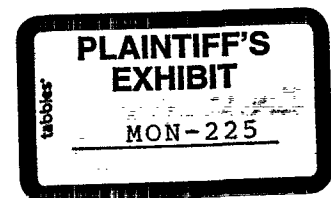


**TOXICITY, HAZARDS AND HANDLING PRECAUTIONS
ASSOCIATED WITH CHEMICALS HANDLED
IN THE TEXAS CITY PLANT**



**MONSANTO COMPANY
TEXAS CITY, TEXAS**

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INTRODUCTION

Monsanto is vitally concerned with the safe handling of the various chemicals in use at the Texas City site. The possibility of acute or chronic exposure in this plant is extremely remote; however, the fact that such a possibility does exist is reason enough to publish this data.

This manual is intended as a guide to help protect the worker from exposure to chemicals which could have adverse health effects. It is not an exhaustive treatise on the safety and toxicological effects of the chemicals. Rather it is a guide and relies heavily upon common-sense application of its guidelines.

Personnel with varying degrees of chemical training and experience will be using this manual. For this reason, non-technical terms are used whenever possible. The Index was prepared using various synonyms for each compound. The intent was to make the data more readily accessible to persons who may know a compound by some name other than its official IUPAC name.

This Toxicity Manual is intended to be used in the initial stages of emergencies and users should seek competent emergency medical services as soon as possible when additional help is needed. The latest First Aid information can be obtained by calling the Monsanto Medical Department (945-4431), extension 2301.

EXPLANATION OF DATA

2.

NAME

The name most commonly recognized at this site is listed in bold type in the upper left hand corner of each data page. This is the name by which the data is arranged in alphabetical order.

SYNONYMS

Alternate and common names are listed. In some instances, proprietary and trade names are included. These synonyms are included in the Index where they are cross referenced to the name by which the chemical is listed in the data sheets. For example, a person may want information on methyl cyanide. He can look for methyl cyanide in the Index where he will be told to see acetonitrile.

FORMULA

A simplified structural formula for each compound is given.

TLV

The TLV is the Threshold Limit Value. This is a copywrited term belonging to The American Conference of Governmental Industrial Hygienists. It is the equivalent of the Permissible Exposure Limit (PEL) and the 8-hour Time Weighted Average (TWA).

The TLV is that concentration of a given chemical to which the average worker can be exposed for an 8-hour workday and a 40-hour work week with no adverse effects. It is expressed in parts per million (ppm) or milligrams per cubic meter (mg/m³). The designation "skin absorption" means that toxic amounts of the material can be readily absorbed through the unbroken exposed skin.

ODOR THRESHOLD

This is the minimum concentration of a chemical which the average person can smell. Odor has at least two parameters - quality and intensity. Quality or "how it smells" can greatly affect intensity. If something is foul smelling, it will be noticed at lower concentrations than if it is pleasant smelling. For this reason, odor threshold varies from one individual to another and from one day to the next. In the special case of hydrogen cyanide, some people can smell concentrations well below 10 ppm, while others are unable to smell even lethal concentrations. The odor of a potentially dangerous chemical can be hidden by the odor of another chemical. Therefore, the sense of smell alone is not a reliable indication of the presence or absence of a dangerous vapor.

PROPERTIES

Several of the physical properties of each chemical are listed. The physical state (solid, liquid or gas) at standard temperature and pressure is given as well as any color or other description of physical appearance. Specific gravity is the ratio of the weight of a chemical to the weight of an equal volume of water. Chemicals with specific gravities less than 1 are lighter than water. Those with specific gravities greater than 1 are heavier than water. Similarly, vapor densities are a measure of the relative density of a vapor as compared to air. Chemicals with vapor densities less than 1 will rise and rapidly dissipate. When vapor densities are greater than 1, chemicals tend to lay along the ground and pool in low spots creating hazards. Other information such as boiling point, flash point and flammability limits are useful in assessing the fire hazards of the material.

SYMPTOMS

The most common symptoms of exposure are given. They are generally divided according to route of exposure (i.e., skin, eyes, inhalation and ingestion). Both acute and chronic symptoms are given where they differ and where the data is available. The symptoms are for a normal healthy worker and may differ or be more pronounced in some individuals. Symptoms other than those listed may be experienced and not all of those listed should be expected. Here again, the manual is a guide to help you know what can be expected from exposure to a given chemical.

The term LD₅₀ is used along with the type of laboratory animal used. This is the minimum Lethal Dose which kills 50% of the animals to which it is given. It generally refers to material that is eaten. The term LC₅₀ is the minimum Lethal Concentration of a vapor which will kill 50% of the test animals. The LD₅₀ is given in milligrams or grams of chemical per kilogram of animal body weight (mg/Kg). The LC₅₀, on the other hand, is given in parts per million (ppm) of vapor in the air. Both are an indication of the toxicity of a chemical.

PROTECTIVE EQUIPMENT

It is advisable to protect your skin and eyes from most of the chemicals with which you will be working. In many instances chemical gloves and goggles are sufficient protection; however, if a chemical is highly corrosive, such as a caustic or strong acid, or is highly toxic, such as phenol, additional protection is required. This additional protection may be a face shield, an acid hood or slicker suit and boots. In some cases, such as with high HCN concentrations, a vapor-proof suit is required.

Often adequate respiratory protection is provided by a mask equipped with appropriate cannisters or filters. However, these masks are limited to use in atmospheres which contain at least 19.5% oxygen and no more than 10 times the TLV of the chemical for short 5-10 minute periods. If the oxygen content is less than 19.5%, the chemical concentration greater than 10 times the TLV or the chemical is highly toxic, a full facepiece mask with supplied air is recommended. This mask may be either an air-line mask or a Scott air pack.

In every instance common sense must be used. If it appears that the minimum equipment is inadequate, contact your supervisor. He will provide additional protective equipment as needed.

FIRE HAZARDS

Information necessary to evaluate the degree of fire hazard presented by the particular chemical is listed as well as precautions for personnel, equipment and environmental protection when fighting a fire that involves the chemical. Choices of extinguishing agents are given for some of the chemicals.

Some of the parameters given are the NFPA Class for flammable liquids:

Flammable Liquids

<u>Class</u>	<u>Flash Point</u>	<u>Boiling Point</u>
I	<100°F (37.8°C)	--
IA	< 73°F (22.8°C)	<100°F (37.8°C)
IB	< 73°F	>100°F
IC	> 73°F	<100°F

Combustible Liquids

II	>100°F	<140°F
IIIA	>140°F	<200°F
IIIB	>200°F	--

Flash Point: The lowest temperature at which the vapors of a liquid may be ignited momentarily.

Flammable Limits: The range of gas or vapor concentrations (percent by volume in air) which will burn or explode if an ignition source is present. Below the lower limit, the mixture is too lean to burn, and above the upper limit the mixture is too rich to burn.

Autoignition Temperature: The minimum temperature required to ignite gas or vapor without a spark or flame being present. Values given are only approximate and may change substantially either with changes in gas or vapor concentration, the presence of catalysts, or other factors.

FIRST AID

If a worker has been exposed to a harmful substance, he must be removed from the contaminated area. The rescuer's first concern is whether or not the victim is breathing. If he is not breathing, he will die within 5 to 7 minutes. Mouth-to-mouth resuscitation is the most effective method to use. Other common methods are not as effective and may not save the victim's life. However, there are rare instances in which the mouth-to-mouth method should not be used. If the victim has been exposed to highly toxic chemicals such as HCN, phosgene or phenol, the mouth-to-mouth method would expose the rescuer to the highly toxic chemicals and could result in him becoming a victim. In these rare instances an AMBU bag should be used if available, or lacking an AMBU bag, use best available alternate method such as the back pressure/arm lift method.

The next consideration is removal of chemicals from the eyes and skin. This can usually be done in conjunction with artificial respiration. Again, care must be taken to protect the rescuer from the chemicals.

If the eyes are involved they require immediate attention. Help the victim hold his eyes open and flush them with plenty of low velocity water. Have him move his eyes around while flushing to help remove the chemicals. This should continue for at least 15 minutes and then the victim should be taken immediately to a doctor.

Always remove contaminated clothing and flush the affected skin with water. In most instances, soap can be used to help remove the chemical from the skin. Here also, common sense must be used. If the affected area may be injured by rubbing it as in the case of second or third degree burns, frostbite, and traumatic injury, simply flush the area with plenty of low velocity water for at least 15 minutes to be sure that the chemicals are flushed off the skin.

When a chemical has been swallowed, the first action, providing the victim is conscious, should be to have the victim drink 3 or 4 glasses of milk or water to dilute the contents of his stomach. This slows the action and absorption of the chemical. Care must be taken in deciding whether the victim should vomit. It is not always safe to have him vomit. If the swallowed chemicals are corrosive, he will expose his esophagus, mouth, etc. to their corrosive effects twice by vomiting. Also, if the chemical is a

liquid hydrocarbon, it is dangerous to vomit because the chemical could be aspirated into the lungs and cause suffocation or at least chemical pneumonia. In the case of suffocation, there is usually nothing that can be done to help the victim. The organics coat the surfaces of the lung shutting out oxygen and when severe enough, he may die.

In those instances when it is desirable for the victim to vomit, he should be given milk or water to dilute the contents of his stomach. He should then stick his own finger down his throat to cause himself to vomit. This should not be done for him. If he is unconscious or too weak to do it for himself, it would be dangerous for him to vomit.

In all instances, the first aid suggestions in this manual are intended as guidelines and as such depend heavily upon the common sense and good judgment of the rescuers to apply them appropriately and effectively.

NOTES TO THE PHYSICIAN

This section appears on only a few of the data sheets. The information is not presumed to direct a physician's course of action but rather to provide information and suggestions that might not otherwise be readily available. The final course of action is left to the professional judgment of the attending physician.

ACETALDEHYDE

7.

Acetic aldehyde
Ethyl aldehyde

CH_3CHO

TLV, 100 ppm
Odor Threshold; 0.21 ppm

PROPERTIES: Acetaldehyde is a colorless, fuming liquid having a pungent fruity odor. It has a specific gravity of 0.7827, a boiling point of 20.8°C , a molecular wt. of 44.05, a melting point of -123.5°C . It is miscible with water, alcohol.

SYMPTOMS: Acetaldehyde, particularly in the vapor phase, is a local irritant. In concentrations of 1100 ppm for 2 hours the vapor is irritating to the nose, throat and respiratory tract and can cause bronchitis and lung edema. Signs and symptoms of excessive exposure are coughing, a burning sensation in the nose, throat, and eyes. If exposure is prolonged, the victim may become drowsy. Symptoms of chronic exposure resemble those of chronic alcoholism.

Acetaldehyde may cause only a mildly irritating sensation upon contact with the skin which may not be sufficient to cause the victim to decontaminate the exposed area. In severe cases the skin may become reddened and later become white and wrinkled. Dermatitis and other evidence of allergy can result from repeated or prolonged contact with concentrations of the vapor.

Acetaldehyde is hazardous to the eye and is capable of producing serious eye burns. Upon contact of the liquid or vapor with the eye, there is a burning sensation with watering of the eyes which may be followed by blurring of the vision. Fifteen minute exposure to vapor concentrations as low as 50 ppm may produce some temporary eye irritation.

Ingested acetaldehyde is not considered a poison by definition.

The LD_{50} for rats is 0.5 to 5.0 g/kg.

PROTECTIVE EQUIPMENT: In atmospheres containing less than 0.1% concentration of acetaldehyde vapors, organic vapor canister masks may be worn.

When the vapor concentration exceeds 0.1%, full facepiece supplied air masks are required.

Chemical gloves should be worn when handling the material. A chemical apron is recommended when there is a possibility of exposure of the body to spilled or sprayed liquid.

Splash-proof chemical goggles should be worn if danger of eye contact exists. Such goggles are only effective protection from liquid and cannot protect from vapor exposure to the eye.

FIRE HAZARDS: Acetaldehyde is a Class 1B liquid. The flammable limits by volume in air are 4% to 57%. The flash point is -38°C and the auto-ignition temperature is 185°C .

FIRST AID: Remove the worker from the contaminated area. Remove any contaminated clothing and begin artificial respiration if needed. Wash exposed skin with large amounts of water. Soap may be used if available to facilitate removal of acetaldehyde from the skin. If available, oxygen should be given.

If the eyes are involved, they should be flushed immediately with large amounts of water for at least 15 minutes.

If swallowed, an emetic of luke warm salt water, soapy water or 2 glasses of plain water followed by sticking the finger down the throat to induce vomiting.

Keep the victim warm and consult a physician as soon as possible.

ACETIC ACID

Methane carboxylic acid

CH_3COOH

TLV, 10 ppm

Odor Threshold; 1.0 ppm

PROPERTIES: Acetic acid is a clear, colorless liquid having a pungent, sour, vinegar-like odor. It has a specific gravity of 1.049, a boiling point of 118.1°C , a molecular wt. of 60.05, a melting point of 16.7°C , a vapor pressure of 11.4 mm at 20°C and a vapor density of 2.07. Acetic acid is miscible with water, alcohol, glycerol, ether, carbon tetrachloride, and is practically insoluble in carbon disulfide.

SYMPTOMS: Chronic exposure to acetic acid vapors may cause dental enamel erosion, bronchitis, and/or eye irritation.

Inhalation of concentrated vapor or mist may cause serious damage to the membranes of the upper respiratory tract and even to the lung tissue. 200 to 500 ppm is extremely irritating, but may be tolerated for brief periods by some individuals.

Concentrated acetic acid solutions can be destructive to tissues with which they come in contact. It attacks the skin easily and can cause dermatitis and ulcers. Although capable of producing severe burns, experience has demonstrated that it is not as hazardous in this respect as sulfuric or nitric acid.

Exposure of the eyes to acetic acid vapor causes watering and reddening of the eyes. Contact with the eyes by concentrated solutions can cause severe damage and may result in total loss of sight.

Ingestion may cause severe injury or death due to burns of the mucous membranes of the mouth, throat, esophagus, and stomach.

The LD_{50} is 0.5 to 5.0 g/kg (rat).

PROTECTIVE EQUIPMENT: Air supplied breathing apparatus is the equipment of choice for respiratory

protection. A gas mask having an acid canister may be used in atmospheres containing less than 100 ppm acetic acid. Chemical gloves and splash-proof cover goggles should be worn while handling acetic acid. A face shield and impervious protective clothing should also be worn if more than very small quantities are being handled. In cases where there is a potential for exposure to large quantities of acid, rubber acid suits, acid hoods and rubber boots are recommended. In all cases water in ample quantity should be immediately available.

FIRE HAZARDS: Acetic acid is a Class II combustible liquid with a flash point of 110°F and a boiling point of 245°F . The flammability limits are 5.4% to 16% at 212°F . The autoignition temp. is 1050°F . Extinguishing agents are CO_2 , dry chemical, alcohol foam, and water fog.

FIRST AID: If the exposure is to vapor only, remove victim to fresh air. If breathing has stopped, apply mouth to mouth artificial respiration. Remove coats, jackets, slicker suits or any outer clothing which may be holding vapors next to the victim's body.

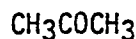
If the victim has been exposed to liquid acetic acid, immediately remove contaminated clothing and flush exposed skin with large quantities of running water for at least 15 minutes. Soap may be used if available. If even minute quantities enter the eyes, they should immediately be flushed with large quantities of running water for at least 15 minutes.

If the victim has swallowed any acetic acid, DO NOT ATTEMPT TO INDUCE VOMITING! If he is conscious, have him wash out his mouth and then drink as much milk or water as possible.

Consult a physician as soon as possible.

ACETONE

Dimethyl Ketone
2-Propanone
Ketone Propane



TLV, 750 ppm
Odor Threshold; 100 ppm

PROPERTIES: Acetone is a colorless volatile liquid with an aromatic odor that has been described as fragrant or mint-like. It has a molecular weight of 58.08, a specific gravity of 0.788. The boiling point is 56.5°C, melting point is -94°C and it is soluble in all proportions in water, alcohol and ether.

SYMPTOMS: Acetone is more of a fire hazard than anything else. Acute exposures to high (0.5%) vapor concentrations can produce eye and upper respiratory irritation. If the exposure continues, the victim may experience dryness of the mouth and throat, dizziness, nausea, incoordinated movements, loss of coordinated speech, drowsiness, and in extreme cases, coma. It can cause dermatitis because of its defatting action upon prolonged exposure.

Acetone does not have a strong toxic effect when swallowed. The literature cites one case of a man who swallowed 200 ml of acetone, became comatose, but recovered within 12 hours when given supportive therapy.

The organs most susceptible to damage by acetone are the respiratory system and skin.

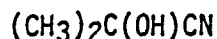
PROTECTIVE EQUIPMENT: Workers should wear appropriate equipment to prevent repeated or prolonged contact. Goggles should be worn if there is any reasonable probability of eye exposure.

Adequate respiratory protection in atmospheres which contain no more than 5000 ppm vapor is provided by a gas mask equipped with organic vapor canisters. For greater concentrations, a respirator with supplied air should be used.

FIRE HAZARDS: Acetone is a Class C flammable liquid. Flashpoint = 15°F, flammable limits = 2.5% to 12.8% in air, autoignition temp. = 1040°F.

Extinguishing agents = CO₂, dry chemical, alcohol foam, or water fog. If water is used, large quantities should be used to prevent re-ignition. A solution of 4% acetone in water has a flashpoint of 129°F.

FIRST AID: Remove victim from contaminated area. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen. If the eyes are involved, flush with plenty of low velocity water for at least 15 minutes and get prompt medical attention. If there has been skin exposure, remove contaminated clothing and wash affected areas with soap and water. If the victim has swallowed acetone, give 3-4 glasses of milk or water to dilute stomach contents and have him vomit by sticking his finger down his throat.

ACETONE CYANOHYDRIN (ACY)**a-hydroxy isobutyronitrile****TLV, 10 ppm; Skin Absorption
Odor Threshold; Data Not Available**

PROPERTIES: Acetone cyanohydrin is a highly toxic colorless liquid with a bitter almond odor characteristic of hydrogen cyanide. It is extremely toxic by inhalation, absorption or ingestion. The molecular weight is 85.1, the specific gravity is 0.93, the boiling point is 120°C, the freezing point is -2°F. It is completely soluble in water.

SYMPTOMS: Acetone cyanohydrin readily decomposes to hydrogen cyanide and acetone. The symptoms are the same as those of hydrogen cyanide exposure. Acute exposure produces headache, dizziness, nausea, and blueness of lips and fingernails. The onset of the symptoms may be within a few minutes for extensive exposure or may be delayed a few hours in the case of lesser exposures. The length of delay is the result of the time necessary for the chemical dissociation to yield free hydrogen cyanide. The toxic hazards appear to be from acute exposure; chronic exposure to 10 ppm or less does not appear to present a problem.

Frequently the victim is unaware that he has been contaminated. ACY is not highly volatile and does not produce a cooling effect from a wet spot on skin or clothing to serve as a warning of contamination to the victim.

PROTECTIVE EQUIPMENT: Workers should wear appropriate protective equipment to prevent any exposure to either the liquid ACY or its vapors. Both the liquid and the vapor, which always has a high HCN content, is readily absorbed through the skin. For entry into an area contaminated with ACY, a full vapor-proof suit and supplied air respirator in positive pressure mode must be used.

FIRE HAZARDS: ACY is a Class E combustible liquid. When heated or mixed with water, it gives off hydrogen cyanide gas. Flashpoint = 210°F, flammable limits in air = 2.25% to 11%, autoignition temp. = 1270°F, extinguishing media = CO₂, alcohol foam, water fog. DO NOT USE SODA-ACID EXTINGUISHER. Wear full protective, airtight clothing.

FIRST AID: Remove victim from contaminated area. Be careful not to contaminate yourself when handling the victim. Immediately remove any contaminated clothing and thoroughly wash affected area with soap and copious amounts of water. If breathing has stopped, give artificial respiration but NOT MOUTH-TO-MOUTH. If breathing is difficult give oxygen and support respiration. If the eyes are involved, flush with plenty of low velocity water for at least 15 minutes. If any liquid has been swallowed and the victim is conscious, give 3-4 glasses of milk or water to dilute stomach contents and have victim vomit by sticking his finger down his throat.

See Acrylonitrile FIRST AID and NOTES TO PHYSICIAN concerning cyanide kit.

ACETONITRILE

Methyl cyanide



TLV, 40 ppm; Skin Adsorption
Odor Threshold; 2 ppm (Est.)

PROPERTIES: Acetonitrile is a colorless, limpid liquid with an aromatic odor. It has a specific gravity of 0.783, a boiling point of 82°C, a molecular weight of 41, a melting point of 41°C, and a vapor pressure of 73 mm Hg at 20°C. It is soluble in water and alcohol.

SYMPTOMS: Compared to other organic cyanides, acetonitrile has a relatively low acute toxicity. Four hour exposures at the 40-160 ppm may produce a transitory flushing of the face and a feeling of chest tightness. At 160 ppm one subject experienced a "cooling sensation" similar to that experienced when inhaling menthol. On the other hand, there have been cases with more severe symptoms and several deaths after inhaling much higher concentrations. In most acute cases there is a latent period of up to several hours before the appearance of weakness, chest pain, abdominal pain, convulsions and unconsciousness.

Acetonitrile may be absorbed through the naked skin although it usually evaporates before toxic quantities can be taken up. As with many organic liquids, repeated spills on exposed skin may result in dermatitis due to solvent effects. The vapors only mildly irritate the eye, but liquid splashed into this sensitive organ will result in severe irritation. Orally it is slightly toxic with a LD_{50} in rats of 3.8 g/kg.

PROTECTIVE EQUIPMENT: Full face piece, air supplied, respirators are preferred but a mask with organic vapor cartridges may be used for concentrations < 100 ppm. A full face piece mask operating in pressure-demand or continuous-flow mode is mandatory for concentrations above 100 ppm. Use chemical gloves to protect the hands and safety goggles for the eyes.

FIRE HAZARDS: Class IB liquid, flammable limits = 3-16%. Flashpoint = 42°F, auto-ignition = 975°F.

