

## ADVISORY NO. 7.4: HANDLING HAZARDOUS CHEMICALS

### GENERAL PRINCIPLES

Every worker should observe the following rules and contact EH&S for guidance:

- Know the safety rules and procedures that apply to the work being done. Determine the potential safety hazards and appropriate safety precautions before beginning any new operation. Material Safety Data Sheets provide useful information.
- Know the location of and how to use the emergency equipment in your area, as well as how to obtain additional help in an emergency. Be familiar with emergency procedures.
- Know the types of protective equipment available and use the proper type for each job.
- Be alert to unsafe conditions and actions and call attention to them so corrections can be made as soon as possible. Someone else's accident can be as dangerous to you as any you might have.
- Avoid consuming food or beverages or smoking in areas where chemicals are being used or stored.
- Avoid hazards to the environment by following accepted waste disposal procedures.
- Be certain all chemicals are correctly and clearly labeled. Post warning signs when unusual hazards, i.e., asbestos, laser operations, radiation, biohazards or other special problems exist.
- Remain out of the area of a fire or personal injury unless it is your responsibility to help resolve the emergency.
- Avoid distracting or startling other workers.
- Use equipment only for its designated purpose.
- When performing chemical operations, combine reagents in the proper order and avoid adding solids to hot liquids or water to concentrated acids.

### HEALTH AND HYGIENE

**Workers** should observe the following health practices:

- Wear appropriate eye protection at all times.
- Use protective apparel, including face shields, gloves, and other special clothing and footwear as needed. Sandals are not adequate footwear when working with chemicals. Do not wear shoes constructed of fabrics such as canvas or nylon.
- Confine long hair and loose clothing.
- Do not use mouth suction to pipette chemicals or to start a siphon; a pipette bulb or aspirator should be used to provide vacuum.
- Avoid exposure to gases, vapors and aerosols. Use appropriate safety equipment (i.e. fume hoods, respirators) whenever such exposure is likely. Respirators must be approved by EH&S. A medical evaluation is required prior to respirator use.
- Wash well before leaving the lab or work area. Avoid the use of solvents when washing the skin as they can cause irritation and inflammation and may facilitate absorption of a toxic chemical.

### TYPES OF HANDLING PROCEDURES

The following procedures should be followed when handling toxic chemicals:

- OSHA has published detailed procedures for working with substances they have classified as carcinogens (**see Appendix A**). Anyone contemplating work with these materials should consult EH&S who will advise them of the necessary approvals, training, working conditions, monitoring, record-keeping and medical surveillance.
- **Appendix B** should be followed in operations using those substances believed to have a high chronic toxicity even when used in small amounts. This includes certain heavy metal compounds and carcinogens not currently regulated by OSHA (**see Appendix D**).
- **Appendix C** should be followed in operations using substances of moderate chronic or high acute toxicity, i.e., substances for which infrequent small quantities do not pose a significant toxic hazard, but which can be dangerous to those exposed to high concentrations or repeated small doses. These substances include corrosives and irritants.

The basic precautions for safe handling of flammable materials include the following:

- Flammable substances should be handled only in areas free of ignition sources.
- Flammable substances should never be heated by using an open flame. Preferred heat sources include steam baths, water baths, oil baths, heating mantles and hot air baths.
- When transferring flammable liquids in metal equipment, static generated sparks should be avoided by bonding and the use of ground straps.
- Ventilation is one of the most effective ways to prevent the formation of flammable mixtures. An exhaust hood should be used whenever appreciable quantities of flammable substances are transferred from one container to another, allowed to stand in open containers, heated in open containers, or handled in any other way.

Handling of explosive chemicals requires special precautions as follows:

- Barriers such as shields, barricades and guards should be used to protect personnel and equipment from injury or damage and should completely surround the hazardous area.
- Protective safety glasses should be worn at all times and face shields with throat protectors when worker is in a hazardous, exposed position, i.e. when operating or manipulating synthesis systems, when bench shields are moved aside, or when handling or transporting explosive chemicals.
- Protective gloves, i.e. electric lineman's gloves, should be worn whenever it is necessary to reach behind a shielded area while a hazardous experiment is in progress or when handling adducts or gaseous reactants.
- Lab coats must be worn at all times while in labs where explosives are present. They should be of a slow-burning material and fitted with quick release cloth buttons.
- Explosive materials should be brought into the lab only as required and then in the smallest quantities adequate for the experiment being conducted.
- When potentially explosive materials are being handled, the area should be posted with a sign such as:

