

CHEMICAL HAZARDS

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Chemicals are considered hazardous if they pose either *PHYSICAL* or *HEALTH* hazards to workers exposed to them.

PHYSICAL HAZARDS include:

- Fire or explosions
- Sudden releases of pressure (for example what happens when a tank of compressed gas is punctured) and:
- Reactivity (if a chemical can burn, explode or release dangerous gases after contact with water, air or other chemicals).

HEALTH HAZARDS are illnesses or other health problems that could develop as a result of exposure to a hazardous chemical. Health hazards could be as minor as a headache or mild skin irritation or as major as cancer (or in rare cases, death)

HAZARD TYPES

CORROSIVE—substances that by direct chemical action are injurious to body tissue or corrosive to metal. Corrosive injury may be to a minor degree (irritation) or actual physical disruption of the body tissues.

COMMON CORROSIVE LIQUIDS

<u>INORGANIC ACIDS</u>	<u>ORGANIC ACIDS</u>	<u>OTHER INORGANICS</u>
Chlorosulfonic	Acetic	Bromine
Chromic	Butyric	Phosphorous Trichloride
Hydrochloric	Chloroacetic	Silicon Tetrachloride
Nitric	Formic	Sulfuryl Chloride
Sulfuric		Thionyl Chloride
		Peroxides

<u>CAUSTIC SOLUTIONS</u>	<u>ORGANIC SOLVENTS</u>	<u>OTHER ORGANICS</u>
Ammonia	Dichlorethylene	Acetic Anhydride
Sodium Hydroxide	Ethylene Chlorohydrin	Liquefied Phenol
Potassium Hydroxide	Perchloroethylene	Triethanolamine
Methyl Ethyl Ketone	2-Aminoethanol	Gasoline

HAZARDS AND PRECAUTIONARY MEASURES

Everyone knows mineral acids can cause burns. Few persons realize the extent to which they can damage body tissue. The concentration and duration of exposure control the degree of injury. The primary modes of attack of corrosive liquids are the skin and eyes.

Concentrated alkaline solutions have a more corrosive effect on tissue than most strong acids. Initial contact may not be painful. Strong alkalis gelatinize tissue thereby

producing deep painful penetrating burns. Even relatively dilute alkaline solutions can dissolve skin fats, soften the epidermis and sensitize the skin to other chemicals. In the eyes, caustics are extremely destructive and more difficult to remove than acids. In fact, isotonic solutions of sodium hydroxide (2%) cause irreparable damage to the eye within three minutes. Concentrated solutions, 50% or greater can cause irreparable damage within fifteen seconds.

Always wear adequate protective equipment (gloves, goggles, face shield, etc.). If the danger of inhaling corrosive fumes exists, wear suitable respiratory protection. Immediate first aid must include flushing with large amounts of cool water for a minimum of 15 minutes followed by medical attention. Do not rub the skin.

If caustic material gets into the eye, it is imperative that the eyes are washed out immediately with water for a **minimum of 15 minutes** before leaving the area to seek medical attention. Seconds count!

CORROSIVE SOLIDS

The effects of corrosive solids are largely dependent on their solubility in skin, respiratory moisture and on the duration of contact. Some compounds do have a specific ability to penetrate the skin. Besides the corrosive properties of solids, the heat of the solution is often an important factor in damaging tissues.

COMMON CORROSIVE SOLIDS

<u>ALKALIS</u>	<u>ORGANIC ACIDS</u>	<u>METAL SALTS</u>
Calcium oxide	Oxalic	Tin (IV) chloride
Sodium	Calcium hydroxide	Phenol
Phosphorous pentoxide	Potassium	Cement
Salicylic	Potassium chromate	Lithium
Sodium Hydroxide	Trichloroacetic	Mercury (II) chloride
Phosphorous	Sodium peroxide	Iodine
Sodium phosphate		

HAZARDS AND PRECAUTIONARY MEASURES

As with liquids, adequate protective equipment should be worn. Of primary importance is the use of adequate respiratory protection. Protective equipment for the skin and eyes is necessary. Full eye protection is particularly important. All gases and vapors from corrosive liquids or solids cause severe eye irritation or damage. Skin and eyes contacted by corrosive gases and vapors should be washed off thoroughly as suggested for liquids. A good exhaust system is highly recommended for those areas where corrosive gases may be encountered. Immediate medical attention should be sought when exposure occurs. First aid must include flushing with large amounts of cool water for a minimum of 15 minutes.