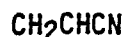
FIRST AID: Remove victims to fresh air immediately. Apply artificial respiration if breathing stops. Wash exposed skin or eyes with large amounts of water and remove contaminated clothing and shoes. If material has been swallowed and the victim is conscious, induce vomiting. If the victim is unconscious but still breathing, administer vapor of amyl nitrite under the victim's nose for 15 seconds. Repeat five times at 15-second intervals. Consult a physician as soon as possible.

Chemical burns and blistering can occur if contaminated clothing, particularly shoes, are not removed promptly and decontaminated (washed). Shoes contaminated on the inside are best disposed of and replaced.

NOTES TO PHYSICIAN: A possible explanation of the delayed onset of symptoms might be that acetonitrile is metabolized more slowly to cyanide than other similar nitriles, and that the final clinical picture is a result of effects of the intact molecule combined with the effects of gradually released cyanide ions. No reliance should be placed on blood cyanide or urinary thiocyanate levels as evidence of brief exposure to low concentrations of acetonitrile vapors.

ACRYLONITRILE (AN)

Propene nitrile



TLV, 2 ppm; Skin Adsorption
Odor Threshold; 21.4 ppm

PROPERTIES: Acrylonitrile (AN) is a clear colorless liquid having a mildly pungent onion-garlic odor. It has a specific gravity of 0.811, a boiling point of 77.3°C, a molecular weight of 53, a melting point of -82°C, and a vapor pressure of 100 mm at 22.8°C. It is soluble in water and miscible with most organic solvents.

SYMPTOMS: Mild exposure to AN causes nausea, vomiting, weakness, shortness of breath, headache, and occasionally diarrhea. These exposures resemble mild Hydrogen cyanide (HCN) intoxication. If the exposure is terminated promptly at this point, the symptoms subside spontaneously, usually within an hour, leaving no residual disability.

Exposure to high concentrations result in a loss of consciousness, asphyxia, and death. It closely resembles acute HCN poisoning. The odor of AN cannot be detected at the threshold limit. It can be detected at higher levels (> 20 ppm), but the sense of smell fatigues rapidly and is unreliable as an index of exposure.

AN may be absorbed through the unbroken skin. Repeated skin exposure may cause dermatitis. Serious chemical burns and blistering have occurred following contamination of clothing, particularly shoes, belts, etc., that were not removed promptly. Contaminated clothing should never be reworn until thoroughly cleaned and dried. Generally, contaminated leather items are best disposed of and not re-used.

AN can be absorbed through the mucous membranes of the eye and in large quantities will produce the same symptoms as those from inhalation of the vapors. The eyes are only mildly irritated by vapors but a splash of liquid into the eyes will result in severe irritation.

When ingested, AN is only moderately toxic. It may cause inflammation of the mouth and esophagus and in sufficient quantities can result in fatal systemic toxic effects.

PROTECTIVE EQUIPMENT: Full face air supplied breathing apparatus is the equipment of choice for protection from inhalation of AN vapors. Masks equipped with chemical cartridges can be used in vapor concentrations below 20 ppm. In concentrations above 20 ppm, supplied air apparatus with full face piece in positive pressure mode is to be used. Chemical gloves, splash-proof safety goggles, and impervious aprons should be worn when there is a danger of either skin or eye contact. In instances where there is a danger of exposure to larger quantities, rain suits and boots should also be worn.

FIRE HAZARD: Class 1B liquid, flammable limits = 3.05-17.0%, flashpoint = 32°F, auto-ignition = 898°F.

FIRST AID: Remove victim to fresh air immediately. Remove contaminated clothing and shoes and wash exposed skin or eyes with large amounts of water for at least 15 minutes. Soap may be used if available to remove AN from exposed skin. If breathing has stopped, apply mouth to mouth artificial respiration until a resuscitator is available or until normal breathing returns. If the victim is unconscious or breathing impaired, administer vapor of amyl nitrite under victim's nose for 15 seconds. Repeat 5 times at 15 minute intervals. If available, oxygen should be given. If AN has been swallowed and the victim is conscious, he should be made to vomit by giving 2 glasses of water or milk and sticking finger down throat.

A cyanide kit containing amyl nitrite, sodium nitrate, and sodium thiosulfate should be readily available for use by properly trained and qualified personnel.

NOTE TO PHYSICIAN: (See back)

(
NOTE TO PHYSICIAN: If patient has not responded to amyl nitrite, inject intravenously 10 ml of a 3% solution of sodium nitrite at a rate not greater than 2.5-5.0 ml per minute. Follow directly with 50 ml of a 25% solution of sodium thiosulfate at the same rate by the same route. Keep patient under observation. If signs of poisoning persist or reappear, repeat nitrite and thiosulfate injections one hour later and in one-half of the original doses. Methylene Blue should not be used if the victim has been treated with amyl nitrite.

12A.

ALDEHYDE MIX (C₆ - C₁₁)

13.

TLV, Not Established
Odor Threshold, Data Not Available

PROPERTIES: The aldehyde mix is an intermediate product in the oxo alcohol process. It is a mixture containing the following:

	%
Aldehydes (C ₆ -C ₁₁)	80
Unreacted olefins & heavy ends	14
Carbon monoxide	5
Cobalt hydrocarbonyl	0.5
Hydrogen	0.5

SYMPTOMS: Aldehydes, particularly the lower molecular weight materials, are irritating to the eyes, skin and respiratory mucous membrane. It can cause conjunctivitis or upset of the cornea, sensitization of the skin, and can produce accurate pulmonary edema in high enough concentrations.

The signs of skin sensitization are often difficult to distinguish from signs of irritation. This is valid up to C₄ or C₅, but at present, no further particulars are available regarding the higher aldehydes, but the same precautions should be taken.

The degassing of the aldehyde mix will release carbon monoxide and cobalt hydrocarbonyl. These both have toxic properties which are discussed in their own sections. (See sections on Cobalt Hydrocarbonyl and Carbon Monoxide).

Ingestion will result in irritation of the gastric mucosa as well as the toxic symptoms from cobalt hydrocarbonyl and carbon monoxide.

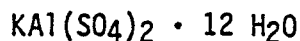
PROTECTIVE EQUIPMENT: Workers should wear appropriate protective clothing and equipment to prevent any prolonged or repeated skin contact. (See Fire Hazards) Goggles should be worn if there is any reasonable probability of eye contact. Due to the presence of cobalt hydrocarbonyl, air supplies breathing apparatus is the equipment of choice.

FIRE HAZARDS: The aldehydes mix is flammable. The actual physical data will be a function of the composition of the mix. Of prime concern, in addition to its flammability, is the fact that it will spontaneously ignite rags or clothing which has been soaked in the aldehyde mix. Contaminated clothing and rags should be soaked in water.

FIRST AID: A person suffering from over-exposure to vapors should be promptly removed from the contaminated atmosphere. Artificial respiration should be started if breathing has stopped. Give oxygen if breathing is difficult.

Aldehydes should be carefully flushed from the eyes using low velocity water and flushing for 15 minutes.

The use of an acid type soap is recommended to remove aldehydes from the skin. Prompt removal and water soaking of contaminated clothing is essential. (See Fire Hazards; see also carbon monoxide and cobalt hydrocarbonyl toxicity information.)

ALUM**Potassium Aluminum Sulfate**

PROPERTIES: Alum is a white powder or may appear as colorless crystals. It has a molecular weight of 474.4, a melting point of 92.5°C and a density of 1.725 ($\text{H}_2\text{O} = 1$).

SYMPTOMS: Alum may cause slight local skin irritation and upper respiratory irritation. Ingestion of large quantities could produce some gastrointestinal irritation. There are no acute or chronic systemic effects. Alum presents only a slight toxic hazard.

PROTECTIVE EQUIPMENT: Workers should wear appropriate clothing to prevent repeated and prolonged skin contact. Goggles should be worn if there is a reasonable probability of eye contact. Respiratory protection is afforded by a respirator equipped with a high efficiency (MSA Type F) dust filter.

FIRE HAZARDS: Alum is non-flammable and presents no fire hazard.

FIRST AID: Wash contaminated skin with soap and water. If any alum has gotten into the eyes, flush with plenty of low velocity water and have a physician examine the victim. If breathing is difficult give oxygen. If the victim has swallowed any significant amount of alum, give 3-4 glasses of milk or water to dilute stomach contents.

If any symptom appears to be severe or persistent, consult a physician.

ALUMINUM CHLORIDE (ANHYDROUS)

15.



TLV, 5 ppm (hydrogen chloride)

Odor Threshold; 1-5 ppm (hydrogen chloride)

PROPERTIES: Anhydrous aluminum chloride is a gray to white powder which liberates Hydrogen Chloride on contact with water. It has a molecular weight of 133.3, a melting point of 192.4°C, a sublimation point of 182.7°C, and a specific gravity of 2.44 at 25°C.

SYMPTOMS: The principle hazard of anhydrous aluminum chloride is that it reacts violently with water to produce hydrogen chloride and heat.

Inhalation of aluminum chloride dust may produce irritation or burns of the mucous membranes of the nose, mouth and upper respiratory tract and may even involve the tissues of the lung.

Contact of the material with the skin can cause thermal and acid burns. The eyes are especially susceptible to thermal and acid burns. Prolonged exposure to low concentrations causes erosion of the teeth. The LD₅₀ is 770 mg/kg as aluminum (mice).

PROTECTIVE EQUIPMENT: A dust mask is not suitable because of the formation of hydrogen chloride vapors in the presence of moisture. A gas mask, fitted with an acid canister, may be used if the contaminated atmosphere contains less than 50 ppm hydrogen chloride. If the atmosphere contains more than 50 ppm hydrogen chloride a full facepiece mask with supplied air in a continuous flow mode should be used. Caution must be exercised under these conditions because of the danger of skin exposure.

Chemical gloves and cover goggles are the minimum protective equipment required for handling aluminum chloride. Additional protective equipment may be required if dusting is a problem.

FIRE HAZARDS: Aluminum chloride is non-flammable. Due to the violent reaction of aluminum chloride with water, fires in areas adjacent to aluminum chloride should not be fought with water.

FIRST AID: Injury from inhalation is usually restricted to inflammation of the upper respiratory tract. Oxygen usually furnishes relief if coughing or choking persists after removal from the contaminated area.

Body areas that have been exposed to aluminum chloride should be washed with large quantities of running water without delay. CAUTION: Any large amounts of aluminum chloride which may still be clinging to the body or clothing of the victim should be brushed off before flushing with water to prevent further thermal or acid burns when the aluminum chloride reacts with the water.

If the material has entered the eyes, they should be flushed immediately and thoroughly with water for a minimum of 15 minutes.

DO NOT ATTEMPT TO INDUCE VOMITING in victims who has swallowed aluminum chloride. If he is conscious, have him wash out his mouth and then drink as much milk or water as possible.

AMMONIA (ANHYDROUS)

16.

NH₃

TLV, 25 ppm

Odor Threshold; 5 ppm

PROPERTIES: Anhydrous ammonia is a colorless gas with an extremely pungent irritating odor. The molecular weight is 17.03, the density is 0.597 (air = 1), the boiling point is -33.4°C, the vapor pressure is 266.0 mm Hg at 46°C. Ammonia is very soluble in water.

SYMPTOMS: Ammonia is a strong irritant. Inhalation of concentrations of 5000 ppm can be fatal immediately and 2500 ppm can cause death within 30 minutes. Exposure to 150 ppm causes laryngitis, bronchitis, and eye irritation. It is detectable at 5 ppm, easily noticeable at 20 ppm, and is moderately irritating to the nose at 100 ppm.

Liquid ammonia will produce severe chemical burns upon contact with the skin and can produce frostbite by rapid evaporation. Ammonia vapor in concentrations above 2% will produce blistering of the skin because it quickly dissolves on moist body surfaces.

Chronic irritation to the eyes may result from repeated exposure to the vapors. Exposure to high gas concentrations may cause temporary blindness and severe eye damage. Direct contact of the eyes with liquid ammonia will produce serious eye burns and possible permanent blindness.

Swallowing of the liquid results in severe corrosive action on the mouth, throat and stomach.

The LC₅₀ for rats is 7.6 mg/l.

PROTECTIVE EQUIPMENT: An air supplied full face piece mask is the equipment of choice for respiratory protection from vapors below 2% concentration in air. When the vapor concentration is greater than 2%, a vapor tight suit is recommended.

In situations where there is no high concentration of ammonia vapor in the atmosphere but there exists the potential for an exposure, chemical gloves and splash-proof goggles should be worn as a safety precaution.

FIRE HAZARD: Anhydrous ammonia is a fire hazard only when in high concentrations and at high temperature. Flash point is indefinite, below 32°F, flammable limits 16% to 25% in air, autoignition temp. 1024°F. Extinguishing agent--stop the flow of gas (lighter than air); cool tank with water supply.

FIRST AID: Remove victim to fresh air. If not breathing, administer mouth-to-mouth artificial respiration. When victim begins to breathe on his own, give oxygen. If breathing has not stopped but is difficult, give oxygen. If victim has been exposed to liquid ammonia, flush affected areas thoroughly with large amounts of water for 15 minutes. DO NOT RUB FROZEN AREAS. Remove contaminated clothing and shoes. If ammonia has gotten into the eyes, flush with low velocity water for 15 minutes. If the victim has swallowed ammonia and is conscious, DO NOT INDUCE VOMITING, have him drink as much milk or water as he can. If he is unconscious, do nothing except keep him warm and promptly transport to a medical facility. In all cases seek prompt medical attention.

ANTHRACITE COAL

17.

TLV, 2 mg/m³, Respirable dust fraction < 5% quartz

if > 5% quartz
$$\frac{10 \text{ mg/m}^3}{\% \text{ respirable quartz} + 2}$$

PROPERTIES: Anthracite is a natural dark brown to black solid formed from fossilized plants. It consists of amorphous carbon with various organic and some inorganic compounds.

SYMPTOMS: The acute symptoms of coal dust exposure are those of a nuisance dust; i.e., upper respiratory irritation producing coughing and choking, eye irritation and possibly some skin irritation from physical abrasion. The more serious effects are from chronic exposure which produces pneumoconiosis, a destructive lung disease which is also known as "Black Lung".

PROTECTIVE EQUIPMENT: Workers should wear appropriate clothing to prevent skin abrasion from working with coal. Goggles should be worn to prevent the eyes from being injured by flying pieces of coal or irritated by the dust if either is a reasonable probability. Of greatest importance is respiratory protection from coal dust. This is provided by a respirator equipped with a high efficiency (MSA Type F) particle filter.

FIRE HAZARDS: Coal is a combustible solid which can be ignited by intense heat or open flame. It presents a serious dust explosion hazard.

FIRST AID: Move victim to fresh air. If he has become choked on coal dust, give oxygen and support respiration. Coal dust can be washed from the skin with soap and water. If dust has gotten into the eyes, do not rub as this could abrade the cornea, flush with plenty of low velocity water and have a physician examine the victim. Ingestion of coal is not likely, but no adverse effects are associated with swallowing coal.

ASBESTOS

18.

TLV, Recognized Carcinogen

- 0.5 fiber > 5 $\mu\text{m}/\text{cc}$ - Amosite
- 2.0 fibers > 5 $\mu\text{m}/\text{cc}$ - Chrysotile
- 0.2 fiber > 5 $\mu\text{m}/\text{cc}$ - Crocidolite
- 2.0 fibers > 5 $\mu\text{m}/\text{cc}$ - Other Forms

PROPERTIES: Asbestos is, according to recent authoritative mineralogical definitions,

- 1) a collective mineralogical term encompassing the asbestiform varieties of various minerals;
- 2) an industrial product obtained by mining and processing primarily asbestiform minerals.

Of the three types of asbestos that have been used in North America, Canadian chrysotile has formed 95% of all natural mineral fibers used, with amosite and crocidolite (both imported from South Africa) constituting the other 5%.

SYMPTOMS: It is now generally recognized that excessive inhalation of asbestos dust causes chronic inflammation of lung tissue called asbestosis, as well as cancer.

Asbestosis is a widely spread but nonuniform fibrosis, or scarring, of the lungs that is generally most severe in the lower portion of the lungs. It results in a decreased blood flow and/or thickening of the tissue walls causing the affected tissue to be nonfunctional.

Mesothelioma, a rare type of cancer associated almost exclusively with asbestos exposure, is usually rapidly fatal. It originates from the surface lining of the chest or abdomen.

Smoking greatly increases the risk of cancer from asbestos exposure. Unprotected asbestos workers who do not smoke historically have had approximately 5 times the cancer rate of the normal population. For those who do smoke, the rate jumps astronomically to 14 times that of the normal population. Clearly, asbestos and tobacco are a deadly combination.

PROTECTIVE EQUIPMENT: Workers required to handle asbestos will be provided with special coveralls, plastic gloves, rubber boots, and other equipment to prevent any exposure to asbestos dust. Dust

respirators with Type F filters must be worn when working with asbestos. For extremely dusty conditions (over 200 fibers/cc), supplied air respirators in a positive pressure mode should be worn. When the job is finished, the worker must remove his protective gear and place it in a designated receptacle, thoroughly shower and shampoo his hair before going to the designated clean dressing area. At no time should the asbestos work clothing and the worker's "street" clothes be together in the same area.

FIRE HAZARDS: None.

FIRST AID: There are no first aid procedures associated with asbestos other than to flush it from the eyes or skin. If the dust gets into the worker's eyes, flush with plenty of low velocity water for at least 15 minutes and get medical attention.

SEE GENERAL RULES AND PRACTICES REGARDING THE STRIPPING AND DISPOSAL OF ASBESTOS MATERIAL AT MONSANTO COMPANY, TEXAS CITY, and OSHA SAFETY AND HEALTH STANDARDS (29CFR 1910) §1910.1001 Asbestos.

BENZENE

Benzol
Cyclohexatriene

C_6H_6

TLV, 10 ppm (Carcinogen)
Odor Threshold; 5 ppm

PROPERTIES: Benzene is a colorless, non-polar liquid, with a gasoline-like odor characteristic of aromatic hydrocarbons. It has a molecular weight of 78.11, a boiling point of 80.1°C, a melting point of 5.5°C, a vapor pressure of 75 mm Hg at 20°C and a specific gravity of 0.879 at the same temperature. The vapor density is 2.7 (air = 1). Benzene is soluble in all proportions of alcohol, acetone and ether but is only slightly soluble in water.

SYMPTOMS: Benzene vapors are severely toxic by inhalation. It has a pleasant odor and narcotic effect and thus has poor warning properties.

Acute benzene poisoning results from the breathing of high concentrations of vapor (above 3000 ppm). The effects of breathing benzene vapors occur rapidly. The victim becomes dizzy, nausea and vomiting may occur, he may become breathless if excited, and if not removed at once, loses consciousness and may go into convulsions. In advanced cases of acute poisoning the victim becomes confused and hysterical and invariably very obstinate. Help may be needed in removing him from the contaminated area and restraint may be necessary to prevent him from becoming violent. 5-10 minutes exposure to 20,000 ppm may be fatal.

The effect of chronic (long term) exposure to this chemical is by far the most serious disease caused by any of the common hydrocarbon solvents. Repeated exposure to benzene concentrations above 25 ppm over a prolonged period may cause bone marrow damage and reduce the blood forming function. Many serious illnesses and fatalities have occurred in association with chronic exposures to benzene. Symptoms may occasionally occur after

It is recommended that exposure to 25 ppm or more not be permitted for even brief periods without the use of respiratory protection.

Benzene is a mild skin irritant. Prolonged and repeated contact of liquid benzene with the skin can result in drying of the skin and dermatitis. Liquid benzene can cause chemical burns to the skin in cases where contaminated clothing or equipment is not removed. Liquid benzene and high concentrations of vapor are irritating to the mucous membranes of the eyes.

If benzene is swallowed, the victim can be expected to experience burning abdominal pain, vomiting, staggering gait, drowsiness and unconsciousness.

PROTECTIVE EQUIPMENT: In concentrations below 100 ppm, Comfo or MSA gas masks with an organic vapor cartridge may be used. In concentrations greater than 100 ppm, masks with supplied air should be used.

When handling liquid benzene, chemical gloves and splash-proof goggles should be worn.

FIRE HAZARDS: Benzene is a Class 1A flammable liquid. It has a boiling point of 80.1°C and a flash point of 12°F. The flammable limits are 1.4 to 8.0% in air and the autoignition point is 1076°F. It is extremely flammable, ignited by sparks, heat or open flame. Precautions must be taken to prevent static electricity buildup. Extinguishing agents are CO_2 , dry chemical, foam, water fog.

FIRST AID: (Over)

FIRST AID: Remove victim to fresh air. Remove any contaminated clothing and wash effected area with large amounts of water. Soap may be used if available. If respiration has ceased, begin mouth-to-mouth artificial respiration. If victim is breathing with difficulty give oxygen.

If benzene has gotten into the eyes, flush with low velocity water for 15 minutes.

If any benzene has been swallowed, DO NOT INDUCE VOMITING. Have victim drink as much milk or water as possible. If victim should vomit, extreme care should be taken to prevent aspiration of vomitus into the respiratory tract, chemical pneumonia or suffocation could occur.

BENZOIC ACID

Dracrylic Acid
Phenylformic Acid
Benzenecarboxylic Acid

C_6H_5COOH

TLV, No Data
Odor Threshold; No Data

PROPERTIES: Benzoic acid is a white powder. The molecular weight is 122.12, melting point is 121.7°C and the boiling point is 249°C.

Benzoic acid is soluble in water to the extent of 2.9 g/l at 20°C. It is also soluble in alcohol and several organic solvents.

SYMPTOMS: Benzoic acid is a mild irritant to the skin, eyes and mucous membranes. The irritation will rapidly subside when the exposure is stopped. The only chronic exposure problem is from ingestion and this, too, will stop when the exposure is stopped.

PROTECTIVE EQUIPMENT: Workers should wear appropriate clothing and equipment to prevent prolonged or repeated contact. Goggles should be worn if there is any reasonable probability of eye exposure. A respirator equipped with dust filters will provide adequate protection from benzoic acid dust.

FIRE HAZARDS: Benzoic acid presents a slight fire hazard when exposed to heat or flame. It can react with oxidizing materials.