**WARNING!**  
**VACATE THE AREA AT THE FIRST SIGN OF ODOR**  
**STAY OUT UNTIL THE VENTILATION SYSTEM**  
**HAS BEEN CLEARED**

Precautions for handling peroxides include the following:

- The quantity of peroxide should be limited to the minimum amount required. Unused portions should not be returned to the container.
- All spills should be cleaned up immediately. Solutions of peroxides can be absorbed on vermiculite.
- The sensitivity of most peroxides to shock and heat can be reduced by dilution with inert solvents, such as aliphatic hydrocarbons. However, toluene is known to induce the decomposition of diacyl peroxides.
- Solutions of peroxides in volatile solvents should not be used under conditions in which the solvent might be vaporized, as this will increase the peroxide concentration in solution.
- Metal spatulas should not be used to handle peroxides because contamination by metals can lead to explosive decomposition. Ceramic or wooden spatulas may be used.
- Smoking, open flames, and other sources of heat should not be permitted near peroxides.
- Friction, grinding and all forms of impact should be avoided near peroxides. Glass containers with 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, peroxides should be stored at the lowest possible temperature consistent with their solubility or freezing point. Liquid solutions of peroxides should not be stored 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.

**APPENDIX A: OSHA LIST OF REGULATED CARCINOGENS**  
**29 CFR 1910, 7/1/88**

2-Acetylaminofluorene  
Acrylonitrile  
4-Aminodiphenyl  
Asbestos  
Benzene  
Benzidine  
Bis(chloromethyl)ether  
Coke oven emissions  
3,3-Dichlorobenzidine (and salts)  
4-Dimethylaminoazobenzene  
Ethyleneimine  
Ethylene Oxide  
Formaldehyde  
Inorganic arsenic  
Methyl chloromethyl ether  
alpha-Naphthylamine  
beta-Naphthylamine  
4-Nitrobiphenyl  
N-Nitrosodimethylamine  
beta-Propiolactone  
Vinyl chloride

**APPENDIX B: GENERAL PROCEDURES AND PRECAUTIONS  
FOR WORKING WITH SUBSTANCES OF  
MODERATE CHRONIC OR HIGH ACUTE TOXICITY**

The precautions and procedures described below should be followed if any of the substances being used in significant quantities is known to be moderately or highly toxic. (If any substance being used is known to be highly toxic, it is desirable that two people be present in the area at all times.) These procedures should also be followed if the toxicological properties of any of the substances being used or prepared are unknown. (Consult the MSD sheet or EH&S for the toxicological properties of a chemical.) If any of the substances to be used or prepared are known to have high chronic toxicity (i.e. heavy metal compounds and strong carcinogens) then the precautions and procedures described below should be supplemented with additional precautions (**see Appendix C**).

The following three precautions should always be followed:

- Protect the hands and forearms by wearing both gloves and a lab coat or suitable long gloves to avoid contact of toxic material with the skin. Contact EH&S for information on suitable gloves.
- Procedures involving volatile toxic substances and those involving solid or liquid toxic substances that may result in the generation of aerosols should be conducted in a hood or other suitable containment device. If such a device is not feasible then proper respiratory protection shall be worn. Consult with EH&S regarding approved respiratory protection.
- After working with toxic materials, wash hands and arms immediately. Never eat, drink, smoke, apply cosmetics, take medicine or store food in areas where toxic substances are being used.

**See Appendix D** for a list of substances “known to be carcinogens” of “reasonably anticipated to be carcinogens” by the U.S. Department of Health and Human Services as published in the Annual Reports on Carcinogens. The Reports are informational documents that represent an initial step in hazard identification of the substances selected for inclusion; the Reports do not present assessments of carcinogenic risk.

**APPENDIX C: ADDITIONAL PROCEDURES AND PRECAUTIONS  
FOR WORKING WITH SUBSTANCES OF KNOWN  
HIGH CHRONIC TOXICITY**

All of the procedures and precautions described in **Appendix B** should be followed when working with substances known to have chronic toxicity. In addition, when such substances are used in quantities in excess of a few milligrams to a few grams, the additional precautions described below should be used. Substances in this high-chronic-toxicity category include certain heavy metals (i.e. nickel carbonyl) and compounds normally classified as strong carcinogens.

