SAFETY in the Chemical Laboratory

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...a Chem Ed feature

XLVI. Hazardous Chemicals Data* (*Continued*)

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Editor's Note:

This issue continues the examples of chemical information recorded in "Hazardous Chemical Data," NFPA No. 49.

Special permission was obtained to reprint these examples and the explanatory section in the previous issue, because it is our opinion that "Hazardous Chemicals Data" should be known and used as a reference in teaching, clinical, and research laboratories.

ACETYLENE CH:CH

Dissolved in Acetone in Closed Cylinder

Description: Colorless gas with slight garliclike odor.

Fire and Explosion Hazards: Flammable gas. Forms explosive mixtures with air over a very wide range. Flammable limits, 2.5 and 81%. Ignition temperature is comparatively low and varies according to mixture composition, pressure, water vapor content, and initial temperature; minimum ignition temperature is about 571°F. Lighter than air (vapor density, 0.9). Acetylene not dissolved in acetone is unstable at high pressures and may decompose into hydrogen and carbon with explosive violence. Generation, distribution through hose or piping, or utilization of acetylene should be maintained at a pressure less than 15 psi gage. Under certain conditions, acetylene forms explosive compounds with copper, silver, and mercury. Also forms spontaneously explosive acetylene chloride with chlorine.

Life Hazard: Nontoxic but can cause asphyxiation by exclusion of oxygen.

Fire Fighting Phases: Stop flow of gas. Use water to keep containers cool. Do not extinguish unless necessary to effect an immediate shutoff of flow. Dry chemical and carbon dioxide can be used to extinguish acetylene fires.

Usual Shipping Containers: Steel cylinders, 10 to 300 standard cubic feet capacity, containing a porous material and acetone.

Storage: Protect against physical damage. Isolate from oxidizing gases, especially chlorine. Store in cool, well-ventilated, noncombustible place away from all possible sources of ignition and combustible materials. Protect against lightning and static electricity.

Remarks: Only Class I, Group A electrical equipment permitted in atmospheres containing acetylene. See Standard for the Installation and Operation of Gas Systems for Welding and Cutting (NFPA No. 51), Explosion Venting Guide (NFPA No. 68), National Electrical Code (NFPA No. 70), Static Electricity (NFPA No. 77), Lightning Protection Code (NFPA No. 78), Fire-Hazard Properties of Flammable Liquids, Gases and Volatile Solids (NFPA No. 325M) and Chemical Safety Data Sheet SD-7 (Manufacturing Chemists' Association, Inc.).

ACRYLONITRILE CH_2CHCN

Description: A colorless liquid with faintly pungent odor.

Fire and Explosion Hazards: Flammable liquid. Vapor forms explosive mixtures with air. Flammable limits, 3 and 17%. Flash point, 32°F (open cup). Dilute solutions also are hazardous: Flash point of 2% in water, 70°F; 3% in water, 54°F; 5% in water, less than 48°F. Ignition temperature, 898°F. Liquid is lighter than water (specific gravity, 0.8). Vapor is heavier than air (vapor-air density at 100°F, 1.2) and may travel a considerable distance to a source of ignition and flash back. Violent polymerization occurs in presence of concentrated caustic alkali. In very pure state, may polymerize spontaneously with evolution of heat, especially on exposure to light, but is usually inhibited against this. At elevated temperatures, such as in fire conditions, polymerization may take place. If the polymerization takes place in a container there is possibility of violent rupture of the container.

Life Hazard: Toxic by inhalation, ingestion, or skin absorption. Threshold limit value, 20 parts per million. Wear special protective clothing. If accidental contamination occurs, flush with copious quantities of water.

Fire Fighting Phases: Use dry chemical, "alcohol" foam, or carbon dioxide. Wear special protective clothing.

Usual Shipping Containers: Lined pails, drums, tank cars and tank trucks.

Storage: Protect against physical damage. Outside or detected storage is preferable. Inside storage should be in a standard flammable liquids storage room or cabinet; no alkaline materials such as caustics, ammonia, or amines, or oxidizing materials permitted in storage room or cabinet. Do not store uninhibited acrylonitrile under any conditions. Store drums on end with bungs up, no more than two high. Outside tanks should be above ground and surrounded with dikes of sufficient capacity to hold entire tank contents. Acrylonitrile vapors are uninhibited and may form polymers in vents or flame arresters of storage tanks, resulting in stoppage of vents.

