Guidelines for Drain Disposal of Chemicals at University of California, Berkeley

November 2002

EMERGENCY SPILL REPORTING INSTRUCTIONS:
If a chemical spill enters a sink or floor drain, immediately notify EH&S, (642-3073) during business hours 8:00 AM—5:00 PM. After business hours, immediately notify UCPD (642-6760) and ask them to contact the EH&S off-hours emergency responder. EH&S will notify EBMUD of the discharge.

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1. INTRODUCTION

Disposal of chemicals into the sanitary sewer is regulated by Federal and State laws and regulations, by the local East Bay Municipal Utility District (EBMUD) Ordinance and by the EBMUD Wastewater Discharge Permit issued to Campus. These laws and regulations prohibit any drain disposal of hazardous wastes and limit the allowable wastewater concentration of a number of specific substances. The University of California, Berkeley, is committed to protection of the local community and the environment through strict compliance with these laws and regulations. Discharge of hazardous chemical wastes into the campus sanitary sewer system is prohibited by Campus Policy (Drain Disposal Policy, October 1, 1990).

The range of substances that can be considered hazardous waste is enormous. Indeed, almost any substance is a hazardous waste if it is disposed of in large quantities or in high concentrations. Federal and California hazardous waste laws permit laboratories to drain dispose of small amounts of some chemicals in quantities that do not pose a hazard to human health or the environment.

The following guidelines for drain disposal of chemicals at UC Berkeley were developed by the Hazardous Waste Management Committee together with the Office of Environment Health and Safety. These guidelines are based on State Law, EBMUD regulations and permits, and on procedures set forth in the National Research Council publication "Prudent Practices for Disposal of Chemicals from Laboratories", National Academy Press, Washington D.C., 1983 (Reference 1) and "Prudent Practices for Handling of Hazardous Chemicals in Laboratories", National Academy Press, Washington D.C., 1981 (Reference 2). Drain disposal is permitted, by Campus policy, only within the guidelines set forth in this document.

Notice:
EBMUD regularly monitors campus wastewater. Failure to comply with wastewater discharge regulations could lead to fines of up to $25,000 per day and/or restrictions on University water use.

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2. OVERVIEW OF DRAIN DISPOSAL OF CHEMICALS

Campus interior drains (and several outside drains) are connected to sanitary sewer systems, and their effluent drains to the EBMUD water pollution control plant. Chemicals and some food wastes may be prohibited from drain disposal for a variety of reasons.

Potential Problems at EBMUD Water Pollution Control Plant:

Chemicals and some food wastes may be prohibited from disposal to the water pollution control plant because they:

- interfere with the biological processes of sewage treatment,
- are not digested in the sewage treatment process, pass through treatment and are released as pollutants to the air,
- are released to San Francisco Bay where they are toxic to aquatic organisms or where they accumulate in Bay sediments,
- concentrate in the sewage treatment sludge, compromising EBMUD's ability to use the sludge for beneficial purposes,
- cause blockages in sewers that result in sewage backing up into buildings or discharges from manholes where raw sewage could come into contact with humans and the environment.

UC policies governing drain disposal of chemicals and certain food wastes to campus sewers have specifically been formulated to comply with these prohibitions.

In addition, Bay Area Air Quality Management District (BAAQMD) air toxics regulations require EBMUD to reduce their release of reactive organic gases (ozone precursors) and other toxic air contaminants. One strategy EBMUD uses to reduce air emissions from the water pollution control plant is source control, limiting the release of chemicals through permit restrictions. For example, for campus EBMUD has set very low limits for discharge of chlorinated hydrocarbons to the wastewater, which are eventually released as toxic air contaminants from the water pollution control plant.

Potential Problems in Drains and Campus Sewers:

Chemicals and some food wastes may be prohibited from disposal to laboratory drains because they can:

- create hazards of fire, explosion, or local air pollution or stench,
- react with other chemicals to form hazardous gases,
- corrode lab and building plumbing,
- leak out of old pipes as liquid to pollute campus grounds,
- escape from sewer pipes as air pollutants,
- expose plumbers to contact or inhalation hazards.

Campus drains are generally interconnected; a substance that goes down one sink may well come up as a vapor in another. Sinks are usually communal property, and there is a very real hazard of chemicals from two sources contacting one another; the sulfide poured into one drain may contact the acid poured into another, with unpleasant consequences for all in the building.