The precautions are as follows:

- Each worker's plans for experimental or other work must be approved by a supervisor.
- An accurate record of the amounts of such substances being stored and the amounts used, dates of use, and names of users should be maintained.
- Any volatile substances having high chronic toxicity should be stored in a ventilated storage area in a secondary tray or container with sufficient capacity to contain the material should the primary container break.
- All containers of substances in this category should have labels that identify the contents and include a warning such as:

**WARNING!**  
**HIGH CHRONIC TOXICITY or CANCER-SUSPECT AGENT**

Storage areas for these substances should have limited access and special signs posted if special toxicity hazard exists.

- All work with and transfers of these substances or mixtures thereof should be done in a controlled area which is defined as an area designated for the use of highly toxic materials. Such areas should be clearly marked with a conspicuous sign such as:

**WARNING!**  
**TOXIC SUBSTANCE IN USE or CANCER-SUSPECT AGENT**  
**AUTHORIZED PERSONNEL ONLY**

Only authorized and instructed personnel should be allowed to work in or have access to controlled areas.

- Surfaces on which high chronic toxicity materials are handled should be protected from contamination by using chemically resistant trays that can be decontaminated after work or by using dry, absorbent, plastic-backed paper that can be disposed of after use.
- On leaving a controlled area, workers should remove any protective apparel that has been used and thoroughly wash hands, forearms, face and neck. If disposable apparel or absorbent paper liners have been used, these items should be placed in a closed, impervious container that should then be labeled in some manner such as:

**CAUTION:**

## CONTENTS CONTAMINATED WITH SUBSTANCES OF HIGH CHRONIC TOXICITY

Nondisposable protective apparel should be thoroughly washed and containers of disposable apparel and paper liners should be incinerated.

- In the event of continued experimentation with a substance of high chronic toxicity (i.e. use of significant quantities three times a week), a qualified physician should be consulted to determine whether it is advisable to establish a regular schedule of medical surveillance and/or biological monitoring.

**See Appendix D** for a list of substances “known to be carcinogens” of “reasonably anticipated to be carcinogens” by the U.S. Department of Health and Human Services as published in the Annual Reports on Carcinogens. The Reports are informational documents that represent an initial step in hazard identification of the substances selected for inclusion; the Reports do not present assessments of carcinogenic risk.

**APPENDIX D: LISTING OF SUBSTANCES IN THE ANNUAL REPORT ON  
CARCINOGENS MANDATED BY PUBLIC LAW 95-622:**

For the purpose of this Report, "known carcinogens" are defined as those substances for which there is sufficient evidence of carcinogenicity from studies in humans to indicate a causal relationship between the agent and human cancer. "Reasonably anticipated to be carcinogens" are those substances for which there is limited evidence of carcinogenicity in humans and/or sufficient evidence of carcinogenicity in experimental animals. Sufficient evidence in animals is demonstrated by positive carcinogenicity findings in multiple strains and species of animals, in multiple experiments, or to an unusual degree with regard to incidence, site, type of tumor, or age of onset. Only substances for which the evidence of carcinogenicity has been peer-reviewed are evaluated for possible inclusion in the Annual Reports".

The following list of substances is from the *Seventh Annual Report on Carcinogens, 1994*.

**Substances or groups of substances, occupational exposures associated with a technological process, and medical treatments that are known to be carcinogenic:**