FIRST AID: If the material has gotten into the victim's eyes, flush with plenty of low velocity water for at least 15 minutes and have a physician examine his eyes. If it has gotten onto the skin, flush off with water. Soap may be used to help clean the skin. If the victim has become choked by benzoic acid dust and is having breathing problems, give oxygen and seek medical attention. If he has swallowed any of the material, give 3-4 glasses of milk or water to dilute stomach contents. If he has swallowed a considerable amount of benzoic acid, he should cause himself to vomit by sticking his finger down his throat.

BETZ 55

TLV, 2 mg/m³ (Based upon sodium hydroxide content)
Odor Threshold; Odorless

PROPERTIES: Betz 55 is an aqueous solution of a phosphate salt, a sulfite salt, aromatic heterocyclic mercaptan and sodium hydroxide. It has a pH of 13.1, a boiling point greater than 100°C, a specific gravity of 1.220, and a freezing point of -16.7°C.

SYMPTOMS: This material is corrosive to the skin because of the caustic. It is irritating to the eyes and the upper respiratory tract. Ingestion may burn the mouth, throat and stomach.

PROTECTIVE EQUIPMENT: When handling Betz 55, always use chemical gloves and splash-proof goggles.

FIRE HAZARDS: Betz 55 is a stable, non-flammable aqueous solution. However, if exposed to intense heat of a fire, it may give off oxides of C, N, S, P, or Halogens if present.

FIRST AID: Wash exposed skin with plenty of soap and water. Remove contaminated clothing and launder before reuse. If the eyes are exposed, flush them with a large volume of low velocity water for at least 15 minutes and contact a physician. If the victim has inhaled dusts or mist of Betz 55 and is having breathing difficulty remove him from the contaminated area and give oxygen. If he has swallowed any of the material, DO NOT INDUCE VOMITING. Dilute stomach contents with 3-4 glasses of milk or water. In any case of exposure which results in symptoms of overexposure, consult a physician.

BETZ 65

22.

**Zinc Sulfate Solution
Zinkosite**

**TLV, None Established
Odor Threshold; Odorless**

PROPERTIES: Betz 65 is an aqueous solution of zinc sulfate which is designed for use in treating cooling water systems. It has a pH of 2.9, a specific gravity of 1.366, and a freezing point of -10°C.

SYMPTOMS: Betz 65 is a minimal exposure hazard. It is only slightly irritating to the eyes and because it is an aqueous solution, would not be a respiratory hazard. Zinc sulfate is not considered to be toxic by ingestion but may cause nausea and vomiting.

PROTECTIVE EQUIPMENT: Use chemical gloves and splash-proof protective goggles when handling Betz 65. Respiratory protection is not indicated.

FIRE HAZARDS: Betz 65 is a non-flammable aqueous solution, but may decompose in a fire to yield oxides of carbon, nitrogen, sulfur, phosphorous, or halogens if present.

FIRST AID: If Betz 65 is spilled on the skin, the affected area should be washed with soap and water. Contaminated clothing should be removed and laundered before being worn again. If the eyes are exposed, they should be flushed for 15 minutes with low velocity water. If the victim has swallowed any of the material, he should be given plenty of milk or water to drink and should cause himself to vomit by sticking his finger down his throat. Contact a physician if symptoms appear.

BETZ 2020

**TLV, None Established
Odor Threshold; No Data Available**

PROPERTIES: Betz 2020 is a colorless to brown aqueous solution of an acrylate copolymer. The pH is 5.3, the specific gravity is 1.125 and the freezing point is -3.3°C.

SYMPTOMS: May cause skin irritation after prolonged contact. It is irritating to the upper respiratory tract and slightly irritating to the eyes.

PROTECTIVE EQUIPMENT: If ventilation is inadequate or significant product exposure is likely, use a respirator with organic vapor and dust/mist/fume cartridge. Chemical gloves and goggles should be worn when handling Betz 2020.

FIRE HAZARDS: Betz 2020 is a stable non-flammable aqueous solution, but may yield oxides of C, N, S, P, or halogens if present when subjected to extreme temperature of a fire.

FIRST AID: Remove contaminated clothing and wash affected skin with soap and water. Contaminated clothing should be laundered before reuse. If the eyes have been exposed to Betz 2020, flush with plenty of low velocity water for at least 15 minutes. Consult a physician as soon as possible. If Betz 2020 has been swallowed, dilute stomach contents with 3-4 glasses of milk or water and have him induce vomiting by sticking his finger down his throat. Consult a physician as soon as possible.

BETZ 2040

24.

TLV, None Established
Odor Threshold; No Data Available

PROPERTIES: Betz 2040 is a yellow aqueous solution of organophosphonate, inorganic phosphates, an aromatic nitrogen heterocycle and potassium hydroxide.

SYMPTOMS: May cause skin irritation after prolonged contact. It is a severe eye irritant and causes irritation to the upper respiratory tract.

PROTECTIVE EQUIPMENT: If ventilation is inadequate or significant product exposure is likely, use a respirator with dust/mist/fume cartridges. Chemical gloves and goggles should be worn when handling Betz 2040.

FIRE HAZARDS: Betz 2040 is a stable, non-flammable aqueous solution, but may yield oxides of C, N, S, P, or halogens when exposed to extreme temperatures of a fire.

FIRST AID: Remove contaminated clothing and wash affected skin with soap and water. Contaminated clothing should be laundered before reuse. If any product has gotten into the eyes, flush with plenty of low velocity water for at least 15 minutes. Consult a physician as soon as possible. If any of the material has been swallowed, DO NOT INDUCE VOMITING. Dilute stomach contents with 3-4 glasses of milk or water and consult a physician as soon as possible.

BETZ BALANCED POLYMER 6278

25.

TLV, 14 mg/m³ (Based upon sodium hydroxide content)
Odor Threshold; Odorless

PROPERTIES: Balanced polymer is a colorless to yellow aqueous solution containing any or all of: sodium hydroxide salts, salts of EDTA, nitrate, silicate, sulfite, polycarboxylic acid, or sulfonated polycarboxylic acid, polyalkylene glycol, anhydrous polyphosphate. It has a pH of 13.0, a boiling point of 100°C, a freezing point of -4°C, and a specific gravity of 1.166.

SYMPTOMS: The caustic in this material exerts a marked corrosive action on any tissue with which it comes in contact. It is a severe irritant to the eyes and may irritate the upper respiratory tract. Ingestion will burn the mouth, throat and stomach.

PROTECTIVE EQUIPMENT: Use chemical gloves and goggles (or face shield) when handling this product. The use of complete body protection (slicker suit) is sometimes recommended.

FIRE HAZARDS: Balanced polymer 6278 is a stable non-flammable aqueous solution. However, it may give off oxides of C, N, S, P, or halogens if present when subjected to extreme heat in a fire.

FIRST AID: Remove contaminated clothing and wash exposed skin with soap and water. Launder contaminated clothing before reuse. If product has gotten into the eyes, flush them with plenty of low velocity water for at least 15 minutes and consult a physician as soon as possible. If any of the product has been swallowed, DO NOT INDUCE VOMITING. Dilute stomach contents with 3-4 glasses of milk or water and consult a physician as soon as possible.

BETZ FOAM-TROL 174

26.

TLV, None Established
Odor Threshold; None Established

PROPERTIES: Betz Foam-Trol 174 is a clear light amber liquid which is a blend of polyalkylene glycol, mixed fatty alcohols, mixed polyalkylene glycol fatty esters and fatty esters in mineral oil. A 50% solution has a pH of 3.7. The undiluted material has a specific gravity of 0.882.

SYMPTOMS: The likelihood of this material being an exposure hazard appears small. Foam-Trol is slightly irritating to the eyes and skin if the exposure is prolonged.

PROTECTIVE EQUIPMENT: Chemical gloves and splash-proof goggles should be worn when handling Foam-Trol.

FIRE HAZARDS: Foam-Trol is only slightly flammable and must be preheated in order to burn. Use dry chemical, carbon dioxide, foam, or water to extinguish fire. Foam or water create a slippery condition; spread sand or grit.

FIRST AID: If skin is exposed, wash affected area with plenty of soap and water. Remove contaminated clothing and launder before reuse. If any Foam-Trol gets into the eyes, flush with plenty of low velocity water for at least 15 minutes and consult a physician. If Foam-Trol has been swallowed, DO NOT INDUCE VOMITING. Dilute stomach contents with 3-4 glasses of milk or water and consult a physician as soon as possible.

BETZ KROM-TROL X-5

TLV, 0.15 mg/m³ (Based upon Chromium VI soluble)
Odor Threshold; Odorless

PROPERTIES: Krom-Trol X-5 is a yellow aqueous solution of a chromate salt and an alkali metal sodium hydroxide. The pH is 8.0, the specific gravity is 1.310 and the freezing point is -11.7°C.

SYMPTOMS: The low TLV is calculated from the material's chromium content. Some forms of Chromium VI are recognized to have carcinogenic or cocarcinogenic potential. Acute exposure causes immediate irritation upon contact with the skin and is a skin sensitizer. This material is a severe irritant to the eyes and upper respiratory tract. It is toxic by inhalation or ingestion. Swallowing Krom-Trol causes immediate irritation to the mouth, throat and stomach and can cause death.

PROTECTIVE EQUIPMENT: Provide adequate ventilation to keep contaminants below exposure limits. If ventilation is inadequate or significant product exposure is likely, use a respirator equipped with cartridges for highly toxic particulates. When handling Krom-Trol, use chemical gloves, face shield and goggles.

FIRE HAZARDS: Krom-Trol is a stable, non-flammable aqueous solution, but may yield oxides of C, N, S, P, or halogens, if present, when exposed to extreme temperatures in a fire.

FIRST AID: Remove victim from contaminated area and give oxygen if breathing is difficult. Remove contaminated clothing (launder before re-use) and wash affected skin areas with soap and water. In case of eye contact, flush eyes with a large volume of low velocity water for at least 15 minutes. Consult a physician immediately. If Krom-Trol has been swallowed, dilute stomach contents with 3-4 glasses of milk or water and have victim induce vomiting by sticking his finger down his throat. Consult a physician immediately.

BETZ POLYMER 1165 L

28.

TLV, 500 ppm (Based upon Naptha content)
Odor Threshold; 300 ppm (Based upon Naptha content)

PROPERTIES: Betz polymer 1165 L is a white emulsion of Quaternary Ammonium Polyacrylamide. The pH is 3.7, flashpoint is $>94^{\circ}\text{C}$, specific gravity is 1.026 and the freeze point is -6.7°C . It is 100% soluble in water.

SYMPTOMS: This material is moderately irritating to the skin and severely irritating to the eyes. The respiratory effects of prolonged exposure are dizziness and headache and are due to the naptha content. Ingestion will result in irritation of the mouth, esophagus and stomach as well as those symptoms associated with the ingestion of petroleum distillates.

PROTECTIVE EQUIPMENT: Workers handling this product should use chemical gloves and goggles. A rubber apron may be advisable in certain instances. If there is a likelihood of prolonged exposure to high vapor concentrations, a respirator equipped with organic vapor canisters should be used.

FIRE HAZARDS: Betz polymer 1165 L is non-flammable and non-reactive.

FIRST AID: Remove victim from contaminated area. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen. In case of skin exposure, immediately remove contaminated clothing and wash affected area with soap and plenty of water. If any of the material has gotten into the eyes, flush them with plenty of low velocity water for at least 15 minutes and get medical attention. If the material has been swallowed, give 3-4 glasses of milk or water to dilute stomach contents but DO NOT INDUCE VOMITING. Immediately contact a physician.

BETZ SLIMICIDE C-30

**TLV, 30 mg/m³ (Based on Dimethylformamide content) Skin Absorption
Odor Threshold; Data Not Available**

PROPERTIES: Betz Slimicide is a colorless to yellow mixture of Bis (Trichloromethyl) Sulfone, Methylene Bis Thiocyanate and inert ingredients. A 50% solution has a pH of 2.6. The product has a boiling point of 94°C, a specific gravity of 1.045, a freeze point of <-34.4°C, and is 25% soluble in water.

SYMPTOMS: Prolonged contact with the product may cause skin irritation. It is corrosive to the eyes and the vapors may cause dizziness and headache after prolonged exposure.

PROTECTIVE EQUIPMENT: If ventilation is inadequate or significant product exposure is likely, use a respirator equipped with organic vapor canisters. Chemical gloves and goggles should be worn when handling slimicide C-30.

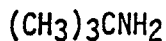
FIRE HAZARDS: Slimicide C-30 is only slightly flammable. It must be preheated in order to burn and then burns with difficulty. To extinguish fire, use dry chemical, carbon dioxide, foam or water.

FIRST AID: Remove victim from contaminated area. Remove contaminated clothing and wash affected skin with soap and water for 15 minutes. If slimicide has gotten into the eyes, flush with plenty of low velocity water for at least 15 minutes. Contact a physician immediately. If breathing is difficult give oxygen. If any slimicide has been swallowed, DO NOT INDUCE VOMITING. Dilute stomach contents with 3-4 glasses of milk or water. Contact a physician immediately.

TERT-BUTYLAMINE (TBA)

30.

2-Aminoisobutene
2-Amino-2-methylpropane
1,1-Dimethylethylamine
Trimethylaminomethane



TLV, 5 ppm; Skin Adsorption
Odor Threshold; Unavailable

PROPERTIES: TBA is a clear colorless liquid with an ammonia-like odor. The specific gravity is 0.698, the boiling point is 45.2°C, the molecular weight is 73.14, the vapor pressure is 340 mm Hg (20°C), the vapor density is 2.5 (air = 1). t-Butylamine is completely soluble in water.

SYMPTOMS: TBA can cause severe pulmonary irritation. Thus intense irritation of the nose and throat would act as a warning and cause voluntary withdrawal if the exposed person was not trapped. Exposure to 2,000 ppm TBA vapors will cause immediate pain in the nose, throat and lungs followed by mental confusion and, if not immediately removed from exposure, convulsions and eventually death.

It is considered highly possible that repeated exposure to sub-acute levels could cause chronic symptoms. These symptoms would probably be manifested as pulmonary distress, blood changes, and possibly liver and kidney damage.

Skin contact with TBA is followed by an immediate burning sensation similar to sulfuric acid burns. TBA contact can lead to burns similar to third degree thermal burns with complete destruction of the skin in the area of the contact.

TBA is a very serious eye irritant and can cause permanent sight impairment in a very short time. The action of TBA in this case is not that of caustic corrosion alone, but is probably the result of rapid protein extraction from the eye tissue.

If TBA is swallowed, it can cause severe injury or death. Ingestion causes burns of the mucous membranes of the mouth, throat, esophagus and stomach.

PROTECTIVE EQUIPMENT: MSA or Comfo masks equipped with organic vapor canisters may be used in atmospheres containing less than 50 ppm TBA.

In cases where the TBA vapor concentration exceeds 50 ppm, masks having supplied air should be worn.

Plastic coated gloves and splash-proof cover goggles should be worn when handling TBA. Do not depend upon rubber gloves for protection because TBA can penetrate them. Slicker suits, face shields or acid hoods, rubber boots, etc. may be indicated in cases where the possibility of being splashed or sprayed with TBA exists.

FIRE HAZARDS: tertiary-Butylamine is a Class 1B flammable liquid. It has a flash point of 50°F and a boiling point of 113°F. The flammable limits are 1.7% to 9.0% in air, the vapor pressure is 380 mm Hg at 20°C, the vapor density is 2.5 (air = 1) and the autoignition temperature is 612°F. Extinguish fire with dry chemical, alcohol foam, or CO₂. Water may be ineffective on fire but may be used to cool down tanks and to knock vapors down.

FIRST AID: The first 15 seconds is critical in removing TBA from exposed tissue. Most if not all damage is done within this first 15 seconds.

For skin or eye exposure, immediately flush with large volumes of water. All contaminated clothing must be removed immediately. This can best be done under the safety shower. Continue to flush all exposed tissue for 15 minutes.

If oxygen is available it should be administered for inhalation exposure. If victim is not breathing, mouth-to-mouth artificial respiration should be started immediately followed by oxygen when victim begins to breathe on his own.

If victim has swallowed any TBA and is conscious, give as much milk or water as victim can drink followed by inducing him to vomit by sticking his finger down his throat.

P-TERT-BUTYL CATECHOL (TBC) (85% IN METHANOL)

31.



TLV, 200 ppm (based on Methanol exposure); Skin Adsorption
Odor Threshold; Not Established

PROPERTIES: TBC as used at this location is an 85% solution in methanol. Its appearance is a water white to light yellow liquid and has a phenolic odor. The boiling point is 154°F, the specific gravity is 1.030 at 25°C, the flash point is 86°F and its solubility is 0.5 gr/100 gr in water.

SYMPTOMS: The primary toxic vapor problem with TBC in a methanol solution is the exposure to the methanol vapors. TBC itself is similar to phenol in its toxic effects; it differs in that its corrosive action and its rate of absorption through the skin is much slower. A short single exposure of the skin for several minutes may cause marked irritation or even a burn. Prolonged or repeated exposure may cause a severe burn. This material may cause skin sensitization or allergic response. For systemic intoxication to occur, contact would have to occur over fairly large areas of skin and would have to persist for longer than just a few minutes. Systemic intoxication from exposure to methanol vapors is possible if the worker is exposed to concentrations greater than 200 ppm for an 8 hour work day.

Exposure of the eyes to the liquid solution may cause a severe burn sufficient to result in possible impairment of vision.

The material is highly toxic when swallowed due to the methanol which is considered to be a poison from ingestion in concentrations greater than 4%. The probable lethal dose of methanol for man is estimated to be between 2 and 8 ounces. If solid TBC or concentrated solutions of TBC are ingested it causes corrosive injury to the mucous membranes of the mouth, throat, esophagus, and stomach.

PROTECTIVE EQUIPMENT: MSA or Comfo masks equipped with organic vapor canisters may be used in environments having less than 0.2% (2,000 ppm) methanol. In atmospheres other than this, supplied air masks should be used. Chemical gloves and splash-proof goggles should be used when handling TBC in any form. In addition, boots, face shield, apron, or slicker suit may be recommended as circumstances dictate.

FIRE HAZARDS: The fire hazards associated with this material are essentially those of methanol. It is a Class 1C flammable liquid having a flash point of 86°F and a boiling point of 154°F. The methanol vapors have a flammability range of 5.5 to 36.5% in air and an autoignition temperature of 878°F. Extinguishing agent--water fog, foam, CO₂, dry chemical.

FIRST AID: If ill effects of exposure to vapors occur, immediately get victim to fresh air, keep him quite and warm, and get medical help. If breathing is difficult give oxygen. If breathing has stopped, give mouth-to-mouth artificial respiration followed by oxygen when he begins to breathe on his own. If TBC solution has gotten on skin or in eyes, immediately remove contaminated clothing and flush with large volumes of water for 30 minutes. Soap may be used to help remove TBC from the skin.

If TBC solution has been swallowed, DO NOT INDUCE VOMITING. Give large amounts of milk or water then induce vomiting and get medical help.

NOTES TO PHYSICIAN: 85% p-tert-Butylcatechol in methanol is a corrosive material. Gastric lavage is hazardous; when done, it should be under esophagoscopy control. Methanol is known to cause blindness.

CARBON DIOXIDE

32.

CO₂

TLV, 5000 ppm; Simple Asphyxiant
Odor Threshold; Odorless

PROPERTIES: Carbon dioxide is a colorless, odorless gas. It can be a liquid or solid at low temperatures. The molecular weight is 44, it sublimates at -104°F. The vapor density is 1.527 (air = 1). It is soluble in water to the extent of 171 ml/100 ml at 0°C.

SYMPTOMS: Levels of 3% are readily tolerated for extended uninterrupted periods of several days with no ill effects. The primary dangers from carbon dioxide are suffocation or frostbite. Chronic exposure is not a problem in most industrial settings because the worker does not stay in CO₂ atmosphere 24 hours/day as would a submarine sailor.

Symptoms of acute overexposure are headache, dizziness, sweating, increased heart rate and elevated blood pressure. If the victim is not removed to fresh air, asphyxia, paralysis, convulsions, coma and death may result.

Exposure to CO₂ levels of 5% are sufficient to produce respiratory center stimulation and mild narcotic effect. Exposure to levels above 7% can produce unconsciousness within a few minutes regardless of the oxygen level.

PROTECTIVE EQUIPMENT: Appropriate clothing and equipment should be worn to prevent any body contact with liquid or solid CO₂. There are no known harmful effects of eye or skin contact with CO₂ gas and no toxic effects from ingestion of CO₂ solutions.

Respiratory protection is provided only by respirators with supplied air.

FIRE HAZARDS: CO₂ is a nonflammable gas and is used as an extinguishing agent.

FIRST AID: Remove victim from contaminated atmosphere. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen and support respiration if needed. If the skin or eyes have been frostbitten, flush with plenty of low velocity water. DO NOT RUB AFFECTED AREA. In case of either overexposure or frostbite from CO₂, the victim will need medical observation and attention.

CARBON MONOXIDE

CO

TLV, 50 ppm

Odor Threshold; Odorless

PROPERTIES: Carbon monoxide (CO) is an odorless, colorless and tasteless gas. It has a density of 0.97 (air = 1), a boiling point of -190°C and a molecular weight of 28. It is sparingly soluble in water (3.3 ml/100 ml H_2O at 0°C).

SYMPTOMS: Carbon monoxide is a chemical asphyxiant gas whose primary toxic action is a reduction in the oxygen-carrying capacity of the blood which exerts a finite stress on an exposed worker. The body compensates for this hypoxic stress by increasing cardiac output and blood flow to specific organs, such as the brain or the heart. When this ability is overpowered or is limited by disease, tissue injury results.

Symptoms of poisoning will result from exposure to 1,000 ppm for 30 minutes or 500 ppm for one hour. One hour at 1,500 ppm is dangerous to life. Exposure to concentrations of 500 to 1,000 ppm results in a gradually increasing series of symptoms. Respiration is increased, followed by headaches, nausea and mental confusion. In some instances, the skin and mucous membranes may appear cherry red even after respiration has ceased.

