

NIH Green Chemical Procurement Fact Sheet

The NIH Department of Environmental Protection (DEP) has created this fact sheet to assist the NIH laboratories with the identification and use of “environmentally friendly” laboratory products and chemicals.

CHEMICALS TO AVOID

The following is a brief description of chemicals to avoid when planning laboratory experiments for research, analytical or instructional purposes:

- Eliminate or reduce the use of **reactive** chemicals, where possible, for safety and to avoid the generation of hazardous waste. If wastes from laboratory work are reactive, deactivate their reactive characteristic(s) as one step in the experiment.
 - A reactive material is one that can undergo a chemical reaction under certain specified conditions. Generally, reactive chemicals are substances that undergo a violent or abnormal reaction in the presence of water or under normal ambient atmospheric conditions.
 - Reactive chemicals include materials that react vigorously with moisture and other substances. Common reactive solids include the metals sodium, potassium, and lithium metals; acid anhydrides and acid chlorides.
- Eliminate or reduce the use of **halogenated solvents**, where possible. Many halogenated solvents are carcinogens or suspected carcinogens.
 - Halogenated solvents refer to solvents that contain halogen atoms (e.g., fluorine (F), chlorine (Cl), bromine (Br), iodine (I), and astatine (At))
 - Examples of common halogenated solvents include: tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, and carbon tetrachloride.
- Eliminate or reduce the use of **non-halogenated flammable solvents**, where possible. Try to find nonflammable, biodegradable substitutes.
 - Examples of non-halogenated flammable solvents include xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol.
- Reduce or eliminate the use of arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver where possible. If silver must be used, recover for reclamation.
- Eliminate or reduce the use of oxidizers, where possible.
- Eliminate or reduce the use of highly toxic chemicals, where possible. Refer to the following table.

Alternative, environmentally preferable laboratory products that do not contain hazardous or highly toxic chemicals are presented in the following table. In some cases, specific product options are included.

ALTERNATIVE, ENVIRONMENTALLY PREFERABLE LABORATORY PRODUCTS

Laboratory Activity	Instead of ...	Use ...	Specific Product Options
Glassware cleaning	<ul style="list-style-type: none"> Chromic-sulfuric acid solutions Alcoholic potassium hydroxide 	<ul style="list-style-type: none"> Laboratory detergents Enzymatic cleaners Aqueous solvents 	<ul style="list-style-type: none"> Alconox Lab Cleaner Powder Pierce RBS 35 FL 70 Concentrate Detergent HaemoSol No Scrub Cleaner Linbro 7X Lab Glass Cleaner RBS35 General Purpose cleaner Nochromix
Density determination	Methanol solution	<ul style="list-style-type: none"> Sugar water 	
Organic synthesis	<ul style="list-style-type: none"> Chromate ion Ethyl ether 	<ul style="list-style-type: none"> Hypochlorite ion Methyl t-butyl ether 	
Qualitative test for heavy metals	Sulfide ion	<ul style="list-style-type: none"> Hydroxide ion 	
Molecular weight determination by freezing point lowering methods	Benzene	<ul style="list-style-type: none"> Cyclohexane 	
Temperature measurement	Mercury thermometers Mercury thermostats	<ul style="list-style-type: none"> Red alcohol filled thermometers Mineral spirit filled thermometers Biodegradable green liquid thermometers All metal thermometers Digital thermistor/thermocouple Electronic/Digital thermostats Snap switch thermostats 	

Laboratory Activity	Instead of ...	Use ...	Specific Product Options
Pressure measurement	Mercury manometers	<ul style="list-style-type: none"> • Pressure transducers • Electronic pressure gauges • Oil-based manometers 	
Biocide solutions	Mercuric chloride	<ul style="list-style-type: none"> • Sodium hypochlorite 	
Storage of biological specimens	Formaldehyde	<ul style="list-style-type: none"> • Ethanol or other preservatives 	
In-phase change and freezing point depression	Acetamide	<ul style="list-style-type: none"> • Stearic acid 	
Qualitative test for halide ions	Carbon tetrachloride	<ul style="list-style-type: none"> • Cyclohexane 	
Measurement of vapor pressure-temperature by isotenscope	Carbon tetrachloride	<ul style="list-style-type: none"> • Isopropyl alcohol 	
Acid-base experiments	<ul style="list-style-type: none"> • Conventional acids • Conventional bases 	<ul style="list-style-type: none"> • Vinegar • Ammonia 	
Nucleic acid gel stain	Ethidium bromide		<p>GelRed™ Precast Gel Stains</p> <p>SYBR Green and SYBR Red</p>
Isolation and purification of DNA	Phenol chloroform		<ul style="list-style-type: none"> • Promega Corporation, Magic Preps • Stratagene, Lambda DNA Purification Kit

Laboratory Activity	Instead of ...	Use ...	Specific Product Options
Radioactive tracer studies	Xylene or toluene based liquid scintillation cocktails	<ul style="list-style-type: none"> Nonhazardous proprietary liquid scintillation cocktails 	<ul style="list-style-type: none"> National Diagnostics
Clearing agents in histology (e.g., dewaxing tissue sections)	Xylene	<ul style="list-style-type: none"> Histo-Clear 	<ul style="list-style-type: none"> National Diagnostics
In phase change and freezing point depression	Acetamide	<ul style="list-style-type: none"> Stearic acid 	
Polymer catalyst	Benzoyl peroxide	<ul style="list-style-type: none"> Lauryl peroxide 	
Test for halide ions	Carbon tetrachloride	<ul style="list-style-type: none"> Cyclohexane 	
Biological specimen storage	Formaldehyde Formalin	<ul style="list-style-type: none"> Ethanol “Formalernate” (Flinn Scientific) 	
Parts washers or other solvent processes	Halogenated solvents	<ul style="list-style-type: none"> Nonhalogenated solvents 	
Heavy metals analysis	Sulfide ion	<ul style="list-style-type: none"> Hydroxide ion 	
Kjeldahl digests	Mercury salts	<ul style="list-style-type: none"> Mercury-free catalysts (e.g., CuSO₄, TiO₂, K₂) 	
General substitutions	Benzene Chloroform Carbon tetrachloride Picric acid Sodium dichromate Toluene Wood’s metal	<ul style="list-style-type: none"> Alcohol 1,1,1-trichloroethane 1,1,1-trichloroethane 1,1,2-trichlorotrifluoroethane ??? Sodium hypochlorite Simple alcohols and ketones Onion’s fusible alloy 	