FLAMMABLE CHEMICALS

Flammable Liquids-any liquid having a flashpoint below 100 °F except any mixture having components with flash points of 100 °F. Flammable solvents are the most common source of fire.

NECESSARY COMPONENTS FOR INITIATING FIRE

<u>FUELS</u>	<u>OXIDIZERS</u>	<u>IGNITION SOURCES</u>
<u>Flammable Liquids</u>	<u>Gases</u>	
Acetone	Oxygen	Sparks
Alcohol	Fluorine	Flames
Hexane	Nitrous Oxide	Static Electricity
Ether	Oxygen Difluoride	Heat
Toluene	Ozone	Electrical
<u>Flammable Solids</u>	<u>Liquids</u>	
Plastics	Hydrogen Peroxide 30%	Cigarettes
Fibers	Nitric Acid	Light Bulbs
Wood/Paper	Perchloric Acid	Heaters
Dusts	Bromine	Lightning
Pyrophoric Metals		Catalytic Surfaces
<u>Flammable Gases</u>	<u>Solids</u>	
Acetylene	Metallic	Lasers
Propane	Perchlorates	Self Heating
Carbon Monoxide	Metallic Peroxides	
Hydrogen	Ammonium Nitrate	
Ethylene Oxide	Ammonium Nitrite	

COMMON CONTROL MEASURES

- DO NOT store more than a total of 5 gallons of solvents in a laboratory.
- Transfer solvents in a working fume hood.
- Eliminate all sources of ignition.
- Store solvents in a cool area, maximum temperature of 80 °F.
- Transport solvents in metal, plastic buckets or other protective containers.

Flammable solids are solids that can cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing. Flammable solids can ignite readily and burn so vigorously and persistently creating a serious hazard

Flammable solids can form explosive mixtures in the atmosphere and react in much the same way as flammable gases. Dust accumulated on surfaces and can be fanned into the air by a fire or even an improperly chosen fire extinguisher.

Dangers from flammable solids (dust) can be minimized by:

- ❖ Using dust tight containers.
- Using adequate ventilation.
- Using proper fire extinguishers.
- **Isolation from ignition sources**

REACTIVE CHEMICALS

Reactive chemicals -substances that can cause violent reactions that liberate heat and/or gases too rapidly to be safely dissipated by the surroundings.

Reactive chemicals can be categorized into two groups:

Unstable Compounds

Unstable Mixtures

UNSTABLE COMPOUNDS

a. Explosives

Explosives are substances that decompose with violent rapidity releasing large quantities of gases and heat. The process of explosion causes the rapid expansion of surrounding air accompanied by burning gases and flying objects. This process is usually destructive to both life and property. High explosives detonate at rates up to four miles per second, while low explosives detonate at rates of only thousands of feet per second.

COMMON EXPLOSIVE COMPOUNDS

Acetylenic Compounds

- Acetylene**
- Copper (I) Acetylide**
- Ethoxyacetylene**
- Propylene**

Azide Compounds

- Benzenesulphonyl azide**
- Carbonyl Diazide**
- Silver Azide**
- Lead (II) Azide**
- Sodium Azide**

Azo Compounds

- **Diazirine**
- **Azomethane**
- **Diazomethane**

Chlorite/Chlorate/Perchlorates

- Silver Chlorite**
- Silver Chlorate**
- Sodium Perchlorate**
- Magnesium Perchlorate**

Fulminates

- **Silver Fulminate**
- **Mercury (II) Fulminate**
- **Sodium Fulminate**
- **Copper (II) Fulminate**

Nitro Compounds/Nitrate Esters

- Nitromethane**
- Nitroglycerine**
- Nitrocellulose**
- Trinitrotoluene**

Picrates

- **Picric Acid**
- **Lead Picrate**

Peroxides

- Diacetyl Peroxide**
- Zinc Peroxide**
- Dimethyl Peroxide**

Polymerizable Compounds

- | | |
|-----------------------|------------------------|
| • Acrylic Acid | Styrene |
| • Ethylene | Vinyl Chloride |
| • Butadiene | Cyclopentadiene |

UNSTABLE MIXTURES

a. Explosives

1. Nitroglycerine and Ammonium Nitrate
2. Nitroglycerine and Potassium Nitrate

b. Water-Reactive Chemicals

Compounds that are water reactive should not be stored where automatic sprinkler systems are installed. No water should service the storage area. The storage area should be placarded with “DO NOT USE WATER” signs. They should be properly desiccated whenever possible. Store in a cool, waterproof area.