There is no known problem from skin or eye exposure to gaseous carbon monoxide. Liquidified CO, on the other hand, presents a frostbite hazard.

PROTECTIVE EQUIPMENT: Air masks should be used in concentrations above 100 ppm. In lower concentrations, the MSA or Comfo mask equipped with a Type D or Type N cartridge rated for use with carbon monoxide may be used. Appropriate gloves and eye protection should be worn where there exists a possibility for exposure to liquidified CO.

FIRE HAZARDS: Carbon monoxide is a flammable gas. Flammable limits = 12% to 75%, autoignition = 1128°F , extinguishing agent = let fire burn; shut off flow of gas and cool adjacent exposures with water. Extinguish (only if wearing self contained breathing apparatus) with dry chemicals or carbon dioxide.

FIRST AID: Move victim to fresh air. If breathing has stopped, give mouth-to-mouth artificial respiration followed by oxygen when he begins to breathe on his own. If breathing has not stopped, give oxygen. In either case, support respiration as needed, do not allow victim to physically exert himself. Keep him warm and get medical attention as soon as possible.

If skin has been exposed to liquid CO, flush with plenty of water. DO NOT RUB AFFECTED AREAS.

CAUSTIC (SODIUM HYDROXIDE)

Caustic Soda
Lye

NaOH

Ceiling Limit, 2 mg/m³
Odor Threshold; Not Pertinent

PROPERTIES: Sodium hydroxide is a white solid which will readily absorb moisture from the air and liquify. It has a molecular weight of 40.01 and a specific gravity of 2.13. It boils at 1390°C and melts at 318.4°C. It is soluble in water (42 g/100 ml at 0°C), alcohol and glycerine, but insoluble in non-polar solvents.

SYMPTOMS: Caustic is very strongly corrosive to tissues with which it comes into contact. It can cause severe burns, frequently deep ulceration and ultimate scarring. Severe burns result not only from contact with solid material, but also from solutions of this compound. Even dilute solutions, on prolonged contact, exert a destructive effect on tissues. Injury may result before one realizes that the chemical is in contact with the skin, because signs and symptoms of irritation are frequently not evident immediately after contact.

Dermatitis of the primary irritant type may occur following single or repeated exposure to dilute solutions. Repeated exposures result in itching or scaling condition of the skin, which may require prolonged treatment by a dermatologist.

Contact with the eyes, either in a solid form or in a solution, causes severe damage.

Swallowing either the solid form or the solution causes severe damage to the mucous membranes of the mouth, throat, esophagus and stomach. Perforation of these tissues may follow severe exposure.

PROTECTIVE EQUIPMENT: For dust and particulate protection use a full facepiece mask with a high efficiency particulate cartridge or supplied air mask.

Chemical gloves and splash-proof goggles should be worn when handling caustic. The use of complete body protection involving slicker suits, boots, acid hood or face shield, etc., is sometimes recommended.

FIRE HAZARDS: Caustic is non-flammable, however, it may produce flammable gas on contact with metals. It may cause fire on contact with combustible materials.

FIRST AID: If contact with the skin is made either by the solid form or solution form, it should be washed off immediately with large volumes of running water. Remove contaminated clothing while under safety shower. Washing should continue until medical help arrives. Washing with large amounts of flowing water is less damaging than are attempts at chemical neutralization. If even minute quantities of either solid or solution enter the eyes they should be irrigated immediately with copious amounts of low velocity water for at least 15 minutes.

If victim has inhaled caustic dust, give oxygen if he is breathing or mouth-to-mouth artificial respiration followed by oxygen if he is not breathing.

If the victim has swallowed any caustic, DO NOT INDUCE VOMITING. If victim is conscious have him wash out his mouth and drink as much milk or water as possible.

NOTE TO PHYSICIAN: Sodium hydroxide is extremely corrosive. Gastric lavage is hazardous, when done, it should be under esophagoscopy control.

CHLORINE

35.

Cl₂

TLV, 1 ppm

Odor Threshold; 3.5 ppm

PROPERTIES: Chlorine is a non-combustible greenish-yellow gas with a suffocating, bleach-like odor. It liquefies at -35°C. The liquid has a specific gravity of 1.478 at 0°/4°C. The vapor density is 2.49 (air = 1). The molecular weight is 70.91. Chlorine has a solubility in water of 1% at 60°F.

SYMPTOMS: Chlorine is extremely irritating to the mucous membranes of the eyes and respiratory tract. It combines with moisture to liberate oxygen and form hydrochloric acid. Both these substances, if present in quantity, cause inflammation of the tissues with which they come into contact. If lung tissues are attacked, pulmonary edema may result. A concentration of 15 ppm causes immediate irritation of the throat. Concentrations of 50 ppm are dangerous for even short periods of exposure. 1000 ppm may be fatal, even where the exposure is brief.

The initial reaction to concentrations above 10 ppm is irritation of the eyes and mucous membranes of the nose and throat. This is followed by coughing, a feeling of suffocation, and later, pain and a feeling of constriction in the chest. In sufficient concentrations or for sufficient duration, this is followed by a loss of consciousness.

A high concentration of chlorine gas irritates the skin and eyes causing a burning or itching sensation. Inflammation or blisters may occur if the exposure persists.

PROTECTIVE EQUIPMENT: Chemical cartridge respirators may be used in concentrations below 10 ppm. For conditions other than these, air supplied full facepiece respirators should be used.

If there is danger of contact with liquid or high concentrations of vapor, plastic gloves and cover goggles should be worn. Additional body protection may be indicated in certain circumstances.

FIRE HAZARDS: Chlorine is a non-flammable gas but may cause fire on contact with combustible material. POISONOUS GASES ARE FORMED IN FIRES.

FIRST AID: Remove victim from contaminated atmosphere. Loosen constricting clothing. If victim is not breathing, start mouth-to-mouth artificial respiration. When victim begins to breathe on his own, give oxygen. If victim has not stopped breathing, give oxygen to assist respiration and ease pain of deep respiratory effort. Continue to support respiration as needed.

If victim has been exposed to liquid chlorine, the affected areas may be frostbitten. Flush with plenty of water. DO NOT RUB AFFECTED AREAS.

If the eyes have been exposed to chlorine, they should be promptly flushed with copious amounts of low velocity water for 15 minutes. In all cases, the victim should be taken for medical attention.

COBALT HYDROCARBONYL

HCo(CO)_4

TLV, 0.1 ppm

PROPERTIES: Cobalt hydrocarbonyl is an unstable toxic and flammable gas. It readily decomposes in air within one minute to cobalt oxide and carbon monoxide. It has a molecular weight of 171.98, a melting point of -26.2°C and decomposes rapidly in air at room temperature.

SYMPTOMS: Respiratory exposure is unlikely due to its instability in air. It produces the same symptoms as nickel carbonyl and iron pentacarbonyl but is about $1/2$ the acute toxicity of nickel carbonyl. The symptoms of overexposure are immediate symptoms of headache and dizziness followed in 12 to 36 hours by symptoms of fever, blueness of lips and fingernails, cough and shortness of breath.

The primary effects are on the lungs but degenerative changes in the central nervous system have also been reported.

PROTECTIVE EQUIPMENT: In concentrations above 0.1 ppm, only full facepiece supplied air respirators in the positive pressure mode should be used.

Appropriate protective clothing and equipment should be worn if there is any reasonable probability of contact with material which contains cobalt hydrocarbonyl.

FIRE HAZARDS: Cobalt hydrocarbonyl is a highly flammable and toxic gas. Full facepiece respirators with supplied air operated in the positive pressure mode should be worn when fighting fires.

FIRST AID: Move victim to fresh air. If breathing has stopped, give artificial respiration. DO NOT USE THE MOUTH-TO-MOUTH METHOD. Remove any clothing which has been contaminated and flush affected areas with plenty of water. If any material has gotten into the eyes, flush with plenty of low velocity water for 15 minutes. Get immediate medical attention. If any material containing cobalt hydrocarbonyl is swallowed, give 3-4 glasses of milk or water to dilute stomach contents and treat according to the material swallowed.

NOTE TO PHYSICIAN: The literature reports that chelating agents such as calcium disodium ethylenediamine - tetra acetic acid (EDTA) or sodium Diethyldithiocarbamate (Dithiocarb) may be used to treat workers who have been exposed to high levels of carbonyls.

COBALT OXIDE

37.

CoO

TLV, 0.1 mg/m³

Odor Threshold; Data Unavailable

PROPERTIES: Cobalt oxide occurs as a powder or cubic or hexagonal crystals. The commercial material is usually dark gray and contains about 76% Co. The molecular weight is 74.94 and the melting point is about 1935°C. Readily absorbs O₂ even at room temperature. Practically insoluble in water but soluble in acids or alkalis.

SYMPTOMS: Cobalt oxide enters the system by inhalation, ingestion and skin and eye contact. The symptoms of overexposure are cough, difficulty in breathing, decrease of pulmonary function, loss of weight, dermatitis, respiratory hypersensitivity and diffuse nodular fibrosis in the lungs.

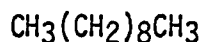
The organs most susceptible to damage by cobalt oxide are the respiratory system, skin and lungs.

PROTECTIVE EQUIPMENT: Workers should wear appropriate protective clothing and equipment to prevent repeated or prolonged skin contact. Goggles should be worn if there exists any reasonable probability of the eyes being exposed.

Respirators equipped with dust filters are good up to 0.5 mg/m³. From 0.5 mg/m³ to 1.0 mg/m³, full facepiece respirators with dust filters may be worn. For other conditions, respirators with supplied air should be worn. Disposable dust masks are not acceptable for any condition.

FIRE HAZARDS: Cobalt oxide is a nonflammable solid.

FIRST AID: Remove victim from contaminated area. Give mouth-to-mouth artificial respiration if breathing has stopped and oxygen for difficult breathing. Remove contaminated clothing and wash affected skin with soap and water. Flush the eyes with plenty of low velocity water if any of the dust has gotten into them. If any of the material has been swallowed, give 3-4 glasses of milk or water and have him vomit by sticking his finger down his throat. Get prompt medical attention.

DECANE**Decyl Hydride****TLV, Simple Asphyxiant****Odor Threshold; Data Not Available**

PROPERTIES: Decane is a liquid. It has a molecular weight of 142.3, a melting point of -29.7°C , a boiling point of 174.1°C , and a density of 0.730 at 20°C .

SYMPTOMS: Decane is a simple asphyxiant but can produce a narcotic effect in high concentrations. Prolonged inhalation of high concentrations can cause chemical pneumonia. Repeated or prolonged exposure of the skin to liquid Decane can cause dermatitis.

FIRE HAZARDS: Decane is a moderate fire hazard when exposed to heat or flame. It can react with oxidizing materials. Flammable limits in air = 0.8% to 5.4%, flash point = 115°F , autoignition temp. = 482°F , vapor density = 4.90 (air = 1).

FIRST AID: Remove victim from contaminated area. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen. If the clothing is contaminated with the liquid, remove contaminated clothing and wash affected areas. If any material has gotten into the eyes, flush with plenty of low velocity water for at least 15 minutes and get medical attention. If any of the material has been swallowed, give 3-4 glasses of milk or water to dilute stomach contents. DO NOT INDUCE VOMITING. Get immediate medical attention.

DEHYDROGENATION CATALYST (DEPT. 15/16)

39.

Nominal Composition:

	<u>G64I</u>	<u>G6HC</u>	<u>S-015</u>	<u>S-105</u>
Fe ₂ O ₃	50%	62%	74%	86%
K(OH)	37%	23%	20%	11%
Ce ₂ O ₃	6%	5%	2%	--
MoO ₃	3%	3%	--	--
Cr ₂ O ₃	0.1%	--	1%	3%
CoO	--	--	1%	--
V ₂ O ₅	--	--	1%	--
W ₂ O ₃	--	--	1%	--
CaO	--	3%	--	--

TLV, 1.0 mg/m³ (Based on Cr Content)
Odor Threshold; Data Unavailable

PROPERTIES: Dehydro catalyst is a reddish-brown, non-flammable pelletized material with no odor. It weighs approximately 80 lb/ft³.

SYMPTOMS: The primary health hazard of this material is its caustic properties due to the potassium carbonate (potash) content. If the dust gets on moist skin, the caustic potassium carbonate can cause dermatitis or skin irritation in extreme cases. The most frequent complaint of those whose skin has been exposed to the dust is an itching sensation at the site of exposure.

Inhaled dust can cause inflammation of the nose, throat and respiratory tract in extreme cases. Also of concern with inhaled or ingested dust is the toxicity of the heavy metals such as chromium and vanadium. These metals do not, however, present a great hazard because of their low levels of concentration.

The eyes are particularly sensitive to the catalyst dust both because of the chemical and the mechanical irritation.

PROTECTIVE EQUIPMENT: Adequate respiratory protection is given by a dust respirator equipped with a high efficiency particulate canister. Cover goggles, rubber or plastic gloves and coveralls will provide the necessary protection for the skin and eyes.

FIRE HAZARDS: There are no fire hazards associated with dehydro catalyst.

FIRST AID: Wash exposed skin with freely flowing water. Soap may be used to help remove dust.

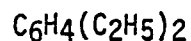
If dust has gotten into the eyes, flush for 15 minutes with low velocity water and treat as for caustic exposure.

If dust has been inhaled and the victim is experiencing breathing difficulty, give oxygen.

If the dust or pellets have been swallowed, give as much water or milk as the victim can drink.
DO NOT INDUCE VOMITING.

In all cases of eye exposure or ingestion of catalyst, a physician should be consulted. In cases of respiratory exposure which produces coughing or irritation of the nose, throat or respiratory tract, consult a physician.

Skin exposure which causes only mild and temporary local irritation will probably need nothing more than washing of the affected area. If the symptoms are anything other than mild and temporary irritation, seek medical attention.

DIETHYLBENZENE (DiEB)

TLV, 100 ppm (Based on TLV for Ethylbenzene)
Odor Threshold; Data Unavailable

PROPERTIES: DiEB is a colorless liquid with a Benzene-like hydrocarbon odor. It has a specific gravity of 0.87, the molecular weight is 134.21, the boiling point is 182°C, the freezing point is -43°C. It is negligibly soluble in water.

SYMPTOMS: DiEB is an irritant to the eyes and mucous membranes. It can cause dermatitis from prolonged or repeated exposure. Inhalation of high concentrations of the vapor is unlikely at normal ambient conditions. It can cause headache, dizziness, nausea and coma at very high concentrations.

PROTECTIVE EQUIPMENT: Workers should wear appropriate clothing and equipment to prevent prolonged or repeated contact. Goggles should be worn if there is any reasonable probability of eye exposure. For respiratory protection a full facepiece chemical cartridge respirator equipped with organic vapor cartridges may be used if the vapor concentration does not exceed 1000 ppm. For vapor concentrations greater than this, a respirator with supplied air should be used.

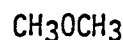
FIRE HAZARDS: DiEB is a moderate fire hazard when exposed to heat or flame. It can react with oxidizing materials. Flash point = 133°F, autoignition temp. = 806°F, vapor density = 4.62 (air = 1). Extinguishing agents = CO₂, dry chemical, foam, water fog. Fight fire in the same manner as any Grade D petroleum fire. Firefighters should wear respiratory protection.

FIRST AID: Remove victim from contaminated area. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen. If the eyes have been splashed with DiEB, flush with plenty of low velocity water for at least 15 minutes and get medical attention. If the body has been splashed, remove contaminated clothing and wash affected areas with soap and water. If the victim has swallowed any DiEB, give 3-4 glasses of milk or water to dilute stomach contents. DO NOT INDUCE VOMITING. Get immediate medical attention.

6113
23035

DIMETHYL ETHER

Methyl Ether
Wood Ether
Methoxymethane



TLV, Data Not Available
Odor Threshold; Data Not Available

PROPERTIES: Dimethyl ether is a colorless flammable gas with a sweet chloroform-like odor. The molecular weight is 46.1, the boiling point is -12.5°F , and the vapor density is 1.6 (air = 1).

SYMPTOMS: Dimethyl ether is not toxic in the sense of being a poison. Inhalation produces some anesthesia, but less than that of ethyl ether, blurring of vision, headache, intoxication, and loss of consciousness. Death due to respiratory failure may result from severe and continued exposure. Liquid or concentrated vapor is irritating to the eyes. Contact of liquid with skin may cause frostbite.

PROTECTIVE EQUIPMENT: Masks equipped with an organic vapor canister may be used in atmospheres containing less than 2% dimethyl ether. For conditions other than these, supplied air masks should be used.

Chemical gloves and splash-proof cover goggles should be worn when handling liquid dimethyl ether.

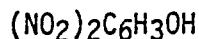
FIRE HAZARDS: Dimethyl ether is a flammable gas. The flammable limits = 2% to 50% in air, ignition temperature = 662°F . Let fire burn. Stop flow of gas if possible. Cool exposed containers and protect men affecting shut-off with water.

FIRST AID: Move victim to fresh air. If breathing has stopped, give mouth-to-mouth artificial respiration followed by oxygen when he starts breathing on his own. If breathing has not stopped but is difficult, give oxygen.

If victim has been exposed to liquid dimethyl ether, remove contaminated clothing and flush affected areas with plenty of water. DO NOT RUB AFFECTED AREAS. If the liquid has gotten into the eyes, flush with plenty of low velocity water. If victim has swallowed any liquid and is conscious, have

him drink as much milk or water as possible. DO NOT INDUCE VOMITING. In all cases of over-exposure, consult a physician as soon as possible.

2,4 DINITROPHENOL (NSI)



TLV, 0.2 mg/m³, Skin Absorption
Odor Threshold; Unknown

PROPERTIES: Dinitrophenol is a yellow crystalline powder. It has a molecular weight of 184.11, a melting point of 112°C, and a density of 1.683 at 24°C.

SYMPTOMS: The most characteristic systemic effect is that of increasing the metabolic rate. This increase may result in liver and kidney damage. Oxygen consumption, body temperature, respiratory rate, and heart rate are all increased. The skin becomes hot and flushed, and profuse perspiration, intense thirst, severe headache, nausea, vomiting, abdominal pain, restlessness, anxiety, delirium, and general weakness occur. Excessive hunger, acidosis, and dehydration may be followed by circulatory or respiratory collapse and death. Additionally, the literature reports the formation of cataracts in the eyes of laboratory animals exposed to Dinitrophenol.

PROTECTIVE EQUIPMENT: Workers should wear clothing and equipment to prevent contact with 2,4 Dinitrophenol. Goggles should be worn if there is any possibility of the eyes being exposed. Disposable high efficiency dust masks (blue 3M #8706) should be worn when handling the material. When the material is wet (the normal condition when being handled) it does not present a dust or respiratory problem.

FIRE HAZARDS: When dry, Dinitrophenol is a serious fire hazard when exposed to heat or flame. It can be extinguished with CO₂, dry powder, or water fog.

FIRST AID: If the material has gotten into the eyes, flush with plenty of low velocity water for at least 15 minutes. If the body has been exposed to contamination, remove contaminated clothing and wash affected areas with soap and water. If the affected area is no more than a hand or the sum of the areas is no more than the size of your hand, no action is required beyond thoroughly scrubbing the areas with soap and water. If, however, the areas are equal to or greater than the area of an arm or leg, thoroughly wash with soap and water and get medical attention. Anytime a worker shows any of the symptoms of overexposure he should be seen by a physician.

ETHYLBENZENE

43.

EB
Phenylethylene

C₈H₁₀

TLV, 100 ppm
Odor Threshold; 140 ppm

PROPERTIES: Ethylbenzene is a colorless liquid with a sweet gasoline-like aromatic odor. It has a molecular weight of 106.16, a specific gravity of 0.86258 at 25°C and a vapor pressure of 3.7 (air = 1). "Saturated" air with the vapor at 26°C and 760 mm is 1.32%. It boils at 136.2°C and freezes at 95.01°C. The flashpoint is 63°F, autoignition temperature is 810°F. Ethylbenzene is only slightly soluble in water at 15°C (14 mg/100 ml), but is miscible with alcohol and ether.

SYMPTOMS: Ethylbenzene toxicity is characterized by its irritancy to the skin, and less markedly to the mucous membranes. At a vapor concentration of 200 ppm in the air, the vapor has a transient irritant effect on the eyes; at 1000 ppm, irritation and tearing, but tolerance develops rapidly; at 2000 ppm, eye irritation and tearing are immediate and severe, and are accompanied by moderate nasal irritation, decreasing somewhat in several minutes; at 5000 ppm, the vapor causes intolerable irritation to the eyes and nose.

Animal tests performed in EB vapor concentrations from 400 to 2200 ppm, 7 to 8 hours per day, 5 days per week, for as long as 6 months, showed no harmful effects by any criteria of injury. It is apparent that no systemic effects can be expected at levels producing distinctly disagreeable, yet tolerable, skin and eye irritation.

EB is a skin irritant which can produce blistering in severe cases of continuous or repeated contact. This most frequently occurs when EB is held in contact with the skin by clothing, shoes, rings, watches, etc. It can cause drying of the skin and dermatitis.

Liquid and high concentrations of the vapor are severely irritating to the eyes and can cause burns in extreme cases.

Ingestion of EB causes irritation and possibly burns to the mucous membranes of the mouth, esophagus, and stomach. If any EB enters the lung it will cause chemical pneumonia and possible suffocation. The symptoms associated with ingestion of EB are headache, dermatitis, narcosis, and coma. The LD₅₀ is 0.5 to 5 gm/Kg (rat).

PROTECTIVE EQUIPMENT: Masks equipped with organic vapor canister will provide respiratory protection in atmospheres containing less than 1000 ppm EB vapor. In conditions other than these, supplied air respirators are recommended.

Chemical gloves and splash-proof goggles are recommended when handling EB.

Additional protection such as slicker suits, boot face shield, and self contained breathing apparatus, may be required in some instances.

FIRE HAZARDS: Ethylbenzene is a Class 1B flammable liquid. Flashpoint = 63°F, flammable limits = 1% to 6.7% in air, autoignition temperature = 810°F. Irritating vapors are generated when heated. Fire extinguishing agents = foam (most effective), water fog, carbon dioxide or dry chemical.