Remarks: Electrical installations in Class I hazardous locations, as defined in Article 500 of the National Electrical Code, should be in accordance with Article 501 of the Code; and electrical equipment should be suitable for use in atmospheres containing acrylonitrile vapors. See Flammable and Combustible Liquids Code (NFPA No. 30), National Electrical Code (NFPA No. 70), Static Electricity (NFPA No. 77), Lightning Protection Code (NFPA No. 78), Fire-Hazard Properties of Flammable Liquids, Gases and Volatile Solids (NFPA No. 325 M) and Chemical Safety Data Sheet SD-31(Manufacturing Chemists' Association, Inc.).

ANILINE $C_6H_5NH_2$

Description: Colorless oily liquid with a characteristic odor. Darkens on exposure to air.

Fire and Explosion Hazards: Combustible liquid. Flash point, 158°F. Vapor forms explosive mixtures with air. Flammable limits: lower, 1.3%; upper, unknown. Ignition temperature, 1418°F. Specific gravity of liquid, 1.02.

Life Hazard: Highly toxic when absorbed through the skin, inhaled as a vapor, or swallowed. Threshold limit value (skin), 5 parts per million. Odor detectable at 1 ppm. Excessive exposures cause respiratory paralysis.

Fire Fighting Phases: Only slightly soluble in water. To fight fires, use water spray or fog, carbon dioxide, "alcohol" foam, and dry chemical. If fire involves storage tanks, keep tanks cool with water. Protection is required from toxic vapors given off at elevated temperatures.

Usual Shipping Containers: Glass bottles, cans, drums, tank vehicles, tank cars, tank barges.

Storage: Protect against physical dam-

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age. Locate storage area away from any area where the fire hazard may be acute. Outside or detected storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Inspect containers for leaks.

Remarks: See Flammable and Combustible Liquids Code (NFPA No. 30), National Electrical Code (NFPA No. 70), Fire-Hazard Properties of Flammable Liquids, Gases, and Volatile Solids (NFPA 325M), Chemical Safety Data Sheet SD-17 (Manufacturing Chemists' Association, Inc.).

BENZENE C_6H_6

Description: Colorless liquid with aromatic odor.

Fire and Explosion Hazards: Flammable liquid. Vapor forms explosive mixtures with air. Flammable limits, 1.3 and 7.1%. Flash point, 12°F. Ignition temperature, 1044°F. Liquid is lighter than water (specific gravity, 0.9). Vapor is heavier than air (vapor-air density at 100°F, 1.4) and may travel considerable distance to a source of ignition and flash back.

Life Hazard: Breathing of high concentrations of benzene may cause acute poisoning and death. Repeated inhalation of low concentrations often results in severe or fatal anemia. Also a skin and eye irritant. Threshold limit value, 25 ppm Wear self-contained breathing apparatus.

Fire Fighting Phases: Use water spray, carbon dioxide, dry chemical, or foam. Wear self-contained breathing apparatus.

Usual Shipping Containers: Small glass bottles, 1-gal cans, 5- to 55-gal metal drums, tank cars and tank trucks. Tank barges.

Storage: Protect against physical damage. Outside or detached storage is preferable. Inside storage should be in a standard flammable liquids storage room or cabinet.

Remarks: Only Class I, Group D electrical equipment permitted in atmospheres containing benzene vapors. See Flammable and Combustible Liquids Code (NFPA No. 30), National Electrical Code (NFPA No. 70), Static Electricity (NFPA No. 77), Lightning Protection Code (NFPA No. 78), Fire-Hazard Properties of Flammable Liquids, Gases and Volatile Solids (NFPA No. 325M), and Chemical Safety Data Sheet SD-2 (Manufacturing Chemists' Association, Inc.).

BUTADIENE-1,3 $CH_2CHCHCH_2$

Description: A colorless, mildly aromatic gas.

