuropneumonia), and any subtypes of Venezuelan

equine encephalitis virus except for Subtypes IAB or IC, provided that the individual or entity can verify that the agent is within the exclusion category. 9/10/13

Appendix D

West Texas A&M University
Academic Research Environmental Health and Safety
WTAMU Box 60217 Canyon, Tx 79016
806.651.2270

Chemical Inventory Barcode Form

In order to maintain an accurate chemical inventory, Environmental Health and Safety (EHS), is requesting that each lab please remove the EHS chemical inventory barcode sticker from empty chemical containers and place the sticker onto this chemical inventory barcode form before placing the empty container into the appropriate waste bin. EHS can also be contacted (ext. 2270) to pick up the empty chemical containers and remove them from the chemical inventory, if this is the principle investigator's preference. EHS will stop by your laboratory each month to retrieve empty chemical containers or this barcode form. Thank you for your cooperation.

Principle Investigator's Name:________________________.
Bldg:______________________.
Room number:________________.
Contact Phone number;_________________.

Appendix E

West Texas A&M University

Academic Research Environmental Health and Safety

WTAMU Box 60217 Canyon, Tx 79016
806.651.2270

Non Hazardous Expired Chemical Exemption Request

This request form is intended to help the principle investigator keep expired non-hazardous chemicals for an extended period of time in their laboratory. Expiration dates are placed on chemical containers for one of three reasons: 1.) Safety/Hazard – some chemicals, e.g., peroxide formers, become unstable with age and, thus, an expiration date is assigned by the manufacturer becomes critical to safely managing these materials in storage. Note: Expiration dates can also be assigned by the User as related to when the container was first opened as is the case for organic peroxides. 2.) Quality Assurance/QA – manufacturers will assign expiration dates as a part of a QA program to ensure that the product performs as designed, i.e., "within spec's". 3.) Combination – the manufacturer assigned expiration date may cover both of the above examples.

Based on the information above, I am requesting Environmental Health and Safety (EHS), to accept this request to allow the following non-hazardous chemical to stay in my laboratory until it has been used or for an extended period of time in which I deem is appropriate to remove from my laboratory. The date I request to remove from the non-hazardous chemical from my laboratory is listed below.

Building	Room No.	Chemical Name	Physical State S, L, G	Container Size	Barcode No.	Date to remove chemical from laboratory

Justification needed for exemption:

I understand and take full responsibility for using an expired non-hazardous chemical, which may affect the outcome of my research. I also understand all (hazardous/non-hazardous) chemicals must be current when conducting any research involving vertebrate animals.

By submitting this statement of exemption request, all required signatories, including the principle investigator (laboratory supervisor), department head, and college dean, acknowledge that no laboratory environment or conditions exist as described above and/or in TAMUS Policy 24.01 and WTAMU Hazard Communications Program 24.01.01W1.01AR and Chemical Hygiene 24.01.01.W1.33AR.

If approved for exemption, each signatory understands they are responsible for notifying Environmental Health and Safety (EHS) prior to any change in the lab risk activities. For questions and concerns, please contact EHS. Exemption requires approvals from all of the following levels: principle investigator/laboratory supervisor, department head, college dean, supervisor of EHS.

______________________________________ ________________________

Principle investigator Signature Date

______________________________________ ________________________

Department Head Date

______________________________________ ________________________

College Dean Date

Approved________________Denied__________________ Date:__________________

____.

Supervisor of Environmental Health and Safety