FIRST AID: (OVER)

FIRST AID: Remove victim from contaminated atmosphere. Remove contaminated clothing under safety shower. Wash affected areas thoroughly with plenty of water. Soap may be used if available.

If victim is not breathing, start mouth-to-mouth artificial respiration followed by oxygen when he starts to breathe on his own. If breathing has not stopped but is difficult, give oxygen.

If any EB has gotten into the eyes, flush with plenty of low velocity water for at least 15 minutes.

In case of ingestion, if the victim is conscious, give as much milk or water as he can drink. DO NOT INDUCE VOMITING.

In all cases of overexposure consult a physician as soon as possible.

ETHYL CHLORIDE

Chloroethane
Monochloroethane
Hydrochloric Ether
Muriatic Ether



TLV, 1000 ppm
Odor Threshold; Data Not Available

PROPERTIES: Ethyl chloride is a colorless liquid or gas with a pungent ether-like odor. It has a molecular weight of 64.52 and a vapor density of 2.23 (air = 1). It has a melting point of -138.7°C , a boiling point of 12.2°C , and a vapor pressure of 1064 mm Hg at 20°C . The flash point is 58°F , the autoignition temperature is 966°F , and the flammable limits are 3.75 to 15.4% in air. Ethyl chloride is 0.57% soluble in water at 20°C , 48% soluble in ethyl alcohol at 21°C , and is soluble in ethyl ether.

SYMPTOMS: Exposure to vapor concentrations of 13,000 ppm produce only slight symptoms of toxicity, 19,000 ppm produce weak analgesia within 12 minutes, 25,000 ppm produce a lack of coordination within a few minutes of exposure, and 40,000 ppm causes almost immediate symptoms of eye irritation, loss of coordination, stomach cramps and stupor. The most serious concern is a high level exposure to ethyl chloride. Chronic exposure to levels in excess of 1,000 ppm can cause liver and kidney damage. The most serious concern from exposure to high concentrations of the vapor, other than the anesthetic effect, is the possibility of potentiation of adrenalin and resultant cardiac arrhythmias.

Liquid ethyl chloride spilled on the skin or in the eyes causes rapid cooling, presenting the possibility of frostbite.

Ingestion of the liquid results in the probability of frostbite of the mouth, throat and stomach. Toxic symptoms from ingestion are the same as those from inhalation of the vapors.

PROTECTIVE EQUIPMENT: For vapor concentrations from 1,000 ppm to 2% for $1/2$ hour or less, full facepiece respirators equipped with organic vapor canister is sufficient. For other conditions, air supplied, full facepiece respirators are recommended. Slicker suit, boots, gloves and cover goggles or face shield are recommended where

there is a possibility of contact with liquid ethyl chloride.

FIRE HAZARDS: Ethyl chloride is a highly flammable gas. Toxic and irritating gases are generated in fires. Flashpoint = -58°F , auto ignition point = 966°F , flammable limits = 3.75% to 15.4% in air. Fire extinguishing procedure = let fire burn, shut off flow of ethyl chloride, cool surrounding equipment with water. Smaller fires may be extinguished with water fog, carbon dioxide or dry chemical.

FIRST AID: Move victim to fresh air. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult give oxygen. If liquid has gotten into eyes or on skin, flush with plenty of water for 15 minutes. DO NOT RUB AFFECTED AREAS.

If any of the material has been swallowed, and the victim is conscious, give as much milk or water as he can drink, then induce vomiting by having him stick his finger down his throat.

ETHYLENE

Ethene
Olefiant gas
Etherine

C_2H_4

TLV, Simple Asphyxiant
Odor Threshold; Data Not Available

PROPERTIES: Ethylene is a liquifiable colorless gas which has a suffocating faint sweet ether-like odor. The molecular weight is 28.05, the boiling point is $-154.7^{\circ}F$, the specific gravity of the liquid is 0.569 at $-103.8^{\circ}C$ and the vapor density is 1.0 (air = 1).

SYMPTOMS: The primary health hazard of ethylene is that it is an asphyxiant. Exposure to moderate concentrations in air causes drowsiness and dizziness. Overexposure causes headache, drowsiness and muscular weakness and may lead to unconsciousness and death from suffocation.

Ethylene is not irritating nor injurious to the skin, eyes, nose or throat in gas form. Liquid ethylene can cause frostbite to exposed tissue.

PROTECTIVE EQUIPMENT: In vapor concentrations up to 1%, masks equipped with an organic vapor canister will provide adequate respiratory protection for short (5 to 10 minutes) periods. For conditions other than these, a full facepiece mask with supplied air is recommended. If there is a likelihood of exposure to liquid ethylene, slicker suit, boots, gloves and faceshield are recommended.

FIRE HAZARDS: Ethylene is a highly flammable gas. Flashpoint = $-213^{\circ}F$, flammable limits in air = 2.75% to 28.6%, autoignition temperature = $842^{\circ}F$. Fire extinguishing agents = stop flow of gas, cool surrounding equipment with water. Do not extinguish flames without stopping flow of gas, extreme danger of flashback explosion will result.

FIRST AID: Move victim to fresh air. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen.

If victim has been exposed to liquid ethylene, flush exposed tissue with plenty of water. DO NOT RUB AFFECTED AREAS. Consult a physician as soon as possible.

FREON

Genetron
Isotron
Ucon

Various Trade Names

Freon is a trademarked name for a series of fluorinated-chlorinated hydrocarbons.

TLV, Simple Asphyxiant
Odor Threshold; Data Not Available

PROPERTIES: Most freons are gases at room temperature and are usually colorless and odorless although some may have a sweetish odor. Freons are liquifiable with pressure.

SYMPTOMS: Freons are not toxic from a systemic standpoint. Their greatest health hazard is their asphyxiant quality. The gas is non-irritating to the skin, eyes, nose or throat. The liquid can cause frostbite to exposed tissue.

The symptoms of overexposure are those of simple asphyxia, i.e., drowsiness with or without nausea, headache, lack of coordination and muscular weakness. If the exposure continues, unconsciousness and death result for hypoxia.

PROTECTIVE EQUIPMENT: In environments having a freon vapor concentration greater than 1,000 ppm up to 1%, MSA or Comfo masks equipped with organic vapor canisters may be used. For other conditions, a supplied air respirator should be used.

Chemical gloves and face shield should be used if there is a likelihood of exposure to liquid freon.

FIRE HAZARDS: Freon is non-flammable and is not a fire hazard itself. However, if it contact hot surfaces or a naked flame, it produces phosgene, an extremely poisonous gas.

FIRST AID: Move victim to fresh air. If breathing has stopped, give mouth-to-mouth artificial respiration UNLESS the victim has been exposed to combustion products of freon. In the latter case use an alternative form of artificial respiration. Do not use mouth-to-mouth. If the victim is having

difficulty breathing give oxygen. If he has been exposed to liquid freon, flush exposed areas with plenty of water. DO NOT RUB AFFECTED AREAS. For overexposure to freon or ANY exposure to phosgene, consult with a physician as soon as possible.

NOTE TO PHYSICIAN: When treating for freon exposure, consideration should always be given to the possibility of phosgene exposure if there has been a fire (see FIRE HAZARDS).

HEAVY OXO ENDS

TLV, Not Established
Odor Threshold, Data Unavailable

PROPERTIES: Heavy Oxo Ends are composed of approximately 75% high alcohols (greater than C₁₁) with the balance primarily composed of ethers, carboxylic acid groups and acetals. The material is a clear to yellow oily liquid which may have a green cast. The specific gravity is 0.854, the molecular weight averages 283.4, and the flash point is 350°F.

SYMPTOMS: See Oxo Alcohol.

PROTECTIVE EQUIPMENT: See Oxo Alcohol.

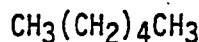
FIRE HAZARDS: Heavy Oxo Ends are a Class IIIB combustible liquid and therefore present a similar, albeit, somewhat less fire hazard than oxo alcohol. See Oxo Alcohol.

FIRST AID: See Oxo Alcohol.

HEXANE

48.

Hexyl Hydride
Normal Hexane



TLV, 50 ppm
Odor Threshold; Data Unavailable

PROPERTIES: Hexane is a clear, volatile liquid with a mild gasoline-like odor. It has a molecular weight of 86.17, and a specific gravity of 0.660. It solidifies between -95°C and -100°C and boils at 68.95°C . It has a vapor pressure of 150 mm Hg at 25°C . The flash point is -23°F and it is miscible with most organic solvents and quite soluble in alcohol.

SYMPTOMS: High concentrations of hexane can be irritating to the eyes and nose. The liquid is irritating to the eyes and can produce dermatitis through prolonged or repeated contact. Inhalation of high concentrations causes light headedness, dizziness, nausea, headache, muscular weakness, numbness and can eventually cause chemical pneumonia. Central nervous system damage has been described in employees exposed to 650 ppm in a furniture factory. Other organs susceptible to damage by hexane are the skin, eyes and respiratory system.

PROTECTIVE EQUIPMENT: Workers should wear appropriate clothing and equipment to prevent prolonged or repeated skin contact. If there is any reasonable probability of eye contact, chemical goggles should be worn. In environments of not more than 1000 ppm hexane, respirators equipped with organic vapor cartridges may be worn. When the concentration exceeds 1000 ppm up to 5000 ppm, a full facepiece respirator with organic vapor cartridges may be used. For other conditions, only a respirator with supplied air should be used.

FIRE HAZARDS: Hexane is a Grade C flammable liquid. Flash point = -7°F , flammable limits in air = 1.1% to 7.7%, autoignition temp. = 500°F , vapor density = 2.98 (air = 1). Extinguishing agents = dry chemical, foam, or carbon dioxide.

FIRST AID: Remove the victim from the contaminated area. If breathing has stopped, give mouth-to-mouth artificial respiration. Give oxygen if breathing is difficult. Promptly remove contaminated clothing (fire hazard) and wash affected areas with soap and water if clothing has become wet with hexane. If any hexane has entered the eyes, immediately flush with plenty of low velocity water for at least 15 minutes. If any has been swallowed, give 3-4 glasses of milk or water to dilute stomach contents. DO NOT INDUCE VOMITING. Get prompt medical attention.

HYDRAZINE SOLUTION

N_2H_4

TLV, 0.1 ppm; Skin Absorption
Odor Threshold; Data Not Available

PROPERTIES: Hydrazine is a colorless liquid with an ammonia-like odor. It has a molecular weight of 32.05 and a specific gravity of 1.0036. The boiling point is 113.5°C, melting point is 2°C, and a flash point of 10°F. It is insoluble in chloroform and ether, miscible with water and methyl, ethyl, propyl and isobutyl alcohols.

SYMPTOMS: The liquid is irritating to the skin and eyes and may cause burns to either. The vapors are irritating to the eyes, nose, throat and, in high concentrations, to the skin. Exposure causes dizziness, nausea, dermatitis, and may cause temporary blindness.

PROTECTIVE EQUIPMENT: Workers should wear clothing and equipment to prevent any possible exposure. If there is any possibility for the eyes to be exposed, goggles should be worn. In atmospheres containing no more than 50 ppm, a supplied air respirator in the demand mode may be used. When the vapor concentration exceeds 50 ppm, the respirator should be switched to the continuous flow mode.

FIRE HAZARDS: Hydrazine is a flammable liquid. Vapor pressure = 10 mm Hg at 20°C, the flammable limits in air = 4.7% to 100%.

FIRST AID: Remove victim from contaminated area. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult give oxygen. Immediately flush with plenty of low velocity water for at least 15 minutes if hydrazine enters the eyes. Remove contaminated clothing and wash affected areas with soap and water if the body has been exposed. If any hydrazine has been swallowed, give 3-4 glasses of milk or water to dilute stomach contents and have victim induce vomiting by sticking his finger down his throat.

6113
23045

HYDROGEN

50.

H₂

TLV, Simple Asphyxiant
Odor Threshold; Odorless

PROPERTIES: Hydrogen is a colorless and odorless gas. It has a density of 0.069 (air = 1), a molecular weight of 2, and a boiling point of -252.8°C.

SYMPTOMS: Hydrogen is a simple asphyxiant and can cause hypoxia or suffocation by replacing the oxygen in the air needed to sustain life. The early symptoms of hypoxia are headache, shortness of breath, and mental sluggishness. If the person is not removed to fresh air, he will exhibit blueness about the lips, face and fingernails. This will be followed by unconsciousness and death.

There is no known problem associated with skin or eye contact. Ingestion is not a problem due to the fact that hydrogen is a gas under normal conditions.

PROTECTIVE EQUIPMENT: Full facepiece supplied air breathing apparatus is the equipment of choice for entering atmospheres containing high concentrations of hydrogen.

FIRE HAZARDS: Hydrogen is a flammable gas. The autoignition temperature = 585°C, flammable limits = 4% to 75% in air, the density is 0.069 (air = 1). Fire extinguishing agents = flow of gas must be stopped before fire is extinguished to prevent accumulation of explosive vapors. Extinguish with CO₂, dry chemical, water.

FIRST AID: Remove victim to fresh air. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen. Recovery will usually be rapid.

HYDROGEN CHLORIDE

51.

Hydrochloric Acid

HCL
HCl

TLV, 5 ppm (Ceiling)
Odor Threshold; 1 to 5 ppm

PROPERTIES: Anhydrous hydrogen chloride is a colorless gas with a sharp, biting odor. It has a molecular weight of 36.5, a boiling point of -85°C , and a density of 1.3 (air = 1).

The aqueous solution is clear to slightly yellow. It has a boiling point of 110°C and a specific gravity of 1.16 (20°Be).

SYMPTOMS: Inhalation of excessive concentrations of hydrogen cyanide vapors immediately produces severe irritation of the upper respiratory tract, resulting in coughing, burning of the nose and throat, and a choking sensation. 10 ppm can be tolerated for 60 minutes, 20 ppm for 30 minutes, 30 ppm for 10 minutes, and work becomes impossible at concentrations of 50-100 ppm. Concentrations of 1,000-2,000 ppm are immediately hazardous to life. Chronic exposure to low concentrations causes erosion of the teeth.

Concentrated solutions of HCl are destructive to clothing and, on contact with the skin, causes severe burns unless promptly washed off. Repeated skin contact with dilute solutions may lead to dermatitis. Exposure to concentrated vapors may also result in burns or dermatitis.

Contact of the eyes with HCl, either as a gas or in solution, rapidly causes severe irritation of the eyes and eyelids. If not quickly removed, there may be permanent visual impairment.

Ingestion of concentrated HCl solution causes severe burns of the mouth, esophagus, and stomach.

PROTECTIVE EQUIPMENT: Full facepiece respirators with acid canisters may be used in concentrations of up to 50 ppm. At other conditions, supplied air masks should be worn. Chemical safety goggles and gloves should be worn when handling HCl. Additional protective clothing may be indicated under some circumstances.

FIRE HAZARDS: Non-flammable, but may cause fire if allowed to contact organic material.

FIRST AID: Quickly remove victim from contaminated atmosphere and flush affected areas of the body with large volumes of water. If victim has inhaled HCl vapors and is having difficulty breathing, give oxygen. If any aqueous HCl has been swallowed, DO NOT INDUCE VOMITING. Have victim wash out his mouth and then drink as much milk or water as he can.

HYDROGEN CYANIDE

Hydrocyanic Acid
Prussic Acid

HCN

TLV, 10 ppm (Skin)

Odor Threshold; 2 to 5 ppm (Some people may be unable to smell HCN)

PROPERTIES: Hydrogen cyanide is a colorless flammable gas at room temperature, or bluish-white when liquified. It has a characteristic faint odor resembling bitter almonds. It has a molecular weight of 27.03, specific gravity of 0.941, boiling point of 25.6°C and a melting point of -13.4°C. The closed cup flashpoint is 0°F, the flammable limits are 5.6% to 40% in air. The vapor pressure is 620 mm/Hg at 20°C. Hydrogen cyanide is slightly soluble in ether, miscible with water and alcohol.

SYMPTOMS: Concentrations of 18-36 ppm will produce slight symptoms of weakness, headache, sweating and nausea after several hours. 45-55 ppm can be tolerated for only 1/2 to 1 hour before producing symptoms. 110-135 ppm is dangerous to life within 1/2 to 1 hour. 135 ppm is fatal within 30 minutes. 181 ppm is fatal within 10 minutes, and 270 ppm is immediately fatal.

HCN can be absorbed through the skin; therefore, all bodily contact with gas or liquid must be avoided. In atmospheres having greater than 100 ppm, respiratory protection alone is inadequate. Under these conditions, a vapor-proof suit must be worn. HCN is also readily absorbed through the mucous membranes of the eyes. Exposure of the eyes to either HCN vapors or liquid HCN will produce the same systemic effect as inhaling vapor. In addition, there will be considerable eye irritation.

Ingestion of as little as 0.3 gram of HCN would be fatal for a 165 pound man.

PROTECTIVE EQUIPMENT: A respirator with cartridges rated for HCN may be used in concentrations up to 100 ppm. However, the supplied air respirator is a better choice. When the concentration exceeds 100 ppm, a vapor-proof suit should be worn. Anytime HCN is being handled, chemical gloves and eye protection should be worn.

FIRE HAZARDS: Flammable gas. Flashback may occur along vapor trail. Vapor may explode if ignited in an enclosed area. Flash point 0°F, flammable limits in air 5.6% to 40.0%. Ignition temperature 1004°F. **CAUTION:** Do not extinguish flames before stopping flow of gas, extremely toxic and potentially explosive concentrations of vapor will result.

FIRST AID: Move to fresh air. If victim has been exposed to HCN vapors and breathing has stopped, give artificial respiration but NOT MOUTH-TO-MOUTH. If breathing is difficult, give oxygen and support respiration. If victim has been exposed to liquid HCN, remove contaminated clothing and flush exposed areas with copious amounts of water. If any liquid has been swallowed and victim is conscious, give milk or water to drink and have victim induce vomiting.

See ACRYLONITRILE FIRST AID and NOTES TO PHYSICIAN concerning cyanide kit.

HYDROGEN IODIDE

Anhydrous Hydriodic Acid

HI

TLV, 0.1 ppm (Ceiling)
Odor Threshold; Data Unavailable

PROPERTIES: Hydrogen iodide is a colorless, acrid, non-flammable gas. It fumes in moist air and is decomposed by exposure to light. The molecular weight is 127.93, melting point is -50.8°C , boiling point -35.1°C . It is extremely soluble in water.

SYMPTOMS: Hydrogen iodide is a strong irritant to the eyes, skin and respiratory tract. The toxicity of hydrogen iodide is due to the iodine; the symptoms, therefore, are the same as those of iodine exposure. See Iodine.

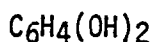
PROTECTIVE EQUIPMENT: Workers should wear appropriate protective clothing to prevent any skin contact. Hydrogen iodide attacks natural rubber. Therefore, only synthetic rubber or plastic gloves, aprons, etc. should be used. If there is any reasonable probability of eye exposure, goggles should be worn. Full facepiece supplied air respirators should be used for respiratory protection.

FIRST AID: Remove victim from contaminated area. Remove contaminated clothing and flush affected skin with soap and water. Flush eyes with plenty of low velocity water for at least 15 minutes. Give mouth-to-mouth artificial respiration if breathing has stopped or oxygen if breathing is difficult. Ingestion of hydrogen iodide is not a problem due to the fact that it is a gas. If the person has swallowed any material containing hydrogen iodide, consideration must be given to the nature of the material swallowed. Unless the nature of the swallowed material indicates otherwise, the first aid treatment is to give 3-4 glasses of milk with approximately 1 tablespoon common cooking oil mixed in each glass. This will dilute the stomach contents and take up the iodine. DO NOT INDUCE VOMITING. Get immediate medical attention.

HYDROQUINONE

54.

1,4 Benzenediol
p-Dihydroxybenzene
Hydroquinol
Pyrogentisic acid
Quinol



TLV, 2 mg/m³

Odor Threshold; Data Not Available

PROPERTIES: Hydroquinone (HQ) is a white to light tan or gray crystalline combustible material. It has a molecular weight of 110.11 and a specific gravity of 1.330. HQ melts at 172.3°C and boils at 286°C. The closed cup flashpoint is 329°F and at 25°C the vapor pressure is 1.8×10^{-5} mm. It is moderately soluble in water, and quite soluble in alcohol and ether.

SYMPTOMS: Hydroquinone exhibits a low order of acute or chronic toxicity by inhalation. Exposures at or below the 2 mg/m³ level have no systemic effect. HQ is toxic by ingestion. The LD₅₀ for rats is 370 mg/Kg. Ingestion can cause ringing in the ears, nausea, dizziness, a sense of suffocation, increased respiration rate, vomiting, palor, muscular twitching, headache, difficulty breathing, cyanosis, delirium, and collapse. The urine is green or brownish-green. Lethal adult dose is 2 grams. Direct contamination of the eye with particles of HQ can cause immediate irritation and may result in ulceration of the cornea. Contact with the skin may cause dermatitis.

PROTECTIVE EQUIPMENT: Approved type dust respirators should be worn when hydroquinone dusts are present. Chemical gloves should be worn when handling HQ. If there is a potential for eye exposure to HQ dust, chemical goggles should be worn.

FIRE HAZARD: Hydroquinone is a combustible solid. The flashpoint is 350°F. Dust explosion is possible. Extinguish fire with water, foam, dry chemical, carbon dioxide.

FIRST AID: HQ is not a serious skin irritant or sensitizer; however, if contact is made with the skin, it should be washed off immediately. HQ has a chronic effect on the eye as well as an acute irritating effect. If the eyes are exposed, they

should be immediately flushed with plenty of water for 15 minutes.

If HQ is inhaled, some will also be swallowed. If victim is conscious, give milk or water and have him vomit. If breathing is difficult, give oxygen and support respiration. If breathing has stopped, give artificial respiration. If victim is unconscious or having convulsions, do nothing except keep victim warm and seek medical attention.