Much of the campus plumbing infrastructure is old and may not be resistant to chemicals placed into the drains. The cost of replacing corroded plumbing can easily exceed the cost of disposal of corrosive chemicals as hazardous waste.

3. Characteristics of Hazardous Wastes

Hazardous wastes are prohibited from discharge. Chemical wastes are hazardous if they are:

- corrosive
- reactive
- ignitable
- moderately or highly toxic

Drain Disposal of Radioactive, Biohazardous and Mixed Wastes

Disposal of radioactive waste into the campus sewer system is prohibited. Exceptions to this policy may be permitted by Radiation Use Authorizations issued by the Radiation Safety Officer provided all restrictions are strictly adhered to.

Disposal of infectious or biohazardous waste, as defined by the California Department of Health Services, into the campus sewer system is prohibited. Infectious or biohazardous waste must be handled, stored, treated and disposed of in accordance with applicable California regulatory requirements and requirements of Biosafety Use Authorizations.

Mixed wastes (wastes which are any combination of chemical, radioactive, or biohazardous wastes) must comply with all pertinent requirements.

4. GENERAL RULES FOR SANITARY DRAIN DISPOSAL

The following general rules apply to drain disposal of chemicals to sanitary sewers at UC Berkeley*. Disposal of chemicals is limited to occasional disposal of small amounts of chemicals, as detailed in the guidelines below. Large scale or continuous disposal of any chemical is permitted only with the written approval of the Hazardous Waste Management Committee. (The Office of Environment, Health and Safety should be contacted to obtain this approval.)

a. Only water-soluble substances may be disposed of in sinks, toilets, and floor drains. Solutions should be flushed down the drain with an appropriate amount of water. (Residue animal or vegetable fats and oils generated as a result of normal cleaning activities are an exception to the solubility rule. However, significant amounts of these oils and fats (more than a pint say) can cause clogging in interior drains and so should be collected and disposed of appropriately).

   (**Note****: A compound is considered water-soluble if it dissolves to the extent of at least 3%. In general, a soluble substance that contains a substance that is not soluble should not be poured down the drain. However, if the water-insoluble material comprises less than about 2% of the mixture, drain disposal is usually acceptable because the small quantity of water-insoluble material will be well dispersed in the aqueous effluent.)

b. Only acid and basic solutions in the range of pH 5-10 may disposed of in the sink.

c. Highly toxic, malodorous, or lachrymatory (that is, those that cause strong eye irritation) chemicals shall not be disposed of down the drain.

d. Old, unwanted, or waste chemicals and products must not be poured down the drain as a means of disposal. These materials must be picked up EH&S personnel.

* Adapted from Reference 2, pp 231-232.

** Adapted from Reference 1, pp 52-53.

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5. SPECIFIC GUIDELINES FOR LABORATORY DRAIN DISPOSAL

We divide chemicals into three groups with regard to drain disposal in laboratories:

(1) **Class A.** Chemicals of little or no hazard in dilute aqueous solution. These aqueous solutions are suitable for disposal down the drain in quantities of up to about 100 g of solute per laboratory per day (e.g. 100 g of ethanol in one liter of water).

(2) **Class B.** Chemicals of moderate hazard in dilute aqueous solution. These aqueous solutions are suitable for disposal down the drain with excess water in quantities no greater than 1 g of solute per laboratory per day.

(3) **Class C.** Chemicals that may not be drain disposed in any amount ***except by written approval*** of the Hazardous Waste Management Committee. *(The Office of Environment, Health and Safety should be contacted to obtain this approval.)*

Class A chemicals include many simple organic and inorganic compounds, as well as common inorganic chemicals. This includes most normal biological metabolites and nontoxic cellular constituents (proteins, nucleic acids, carbohydrates, soluble fats, and their precursors and catabolites). A partial list of Class A chemicals, derived from State regulations and Appendix K of Reference 2, is provided below in Appendix I.

Class B chemicals include all of those listed as toxic (T) in the California Code of Regulations Section 22-66261.30 et. seq. that are water soluble, except for those listed as Class A chemicals in Appendix I or Class C chemicals in Appendix III. Class B chemicals also include all inorganic salts listed in reference 2 as "high hazard" in tables 6.1 and 6.2. A partial list of Class B chemicals appears in Appendix II.