Aflatoxins, CAS No. 1402-68-2

4-Aminobiphenyl, CAS No. 92-67-1

Analgesic Mixtures Containing Phenacetin

Arsenic and Certain Arsenic Compounds: **[OSHA Regulated - see Appendix A]**

Arsenic, CAS No. 7440-38-2

Arsenic pentoxide, CAS No. 1303-28-2

Arsenic trioxide, CAS No. 1327-53-3

Calcium arsenate, CAS No. 7778-44-1

Calcium arsenite 1:1, CAS No. 52740-16-6

Calcium arsenite 2:1, CAS No. 15194-98-6

Calcium arsenite 2:3, CAS No. 27152-57-4

Disodium hydrogen arsenate, CAS No. 10048-95-0

Lead arsenate, CAS No. 7784-40-9

Potassium arsenate, CAS No. 7784-41-0

Potassium arsenite, CAS No. 13464-35-2

Sodium arsenate, CAS No. 7631-89-2

Sodium arsenite, CAS No. 7784-46-5

Asbestos, CAS No. 1332-21-4 **[OSHA Regulated - see Appendix A]**

Azathioprine, CAS No. 446-86-6

Benzene, CAS No. 71-43-2 **[OSHA Regulated - see Appendix A]**

Benzidine, CAS No. 92-87-5 **[OSHA Regulated - see Appendix A]**

Bis (chloromethyl) ether, CAS No. 542-88-1 **[OSHA Regulated - see Appendix A]**

Chloromethyl methyl ether, technical grade, CAS No. 107-30-2

1,4-Butanediol dimethylsulfonate (Myleran), CAS No. 55-98-1

Chlorambucil, CAS No. 305-03-3

1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea (MeCCNU), CAS No. 13909-09-6

Chromium and Certain Chromium Compounds:

Chromium, CAS No. 7440-47-3  
Calcium chromate, CAS No. 13765-19-0  
Calcium trioxide, CAS No. 1333-82-0  
Lead chromate, CAS No. 7758-97-6  
Strontium chromate, CAS No. 7789-06-2  
Zinc chromate, CAS No. 13530-65-9

Conjugated estrogens

Cyclophosphamide, CAS No. 50-18-0

Cyclosporin (newly listed as a known carcinogen-8<sup>th</sup> Annual Report)

Diethylstilbestrol, CAS No. 56-53-1

Erionite, CAS No. 66733-21-9

Melphalan, CAS No. 148-82-3

Methoxsalen with ultraviolet A therapy (PUVA), CAS No. 298-81-7

Mustard gas, CAS No. 505-60-2

2-Naphthylamine, CAS No. 91-59-8

Radon, CAS No. 10043-92-2

Thorium dioxide, CAS No. 1314-20-1

Tris(1-aziridinyl)phosphine sulfide (Thiotepa), CAS No. 52-24-4 (reclassified as a known carcinogen in 8<sup>th</sup> Annual Report)

Vinyl chloride, CAS No. 75-01-4 **[OSHA Regulated - see Appendix A]**

**Substances or groups of substances, occupational exposures associated with a technological process, and medical treatments which may reasonably be anticipated to be carcinogens:**

Acetaldehyde, CAS No. 75-07-0

2-Acetylaminofluorene, CAS No. 53-96-3

Acrylamide, CAS No. 79-06-1

Acrylonitrile, CAS No. 107-13-1

Adriamycin, CAS No. 23214-92-8

2-Aminoanthraquinone, CAS No. 117-79-3

o-Aminoazotoluene, CAS No. 97-56-3

1-Amino-2-methylantraquinone, CAS No. 82-28-0

Amitrole, CAS No. 61-82-5

o-Anisidine hydrochloride, CAS No. 134-29-2

Azacitidine (newly listed in 8<sup>th</sup> Annual Report)

Benzotrithloride, CAS No. 98-07-7

Beryllium and certain beryllium compounds:

Beryllium, CAS No. 7440-41-7  
Beryllium-aluminum alloy, CAS No. 12770-50-2  
Beryllium chloride, CAS No. 7787-47-5  
Beryllium fluoride, CAS No. 7787-49-7  
Beryllium hydroxide, CAS No. 13327-32-7  
Beryllium oxide, CAS No. 1304-56-9  
    Beryllium phosphate, CAS No. 13598-15-7  
    Beryllium sulfate, CAS No. 13510-49-1  
Beryllium sulfate tetrahydrate, CAS No. 7787-56-6  
Beryllium zinc silicate, CAS No. 39413-47-3  
Beryl ore, CAS No. 1302-52-9

Bischloroethyl nitrosourea, CAS No. 154-93-8

Bromodichloromethane, CAS No. 75-27-4

1,3-Butadiene, CAS No. 106-99-0

Butylated hydroxyanisole, CAS No. 25013-16-5

Cadmium and certain cadmium compounds:  
    Cadmium, CAS No. 7440-43-9  
    Cadmium chloride, CAS No. 10108-64-2  
    Cadmium oxide, CAS No. 1306-19-0  
    Cadmium sulfate, CAS No. 10124-36-4  
    Cadmium sulfide, CAS No. 1306-23-6