6113
23050

IODINE

I₂

TLV, 0.1 ppm (Ceiling)(Do not exceed for even brief periods)
Odor Threshold; Data Not Available

PROPERTIES: Iodine is a heavy grayish black to purple crystalline solid which has a metallic luster and characteristic odor. It melts at 113.5°C, boils at 184°C, but sublimates readily at 20°C. It has an atomic weight of 126.9. Iodine is insoluble in water but is dissolved by concentrated aqueous solutions of potassium iodide or other iodides. It is soluble in alcohol and many other organic solvents. It has a specific gravity of 4.98 (H₂O = 1) and a vapor density of 9.0 (air = 1).

SYMPTOMS: Inhalation of iodine vapors may cause irritation to the nasal and respiratory tract, causing burning sensations to the mucosal, tracheal, and pulmonary tissues. High exposures may cause lung edema. Dermatitis and eye irritation are possible from vapor exposure. Eye contact with solid iodine can cause severe burns leading to corneal opacities with potential irreversible blindness.

Ingested iodine induces lethargy, irritation of the mouth and nasal passages, labored breathing, and bloody urine. Because of its irritating properties, iodine ingestion may cause gastrointestinal upset with vomiting and diarrhea, shock, corrosive gastritis, asphyxiation from constriction of the esophagus or chemical pneumonia. High dose ingestion of iodine may be fatal. Long-term high level exposures will cause a reversible reduction in thyroid function.

PROTECTIVE EQUIPMENT: Full facepiece respirators equipped with NIOSH/MSHA approved cartridges may be used when vapor concentrations do not exceed 1 ppm. For other conditions, full facepiece supplied air respirators should be worn. Rubber gloves and chemical goggles should be worn when handling iodine. Boots, aprons or chemical suits should be worn when necessary to prevent skin contact.

FIRE HAZARDS: Iodine is non-flammable but may ignite some combustible materials on contact.

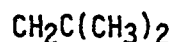
FIRST AID: Remove victim from contaminated area. If respiration has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen. In case of eye contact, immediately flush with water for at least 15 minutes. For skin contact, remove contaminated clothing and flush affected areas with large volume of water. If sodium thiosulfate is available, rinse skin with a 5% solution. If this is not available, use rubbing alcohol and/or any common cooking (vegetable) oil. If irritation occurs, consult a physician. Thoroughly clean contaminated clothing and shoes before reuse.

If victim has swallowed iodine, have him drink large quantities of milk and any common cooking (vegetable) oil if available. DO NOT INDUCE VOMITING. Take immediately to a hospital or physician. If vomiting occurs, give additional water. If unconscious or in convulsions, do nothing except transport immediately to a hospital.

NOTES TO PHYSICIAN: Treat victim of iodine vapor overexposure symptomatically. Also, observe and treat for possible onset of pulmonary edema, which may be delayed. For ingestion cases, gastric lavage with a soluble starch or protein solution will remove iodine from the stomach. Further treatment consists of correcting fluid and electrolyte imbalance. Therapy for shock may be necessary.

ISOBUTYLENE

Isobutene
2-Methylpropane



TLV, 1000 ppm

Odor Threshold; Data Not Available

PROPERTIES: Isobutylene is a volatile liquid or easily liquified gas with a faint odor. The molecular weight is 56.1, a boiling point of -6.9°C , a specific gravity of 0.594 ($20^\circ/4^\circ\text{C}$) and a vapor density of 2.01 (air = 1).

SYMPTOMS: Isobutylene can be irritating to the eyes, nose and throat in very high concentrations. Most people do not find the vapors irritating at or below the TLV. Inhalation of high concentrations (above the TLV) will cause dizziness or loss of consciousness. This is caused by both suffocation and the anesthetic action of the vapor. Its lethal effects are caused by the depletion of oxygen more than the anesthetic effect. Other symptoms of overexposure are lack of coordination and muscular weakness. Exposure of the skin to the vapor presents no hazard, but liquid isobutylene can cause frostbite. Exposure of the eyes to the vapor presents no known hazard. Ingestion is not a problem because isobutylene is a gas at temperatures above -7°C .

PROTECTIVE EQUIPMENT: Air supplied breathing apparatus is the equipment of choice for respiratory protection. Chemical goggles and gloves should be worn when handling liquid isobutylene. Additional protective equipment may be required if there exists the possibility of exposure of the body to liquid isobutylene.

FIRE HAZARDS: Isobutylene is a flammable gas. The flammable limits in air = 1.8% to 9.6%, flash point = -105°F , ignition temperature = 869°F . Extinguishing agents: let fire burn, stop flow of gas. Extinguish small fires with water fog, dry chemical or carbon dioxide. May form explosive concentrations or flash back along vapor trail if fire is extinguished before gas is shut off.

FIRST AID: Move victim to fresh air. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen and support respiration. Usually, as soon as the patient is moved to fresh air recovery is rapid. If skin has been exposed to liquid isobutylene, flush with water but DO NOT RUB AFFECTED AREAS.

LACTIC ACID

2-Hydroxypropanoic Acid
Racemic Lactic Acid
Milk Acid
Alpha-hydroxypropionic Acid

$\text{CH}_3\text{CHOHCOOH} - \text{H}_2\text{O}$

TLV, Not Established
Odor Threshold; Not Established

PROPERTIES: Lactic acid is a thick, syrupy liquid which is clear to yellow in color. It has a weak, unpleasant, sour odor. The molecular weight is 90.08, the boiling point is 122°C, 14 mm/Hg, and the specific gravity is 1.249 (15°C).

SYMPTOMS: Inhalation of lactic acid mist causes coughing and irritation of the mucous membranes. Contact with concentrated solutions can cause severe burns to the skin or eyes. Ingestion of the more concentrated solutions has a corrosive effect on the esophagus and stomach. In very dilute concentrations, it is used in foods as an acidulate.

PROTECTIVE EQUIPMENT: In atmospheres containing less than 2% acid vapors, a mask with an acid canister may be worn. In conditions other than these, air supplied full facepiece breathing apparatus should be used. Vapor exposure is not likely. When there is a possibility of skin or eye contact, chemical gloves and goggles should be worn.

FIRE HAZARDS: Lactic acid is a combustible liquid which burns with difficulty. Extinguish with water, dry chemicals or carbon dioxide.

FIRST AID: Remove victim from contaminated area. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen. If liquid has gotten into the eyes, flush with large amounts of low velocity water for at least 15 minutes and seek medical attention. For skin contact, remove contaminated clothing and flush affected areas with large amounts of water.

If victim has swallowed lactic acid and is conscious have him drink as much water or milk as he can. If he is unconscious or having convulsions, do nothing except keep him warm and seek immediate medical attention.

LACTONITRILE (LN)

58.

2-Hydroxy-propanenitrile
Acetaldehyde Cyanohydrin
Ethylidene Cyanohydrin

$\text{CH}_3\text{CH}(\text{OH})\text{CN}$

TLV, 10 ppm; Skin Absorption
Odor Threshold; Data Unavailable

PROPERTIES: Lactonitrile is a straw-colored, relatively odorless liquid. The molecular weight is 71.06 and the specific gravity is 0.983 at 25°C. The boiling point is 182°C to 184°C and the melting point is -40°C.

SYMPTOMS: Lactonitrile is a very hazardous material. There are no known health effects with lactonitrile itself, but it readily decomposes liberating HCN which is extremely toxic. Most cases of overexposure to cyanohydrins such as lactonitrile result from not removing contaminated clothing. It is readily adsorbed through the skin. The symptoms of overexposure are the same as those for HCN exposure. See Hydrogen Cyanide.

PROTECTIVE EQUIPMENT: See Hydrogen Cyanide.

FIRE HAZARDS: Lactonitrile present a moderate fire hazard when exposed to heat or open flame. It readily decomposes to yield HCN which is hazardous to firefighters. Flash point = 76.7°C (closed cup) vapor pressure = < 2 mm Hg at 20°C, vapor density = 2.45 (air = 1). See also Hydrogen Cyanide.

FIRST AID: See Hydrogen Cyanide.

LIME

Calcium Oxide
Quick Lime
Caustic Lime
Unslaked Lime

CaO

TLV, 5 mg/m³
Odor Threshold; Odorless

PROPERTIES: Lime is a white to grey corrosive solid. It is most frequently either powder or granular. The molecular weight is 56.08, the boiling point is 2850°C and the density is 3.37. It sinks and reacts violently with water. Water appears to boil.

SYMPTOMS: Lime dust, if inhaled, causes the worker to sneeze and cough. It causes an inflammatory condition of the respiratory passages, which occasionally may be followed by ulceration and penetration of the nasal wall. A person exposed to lime dust will usually withdraw from the area thereby limiting exposure.

If lime dust gets on the skin, it will absorb the oil causing chafing, scaling, and cracking. Moisture on the skin will cause the lime to react, liberating heat and causing irritation or even burns which may be followed by ulcers or lesions. Lime dust will irritate the eyes and lids, and may cause severe burns which may be followed by scarring or perforation of the eyeball. Impairment of vision and permanent turning out of the eyelids may result from exposure.

Ingestion of lime dust or paste will cause irritation and possibly severe burns of the mouth, throat and stomach.

PROTECTIVE EQUIPMENT: Dust respirators should be worn when there is a possibility of exposure to lime dust. For skin and eye protection, chemical gloves, goggles, apron and rubber boots should be worn.

FIRE HAZARDS: Lime is non-flammable, but may cause fire on contact with water and combustibles. DO NOT USE WATER to extinguish adjacent fires. Extinguish adjacent fires with dry chemicals or carbon dioxide.

FIRST AID: Move victim to fresh air. If respiration is difficult, give oxygen and support breathing. If skin has been exposed, remove contaminated clothing and flush affected areas with large amounts of water. If the eyes have been exposed, flush with large amounts of low volume water while holding the eyelids apart to insure irrigation of all the tissues of the surface of the eyes and lids. In case of ingestion, DO NOT INDUCE VOMITING. If victim is conscious, have him drink plenty of water or milk. Seek medical attention.

MALEIC ANHYDRIDE

cis-Butenedioic Acid
 cis-1,2-Ethylenedicarboxylic Acid
 Maleinic Acid
 Malenic Acid
 Toxillic Acid

HOOC - CH = COOH

TLV, 0.25 ppm (1 mg/m³)
 Odor Threshold; 1.5 mg/m³

PROPERTIES: Maleic anhydride is a white crystalline solid with a penetrating odor. It has a molecular weight of 98.06, a flashpoint of 215°F, a boiling point of 202°C, a specific gravity of 0.934 at 20°C (water = 1), and a vapor density of 3.4 (air = 1).

SYMPTOMS: The oral LD₅₀ for rats is 481 mg/Kg. Maleic anhydride closely resembles phthalic anhydride in its toxicologic properties of skin, eye and upper respiratory tract irritation although it is somewhat more potent as an irritant. Maleic anhydride is regarded to be a sensitizer of the skin and respiratory tract.

Inhalation causes coughing, sneezing and throat irritation. Concentrations of 1.5 ppm to 2 ppm causes nasal irritation within one minute and eye irritation within fifteen minutes. Levels above 2.5 ppm are extremely irritating. Acute exposures are not normally encountered because a worker would voluntarily leave an area of high concentrations of maleic anhydride.

Skin contact causes redness and irritation. This is particularly true if the skin is moist, because of the rapid hydrolysis of maleic anhydride to maleic acid in the presence of moisture.

Exposure of the eyes to maleic anhydride vapor causes severe eye irritation; photophobia and double vision may occur. The victim may also experience colored rings in the visual field, particularly around light sources (halo effects). These visual effects are transitory.

PROTECTIVE EQUIPMENT: Full or half masks equipped with approved organic vapor-acid gas canisters may be used if the maleic anhydride concentration is less than 2.5 ppm, and the time spent in the

contaminated area will be short. For other conditions, only a full facepiece mask with supplied air should be used.

Chemical goggles and rubber gloves should be worn when handling maleic anhydride. If there is a possibility of skin exposure, additional equipment such as rubber apron, boots or rain suit may be necessary.

FIRE HAZARDS: Maleic anhydride is a combustible solid. Dust cloud may be ignited by spark or flame. Flash point = 215°F, flammable limits in air = 1.4% to 7.1%, ignition temperature = 878°F. When heated above 300°F in the presence of various materials may generate heat and carbon dioxide. Will explode if confined. Extinguish with alcohol foam, dry chemicals or carbon dioxide. Water or foam may cause frothing.

FIRST AID: If victim has stopped breathing, give mouth-to-mouth artificial respiration. Give oxygen if he is having difficulty breathing. In case of skin exposure, remove contaminated clothing and flush affected areas with plenty of water. Use soap if it is available. If eyes have been exposed, immediately irrigate with low velocity water for at least 15 minutes. If victim has swallowed maleic anhydride, give plenty of milk or water and induce vomiting.

Workers who have inhaled considerable maleic anhydride vapors or dusts should be kept at rest under observation until the physician is confident that an acute chemical pneumonitis will not develop.

METHANE

Natural Gas
Marsh Gas

CH₄

TLV, Simple Asphyxiant
Odor Threshold; 200 ppm

PROPERTIES: Methane is a colorless flammable gas which has a weak, mild, sweet odor. The molecular weight is 16.04, the boiling point is -162°C, and the vapor density is 0.55 (air = 1).

SYMPTOMS: Methane is a simple asphyxiant. If the concentration is high enough to dilute or exclude the oxygen in the air, the effects produced will be due to oxygen deprivation. It is practically odorless and has no warning properties. There are no known problems associated with skin or eye contact with methane gas. Liquid methane, however, can produce frostbite on exposed tissue. Ingestion is not a problem.

PROTECTIVE EQUIPMENT: Supplied air respirator is the equipment of choice for respiratory protection. If there is a possibility of exposure to liquid methane, gloves and goggles or face shield should be worn. Additional protective equipment may be required if there is a chance of exposure of greater areas of the body to liquid methane.

FIRE HAZARDS: Methane is a flammable gas whose flammable limits in air are 5% to 15%. Auto ignition temperature = 1004°F, burning rate 12.5 mm/min.

Methane may explode if ignited in an enclosed area. Flashback along a vapor trail may occur. To extinguish fire, stop flow of gas and allow fire to burn out. Keep surrounding area cool with water.

FIRST AID: Move victim to fresh air. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen. If skin has been frostbitten by liquid methane, flush affected area with plenty of water. DO NOT RUB EFFECTED AREAS. Seek medical attention.

METHANOL

Methyl Alcohol
Wood Alcohol
Wood Naphtha
Wood Spirit
Pyroxylic Spirit

CH₃OH

TLV, 200 ppm (Skin)
Odor Threshold; 100 ppm

PROPERTIES: Methanol is a watery colorless liquid with a faint, sweet, alcohol-like odor. It has a molecular weight of 32.04, a specific gravity of 0.7915 at 20°C, a vapor density of 1.1 (air = 1), a boiling point of -97.8°C, a vapor pressure of 92 mm/Hg at 20°C, and the closed cup flash point is 54°F. It is miscible with water, ethyl alcohol, ether and many other organic solvents.

SYMPTOMS: Exposure to high vapor concentrations causes eye irritation, headache, fatigue and drowsiness. At concentrations greater than 3,000 ppm, the body begins to accumulate methanol. Under these conditions, central nervous system depression and optic nerve damage (irreversible blindness) can occur. Exposure to 50,000 ppm can cause death within one to two hours.

Methanol can be absorbed through the skin and produce the same symptoms as inhalation of the vapors.

Both liquid and vapor is irritating to the eyes producing lachrymation. Symptoms are transitory with no permanent damage. Methanol can be absorbed through the mucous membranes of the eyes, but it is unlikely that enough could be absorbed via this route to produce a systemic effect.

Swallowing as little as 3 to 4 ounces of methanol can be fatal. Lesser amounts can cause permanent eye damage.

PROTECTIVE EQUIPMENT: Comfo masks equipped with approved organic canisters may be used in vapor concentrations up to 0.2% in air. For other conditions, a full facepiece mask with supplied air is recommended. Chemical gloves and goggles should be worn when handling methanol. Additional protective equipment may be required if there is a chance for exposure of the body to methanol.

FIRE HAZARDS: Methanol is a Class 1B flammable liquid. Flash point = 54°F, boiling point = 148.1°F, flammable limits in air = 6% to 36%, autoignition temperature = 867°F. Vapor may explode if ignited in an enclosed area. Flashback may occur along a vapor trail. Extinguish with dry chemical, alcohol foam, or carbon dioxide. Water may be ineffective on fire.

FIRST AID: Move victim to fresh air. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen. If victim has been exposed to liquid methanol, remove contaminated clothing and shoes and flush affected areas with plenty of water. If methanol has gotten into the eyes, flush with low velocity water for at least 15 minutes. If methanol has been swallowed, have victim drink plenty of milk or water and have him vomit. If he is unconscious or having convulsions, do nothing except keep him warm and transport immediately to medical facility.

METHYLENE CHLORIDE

Dichloromethane
Methylene Dichloride

CH_2Cl_2

TLV, 100 ppm, 500 ppm ceiling
Odor Threshold; 200 to 300 ppm

PROPERTIES: Methylene chloride is a colorless volatile liquid with a sweetish odor, like most chlorinated hydrocarbons. The molecular weight is 84.94, specific gravity is 1.335, boiling point is 40°C and it solidifies at -95°C . It is soluble in water to only 1% by weight, but completely miscible with most organic solvents. It has a high vapor pressure of 315 mm/Hg at room temperature (23.5°C). Because of this, substantial concentrations of vapor are readily achieved whenever methylene chloride is spilled or spread out over a large surface, even in unconfined spaces.

SYMPTOMS: Inhalation of vapor concentrations greater than 5,000 ppm can cause irritation of the nose and throat, fullness in the head and mental confusion. Some workers may experience dizziness, nausea and vomiting. If the worker does not immediately leave the area, he may become unconscious and serious injury may occur. It would require very large amounts of this compound to cause fatalities since laboratory animals have been exposed to 25,000 ppm for two hours without fatal results.

Methylene chloride is irritating to the skin and eyes. Exposure of the skin causes redness and dryness due to removal of skin oils. It may cause dermatitis after repeated or prolonged contact with the skin.

Contact with the eyes causes irritation and is painful but is not likely to cause serious injury unless the exposure is prolonged.

PROTECTIVE EQUIPMENT: Comfo masks equipped with approved organic canister may be used in vapor concentrations less than 0.5%. In other conditions, full facepiece respirators with supplied air is recommended. Chemical gloves and goggles should be worn when handling methylene chloride. Additional equipment may be necessary if there is

a possibility for exposure of the body to liquid methylene chloride.

FIRE HAZARDS: Methylene chloride is non-flammable by standard tests, but will burn in extreme conditions. Ignition temperature = 1184°F , flammable limits in air = 12% to 19%. Toxic gases are produced when heated.

FIRST AID: Move victim to fresh air. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen. If methylene chloride has gotten on clothing or skin, remove contaminated clothing and flush affected areas with plenty of water. If the eyes have been exposed, flush them with plenty of low velocity water for at least 15 minutes. If any has been swallowed, give plenty of milk or water to drink and have him vomit.

NOTES TO PHYSICIAN: Methylene chloride is not considered a poison by definition, but if swallowed, an emetic or gastric lavage is indicated.

Adrenalin should never be given to a person suffering from chlorinated hydrocarbon poisoning.

METHYL ETHER OF HYDROQUINONE (MQ)

p-Methoxyphenol
4-Hydroxy Anisole
Hydroquinone Monomethyl Ether



TLV, 2 ppm (Based upon hydroquinone)
Odor Threshold; Data Not Available

PROPERTIES: Methyl Ether of Hydroquinone (MQ) is a white, waxy solid. It has a molecular weight of 124.13, a melting point of 52.5°C, a boiling point of 246°C and a density of 1.55 at 20°C ($\text{H}_2\text{O} = 1$).

SYMPTOMS: MQ is irritating to the skin, eyes and respiratory tract. It is sufficiently irritating that when inhaled in high concentrations, it acts as a warning. It is not readily absorbed through the intact skin to cause systemic injury. Although irritating to the eyes, present data does not indicate any hazardous effect other than physical irritation as with a nuisance dust. MQ is only slightly toxic when swallowed. The LD_{50} in rats is 1630 mg/Kg.

PROTECTIVE EQUIPMENT: If there is danger of inhaling MQ dusts, an approved type dust respirator should be used. Goggles and chemical gloves should be worn when handling MQ. Additional protective equipment may be required if there is a possibility for the worker's body to be exposed to MQ.

FIRE HAZARDS: There is only a slight fire hazard when exposed to heat or flame. It can, however, react with oxidizing materials to present a fire hazard.

FIRST AID: Move victim to fresh air. Give mouth-to-mouth artificial respiration if breathing has stopped. If breathing is difficult, give oxygen. If skin has been exposed, remove contaminated clothing and flush affected areas with plenty of water. If any MQ has gotten into the eyes, flush with plenty of low velocity water for at least 15 minutes. If any MQ has been swallowed, give plenty of milk or water to drink and have victim induce vomiting.

NOTES TO PHYSICIAN: If the worker has inhaled large quantities of MQ, he should be kept at rest under observation until the physician is confident that an acute pneumonitis will not develop.

METHYL IODIDE

65.

Iodomethane



TLV, 2 ppm; Skin Absorption, Suspended Carcinogen
Odor Threshold; Data Unavailable

PROPERTIES: Methyl iodide is a colorless liquid which turns yellow, red or brown when exposed to light and moisture. It has a molecular weight of 141.95, a specific gravity of 2.28 at 20°C, a boiling point of 42.5°C, a melting point of -66.5°C, and a vapor pressure of 375 mm Hg. Iodine and hydrogen iodide may be released when methyl iodide undergoes thermal decomposition. Methyl iodide has a sweet ethereal odor with poor warning properties. It is soluble in about 50 parts water and miscible with alcohol and ether.

SYMPTOMS: Workers may be exposed to methyl iodide by inhalation, ingestion or by skin or eye contact. Overexposure causes eye irritation and dermatitis and may cause blistering. Systemic symptoms are nausea, vomiting, vertigo, lack of muscular coordination, slurred speech, visual disturbances, drowsiness and coma. The acute oral LD_{50} for man is reported as being 150 to 220 mg/kg. The LC_{50} for mice is reported as 900 ppm for 57 minutes.