Class C chemicals include all chemicals that are not soluble as defined above, chemicals that cause unacceptable concentrations of offensive, toxic or explosive vapors, and chemicals that are toxic or reactive at concentrations below 1 ppm in aqueous solution. Class C chemicals include the chemicals identified in the Main Campus EBMUD Wastewater Discharge Permit "Priority Pollutant Management Plan" Compliance Requirement (Federal Clean Water Act priority pollutants listed in 40 CFR Part 122 Appendix D, Tables II and III). A partial list of Class C chemicals appears in Appendix III.

6. SPECIFIC DRAIN DISPOSAL GUIDELINES FOR SHOPS, STUDIOS, KITCHENS, JANITORIAL AREAS, GROUNDS, ATHLETICS OPERATIONS, MAINTENANCE OPERATIONS, AND CONSTRUCTION SITES

Drain Disposable Chemicals and Process Wastewater

Chemicals and wastewater of little or no hazard in dilute solutions are suitable for disposal down the drain in quantities that would be expected in normal operations (for example, latex paint brush wash-water or a bucket of mop water). Large quantity wastewater discharges from physical plant equipment can be drain disposed if approved by EBMUD (for example, cooling tower discharges and boiler blow-down).

Following are examples of drain disposable chemicals and process wastewater for shops, physical plant operations, kitchens, janitorial, grounds and athletic operations

- Latex paint wash-water from the rinsing of brushes, rollers, sprayers and other water base painting equipment washing.
- Drywall compound wash-water.
- Commercially available custodial and cleaning products such as soaps and detergents if they are used in accordance with the manufacturer instructions.
- Super-chlorinated water used to disinfect new plumbing.
- Photographic developer solutions, neutralized (does not include used fixer solutions).
- Garbage truck and Dumpster wash-out.
- Building wash-water that is managed in accordance with the Procedures for Wastewater Management from UC Berkeley Building Washing and Maintenance Operations.

Hazardous Chemicals That Are Prohibited From Drain Disposal

The following are prohibited from drain disposal.

ORGANIC CHEMICALS

- All alkanes and water-insoluble hydrocarbons, including:

  Mineral spirits
  Stoddard solvent
  Paint stripper (e.g., Jasco)
  Petroleum hydrocarbons
  Naptha
  Solvent based adhesives

- All chlorinated and brominated hydrocarbons
- Chlorinated solvents, including:

  Methylene chloride (dichloromethane)
  Tetrachloroethylene (perchloroethylene)
  Trichloroethane
  Trichloroethylene

- Chlorofluorocarbons (freons)
- Concentrated acids and bases (pH <5.5 or >10)

- Latex paint (other than wash-water)
- Oil and grease (e.g., crankcase oil, lube oil, grease (all kinds), vegetable oil, shortening)
- Oil based paint
- Oil based paint solvents
- PCBs (polychlorinated biphenyls)
- EPA Priority Pollutants (See Appendix C)

7. ACCIDENTAL SPILL PREVENTION AND EMERGENCY NOTIFICATION

UC Berkeley's EBMUD Wastewater Discharge Permit requires that campus maintain a Slug Discharge* Prevention and Contingency (SDPC) Plan. The purpose of this SDPC Plan is to eliminate or minimize the potential for an accidental, or slug discharge of any pollutant including laboratory, construction, maintenance and photoprocessing chemicals which could interfere with EBMUD's Wastewater Treatment Plant.

***Definition of a Slug Discharge**
For the purposes of this plan, a slug discharge means any discharge of a non-routine, episodic nature, including but not limited to:

- an accidental spill or a non-customary batch discharge,
- discharges that exceed EBMUD Ordinance 311 limitations,
- hazardous waste discharges, and
- **discharges that are not allowed by these Guidelines for Drain Disposal of Chemicals at UC Berkeley**

Due to the diverse nature of laboratory, shop, construction and facility operations that use, store, and handle chemicals, the SDPC Plan does not contain specific prevention practices for all campus operations. General best management practices (BMPs) for spill prevention applicable to all chemical use, handling, and storage operations are presented below. These spill prevention measures should be incorporated as standard operating procedures for chemical use operations.