WATER REACTIVE COMPOUNDS

Alkali Metals	Lithium, Sodium
Organometallic Compounds	Tetramethylaluminum
Halides	Acetyl chloride, Titanium tetrachloride
Hydrides	Diborane, Sodium hydride
Peroxides	Sodium peroxide
Carbides	Calcium carbide
Oxides	Sodium oxide
Phosphides	Aluminum phosphide
Anhydrides	Acetic anhydride

c. Peroxidizable Chemicals

- Peroxidizable chemicals are those chemicals that are susceptible to dangerous decomposition. Since these chemicals are packaged in an air atmosphere, peroxides can form even though the container has not been opened. Peroxidizable chemicals should be dated upon receipt. Containers, which show signs of iron or copper oxide should be handled with extra precautions since many metal oxide promote peroxide formation.

Peroxide-Forming Compounds

(Hazard on Storage)	(Hazard on Concentration)	(Peroxide Initiation of Polymerization)
(A)	(B)	(C)
Isopropyl Ether	Ethyl Ether	Styrene
Divinyl Acetylene	Tetrahydrofuran	Butadiene
Vinylidene Chloride	Dioxane	Tetrafluoroethylene
Potassium Metal	Acetal	Chlorotrifluoroethylene
Sodium Amide	Vinyl Ethers	Vinyl Acetylene
	2-Butanol	Vinyl Acetate
	2-Propanol	Vinyl Pyridine
	Cyclohexene	Chloroprene
	Cumene	
	Methylcyclopentane	
	Methyl Acetylene	
	Diacetylene	
	Dicyclopentadiene	

Air Sensitive Compounds

Air sensitive compounds are those that react spontaneously with the oxygen in the air. These compounds usually are pyrophoric—they burst into flames on contact with air.

AIR SENSITIVE COMPOUNDS

- Metallic dust (zinc, nickel, titanium)
- Alkali metals (cesium, potassium)
- Hydrides (barium hydride)
- Others (sodium amide, sodium and many organometallics)

Pyrophoric metals such as finely divided nickel and titanium should be stored in metal containers with some moisture. Other solids are frequently stored under an inert gas or liquid.

Strong Oxidizing Agents and Strong Reducing Agents

Oxidizers are chemicals, other than blasting agents or explosives, which initiates or promotes combustion in other materials causing fire through the release of oxygen or other gases. An oxidizing agent is a chemical that gives off free oxygen in a chemical reaction.

STRONG OXIDIZERS

- Fluorine
- Chlorine
- Peroxides
- Perchlorates
- Permanganates
- Nitrates
- Ozone
- Persulfates
- Peroxy Acids
- Dichromates
- Hypochlorites
- Nitrites

- Nitrous Oxide
- Liquid Air
- Nitromethane
- Liquid Oxygen
- Chlorosulfonic acid
- Chorates

Reducing Agents are agents that cause reduction and is oxidized.

STRONG REDUCERS

- Finely divided metals
- Hydrides
- Aniline
- Lithium
- Butadiene
- Hydrazine
- Hydrogen
- Sodium
- Potassium
- Acetylides

All oxidizers carry the special NFPA symbol **OXY**. Reducers carry no special warning.

PRECAUTIONARY MEASURES

- Isolate reactive chemicals. Store compounds of the same class together, away from other classes.
- For water-sensitive chemicals, do not allow water in the storage area, or water type fire extinguisher and sprinklers
- Store reactive chemicals in a cool, dry area, protect from sunlight, and label with out-of-date dates
- Protect reactive chemicals from shock.
- Store away from flammable and toxic materials.
- Wear adequate personal protective equipment.
- Train workers thoroughly in the hazards of the chemicals they are working with.
- Have antidotes, neutralizers, fire-fighting equipment, etc., close at hand in case of emergency.