The organs most susceptible to damage by methyl iodide are the central nervous system, the skin and the eyes.

PROTECTIVE EQUIPMENT: Workers should wear appropriate clothing and equipment to prevent repeated or prolonged exposure. Goggles should be included where there is a reasonable probability of eye exposure.

Only supplied air respirators such as air line masks or self-contained respirators (Scott Air Pack) should be used for respiratory protection. When the vapor concentration exceeds 250 ppm, the respirators should be operated in the positive pressure mode.

FIRE HAZARDS: Methyl iodide is not combustible but will produce iodine and hydrogen iodide when heated to the point of thermal decomposition.

FIRST AID: Remove the victim from the contaminated area. Start mouth-to-mouth artificial respiration if breathing has stopped. Give oxygen if breathing is difficult. The eyes should be immediately flushed with plenty of low velocity water for at least 15 minutes if any material has gotten into them. Remove contaminated clothing and immediately flush all affected skin with soap and water. If he has swallowed any methyl iodide, give him 3-4 glasses of milk or water to dilute stomach contents and have him vomit by sticking his finger down his throat.

6113
23061

NAPHTHALENE.

Naphthalin
Tar Camphor
White Tar

$C_{10}H_8$

TLV, 10 ppm
Odor Threshold; 0.2 ppm

PROPERTIES: Naphthalene is a colorless to brown solid. It commonly occurs as white, crystalline flakes and has a strong coal tar or mothball odor. It has a molecular weight of 128.16 and a specific gravity of 1.145. It melts at 80.2°C, boils at 217.96°C, and has a vapor pressure of approximately 0.087 mm Hg at 25°C. It is insoluble in water but dissolves in most organic solvents.

SYMPTOMS: Naphthalene can enter the body through ingestion, inhalation, and absorption through skin or eye contact. Overexposure causes local symptoms of eye irritation and dermatitis. Symptoms of systemic intoxication are headache, confusion, excitement, nausea, a general feeling of illness, vomiting, abdominal pain, bladder irritation, profuse sweating, yellow color to skin and eyes, blood in the urine and kidney failure.

The lowest reported lethal dose for man is 50 mg/kg. This means that a 180 lb. man would have to eat at least 4 gm or 1 rounded teaspoonful in order to get a potentially lethal dose.

Vapor concentrations of 15 ppm causes eye irritation and continued exposure may cause eye damage. Therefore, the 10 ppm TLV is to prevent eye damage and is well below the levels of exposure which could result in serious systemic effects.

The organs most susceptible to damage by naphthalene are the eyes, blood, liver, kidneys, skin and central nervous system.

PROTECTIVE EQUIPMENT: Workers should wear protective clothing and equipment to prevent repeated or prolonged exposure. Goggles should be worn if there is any reasonable probability of eye exposure.

Respiratory protection in atmospheres below 500 ppm is adequately provided by chemical cartridge respirators equipped with organic vapor cartridges. If the vapor concentration is such that it causes eye irritation, a full facepiece mask should be worn.

FIRE HAZARDS: Naphthalene is a Grade E combustible solid but in the molten state it presents a Grade C flammable liquid fire hazard. The vapor or dust can form an explosive mixture in air. Flash point = 190°F, flammable limits in air = 0.9% to 5.9%, autoignition temperature = 979°F.

Extinguishing Agents = CO_2 , dry chemical, foam, water fog.

FIRST AID: Remove victim from contaminated area and give mouth-to-mouth artificial respiration if breathing has stopped. Give oxygen to relieve difficult breathing. The eyes should be immediately and thoroughly irrigated with plenty of low velocity water if they have become exposed to naphthalene. Immediately flush any molten naphthalene from the skin and treat for thermal burns. Promptly remove any contaminated clothing and wash affected skin with soap and water to thoroughly remove any residual material.

To treat a victim who has swallowed naphthalene, give 3-4 glasses of milk or water to dilute stomach contents and have him vomit by sticking his finger down his throat.

NITTO CATALYST (DEPT. 51)

67.

Trade Name NS-7338

Nominal Composition:

Antimony	31.10 wt.%
Iron	7.14
Copper	2.60
Tellurium	2.22
Molybdenum	0.69
Tungsten	0.19
Vanadium	0.10
Silicone & Oxygen	Balance

PROPERTIES: Nitto catalyst is a microspherical silica gel based catalyst. Catalyst particles are composed of 40% amorphous silica and 60% complex metal oxides.

SYMPTOMS: Based upon its metal content, it can be inferred that long-term exposure at low levels of inhalation could pose a risk to health. Less than 0.5% of the new finished product is within the respirable particle size range of 5 microns or less. However, the amount of fines may increase due to handling in shipping or when the catalyst has been in use.

Symptomology resulting from chronic overexposure might include a garlic odor to the breath, pneumoconiosis, headache, loss of appetite, nausea, and inflammation of mucous membranes of the nose and throat. Silicosis would not appear to present a problem since the silica is in the amorphous rather than crystalline form.

Eye contact with the catalyst produces no adverse effect other than the physical irritation of the dust. Some particularly susceptible individuals could experience an allergic reaction to the metal oxides.

Skin contact produces no adverse acute effects. Physical irritation and possible allergic reaction to the metals may produce some reaction on long or aggravated exposure to susceptible individuals.

PROTECTIVE EQUIPMENT: Dust respirators equipped with high efficiency particulate cartridges are recommended for protection from respirable dust.

Cover goggles, chemical gloves and coveralls are recommended for eye and skin protection.

FIRE HAZARDS: Nitto catalyst is a non-flammable solid. No fire hazards are associated with this material.

FIRST AID: If sufficient material has been inhaled to cause difficulty in breathing, give oxygen.

If the material has gotten into the eyes, flush with plenty of low velocity water. Avoid rubbing the eyes to prevent physical irritation.

If the material has gotten onto the skin, flush exposed areas with water and wash with soap as soon as convenient. Avoid rubbing which could cause abrasion of the skin.

If an appreciable amount of the catalyst has been swallowed, induce vomiting. For small amounts of dust which may have been swallowed no immediate action is recommended. Drink ample water or milk and seek medical help if symptoms appear.

6113
23063

OLEFIN MIX (HEXENE, OCTENE, DECENE)

68.

General Formula $\text{CH}_3(\text{CH}_2)_3 \text{ to } 7\text{CHCH}_2$

TLV, 1000 ppm for Mixture
Odor Threshold; Data Not Available

PROPERTIES: The properties of the various olefins is a function of their number of carbon atoms. The various isomers of each are considered as one compound. The properties of the mixture are, therefore, a function of the composition of the mixture.

Formula	$\text{CH}_3(\text{CH}_2)_3\text{CHCH}_3$	$\text{CH}_3(\text{CH}_2)_5\text{CHCH}_3$	$\text{CH}_3(\text{CH}_2)_7\text{CHCH}_3$
Molecular Wt.	84.16	112.22	140.26
Flash Point, °C	-29	21	----
Autoignition Temp., °C	275	255	240
Flammability Limits			
in Air, %	1.1-9.0	0.8-6.6	0.5-5.5
Boiling Point, °C	635	121.3	172.3
Specific Gravity	0.674	0.715	0.740
Vapor Density	3.0	3.87	4.83
(Air=1)			

SYMPTOMS: This material is relatively non-toxic. It is generally regarded as potentially toxic when inhaling in high concentrations over long periods of time. At high concentrations, dizziness, headaches and drowsiness occur with evidence of irritation of the respiratory mucous membranes and possible kidney upset.

Prolonged skin contact can result in dermatitis from the defatting and drying effect.

The effects of eye contact are unknown although contact with the eyes is somewhat painful.

Ingestion effects are unknown.

PROTECTIVE EQUIPMENT: Workers should wear proper protective clothing and equipment to prevent prolonged or repeated skin contact. Goggles should be worn if there exists any reasonable probability of eye contact. Organic vapor cannister equipment masks should be worn for respiratory protection when needed or desirable.

FIRE HAZARDS: The olefin mix is a flammable liquid with a relatively low flash point (-29°C to 21°C) and a lower flammability limit of less than 1%. Because the vapor density is greater than 3, it has a tendency to pool in low areas and may form explosive mixtures in drains. (See Properties for other pertinent data)

FIRST AID: Remove victim from contaminated area. Remove contaminated clothing (fire hazard) and wash affected skin areas with soap and water. If breathing has stopped, give mouth-to-mouth artificial respiration. Give oxygen if breathing is difficult. Flush the eyes with plenty of low velocity water for at least 15 minutes if they have been splashed by olefins. In the event the victim has swallowed any of the mixture, given 3-4 glasses of water to dilute the stomach contents and have him vomit by sticking his finger down his throat.

OXO ALCOHOLS

69.

General Formula $\text{CH}_3(\text{CH}_2)_5$ to $9\text{CH}_2\text{OH}$

TLV, Not Established

Odor Threshold; Data Not Available

PROPERTIES: The properties of the oxo alcohols are a function of the number of carbon atoms.

	Heptanol	Nonanol	Hendecanol
Formula	$\text{CH}_3(\text{CH}_2)_5\text{CH}_2\text{OH}$	$\text{CH}_3(\text{CH}_2)_7\text{CH}_2\text{OH}$	$\text{CH}_3(\text{CH}_2)_9\text{CH}_2\text{OH}$
Molecular Wt.	116	144	172
Flash Point, °C		74	113
Boiling Point, °C	176	213	243
Specific Gravity	0.824	0.827	0.830

SYMPTOMS: The oxo alcohols are relatively non-toxic. They are classified as moderate eye irritants in terms of eye injury (rabbits) and the higher alcohols are classed as moderate skin irritants. Prolonged and repeated contact of the liquid with the skin can have a defatting action with resulting drying out of the skin and possible dermatitis. The only inhalation data refers to toxicological response to tests carried out on rats. Inhalation of nonyl alcohol in a saturated atmosphere for 8 hours resulted in no deaths. The oxo alcohols are also only slightly toxic by ingestion. Single oral doses to rats resulted in an LD50 of 3-6 grams/Kg of body weight.

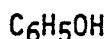
PROTECTIVE EQUIPMENT: Workers should wear appropriate clothing and equipment to prevent prolonged or repeated contact. Goggles should be worn if there is any reasonable probability of eye contact. Should a respirator become necessary or desirable, a chemical cartridge respirator equipped with organic vapor cartridges or an air equip respirator may be worn.

FIRE HAZARD: Oxo alcohols are combustible liquids. They have relatively high boiling points (176°C-243°C) and relatively high flash points (74°-113°C).

FIRST AID: Remove victim from contaminated areas and start artificial respiration if breathing has stopped. Give oxygen if breathing is difficult. Remove contaminated clothing and wash affected skin with soap and water. Irrigate eyes thoroughly for 15 minutes with plenty of low velocity water if they have been exposed. If the person has swallowed oxo alcohol, give 3-4 glasses of water to dilute stomach contents and have him vomit by sticking his finger down his throat. Get prompt medical attention.

PHENOL

Carbolic Acid Hydroxybenzene



TLV, 5 ppm (Can be readily absorbed through the skin)
Odor Threshold; 0.05 ppm

PROPERTIES: Pure phenol is a solid at room temperature. The crystals are white or may have a pinkish hue. The liquid is usually clear to pinkish. It has a characteristic sweet, tarry odor recognized by many as smelling like Lysol. It has a molecular weight of 94.11, a specific gravity of 1.071 ($\text{H}_2\text{O} = 1$), a boiling point of 182°C , and when free from water and cresols, solidifies at 41°C and melts at 43°C . The vapor pressure at 25°C is 0.35 mm/Hg. It is soluble in water and most organic solvents.

SYMPTOMS: Due in part to its low volatility, phenol does not frequently constitute a serious respiratory hazard in industry. However, it is readily absorbed through the respiratory tract and at elevated temperatures where high vapor concentrations are possible, it is highly hazardous to life.

Pure phenol can severely burn eyes and skin. Since it is a skin anesthetic, the first reaction is not of pain, but a whitening of the exposed area. A serious burn or systemic poisoning may occur if the chemical is not promptly and thoroughly removed. Collapse and death may occur in a few minutes after massive exposure despite prompt emergency care. Dermatitis may result from repeated or prolonged skin contact with low concentrations of phenol in any form.

The eyes are very susceptible to the corrosive effects of phenol and will also serve as an absorption route for systemic poisoning.

If phenol is swallowed, it results in severe corrosive injury to the mouth, throat and stomach along with systemic poisoning.

PROTECTIVE EQUIPMENT: If there is any possibility of body contact, rubber rain suit, boots, and face shield should be worn. Minimally, chemical gloves and goggles should be worn when handling smaller amounts of phenol.

Either half mask or full mask with organic vapor canister and dust and mist filters for concentrations less than 50 ppm. Full facepiece mask with supplied air for concentrations below 100 ppm. Water should be readily available for eye wash and quick drench.

FIRE HAZARDS: Phenol is combustible and poisonous gases are produced in a fire. The flashpoint = 175°C , flammable limits in air = 1.7% to 8.6%, ignition temperature = 1319°F . Extinguish fire with water fog, foam, carbon dioxide, or dry chemical. Use complete personal protective equipment when fighting fire.

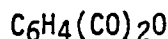
FIRST AID: Move victim to fresh air. If breathing has stopped, give artificial respiration. Use mouth-to-mouth method with CAUTION--Do not contaminate yourself with phenol from the victim's body. If breathing is difficult give oxygen. If there has been skin contamination, remove contaminated clothing and flush all possible affected areas with plenty of water for at least 15 minutes. Use soap if available. If phenol has entered the eyes, flush with plenty of low velocity water while holding the eyelids open. Flush for at least 15 minutes; continue for an additional 15 minutes if a doctor has not taken over.

If phenol has been swallowed, DO NOT INDUCE VOMITING. Give plenty of milk, egg whites, or water to drink and get medical help immediately. No known antidote.

PHTHALIC ANHYDRIDE

71.

Phthalandione



TLV, 1 ppm

Odor Threshold; Data Unavailable

PROPERTIES: Phthalic anhydride occurs as white crystalline needles. Some literature describes its odor as mild while others describe it as choking. Its molecular weight is 148.11 and specific gravity is 1.53. The melting point is 131.2°C, the boiling point is 285°C and it has a closed cup flash point of 305°F. At 20°C its vapor pressure is less than 0.05 mm Hg. It is soluble in alcohol and only slightly soluble in ether and water.

SYMPTOMS: Phthalic anhydride can enter the system by inhalation, ingestion and contact with skin or eyes. Overexposure causes acute local symptoms of eye, skin, and upper respiratory irritation. Chronic symptoms are conjunctivitis, dermatitis, bronchitis, asthma and bleeding ulceration of the phthalic sages. Some people become sensitized to phthalic anhydride and react with a bronchial asthma attack upon exposure to only small amounts.

The organs most susceptible to damage by phthalic anhydride are the respiratory system, eyes, skin, liver and kidneys.

PROTECTIVE EQUIPMENT: Workers should wear appropriate protective clothing and equipment to prevent repeated or prolonged contact. Long sleeves are required in the PA (Dept. 53) plant. If there is any reasonable probability of eye contact with the material, goggles should be worn.

Airline masks or self-containing respirators should be worn when respiratory protection is required.

FIRE HAZARDS: Phthalic anhydride is a Grade E (low probability) combustible solid. Molten phthalic anhydride will burn if ignited and its vapor may form an explosive mixture with air. Flash point = 304°F, flammable limits in air = 1.7% to 10.4%, autoignition temperature = 1083°F. Extinguishing agents = water, CO₂, dry chemical.

FIRST AID: Remove victim from contaminated area. Immediately irrigate eyes with plenty of low velocity water if they have been exposed. Promptly remove contaminated clothing and wash affected skin with soap and water. Give mouth-to-mouth artificial respiration if breathing has stopped or give oxygen if breathing is difficult. If the victim has swallowed any phthalic anhydride, give 3-4 glasses of milk or water to dilute stomach contents and have him vomit by sticking his finger down his throat.

PROPYLENE

Methylethylene
Propene

$\text{CH}_3\text{CH}:\text{CH}_2$

TLV, Simple Asphyxiant
Odor Threshold; Data Not Available

PROPERTIES: Propylene is a colorless gas having a characteristic olefin (gassy) odor. It is readily liquifiable with pressure. The liquid has a specific gravity of 0.52, the vapor density is 1.48 (air = 1), the boiling point is -48°C , the freezing point is -185°C , and it is only slightly soluble in water.

SYMPTOMS: Because propylene has neither a strong odor, nor is irritating, it is very easy to be exposed to concentrations which could produce acute effects. These effects are dizziness, sleepiness, incoordination, anesthesia, and if the victim is not removed to fresh air, death could result from asphyxiation. While the gas has no adverse effect on the skin, eyes or mucous membranes, the liquid can cause frostbite to exposed tissue.

PROTECTIVE EQUIPMENT: A respirator equipped with organic vapor canisters can be used in vapor concentrations up to 0.5%. A better choice under all conditions would be a supplied air respirator such as an air-line mask or a Scott Air Pack.

When there is a possibility of exposure to liquid propylene, a face shield and chemical gloves should be worn; additional protection from the liquid may be advisable under certain conditions.

FIRE HAZARDS: Propylene is a liquifiable, flammable gas. Flash point = -162°F , flammable limits = 2.0-11.0%, autoignition temp. = 927°F . To extinguish fire, stop flow of gas and cool surrounding area with water fog.

FIRST AID: Move victim to fresh air. If breathing has stopped, start mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen. If contact with the liquid has caused frostbite, flush gently with water. DO NOT RUB AFFECTED AREA.

PYRIDINE

HCN(CH)₄

TLV, 5 ppm; Skin Absorption
Odor Threshold; 0.021 ppm

PROPERTIES: Pyridine is a yellow to colorless flammable liquid which has a characteristic disagreeable odor that is detectable well below 1.0 ppm. The boiling point is 115°C and solidifies at -42°C. The molecular weight is 79.10 and specific gravity is 0.9780 at 25°C. It is miscible with water, alcohol, ether, oils and many other organic compounds. It is a good solvent for both organic and inorganic compounds.

SYMPTOMS: Exposure to toxic levels can be by inhalation, skin absorption, ingestion, or eye contact. However, the disagreeable odor usually causes most people to either leave the area or seek respiratory protection quickly. The liquid is mildly irritating to the skin and painfully irritating to the eyes while the vapor is slightly irritating to the respiratory tract with a slight anesthetic effect.

The organs affected by pyridine are the central nervous system, liver, kidneys, skin and gastro intestinal tract.

The symptoms of overexposure are headache, nervousness, dizziness, insomnia, nausea, loss of appetite, frequent urination, eye irritation, dermatitis, and liver and kidney damage.

PROTECTIVE EQUIPMENT: Wear appropriate equipment to prevent any reasonable probability of skin contact or any possibility of eye contact. This may be only goggles and gloves when handling small amounts or up to and including slicker suits and face shields if the situation warrants.

In vapor concentrations up to 250 ppm, full facepiece masks equipped with organic vapor cartridges may be used providing there is at least 19.5% oxygen present. For other conditions or vapor concentrations up to 3600 ppm, full facepiece masks with provided air should be used.

FIRE HAZARDS: Pyridine is a flammable liquid. The flashpoint = 68°F, flammable limits = 1.8% to 12.4% in air, autoignition temp. = 900°F and the vapor density = 2.72 (air = 1). To extinguish fires use alcohol foam, dry chemical or CO₂.

FIRST AID: Remove the victim from the contaminated area. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen. If the eyes have been exposed, flush with plenty of low velocity water for at least 15 minutes. Remove any contaminated clothing and immediately wash affected skin with soap and water. If any of the material has been swallowed, give 3-4 glasses of milk or water to dilute stomach contents and then have him vomit by sticking his finger down his throat.

RHODIUM TRI-IODIDE

74.

Rhodium (III) Iodide
Rhodium Iodide

RhI_3

TLV, 0.01 mg/m³
Odor Threshold, No Data Available

PROPERTIES: Rhodium Tri-iodide is a black crystalline powder. The molecular weight is 483.61. It is insoluble in water.

SYMPTOMS: There exists the possibility of eye or skin irritation or, in some extreme cases, burns. The threshold limit value (TLV) is based upon assumed allergic response to rhodium. However, there have been no recorded cases of any allergic reactions in industrial experience. In fact, there are no data in the literature demonstrating either acute or chronic rhodium related disease or irritation in humans by rhodium or its compounds.

PROTECTIVE EQUIPMENT: Workers should wear appropriate clothing and equipment to prevent prolonged or repeated contact with rhodium tri-iodide. Goggles should be worn if there is any reasonable probability of rhodium tri-iodide getting into the eyes. Breathing protection is provided by a respirator equipped with MSA Type F high efficiency dust filters.

FIRE HAZARDS: Rhodium Tri-iodide is non-combustible. However, when exposed to the extreme heat of a fire, iodine fumes may be evolved. For this reason, full facepiece respirators equipped with approved cartridges or supplied air should be worn when fighting fires involving rhodium tri-iodide.

FIRST AID: Remove victim from contamination area. If he has become choked by RhI_3 dust, give oxygen to ease breathing difficulty. In such an event, he will have swallowed some of the material and should be treated accordingly. The proper treatment for ingested RhI_3 is to give 3-4 glasses of milk or water and have him vomit by sticking his finger down his throat.

The eyes should be flushed with plenty of low velocity water for at least 15 minutes. Affected skin should be washed with soap and water after removing contaminated clothing.

SANTICIZERS 160, 711, 790, DUP

Butylbenzyl Phthalate Esters Phthalic Esters

Mixtures of $C_{19}H_{20}O_4$, $C_6H_4(COOC_7H_{14})_2$, $C_6H_4(COOC_9H_{18})_2$, and $C_6H_4(COO_{11}H_{22})_2$

TLV, 5 mg/m³ by inference to Di-sec-Octyl Phthalate
Odor Threshold, Odorless

PROPERTIES: There are minor variations in the properties depending upon the predominate chain length of the ester side chains (alkyl groups). These plasticizers are clear liquids, with molecular weights in the 312-472 range, specific gravities ca. 0.97 (25/25°C) and vapor pressures ca. 1.2 mm at 210°C.