Measures for containing toxic organic and inorganic pollutants, including solvents, from laboratories, shops, construction and facilities operations:

General best management practices for slug discharge prevention:

- avoid open container use of chemicals near sinks and floor drains,
- where open container use of chemicals near sinks and floor drains is unavoidable, cap or plug sinks and drains during chemical use,
- store chemicals in tubs, cabinets, bermed or diked areas or in other secondary containment,
- avoid storing excess quantities of chemicals - order only what you need and dispose of unwanted or expired chemicals through EH&S,
- secure storage cabinets and shelves to prevent tipping or falling,
- use proper container restraints,
- maintain spill containment and clean-up materials nearby, and
- follow good housekeeping practices - never use sinks to store chemicals.

Inspection and maintenance of storage areas:

All chemical use and storage areas (for example, storerooms) should be inspected for BMP implementation on a regular basis. Storerooms that contain floor drains routed to the sanitary sewer should have the floor drains plugged at all times, except when floor drains are needed (for example, when floors are mopped). Storerooms should use removable drain plugs in such cases.

Material handling and transfer:

When chemicals are transferred within buildings or between buildings, they should be placed in secondary containers which can contain over 100% of the chemical, should the primary container break.

Loading and unloading operations:

Most exterior loading and unloading locations (loading docks) drain to the storm drain system, and storm water pollution prevention BMPs should be followed. Where locations drain to the sanitary sewer, floor drains should be plugged at all times, except when floor drains are needed (for example, when floors are mopped). Temporary drain plugs should be used during time when floor drains are not in use.

Control of site runoff:

Most site runoff drains to the storm drain system, and storm water pollution prevention BMPs should be followed for any operation that has the potential for discharging a pollutant to the storm drain. Prior to initiating any operation, determine the location and drainage route of all drains. Storm water pollution prevention or slug discharge BMPs should be implemented as

necessary. For more information regarding storm water pollution prevention BMPs, contact EH&S at 642-3073.

Worker training:

All laboratory, photoprocessing, shop, construction and facility workers in operations that could cause a slug discharge must be trained in slug discharge prevention and spill reporting. This is accomplished through Chemical Hygiene Plan and Worker Right-to-Know training and other training implemented by Department Safety Coordinators (DSCs). Drain disposal restrictions and spill discharge notification requirements are also posted through the use of sink stickers, which are required for laboratory, shop, and facility chemical use areas.

If prohibited chemicals or substances enter a sink or drain, immediately notify the Office of EH&S at 642-3073 during business hours or, after hours and weekends, call the University Police Department dispatch by dialing 643-6760 or 911 from a regular phone or 642-3333 from a cell phone.

Upon receiving notification of a chemical release, the Office of EH&S will make the appropriate agency and Campus contacts.

Appendix I - Class A

Class A chemicals. *Chemicals of little or no hazard in dilute aqueous solution. These are aqueous solutions suitable for disposal down the drain with in quantities of up to about 100 g of solute per laboratory per day (e.g. 100 g of ethanol in one liter of water)*

Class A chemicals include many simple organic and inorganic compounds, as well as common inorganic chemicals. This includes most normal biological metabolites and nontoxic cellular constituents (proteins, nucleic acids, carbohydrates, soluble fats, and their precursors and catabolites).

1. ORGANIC CHEMICALS

Normal biological metabolites and nontoxic cellular constituents (proteins, nucleic acids, carbohydrates, soluble fats, and their precursors and catabolites).

Alcohols

Alkanols with fewer than 5 atoms
Alkanediols with fewer than 8 atoms
Sugars and sugar alcohols
Alkoxyalkanols with fewer than 7 carbon atoms
butanol, 1-(*n*-butyl alcohol)
butanol, 2-(sec-butyl alcohol)
ethanol
ethanol,2-(2-butoxyethoxy)
ethylene glycol
glycerol
methanol
methyl 1-propanol, 2-(isobutyl alcohol)
methyl 2- butanol, 2-(t-amyl alcohol)
methyl 2-propanol, 2-(*tert*-butyl alcohol)
propanol, 1-(*n*-propyl alcohol)
propanol, 2-(isopropyl alcohol)

Aldehydes:

Aliphatic aldehydes with fewer than 5 carbon atoms
acetaldehyde
butyraldehyde
formaldehyde
gluteraldehyde
propionaldehyde

Amides

$RCONH_2$ and RCONHR with fewer than 5 carbon atoms
$RCONR_2$ with fewer than 11 carbon atoms
formamide
propionamide
methylpropionamide, N-
butanamide