Fire and Explosion Hazards: Flammable gas. Forms explosive mixtures

with air. Flammable limits, 2 and 11.5%. Ignition temperature, 804°F. Heavier than air (vapor density, 1.9) and may travel a considerable distance to a source of ignition and flash back. Usually contains inhibitors to prevent self-polymerization (which is accompanied by evolution of heat) and to prevent formation of peroxides. At elevated temperatures, such as in fire conditions, polymerization may take place. If the polymerization takes place in a container, there is possibility of violent rupture of the container.

Life Hazard: Slightly toxic but may cause asphyxiation by exclusion of oxygen. Slight respiratory irritant. Direct expansion on skin may cause freeze burns. Threshold limit value, 1000 ppm. Wear self-contained breathing apparatus.

Fire Fighting Phases: Stop flow of gas. Use water spray to keep containers cool. Do not extinguish unless necessary to effect an immediate shutoff of flow. Dry chemical and carbon dioxide can be used to extinguish butadiene fires. Wear self-contained breathing apparatus.

Usual Shipping Containers: Liquefied in steel pressure cylinders, tank cars, tank barges.

Storage: Protect against physical damage. Outside or detached storage is preferable. Inside storage should be confined to a fire-resistive room, properly cut off from remainder of building, provided with adequate ventilation and free of sources of ignition. Store cylinders vertically and do not stack. Do not store with oxidizing material. Butadiene vapors are uninhibited and may form polymers in vents or flame arresters of storage tanks, resulting in stoppage of vents.

Remarks: Electrical installations in Class I hazardous locations, as defined in Article 500 of the National Electrical Code, should be in accordance with Article 501 of the Code; and electrical equipment should be suitable for use in atmospheres containing butadiene gas. See Explosion Venting Guide (NFPA No. 68), National Electrical Code (NFPA No. 70), Static Electricity (NFPA No. 77), Lightning Protection Code (NFPA No. 78), Fire-Hazard Properties of Flammable Liquids, Gases and Volatile Solids (NFPA No. 325M), and Chemical Safety Data Sheet SD-55 (Manufacturing Chemists' Association, Inc.).

CRESOL (ortho-Cresol, meta-Cresol, para-Cresol) $CH_3C_6H_4OH$

Cresol (ortho-Cresol, meta-Cresol, para-Cresol)

ortho meta and para

Description: Ortho-cresol, colorless liquid or crystals (melting point, 87.6°F). Meta-cresol, colorless liquid (melting point, 53.6°F). Para-cresol, colorless crystals (melting point, 94.6°F). Commer-

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cial cresols usually are liquids at ordinary temperatures. All cresols have characteristic sweet tarry odor.

Fire and Explosive Hazards: Combustible liquids. Vapors form explosive mixtures with air. Lower flammable limits: ortho-cresol, 1.35% (at 300°F); commercial meta-para-cresol, 1.06% (at 302°F). Flash point: ortho-cresol, 178°F; meta- and para-cresols 187°F; commercial meta-para-cresol, 202°F. Ignition temperature: ortho-cresol, 1100°F; meta-para-cresol, 1038°F. Liquid cresols are slightly heavier than water (specific gravity, 1.03–1.05).

Life Hazard: Corrosive to body tissues. Toxic by inhalation, skin absorption, and swallowing. Threshold limit value, 5 ppm. Wear self-contained breathing apparatus.

Fire Fighting Phases: Use carbon dioxide, dry chemical, foam, or water spray. Wear self-contained breathing apparatus.

Usual Shipping Containers: Glass bottles, 10- and 55-gal metal drums, 55-gal metal barrels, tank trucks, tank cars, tank barges.

Storage: Protect against physical damage. Outside or detached storage is preferable. Inside storage should be in a standard flammable liquids storage room or cabinet.

Remarks: See Flammable and Combustible Liquids Code (NFPA No. 30), National Electrical Code (NFPA No. 70), Fire-Hazard Properties of Flammable Liquids, Gases, and Volatile Solids (NFPA No. 325M), and Chemical Safety Data Sheet SD-48 (Manufacturing Chemists' Association, Inc.).

DIOXANE-1,4 $OCH_2CH_2OCH_2CH_2$

Description: Colorless liquid.