Carbon tetrachloride, CAS No. 56-23-5

Ceramic fibers of respirable size (no CAS Registry number assigned)

Chlorendic acid, CAS No. 115-28-6

Chlorinated paraffins, (C12, 60% chlorine), CAS No. 108171-26-2

1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea, CAS No. 13010-47-4

Chloroform, CAS No. 67-66-3

3-Chloro-2-methylpropene, CAS No. 563-47-3

4-Chloro-o-phenylenediamine, CAS No. 95-83-0

p-Chloro-o-toluidine (newly listed in 8<sup>th</sup> Annual Report)

p-Chloro-o-toluidine hydrochloride (newly listed in 8<sup>th</sup> Annual Report)

Chlorozotocin (newly listed in 8<sup>th</sup> Annual Report)

C.I. Basic Red 9 monohydrochloride, CAS No. 569-61-9

Cisplatin, CAS No. 15663-27-1

p-Cresidine, CAS No. 120-71-8

Cupferron, CAS No. 135-20-6

Dacarbazine, CAS No. 4342-03-4

Danthron (also known as Dantron) (newly listed in 8<sup>th</sup> Annual Report)

DDT (dichlorodiphenyltrichloroethane), CAS No. 50-29-3

2,4-Diaminoanisole sulfate, CAS No. 39156-41-7  
2,4-Diaminotoluene, CAS No. 95-80-7  
1,2-Dibromo-3-chloropropane, CAS No. 96-12-8  
1,2-Dibromoethane (ethylene dibromide), CAS No. 106-93-4  
1,4-Dichlorobenzene, CAS No. 106-46-7  
3,3'-Dichlorobenzidine, CAS No. 91-94-1 **[OSHA Regulated - see Appendix A]**  
3,3'-Dichlorobenzidine dihydrochloride, CAS No. 612-83-9 **[OSHA Regulated - see Appendix A]**  
1,2-Dichloroethane, CAS No. 107-06-2  
Dichloromethane (methylene chloride), CAS No. 75-09-2  
1,3-Dichloropropene (technical grade), CAS No. 542-75-6  
Diepoxybutane, CAS No. 1464-53-5  
Di(2-ethylhexyl) phthalate, CAS No. 117-81-7  
Diethyl sulfate, CAS No. 64-67-5  
Diglycidyl resorcinol ether, CAS No. 101-90-6  
3,3'-Dimethoxybenzidine, CAS No. 119-90-4  
3,3'-Dimethoxybenzidine dihydrochloride, CAS No. 20325-40-0  
4-Dimethylaminoazobenzene, CAS No. 60-11-7 **[OSHA Regulated - see Appendix A]**  
3,3'-Dimethylbenzidine, CAS No. 119-93-7  
Dimethylcarbamoyl chloride, CAS No. 79-44-7  
1,1-Dimethylhydrazine, CAS No. 57-14-7  
Dimethyl sulfate, CAS No. 77-78-1  
Dimethylvinyl chloride, CAS No. 513-37-1  
1,6-Dinitropyrene (newly listed in 8<sup>th</sup> Annual Report)  
1,8-Dinitropyrene (newly listed in 8<sup>th</sup> Annual Report)  
1,4-Dioxane, CAS No. 123-91-1  
Direct Black 38, CAS No. 1937-37-7  
Direct Blue 6, CAS No. 2602-46-2  
Disperse Blue 1 (newly listed in 8<sup>th</sup> Annual Report)  
Epichlorhydrin, CAS No. 106-89-8  
Estrogens (not conjugated): Estradiol-17 $\beta$ , CAS No. 50-28-2  
Estrogens (not conjugated): Estrone, CAS No. 53-16-7  
Estrogens (not conjugated): Ethinylestradiol, CAS No. 57-63-6  
Estrogens (not conjugated): Mestranol, CAS No. 72-33-3  
Ethyl acrylate, CAS No. 140-88-5