Amines**

Aliphatic amines with fewer than 7 carbon atoms
Aliphatic diamines with fewer than 7 carbon atoms
benzylamine
butylamine, n-
dimethylamine
dipropylamine
propylamine
pyridine

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Carboxylic Acids**
- Alkanoic acids with fewer than 6 carbon atoms
- Alkanedioic acids with fewer than 6 carbon atoms
- Hydroxyalkanoic acids with fewer than 6 carbon atoms
- Aminoalkanoic acids with fewer than 7 carbon atoms
- Ammonium, Sodium, and Potassium salts of the above acid classes with fewer than 21 carbon atoms
- acetic acid
- citric acid
- oxalic acid
- potassium binoxalate
- propanoic acid
- formic acid
- sodium acetate
- sodium citrate

** Those organic compounds with a disagreeable odor, such as dimethylamine, 1,4 butanediamine, butyric acids and valeric acids, should be neutralized, and the resulting salt solutions flushed down the drain, diluted with at least 1000 volumes of water.

Esters:
- Esters with fewer than 5 carbon atoms
- ethyl acetate
- isopropyl acetate
- methyl acetate
- methyl formate
- methyl propionate
- propyl formate, n-

Ethers
- dioxane, 1,4-
- dioxolane
- tetrahydrofuran

Ketones:
- Ketones with fewer than 6 carbon atoms
- acetone (2-propanone)
- cyclohexanone
- methyl ethyl ketone (2-butanone)
- methyl isobutyl ketone
- pentanone, 2-

Nitriles:
- acetonitrile
- propionitrile

Sulfonic Acids:
- Sodium or potassium salts of most are acceptable

2. INORGANIC CHEMICALS

This list comprises water-soluble compounds of low toxicity hazard cations and anions. Compounds of any of these ions must be in the range of pH 5.5 - 10.

Cations :
Aluminum Al^{3+}
Ammonium NH^{4+}
Calcium Ca^{2+}
Cesium Cs^{+}
Hydrogen H^{+}
Lithium Li^{+}
Magnesium Mg^{2+}
Potassium K^{+}
Sodium Na^{+}
Strontium Sr^{2+}
Tin Sn^{2+}
Titanium Ti^{3+}, Ti^{4+}
Zirconium Zr^{2+}

Anions:
Borate (BO_3^{3-}, $B_4O_7^{2-}$)
Bromide (Br^{-})
Carbonate (CO_3^{2-})
Chloride (Cl^{-})
Bisulfite (HSO_3^{-})
Hydroxide (OH^{-})
Oxide (O^{2-})
Iodide (I^{-})
Nitrate (NO_3^{-})
Phosphate (PO_4^{3-})
Sulfate (SO_4^{2-})

3. PROPRIETARY PRODUCTS

Bleach (sodium hypochlorite solution)

Detergents (alkanesulfonates)

Photographic solutions - spent black and white developers and developer replenishers (No Fixers!):

Household ammonia

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Alphabetical Lists of Commonly Used Class A Chemicals

CLASS A Organic

acetaldehyde
acetic acid
acetone (2-propanone)
acetonitrile
benzylamine
butanamide
butanol, 1-(*n*-butyl alcohol)
butanol, 2-(sec-butyl alcohol)
butylamine, n-
butyraldehyde
citric acid
cyclohexanone
dimethylamine
dioxane, 1,4-
dioxolane
dipropylamine
ethanol
ethanol, 2-(2-butoxyethoxy)
ethyl acetate
ethylene glycol
formaldehyde
formamide
formic acid
gluteraldehyde
glycerol
isopropyl acetate
methanol
methyl 1-propanol, 2-(isobutyl alcohol)
methyl 2- butanol, 2-(t-amyl alcohol)
methyl 2-propanol, 2-(*tert*-butyl alcohol)
methyl acetate
methyl ethyl ketone (2-butanone)
methyl formate
methyl isobutyl ketone
methylpropionamide, N-
methyl propionate
oxalic acid
pentanone, 2-
potassium binoxalate
propanoic acid
propanol, 1-(*n*-propyl alcohol)
propanol, 2-(isopropyl alcohol)
propionaldehyde
propionamide
propionitrile
propyl formate, n-
propylamine
pyridine
sodium acetate
sodium citrate
tetrahydrofuran