Fire and Explosion Hazards: Flammable liquid. Vapor forms explosive mixtures with air over a wide range. Flammable limits, 2.0 and 22%. Flash point, 54°F. Ignition temperature 356°F. Vapor is heavier than air (vapor-air density at 100°F, 1.2) and may travel a considerable distance to a source of ignition and flash back. Liquid has the same density as water and is soluble in water. Dioxane is capable of forming explosive peroxides under certain conditions, and unless proper precautions are taken, it can explode when redistilled.

Life Hazard: Eye skin, and respiratory irritant. Toxic amounts may be absorbed through the skin and repeated inhalation exposures to low concentrations have been fatal. Threshold limit value, 100 ppm. Wear goggles and self-contained breathing apparatus.

Fire Fighting Phases: Use water, "Alcohol" foam, dry chemical, or carbon dioxide. Wear goggles and self-contained breathing apparatus.

Usual Shipping Containers: Bottles, cans, and metal drums.

Storage: Protect against physical damage. Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Isolate from combustible or oxidizing materials and all possible sources of ignition.

Remarks: Electrical installations in Class I hazardous locations, as defined in Article 500 of the National Electrical Code, should be in accordance with Article 501 of the Code; and electrical equipment should be suitable for use in atmospheres containing dioxane vapors. See Flammable and Combustible Liquids Code (NFPA No. 30) and Fire-Hazard Properties of Flammable Liquids, Gases and Volatile Solids (NFPA No. 325M).

ETHYLENE OXIDE CH_2OCH_2

Description: Colorless gas at ordinary temperatures; liquid below 51°F; has an ether-like odor.

Fire and Explosion Hazards: Flam-

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mable liquid with boiling point of 51°F. Vapor forms explosive mixtures with air over wide range. Flammable limits, 3 and 100%. Flash point, less than 0°F. Ignition temperature in air, 804°F; ignition temperature of 100% ethylene oxide, 1058°F. Liquid is lighter than water (specific gravity, 0.9). Vapor is heavier than air (vapor density, 1.5.) and may travel considerable distance to a source of ignition and flash back. Dangerously reactive; may rearrange chemically and/or polymerize violently with evolution of heat, when in contact with highly active catalytic surfaces such as anhydrous chlorides of iron, tin, and aluminum, pure oxides of iron and aluminum, and alkali metal hydroxides. Although soluble in water, solutions will continue to burn until diluted to approximately 22 volumes of water to one volume of ethylene oxide.

Life Hazard: Moderately toxic by inhalation; eye, skin, and respiratory irritant; prolonged contact with skin may result in delayed burns. Threshold limit value of vapor, 50 ppm. Wear self-contained breathing apparatus.

Fire Fighting Phases: Shut off flow of liquid or gas. Keep containers cool with water spray. Do not extinguish unless necessary to effect an immediate shutoff of flow. Dry chemical or carbon dioxide can be used to extinguish ethylene oxide fires. Wear self-contained breathing apparatus.

Usual Shipping Containers: Steel cylinders, drums, insulated tank cars, tank barges.

Storage: Protect against physical damage. Should be kept cool, below 86°F. Should be stored outside, away from buildings and other materials, in insulated tanks or containers, shielded from sun-heat, provided with cooling facilities and protected by a properly designed water-spray system. Adequate diking and drainage should be provided in tank area to confine and dispose of liquid in case of tank rupture. Avoid pits and depressions. Inside storage should be held to a minimum and confined to a standard fire-resistive flammable liquids storage room, provided with continuous ventilation and free of sources of ignition. Do not permit chlorides, oxides, acids, organic bases, alkali metal hydroxides, metallic potassium or other combustible materials in storage room.

Remarks: Electrical installations in Class I hazardous locations, as defined in Article 500 of the National Electrical Code, should be in accordance with Article 501 of the Code; and electrical equipment should be suitable for use in atmospheres containing ethylene oxide gas. See Flammable and Combustible Liquids Code (NFPA No. 30), National Electrical Code (NFPA No. 70), Static Electricity (NFPA No. 77), Lightning Protection Code (NFPA No. 78) and Fire-Hazard Properties of Flammable Liquids, Gases and Volatile Solids (NFPA No. 325M).