COMMON REACTIVE CHEMICALS

Ammonium Nitrate	Ammonium Perchlorate
Benzoyl Peroxide	2-Butanone Peroxide
Tert-Butyl Hydroperoxide	tert-Butyl Peroxide
Calcium Hydride	Cesium
Chromium Nitrate	Chromium Trioxide
Diborane	Diethylaluminum Hydride
Dimethyl Phosphine	m-Dinitrobenzene
p-Dinitrobenzene	Hydrazine
Hydrazine Hydrate	Hydrogen Peroxide (concentrated)
Magnesium Perchlorate	Mercury (I) Perchlorate
Nitromethane	o-Nitrotoluene
p-Nitrotoluene	Peroxides
Phosphorous (red)	Picric Acid
Potassium	Trinitrotoluene

Shock Sensitive Chemicals

Shock sensitive refers to the susceptibility of the chemical to rapidly decompose or explode when struck, vibrated or otherwise agitated. Some chemicals become increasingly shock sensitive with age. **Write the date received and date opened on all containers of shock sensitive chemicals.** Unless the manufacturer added an inhibitor, closed containers of shock sensitive materials should be discarded after 1 year. Open containers of shock sensitive chemicals should be discarded within 6 months of opening. The label and MSDS will indicate if a chemical is shock sensitive.

SHOCK SENSITIVE CHEMICALS

- Acetylides of heavy metals
- Aluminum ophorite explosive
- Amatol
- Ammonal
- Ammonium Nitrate
- Ammonium Perchlorate
- Ammonium Picrate
- Ammonium Salt Lattice
- Butyl Tetryl
- Calcium Nitrate
- Copper Acetylde
- Cyanuric trazide
- Cyclotrimethylenetrinitramine
- Cyclotetramethylenetranitramine
- Dinitroethyleneurea
- Dinitroglycerine
- Dinitrophenol
- Dinitrophenolates
- Dinitrophenyl hydrazine
- Dinitrotoluene
- Dipicyl sulfone
- Dipicrylamine
- Erythritol tetranitrate
- Fulminate of Mercury
- Fulminate of Silver
- Fulminating Gold
- Fulminating Mercury
- Fulminating Platinum
- Fulminating Silver
- Gelatinized Nitrocellulose
- Guanyl nitrosamino guanyltetrazene
- Guanyl Nitrosaminoguanilydene
- Germane
- Hexanite Explosive Mixtures
- Hexanitrodiphenylamine
- Hexogen
- Hydrazinium Nitrate
- Hydrazoic acid
- Heavy Metal Azides
- Mercury Tartrate
- Mononitrotoluene
- Nitrated Carbohydrate
- Nitrated Glucoside
- Nitrated Polyhydric Alcohol
- Nitrogen Trichloride
- Nitrogen Tri-Iodide
- Nitroglycerine
- Nitroglycide
- Nitroglycol
- Nitroguanidine
- Nitroparaffins
- Nitronium perchlorate
- Nitrourea
- Organic Amine Nitrate
- Organic Nitrosamines
- Organic Peroxides
- Picramic acid
- Picramide
- Picratol
- Picric acid
- Picryl Chloride
- Picryl Fluoride
- Polynitro aliphatic compounds
- Potassium nitroaminotetrazole
- Silver acetylde
- Silver Azide
- Silver Styphnate
- Silver Tetrazene
- Sudatol
- Sodium Amatol
- Sodium Dinitro-o-cresolate
- Sodium Nitrate-potassium
- Sodium picramate
- Tetrazene
- Tetranitrocarbazole
- Tetrytol
- Trimonite
- Trinitroanisole

- Lead Azides
 - Lead Mannite
 - Lead Mononitrosocinate
 - Lead Picrate
 - Lead Salts
 - Lead Styphnate
 - Magnesium ophorite
 - Mannitol Hexanitate
 - Mercury Oxalate
- Trinitrobenzene
 - Trinitrobenzoic acid
 - Trinitrocresol
 - Trinitro-m-cresol
 - Trimethylolethane
 - Trinitronaphthalene
 - Trinitrophenetol
 - Trinitrophenol
 - Trinitroresorcinol
 - Tritonal
 - Urea Nitrate

TOXIC CHEMICALS/CARCINOGENS

Toxic chemicals are any chemical which “when inhaled, ingested or absorbed may cause damage or disturbance to function.” Toxic substances may cause injury by damaging biological structure and/or disturbing body function.