CLASS A Inorganic

ammonium chloride
ammonium nitrate
ammonium sulfate
ammonium thiosulfate
boric acid
calcium carbonate
calcium chloride
calcium hydroxide
calcium nitrate
calcium sulfate
cesium chloride
hydrochloric acid (neutralized)
lithium bromide
lithium chloride
magnesium chloride
magnesium oxide
magnesium sulfate
nitric acid (neutralized)
perchloric acid (neutralized)
phosphoric acid (neutralized)
Plaster of Paris (calcium sulfate)
potassium bicarbonate
potassium bromide
potassium carbonate
potassium chloride
potassium iodide
potassium nitrate
potassium phosphate
potassium sulfate
sodium bicarbonate
sodium borate
sodium carbonate
sodium chloride
sodium hydroxide (neutralized)
sodium iodide
sodium molybdate
sodium nitrate
sodium phosphate
sodium sulfate
sodium sulfite
sodium thiosulfate
sulfuric acid (neutralized)

Appendix II - Class B

Class B Chemicals: *Chemicals of moderate hazard in dilute aqueous solutions. These aqueous solutions are suitable for disposal down the drain with excess water in quantities no greater than 1 gram of solute per laboratory per day. The final concentration in wastewater must not exceed 1 ppm after flushing with an appropriate amount of water.*

1. ORGANIC CHEMICALS

Commonly used Class B organic chemicals:

acrylamide
trypan blue

2. INORGANIC CHEMICALS

Cations of the following metals :

Barium
Cobalt
Gallium
Germanium
Hafnium
Indium
Iridium
Iron
Manganese
Molybdate
Osmium
Platinum
Rhenium
Rhodium
Ruthenium
Tellurium
Tungsten
Vanadium

Anions and neutral compounds:

Aluminum hydride (AlH_4)
Amide (NH_2^-)
Azide (N_3^-)
Borohydride (BH^{4-})
Bromate (BrO^{3-})
Chlorate (ClO^{3-})
Fluoride (F^-)
Hydride (H^-)
Hydroperoxide (O_2H^-)
Hydrosulfide (SH^-)
Hypochlorite (OCl^-)
Iodate (IO_3^-)
Nitrite (NO_2^-)
Perchlorate (ClO_4^-)
Permanganate (MnO_4^-)
Peroxide (O_2^{2-})
Persulfate ($S_2O_8^{2-}$)
Sulfide (S^{2-})

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Appendix III - Class C

Class C Chemicals: *Chemicals that may not be drain disposed in any amount* ***except by written approval*** *of the Hazardous Waste Management Committee. (The Office of Environment, Health and Safety should be contacted to obtain this approval.)*

1. ORGANIC CHEMICALS

All alkanes and water-insoluble hydrocarbons.

All chlorinated and brominated hydrocarbons.

EPA Priority Pollutants (see list below).

Specific commonly used Class C organic chemicals:

- benzene
- cyclohexane
- ethyl ether
- ethidium bromide
- hexane
- phenol and phenolic compounds
- toluene
- xylene
- chlorinated hydrocarbons
  - chloroform
  - carbon tetrachloride
  - methylene chloride (dichloromethane)
  - PCBs
  - tetrachloroethylene
  - trichloroethane
  - trichloroethylene
- chlorofluorocarbons (freons, halons)

2. INORGANIC CHEMICALS

Chemicals containing the following metals and compounds

- Antimony
- Arsenic (including arsenate [AsO_3^-, AsO_4^{3-}] and Arsenite [AsO_2^-])
- Beryllium
- Cadmium
- Chromium (including chromate and dichromate)
- Copper
- Cyanides, Cyanates (OCN^-), Thiocyanates (SCN^-)
- Lead
- Mercury
- Nickel
- Selenium
- Silver, including photographic fixer
- Thallium
- Zinc

Specific commonly used Class C inorganic chemicals

- sodium azide
- sodium cyanide
- chromium glassware cleaners- Chromerge, chromium trioxide/sulfuric acid solutions
- “biodegradable” liquid scintillation cocktails

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3. EPA PRIORITY POLLUTANTS (40 CFR Part 122 Appendix D, Tables II and III)

TABLE II–ORGANIC TOXIC POLLUTANTS IN EACH OF FOUR FRACTIONS IN ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROSCOPY (GS/MS)