Ethylene oxide, CAS No. 75-21-8 **[OSHA Regulated - see Appendix A]**  
Ethylene thiourea, CAS No. 96-45-7  
Ethyl methanesulfonate, CAS No. 62-50-0  
Formaldehyde (gas), CAS No. 50-00-0 **[OSHA Regulated - see Appendix A]**  
Furan (newly listed in 8<sup>th</sup> Annual Report)  
Glasswool (respirable size) (no CAS Registry number assigned)  
Glycidol, CAS No. 556-52-5  
Hexachlorobenzene, CAS No. 118-74-1  
Hexachloroethane, CAS No. 67-72-1  
Hexamethylphosphoramide, CAS No. 680-31-9  
Hydrazine, CAS No. 302-01-2  
Hydrazine sulfate, CAS No. 10034-93-2  
Hydrazobenzene, CAS No. 122-66-7  
Iron dextran complex, CAS No. 9004-66-4  
Kepone® (chlordecone), CAS No. 143-50-0  
Lead acetate, CAS No. 301-04-2  
Lead phosphate, CAS No. 7446-27-7  
Lindane and other hexachlorocyclohexane isomers:  
    Hexachlorocyclohexane, technical grade, CAS No. 608-73-1  
     $\alpha$ -hexachlorocyclohexane, CAS No. 319-84-6  
    Lindane ( $\gamma$ -hexachlorocyclohexane), CAS No. 58-89-9  
     $\beta$ -hexachlorocyclohexane, CAS No. 319-85-7  
2-Methylaziridine (propyleneimine), CAS No. 75-55-8  
4,4'-Methylenebis(2-chloroaniline) (MBOCA), CAS No. 101-14-4  
4,4'-Methylenebis(N,N-dimethyl)benzenamine, CAS No. 101-61-1  
4,4'-Methylenedianiline, CAS No. 101-77-9  
4,4'-Methylenedianiline dihydrochloride, CAS No. 13552-44-8  
Methyl methanesulfonate, CAS No. 66-27-3  
n-Methyl-n'-nitro-n-nitrosoguanidine, CAS No. 70-25-7  
Metronidazole, CAS No. 443-48-1  
Michler's ketone, CAS No. 90-94-8  
Mirex, CAS No. 2385-85-5  
Nickel and certain nickel compounds:  
    Nickel, CAS No. 7440-02-0  
    Nickel acetate, CAS No. 373-02-4  
    Nickel carbonate, CAS No. 3333-67-3

Nickel carbonyl, CAS No. 13463-39-3  
Nickel hydroxide, CAS No. 12054-48-7 or 12125-56-3  
Nickelocene, CAS No. 1271-28-9  
Nickel oxide, CAS No. 1313-99-1  
Nickel subsulfide, CAS No. 12035-72-2  
Nitrilotriacetic acid, CAS No. 139-13-9  
o-Nitroanisole (newly listed in 8<sup>th</sup> Annual Report)  
6-Nitrochrysene (newly listed in 8<sup>th</sup> Annual Report)  
Nitrofen, CAS No. 1836-75-5  
Nitrogen mustard hydrochloride, CAS No. 55-86-7  
2-Nitropropane, CAS No. 79-46-9  
1-Nitropyrene (newly listed in 8<sup>th</sup> Annual Report)  
4-Nitropyrene (newly listed in 8<sup>th</sup> Annual Report)  
N-nitrosodi-n-butylamine, CAS No. 924-16-3  
N-nitrosodiethanolamine, CAS No. 1116-54-7  
N-nitrosodiethylamine, CAS No. 55-18-5  
N-nitrosodimethylamine, CAS No. 62-75-9 **[OSHA Regulated - see Appendix A]**  
N-nitrosodi-n-propylamine, CAS No. 621-64-7  
N-nitroso-n-ethylurea, CAS No. 759-73-9  
4-(n-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK), CAS No. 64091-91-4  
N-nitroso-n-methylurea, CAS No. 684-93-5  
N-nitrosomethylvinylamine, CAS No. 4549-40-0  
N-nitrosomorpholine, CAS No. 59-89-2  
N-nitrosornicotine, CAS No. 16543-55-8  
N-nitrosopiperidine, CAS No. 100-75-4  
N-nitrosopyrrolidine, CAS No. 930-55-2  
N-nitrososarcosine, CAS No. 13256-22-9  
Norethisterone, CAS No. 68-22-4  
Ochratoxin, CAS No. 303-47-9  
4,4'-Oxydianiline, CAS No. 101-80-4  
Oxymetholone, CAS No. 434-07-1  
Phenacetin, CAS No. 62-44-2  
Phenazopyridine hydrochloride, CAS No. 136-40-3  
Phenoxybenzamine hydrochloride, CAS No. 63-92-3  
Phenytoin, CAS No. 57-41-0