1. Damage can be LOCAL and/or SYSTEMIC.

Local toxicity-is the effect of a substance on the body area that has been exposed to the substance. Exposure may be through direct contact, inhalation, ingestion or penetration.

Systemic toxicity-is the effect of a substance on body tissues after absorption into the bloodstream. Absorption may take place through the skin, stomach or lungs.

1. Damage can be ACUTE and/or CHRONIC.

Acute toxicity is defined as that effect manifested on “short exposure” on single contact, ingestion or inhalation.

Chronic toxicity is defined as that effect observed when a toxicant acts on body tissues over a “long” period of time, days to years. A person suffering from chronic toxicity may not observe effects until an advanced stage is reached and permanent damage has been done.

PARAMETERS THAT AFFECT TOXICITY

- Routes of entry—Commonly, toxic materials contact the skin, eye, respiratory tract and/or digestive system.
- Physical Condition—Are you ill? Has your body been damaged by a previous assault?
- Dose—How much of the chemical assaulted your system?
- Duration—How long were you exposed to the chemical?
- Sensitivity—How sensitive are you to the chemical?
- Combined Effects—What other chemicals were you exposed to?
- Stress—Were you under any physical or mental stress during or after the exposure.
- Others—Sex, race, heredity, temperature, altitude and a host of additional parameters sometimes affect toxicity.

COMMON MODES OF ENTRY FOR TOXIC CHEMICALS

SKIN—The skin is the most frequently exposed body tissue to poisons. The most common result is irritation. Many toxic chemicals, however, are rapidly absorbed through the skin and may cause systemic effects. Toxic contamination of the clothing and shoes increases the hazard because of the localization of toxic concentration. Pain sensations do not necessarily accompany an assault on the skin.

NOSE (Inhalation)—The internal surface area of the lungs is estimated to be greater than 100 m², thus allowing rapid absorption of poisons into the bloodstream. Absorption rate and activity are related—the more active the person, the faster the absorption. Many toxic chemicals reveal their presence by giving sensory warnings, such as pain or smell. These sensory effects can be useful because immediate action can be taken. However, the sense of smell may become aware of danger after the fact, or may not respond at all. Olfactory fatigue may prevent detection of toxic materials. Sensory warning is a useful backup, but should not be relied on as a fast line of defense.

EYES—Very few substances are safe when in contact with the eye. The sensitivity of the eye to chemicals is such that irritation, pain, impairment of vision or even blindness can result.

INGESTION

INJECTION—Purposeful injection of poisons can occur through mechanical injury--a cut.

PREVENTIVE MEASURES

- Unless you know definitely that a substance is not toxic, treat it as though it is.
- Cover exposed areas of skin (wear gloves, aprons, caps, etc.).
- Wear appropriate personal protective equipment for the compound
- Change protective garments as required.
- Keep food out of the lab. Do not use lab glassware for food or drink.
- Train all personnel thoroughly.

SOME COMMON POISONOUS CHEMICALS

Acetaldehyde	Acrylamide	Barium & Barium Cmpds
1,3-Butanediene	Cadmium & Cadmium Cmpds	
Carbon Tetrachloride	Chloroform	DDT
1,4-Dichlorobenzene	1,2-Dichloroethane	Dichloromethane
1,1-Dimethylhydrazine	Eprichlorohydrin	Ethyl Acetate
1,4-Dioxane	Formaldehyde	Ethylene Oxide
Lead & Lead Cmpds	Mercury & Mercury Cmpds.	Silver

Assume that a new compound or research chemical is poisonous unless proven otherwise.

Guidelines for Working with Carcinogens

In January 2005, the U.S. Department of Health and Human Services released an updated report on cancer-causing agents. The DHHS listing (attached) includes 58 “known” human carcinogens and 188 substances “reasonably anticipated” to be human carcinogens. Several of the chemical substances found on this list are found in University laboratories. PIs and laboratory supervisors must take precautions to prevent carcinogen exposures to personnel and releases to the environment. This guideline promotes the safe use of carcinogens through the recognition, evaluation and control of exposures in all laboratories at the University of Pittsburgh.