Volatiles

1V	acrolein
2V	acrylonitrile
3V	benzene
5V	bromoform
6V	carbon tetrachloride
7V	chlorobenzene
8V	chlorodibromomethane
9V	chloroethane
10V	2-chloroethylvinyl ether
11V	chloroform
12V	dichlorobromomethane
14V	1,1-dichloroethane
15V	1,2-dichloroethane
16V	1,1-dichloroethylene
17V	1,2-dichloropropane
18V	1,3-dichloropropylene
19V	ethylbenzene
20V	methyl bromide
21V	methyl chloride
22V	methylene chloride
23V	1,1,2,2-tetrachloroethane
24V	tetrachloroethylene
25V	toluene
26V	1,2-trans-dichloroethylene
27V	1,1,1-trichloroethane
28V	1,1,2-trichloroethane
29V	trichloroethylene
31V	vinyl chloride

Acid Compounds

1A	2-chlorophenol
2A	2,4-dichlorophenol
3A	2,4-dimethylphenol
4A	4,6-dinitro-o-cresol
5A	2,4-dinitrophenol
6A	2-nitrophenol
7A	4-nitrophenol
8A	p-chloro-m-cresol
9A	pentachlorophenol
10A	phenol
11A	2,4,6-trichlorophenol

Base/Neutral

1B	acenaphthene
2B	acenaphthylene
3B	anthracene
4B	benzidine
5B	benzo(a)anthracene
6B	benzo(a)pyrene
7B	3,4-benzofluoranthene
8B	benzo(ghi)perylene
9B	benzo(k)fluoranthene
10B	bis(2-chloroethoxy)methane
11B	bis(2-chloroethyl)ether
12B	bis(2-chloroisopropyl)ether
13B	bis(2-ethylhexyl)phthalate
14B	4-bromophenyl phenyl ether
15B	butylbenzyl phthalate
16B	2-chloronaphthalene
17B	4-chlorophenyl phenyl ether
18B	chrysene
19B	dibenzo(a, h)anthracene
20B	1,2-dichlorobenzene
21B	1,3-dichlorobenzene
22B	1,4-dichlorobenzene
23B	3,3'-dichlorobenzidine
24B	diethyl phthalate
25B	dimethyl phthalate
26B	di-n-butyl phthalate
27B	2,4-dinitrotoluene
28B	2,6-dinitrotoluene
29B	di-n-octyl phthalate
30B	1,2-diphenylhydrazine (as azobenzene)
31B	fluroranthene
32B	fluorene
33B	hexachlorobenzene
34B	hexachlorobutadiene
35B	hexachlorocyclopentadiene
36B	hexachloroethane
37B	indeno(1,2,3-cd)pyrene
38B	isophorone
39B	naphthalene
40B	nitrobenzene
41B	N-nitrosodimethylamine
42B	N-nitrosodi-n-propylamine
43B	N-nitrosodiphenylamine
44B	phenanthrene
45B	pyrene
46B	1,2,4-trichlorobenzene

Pesticides

1P	aldrin
2P	alpha-BHC
3P	beta-BHC
4P	gamma-BHC
5P	delta-BHC
6P	chlordane
7P	4,4'-DDT
8P	4,4'-DDE
9P	4,4'-DDD
10P	dieldrin
11P	alpha-endosulfan
12P	beta-endosulfan
13P	endosulfan sulfate
14P	endrin
15P	endrin aldehyde
16P	heptachlor
17P	heptachlor epoxide
18P	PCB-1242
19P	PCB-1254
20P	PCB-1221
21P	PCB-1232
22P	PCB-1248
23P	PCB-1260
24P	PCB-1016
25P	toxaphene

Other

dioxins- 2,3,7,8 tetrachloro-dibenzo -p-dioxin (TCDD) and others

asbestos

TABLE III – OTHER TOXIC POLLUTANTS (METALS AND CYANIDE) AND TOTAL PHENOLS

Antimony, Total
Arsenic, Total
Beryllium, Total
Cadmium, Total
Chromium, Total
Copper, Total
Lead, Total
Mercury, Total
Nickel, Total
Selenium, Total
Silver, Total
Thallium, Total
Zinc, Total
Cyanide, Total
Phenols, Total

APPENDIX 6a

REFERENCES:

1. "Prudent Practices for Disposal of Chemicals from Laboratories", National Academy Press, Washington D.C., 1983.

2. "Prudent Practices for Handling of Hazardous Chemicals in Laboratories", National Academy Press, Washington D.C., 1981

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APPENDIX 6a