Polybrominated biphenyls (no separate CAS Registry number assigned)

Polychlorinated biphenyls, CAS No. 1336-36-3

Aroclor® 1260, CAS No. 11096-82-5

Aroclor® 1254, CAS No. 11097-69-1

Kanechlor® 500, CAS No. 25429-29-2

Polycyclic aromatic hydrocarbons:

Benz[a]anthracene, CAS No. 56-55-3

Benzo[b]fluoranthene, CAS No. 205-99-2

Benzo[j]fluoranthene, CAS No. 205-82-3

Benzo[k]fluoranthene, CAS No. 207-08-9

Benzo[a]pyrene, CAS No. 50-32-8

Dibenz[a,h]acridine, CAS No. 226-36-8

Dibenz[a,j]acridine, CAS No. 224-42-0

Dibenz[a,h]anthracene, CAS No. 53-70-3

7H-Dibenzo[c,g]carbazole, CAS No. 194-59-2

Dibenzo[a,e]pyrene, CAS No. 192-65-4

Dibenzo[a,h]pyrene, CAS No. 189-64-0

Dibenzo[a,i]pyrene, CAS No. 189-55-9

Dibenzo[a,l]pyrene, CAS No. 191-30-0

Indeno[1,2,3-cd]pyrene, CAS No. 193-39-5

5-Methylcrysene, CAS No. 3697-24-3

Procarbazine hydrochloride, CAS No. 366-70-1

Progesterone, CAS No. 57-83-0

1,3-Propane sultone, CAS No. 1120-71-4

β-Propiolactone, CAS No. 57-57-8 **[OSHA Regulated - see Appendix A]**

Propylene oxide, CAS No. 75-56-9

Propylthiouracil, CAS No. 51-52-5

Reserpine, CAS No. 50-55-5

Saccharin, CAS No. 128-44-9

Safrole, CAS No. 94-59-7

Selenium sulfide, CAS No. 7446-34-6

Silica, crystalline (respirable size):

Crystobalite, CAS No. 14464-46-1

Quartz, CAS No. 14808-60-7

Tridymite, CAS No. 15468-32-5

Streptozotocin, CAS No. 18883-66-4

Sulfallate [diethyldithiocarbamic acid 2-chloroallyl ester], CAS No. 95-06-7

2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), CAS No. 1746-01-6

Tetrachloroethylene (perchloroethylene), CAS No. 127-18-4

Tetranitromethane, CAS No. 509-14-8

Thioacetamide, CAS No. 62-55-5

Thiourea, CAS No. 62-56-6

Toluene diisocyanate, CAS No. 26471-62-5

o-Toluidine, CAS No. 95-53-4

o-Toluidine hydrochloride, CAS No. 636-21-5

Toxaphene, CAS No. 8001-35-2

2,4,6-Trichlorophenol, CAS No. 88-06-2

1,2,3-Trichloropropane (newly listed in 8<sup>th</sup> Annual Report)

Tris(2,3-dibromopropyl) phosphate, CAS No. 126-72-7

Urethane\*, CAS No. 51-79-6

4-Vinyl-1-cyclohexene diepoxide, CAS No. 106-87-6

\* The name urethane is sometimes applied to high molecular weight polyurethanes used as foams, elastomers, and coatings. Such products are not made from the chemical urethane and do not generate it upon decomposition.

**Occupational exposures associated with a technological process that are known to be carcinogenic:**

Coke oven emissions (no CAS registry number assigned) **[OSHA Regulated - see Appendix A]**

Soots, tars, and mineral oils (no CAS registry number assigned)

Information on chemicals in *The Eighth Report on Carcinogens, 1998 Summary* is available on-line at: <http://eihs.niehs.nih.gov/roc/toc8.html>