- 1. Recognition:** Laboratory supervisors and PIs should review their protocols and chemical inventories to identify chemical carcinogens. When chemical carcinogens are recognized in a lab, distinctive labeling shall be used to identify the special hazards associated with that material. Lab personnel should be trained on proper techniques for safely handling and storage of chemical carcinogens.
- 2. Evaluation:** Personal exposures to any hazardous chemicals, including carcinogens are dependent on the:
 - quantity of chemical,
 - concentration in air or in solutions,
 - duration of exposure,
 - physical or chemical properties of the carcinogen,
 - potential for exposure via inhalation, ingestion or skin absorption.
 - availability and use of feasible control measures.

Each of these points should be considered for an effective evaluation.

- 3. Control** of carcinogen exposure should always follow a hierarchy for implementation:
 - Engineering controls such as chemical fume hoods, local exhausts or scavenger systems are highly recommended.
 - Administrative controls, including written procedures for carcinogen use and disposal, substitution of less hazardous substances and reduced carcinogen quantities.
 - Personnel protective equipment (PPE) including lab coats, gloves, aprons, respirators, eye and face protection.

Laboratory practice has demonstrated that even the most hazardous chemicals can be handled safely if the health risks are understood and exposures are controlled. Good planning, proper facilities, defined work practices and adequate training are key issues to keep researchers safe when working with chemical carcinogens in the lab.

Carcinogens Listed in the Eleventh Report

Part A. Known to be Human Carcinogens.

Name or synonym	Page No. III-
Aflatoxins	8
Alcoholic Beverage Consumption	10
4-Aminobiphenyl	13
Analgesic Mixtures Containing Phenacetin (See Phenacetin and Analgesic Mixtures Containing Phenacetin)	212
Arsenic Compounds, Inorganic	18
Asbestos	21
Azathioprine	25
Benzene	26
Benzidine (See Benzidine and Dyes Metabolized to Benzidine)	28
Beryllium and Beryllium Compounds	32
1,3-Butadiene	37
1,4-Butanediol Dimethanesulfonate (Myleran®)	39
Cadmium and Cadmium Compounds	42
Chlorambucil	47
1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea (MeCCNU)	53
bis(Chloromethyl) Ether and Technical-Grade Chloromethyl Methyl Ether	56
Chromium Hexavalent Compounds	63
Coal Tar Pitches (See Coal Tars and Coal Tar Pitches)	68
Coal Tars (See Coal Tars and Coal Tar Pitches)	68
Coke Oven Emissions	71
Cyclophosphamide	74
Cyclosporin A	75
Diethylstilbestrol	98
Dyes Metabolized to Benzidine (See Benzidine and Dyes Metabolized to Benzidine)	29
Environmental Tobacco Smoke (See Tobacco Related Exposures)	251
Erionite	114
Estrogens, Steroidal	115
Ethylene Oxide	118
Hepatitis B Virus	131
Hepatitis C Virus	133
Human Papillomas Viruses: Some Genital-Mucosal Types	142
Melphalan	164
Methoxsalen with Ultraviolet A Therapy (PUVA)	165
Mineral Oils (Untreated and Mildly Treated)	174
Mustard Gas	176
2-Naphthylamine	179
Neutrons (See Ionizing Radiation)	150
Nickel Compounds (See Nickel Compounds and Metallic Nickel)	181
Radon (See Ionizing Radiation)	152
Silica, Crystalline (Respirable Size)	231
Smokeless Tobacco (See Tobacco Related Exposures)	253
Solar Radiation (See Ultraviolet Radiation Related Exposures)	266
Soots	233
Strong Inorganic Acid Mists Containing Sulfuric Acid	234
Sunlamps or Sunbeds, Exposure to (See Ultraviolet Radiation Related Exposures)	266
Tamoxifen	239
2,3,7,8-Tetrachlorodibenzo- <i>p</i> -dioxin (TCDD); "Dioxin"	241
Thiotepa	249
Thorium Dioxide (See Ionizing Radiation)	154
Tobacco Smoking (See Tobacco Related Exposures)	255
Vinyl Chloride	272
Ultraviolet Radiation, Broad Spectrum UV Radiation (See Ultraviolet Radiation Related Exposures)	266
Wood Dust	276
X-Radiation and Gamma Radiation (See Ionizing Radiation)	147

Bold entries indicate new or changed listing in *The Report on Carcinogens, Eleventh Edition*.

CARCINOGENS LISTED IN THE ELEVENTH REPORT

Part B. Reasonably Anticipated to be a Human Carcinogen.

Name or synonym	Page No. III-
Acetaldehyde	1
2-Acetylaminofluorene	3
Acrylamide	4
Acrylonitrile	6
Adriamycin® (Doxorubicin Hydrochloride)	8
2-Aminoanthraquinone	12
<i>o</i> -Aminoazotoluene	12
1-Amino-2,4-dibromoanthraquinone	15
1-Amino-2-methylantraquinone	16
2-Amino-3,4-dimethylimidazo[4,5-<i>f</i>]quinoline (MeIQ)	135
2-Amino-3,8-dimethylimidazo[4,5-<i>f</i>]quinoxaline (MeIQx)	135
2-Amino-3-methylimidazo[4,5- <i>f</i>]quinoline (IQ)	136
2-Amino-1-methyl-6-phenylimidazo[4,5-<i>b</i>]pyridine (PhIP)	136
Amitrole	16
<i>o</i> -Anisidine Hydrochloride	17
Azacitidine (5-Azacytidine®, 5-AzaC)	24
Benz[<i>a</i>]anthracene (See Polycyclic Aromatic Hydrocarbons)	220
Benz[<i>b</i>]fluoranthene (See Polycyclic Aromatic Hydrocarbons)	220
Benz[<i>j</i>]fluoranthene (See Polycyclic Aromatic Hydrocarbons)	220
Benz[<i>k</i>]fluoranthene (See Polycyclic Aromatic Hydrocarbons)	220
Benz[<i>a</i>]pyrene (See Polycyclic Aromatic Hydrocarbons)	220
Benzotrichloride	31
Bromodichloromethane	35
2,2-bis-(Bromoethyl)-1,3-propanediol (Technical Grade)	36
Butylated Hydroxyanisole (BHA)	40
Carbon Tetrachloride	44
Ceramic Fibers (Respirable Size)	46
Chloramphenicol	48
Chlorendic Acid	50
Chlorinated Paraffins (C ₁₂ , 60% Chlorine)	51
1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea	52
bis(Chloroethyl) nitrosourea	53
Chloroform	54
3-Chloro-2-methylpropene	57
4-Chloro- <i>o</i> -phenylenediamine	58
Chloroprene	59
<i>p</i> -Chloro- <i>o</i> -toluidine and <i>p</i> -Chloro- <i>o</i> -toluidine Hydrochloride	60
Chlorzotocin	62
C.I. Basic Red 9 Monohydrochloride	66
Cisplatin	67
Cobalt Sulfate	70
<i>p</i> -Cresidine	72
Cupferron	73
Dacarbazine	76
Danthron (1,8-Dihydroxyanthraquinone)	77
2,4-Diaminoanisole Sulfate	78
2,4-Diaminotoluene	79
Diazoaminobenzene	80
Dibenz[<i>a,h</i>]acridine (See Polycyclic Aromatic Hydrocarbons)	220
Dibenz[<i>a,j</i>]acridine (See Polycyclic Aromatic Hydrocarbons)	220
Dibenz[<i>a,h</i>]anthracene (See Polycyclic Aromatic Hydrocarbons)	220
7 <i>H</i> -Dibenzo[<i>c,g</i>]carbazole (See Polycyclic Aromatic Hydrocarbons)	220
Dibenzo[<i>a,e</i>]pyrene (See Polycyclic Aromatic Hydrocarbons)	220
Dibenzo[<i>a,h</i>]pyrene (See Polycyclic Aromatic Hydrocarbons)	220
Dibenzo[<i>a,i</i>]pyrene (See Polycyclic Aromatic Hydrocarbons)	220
Dibenzo[<i>a,l</i>]pyrene (See Polycyclic Aromatic Hydrocarbons)	220
1,2-Dibromo-3-chloropropane	81
1,2-Dibromoethane (Ethylene Dibromide)	82
2,3-Dibromo-1-propanol	84
tris(2,3-Dibromopropyl) Phosphate	84
1,4-Dichlorobenzene	85
3,3'-Dichlorobenzidine and 3,3'-Dichlorobenzidine Dihydrochloride	87
Dichlorodiphenyltrichloroethane (DDT)	89
1,2-Dichloroethane (Ethylene Dichloride)	90
Dichloromethane (Methylene Chloride)	91
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