SYMPTOMS: These materials are not only considered practically non-toxic, they also have such low vapor pressures that inhalation of harmful concentrations would be doubtful. For S-711, an acute skin MLD, greater than 10g/kg, and slight eye irritation with a score of 10.6/110 were found in tests on rabbits (1.4/100 for S-160). An oral MLD greater than 20g/kg were found when tested on rats. Lifetime (2 year) studies of feeding 300-3000 ppm S-711 to rats indicated no neoplastic lesions (tumors) and no mutagenic or teratogen effects have been observed.

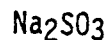
PROTECTIVE EQUIPMENT: Gloves, safety glasses or goggles to protect the hands and eyes.

FIRE HAZARD: Grade E combustible which presents a slight hazard, when exposed to heat and flame (flash point approx. 390°F; autoignition approx. 450°F).

FIRST AID: Contamination of the skin should be treated by washing with soap and water. In the event one of these phthalic esters enters the eyes, they should be irrigated immediately with copious quantities of fresh water for at least 15 minutes.

SODIUM SULFITE

76.



TLV, None Established
Odor Threshold; Odorless

PROPERTIES: Sodium sulfite is a white granular crystalline solid sometimes found in powder form. It has a density of 2.63 ($\text{H}_2\text{O} = 1$). It decomposes at 300°F before melting. It is soluble in water and a 1% solution has a pH of 9.8.

SYMPTOMS: Inhalation of dust will irritate nose and throat. If the material is handled at decomposition temperature, SO_2 gas will be liberated. In this case, consult data sheet on SO_2 .

If sodium sulfite contacts the eyes, minor irritation but no permanent damage would be expected.

Skin contact may result in localized irritation but no absorption through the unbroken skin is known to occur. Sodium sulfite is not a seriously toxic material. However, there is a report in the literature of a death after swallowing a massive dose of 120 grams.

PROTECTIVE EQUIPMENT: Respirators equipped with dust filters are adequate for protection from sodium sulfite dust. However, if the material has come into contact with heat or acid, use a respirator or full facepiece mask approved by NIOSH for sulfur dioxide or hydrogen sulfide gas.

When handling the solid or concentrated solution, chemical gloves should be worn. If there is a possibility of eye contact, safety goggles should be included. Coveralls may be required when handling large quantities of sodium sulfite.

FIRE HAZARDS: Sodium sulfite is non-flammable but will yield sulfur dioxide gas when exposed to high temperatures of a fire. Its presence in a fire does not hinder the use of any standard fire fighting medium. Wear self contained breathing apparatus when fighting fire.

FIRST AID: Remove victim from contaminated area. If the eyes have been contaminated, flush with plenty of low velocity water for at least 15 minutes and get immediate medical attention. For skin contact, remove contaminated clothing and

wash affected skin with soap and water. For dust inhalation and/or ingestion, remove from contact, give 3-4 glasses of milk or water to dilute stomach contents and have victim vomit by sticking his finger down his throat. Get medical attention at once.

STYRENE MONOMER (SM)

Vinyl Benzene
Phenylethylene
Cinnamine

$C_6H_5CHCH_2$

TLV, 50 ppm

Odor Threshold; 25 ppm

PROPERTIES: Styrene monomer is a clear, colorless liquid with a sweet odor when pure or a sharp odor when impure. The specific gravity is 0.92, the boiling point is 293°F, the vapor density is 3.6 (air = 1), the freezing point is -23°F and it is negligibly soluble in water.

SYMPTOMS: The vapor is very irritating to the eyes, moderately irritating to the respiratory tract with moderate systemic effects. The liquid is irritating to the skin and eyes.

Symptoms from exposure to high concentrations of SM are weakness, dizziness, nausea and sleepiness. Exposure of the skin to liquid SM can result in dermatitis from the defatting action of the styrene monomer.

The organs affected by exposure to high concentrations of styrene monomer are the central nervous system, respiratory system, lungs, eyes and skin.

PROTECTIVE EQUIPMENT: Persons working with styrene monomer should wear appropriate clothing to prevent repeated or prolonged contact with the skin. Such clothing may include only chemical gloves or could include a chemical apron. In some instances, complete protection such as a rain suit, boots, etc. may be required.

Goggles should be worn if there is a reasonable probability of eye contact.

If the vapor concentration is less than 400 ppm, a respirator equipped with chemical vapor cartridges should be worn. From 400 ppm to 5000 ppm, a full facepiece gas mask with chemical vapor cartridges or supplied air should be worn. In either case, the air must contain at least 19.5% oxygen. In other conditions, only full facepiece supplied air respirators should be worn.

FIRE HAZARDS: Styrene monomer is a Grade D combustible liquid. It can be ignited by heat and open flame. If the material is exposed to temperatures greater than 125°F, it can polymerize with a resultant production of considerable heat, and may even ignite. Flashpoint = 100°F, flammable limits = 1.1% to 6.1% in air, autoignition temp. = 914°F, vapor density = 3.6 (air = 1). Fires may be extinguished with CO₂, dry chemical, water fog or foam.

FIRST AID: Remove victim from contaminated area. If breathing has stopped give mouth-to-mouth artificial respiration. If breathing is difficult give oxygen. Remove clothing which has been contaminated with liquid SM and wash affected skin with soap and plenty of water. If any liquid has gotten into the eyes, flush with plenty of low velocity water for at least 15 minutes and get immediate medical attention. If any liquid has been swallowed, give 3-4 glasses of milk or water to dilute stomach contents but DO NOT INDUCE VOMITING. Get prompt medical attention.

STYRENE TAR

78.

SM Tar
SM Distillation Residues
Mixed High Boiling Aromatics

TLV, 100 ppm (Based on Polyethylbenzene)
Odor Threshold, Data Not Available

PROPERTIES: Styrene Tar is a dark brown viscous liquid. The boiling point is greater than 150°C, the vapor pressure is less than 1.5 psia @100°F, the closed cup flash point is greater than 150°F and the specific gravity is 1.01-1.04. It is only slightly soluble in water (0.04 g/100 ml @25°C).

SYMPTOMS: Styrene Tar is non-irritating to the skin and only slightly irritating to the eyes. Rats exposed to a saturated atmosphere at 25°C (1.3 mg/L) experienced no deaths after a 6 hour exposure. The conclusion is that there is no acute toxic effect from inhalation of styrene tar vapors.

2,4-Dinitrophenol presents only a slight toxicity problem due to its low concentration in the styrene tar (0.14 wt%). See 2,4-Dinitrophenol. In addition, the tar may contain polynuclear compounds which could, by analogy, be carcinogenic.

PROTECTIVE EQUIPMENT: Workers should wear appropriate protective clothing and equipment to prevent exposure to hot styrene tar. Goggles should be worn if there is any reasonable probability of eye exposure. Masks equipped with organic vapor cannisters are adequate up to 0.1% vapor concentration. Higher concentrations require the use of full facepiece supplied air respirators operated in the positive pressure mode.

FIRE HAZARDS: Styrene tar is a Class IIIA combustible liquid. The flash point is greater than 150°F and the boiling point is greater than 150°C.

FIRST AID: The most serious problem from styrene tar is the potential for thermal burns. Any area of the body splashed by the hot tar should be immediately flushed with plenty of low velocity cool water to stop the thermal burning. DO NOT RUB THE BURNED AREA.

Exposure to vapors should present no problem. If, however, breathing should be impaired by exposure, give oxygen for difficult breathing or mouth-to-mouth artificial respiration if breathing has stopped. Skin and eye exposure should be treated by flushing with plenty of low velocity water (at least 15 minutes for eyes). Soap may be used to help remove tar from the skin.

Get immediate medical attention for thermal burns or symptoms of over exposure.

SULFUR DIOXIDE

SO₂

TLV, 5 ppm

Odor Threshold; 0.47 ppm

PROPERTIES: Sulfur dioxide is a colorless, non-flammable gas with a strong suffocating odor. It has a molecular weight of 64.07 and a boiling point of 14°F. Under ordinary pressure, it condenses at -10°C to a colorless liquid with a specific gravity of 1.434. It solidifies at -72°C. It is soluble in water to the extent of 23 g/100 ml at 0°C and is soluble in alcohol, acetic acid, sulfuric acid, ether or chloroform.

SYMPTOMS: Sulfur dioxide causes tissue irritation as a result of sulfurous acid which is formed when the highly soluble gas dissolves in moisture on the tissue surface.

Symptoms of exposure to high vapor concentrations are irritation of the eyes, nose, throat and may include skin irritation. High levels of SO₂ cause coughing, choking, and reflex bronchoconstriction. If exposure is not immediately terminated, burns to the eyes, respiratory tract and skin can result.

The organs affected by overexposure to SO₂ are the respiratory system, skin, eyes and lungs.

PROTECTIVE EQUIPMENT: Workers handling SO₂ gas under pressure, liquid form or solid form should use whatever protective clothing is necessary to prevent frostbite to exposed skin. In addition, if there is any possibility of exposure to high concentrations of SO₂, goggles should be worn. In concentrations from 5 to 20 ppm, a respirator equipped with SO₂ cartridges should be worn. From 20 ppm to 100 ppm, a full facepiece respirator with SO₂ cartridges or supplied air should be used. At concentrations greater than 100 ppm, irritation of exposed tissue may occur requiring the worker to leave the environment regardless of choice of breathing equipment.

FIRE HAZARDS: SO₂ is a non-flammable gas but will react with powdered and alkali metals such as sodium or potassium.

FIRST AID: Remove the victim from the contaminated atmosphere. If breathing has stopped, start mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen. If the eyes have been exposed, flush with plenty of low velocity water for at least 15 minutes and get immediate medical attention. If the skin has been exposed, remove contaminated clothing and flush affected skin with plenty of water. Soap may be used if available. If the skin has been frost-bitten, DO NOT RUB AFFECTED AREAS. Get medical attention.

SULFURIC ACID

Oil of Vitriol

H_2SO_4

TLV, 1 mg/m³

Odor Threshold; Data Not Available

PROPERTIES: Sulfuric acid is a non-flammable, odorless and colorless oily liquid that is strongly corrosive. The molecular weight is 98.08. The pure anhydrous acid has a specific gravity of 1.84, freezing point of 10.4°C and a vapor pressure of less than 0.001 mm Hg at 20°C. It boils from 315°C to 388°C and decomposes into sulfur trioxide and water at 340°C. It reacts violently with evolution of heat when mixed with water or alcohol. Because of its negligible vapor pressure, it exists in air only as a mist or spray.

Fuming sulfuric acid is a mixture of H_2SO_4 with its anhydride, SO_3 . Ordinarily SO_3 vapor, which boils at 45°C, is rapidly converted in air to a mist of the acid by reaction with atmospheric moisture.

SYMPTOMS: Exposure to H_2SO_4 mist can cause eye, nose and throat irritation. If the concentration is great enough or the exposure is prolonged, pulmonary edema, bronchitis, emphysema, conjunctivitis, irritation of the mucous membranes of the mouth and dental erosion. Exposure to liquid H_2SO_4 or concentrated solutions can cause burns to any exposed tissue. The organs most susceptible to damage by H_2SO_4 are the respiratory system, eyes, skin, teeth and lungs.

PROTECTIVE EQUIPMENT: Appropriate protective clothing such as gloves, rubber apron, goggles, etc. should be worn when there is any possibility of skin contact with liquids containing more than 1% H_2SO_4 , and repeated or prolonged contact with liquids containing 1% or less H_2SO_4 .

In atmospheres containing no more than 50 mg/m³ H_2SO_4 mist, a gas mask with an acid canister and a high efficiency particulate filter should be used. In atmospheres containing no more than 100 mg/m³ of the mist, a Type C supplied air respirator with a full facepiece operated in a pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous flow mode.

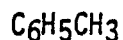
FIRE HAZARDS: Sulfuric acid will not burn. It will react with many metals, giving off hydrogen gas which is highly flammable. If hydrogen is trapped in confined spaces it can form an explosive mixture with air. DO NOT USE WATER to put out fire if the water can get into concentrated sulfuric acid.

FIRST AID: Remove victim from contaminated area. Drench with large volumes of water while removing contaminated clothing. If the eyes are involved, flush with large volume of low velocity water for at least 15 minutes. Get immediate medical attention. If breathing is difficult, give oxygen. If any acid has been swallowed, give 3-4 glasses of milk or water to dilute stomach contents. DO NOT INDUCE VOMITING.

TOLUENE

81.

Toluol
Phenyl Methane
Methyl Benzene



TLV, 100 ppm; Skin Absorption
Odor Threshold; 3 ppm

PROPERTIES: Toluene is a colorless liquid with a typical aromatic hydrocarbon odor described as floral, pungent, solventy, moth ball-like or rubbery. Its molecular weight is 92.13 and specific gravity is 0.866. The boiling point is 110.7°C and it solidifies at -95°C. At 25°C, the vapor pressure is 28 mm Hg. The flashpoint is 40°F. It is insoluble in water, but miscible with most organic solvents.

SYMPTOMS: Overexposure can result in fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, watering eyes, nervousness, sleeplessness, a sensation of tingling or prickling of the skin, dermatitis or sensitivity to light.

The liquid is slightly irritating to the eyes and skin.

The organs most susceptible to toluene exposure are the central nervous system, liver, kidneys, and skin.

PROTECTIVE EQUIPMENT: Workers should wear appropriate clothing to prevent repeated or prolonged skin contact. Chemical goggles should be worn if there is any reasonable probability of eye exposure.

If the vapor concentration does not exceed 500 ppm, a respirator equipped with organic vapor cartridges should be worn. From 500 ppm to 1000 ppm, a full facepiece respirator with chemical cartridges or supplied air should be used. From 1000 ppm to 2000 ppm, a gas mask equipped with organic vapor canisters or supplied air should be used.

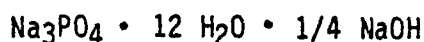
FIRE HAZARDS: Toluene is a Class C flammable liquid. The flashpoint = 45°F. Flammable limits in air = 1.27% to 7.0%. Autoignition temp. = 1026°F, vapor density = 3.14 (air = 1).

Fire should be fought in the same manner as any Grade C flammable petroleum product. The vapors are more toxic than those of petroleum and should be avoided.

FIRST AID: Remove victim from contaminated area. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen. If the eyes are involved, flush with plenty of low velocity water for at least 15 minutes. If the skin is exposed, remove contaminated clothing and wash with plenty of soap and water. If any of the material has been swallowed, give 3-4 glasses of milk or water to dilute stomach contents. DO NOT INDUCE VOMITING. Get immediate medical attention.

TRISODIUM PHOSPHATE

Sodium Phosphate Tribasic TSP



TLV, Not Established
Odor Threshold, No Odor

PROPERTIES: Trisodium phosphate is a white, crystalline, free flowing powder. It has a molecular weight of 390.2, a melting point of 73.3-76.7°C. It has a density of 1.62 at 20°C and is very soluble in water.

SYMPTOMS: TSP is a strong caustic which can cause both reversible and irreversible damage to the skin, eyes, respiratory tract and mucous membranes. Tissue damage can occur from contact with either the solid or solutions of this compound. Injury may result before one realizes that the chemical is in contact with the skin because signs and symptoms of irritation are frequently not evident immediately after contact.

Dermatitis of the primary irritant type may occur following single or repeated exposure to TSP. Repeated exposures result in itching or scaling condition of the skin, which may require treatment by a dermatologist.

Contact with the eyes, either in a solid form or in a solution, may cause severe damage.

Swallowing either the solid or solution can cause severe damage to the membranes of the mouth, throat, esophagus and stomach.

PROTECTIVE EQUIPMENT: For dust and particulate protection a Comfo-mask is sufficient in most instances.

Chemical gloves and splash-proof goggles should be worn when handling TSP. In occasional instances, the use of complete body protection involving slicker suits, boots, face shield, etc. is recommended.

FIRE HAZARDS: Trisodium phosphate is non-flammable but could cause a fire through an exothermic reaction with metals or combustible materials.

FIRST AID: If contact with the skin is made by either the solid or liquid, it should be washed off immediately with large volumes of running water. Remove contaminated clothing immediately. If even small quantities of either the solid or liquid enter the eyes, they should be irrigated immediately with copious amounts of low velocity water for at least 15 minutes.

If victim has inhaled TSP dust, give oxygen to ease respiratory distress. If breathing has stopped, give artificial respiration followed by oxygen.

If the victim has swallowed any TSP, do not induce vomiting. If he is conscious, have him wash out his mouth and drink as much milk or water as possible.

VINYL ACETATE (VAM)



TLV, 10 ppm

Odor Threshold; 0.12 ppm

PROPERTIES: Vinyl acetate is a colorless volatile liquid having a sweet odor. It will polymerize when exposed to light and usually is inhibited with hydroquinone. The molecular weight is 86.09 and the specific gravity is 0.932. It boils at 73°C and has a melting point between -93°C and -100°C. The vapor pressure at 25.3°C is 115 mm Hg. It is only slightly soluble in water and is miscible with alcohol and ether.

SYMPTOMS: Vinyl acetate is not a significant upper respiratory irritant at levels below 10 ppm but at levels above 20 ppm, slight respiratory irritation may occur. It may also produce a slight narcotic effect, dizziness, or drowsiness. It is not considered to be a serious skin irritant or producer of contact dermatitis, or a serious eye injurant provided the affected area is promptly flushed. However, if exposure is prolonged or involves high concentrations, eye irritation and watering may occur and prolonged skin contact with the liquid can produce skin irritation and may even include blistering.

The material is moderately toxic by mouth. The LD₅₀ for rats was found to be 2.5 g/kg in a single oral dose.

PROTECTIVE EQUIPMENT: Workers should wear appropriate clothing to prevent repeated or prolonged contact with the material. Goggles should be worn if there is any reasonable probability of eye exposure to the liquid.

In vapor concentrations which do not exceed 100 ppm, full facepiece respirators equipped with organic vapor canisters should be used. For greater concentrations, a respirator equipped with supplied air should be used.

FIRE HAZARDS: VAM is a Class C flammable liquid. Flash point = 18°F, flammable limits in air = 2.6% to 13.4%, autoignition temp. = 801°F.

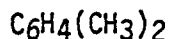
When VAM is heated, acrid vapors are given off. It may be ignited by heat, sparks or open flame.

Extinguish fire with CO₂, dry chemical, alcohol foam or water spray.

FIRST AID: Remove victim from contaminated area. If breathing is difficult give oxygen. If the eyes are involved, flush with plenty of low velocity water for at least 15 minutes and get medical attention. If the skin has been exposed to liquid, remove contaminated clothing and wash affected skin with soap and water. If any of the material has been swallowed, give 3-4 glasses of milk or water and get immediate medical attention. DO NOT INDUCE VOMITING.

O-XYLENE

Ortho-xylene
Xylol
1,2-Dimethylbenzene



TLV, 100 ppm; Skin Absorption
Odor Threshold; 0.5 ppm

PROPERTIES: Xylene is a colorless liquid with a benzene-like or gasoline-like odor. The molecular weight is 106, the boiling point is between 281°F and 292°F depending upon the isomer composition. The freezing point ranges from -53°F to +56°F. It's solubility in water is negligible.

SYMPTOMS: Xylene is irritating to the eyes, nose and throat in high concentrations. The symptoms of acute overexposure, in addition to irritation, are dizziness, excitement, drowsiness, incoherence and staggering gait. This may be followed by nausea, vomiting and abdominal pain.

Chronic exposure to subacute levels results in loss of appetite and the formation of small blister-like, fluid filled cavities on the cornea of the eye in addition to some of the symptoms of acute exposure.

The organs most susceptible to damage by xylene are the central nervous system, eyes, gastrointestinal tract, liver, kidneys and skin.

PROTECTIVE EQUIPMENT: Workers should wear appropriate protective equipment to prevent repeated or prolonged skin contact. If there is any reasonable probability of eye contact, chemical goggles should be worn.

In atmospheres that contain no more than 5000 ppm xylene vapor, a gas mask equipped with organic vapor canisters should be used. When the vapor concentration exceeds 5000 ppm, a full facepiece respirator with supplied air operated in the positive pressure mode should be used.

FIRE HAZARDS: Xylene is a Grade D flammable liquid. Flashpoint = 77°F to 90°F, flammable limits in air = 1.1% to 7.0%, autoignition temp = 867°F to 982°F. Fire extinguishing agents = CO₂, dry chemical, foam, water fog.

FIRST AID: Remove victim from contaminated area. If breathing has stopped, give mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen. If the eyes have been exposed, flush immediately with plenty of low velocity water for at least 15 minutes and get prompt medical attention. If the skin has been exposed, remove contaminated clothing and wash affected areas with soap and water. If any xylene has been swallowed, give 3-4 glasses of milk or water to dilute stomach contents. DO NOT INDUCE VOMITING. Get immediate medical attention.

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Ammonia	Ammonia	16
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Benzene Carboxylic Acid	Benzoic Acid	20
1,4 Benzenediol	Hydroquinone	54
Benzoic Acid	Benzoic Acid	20
Benzol	Benzene	19
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tert-Butylamine	tert-Butylamine	20
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Calcium Oxide	Lime	59
Carbolic Acid	Phenol	70
Carbon Dioxide	Carbon Dioxide	32
Carbon Monoxide	Carbon Monoxide	33
Caustic	Caustic	34
Caustic Lime	Lime	59
Caustic Soda	Caustic	34
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Decane	Decane	38
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DiEB	Diethyl Benzene	40
Diethyl Benzene	Diethyl Benzene	40
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Dimethyl Ether	Dimethyl Ether	41
1,1-Dimethylethylamine	tert-Butylamine	30
Dimethylbenzene	Xylene	83
Dimethyl Ketone	Acetone	9
2,4-Dinitrophenol	2,4-Dinitrophenol	42
Dracyclic Acid	Benzoic Acid	20
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Ethylbenzene	Ethylbenzene	43
Ethyl Chloride	Ethyl Chloride	44
Ethylene	Ethylene	45
cis-1,2 Ethylene Dicarboxylic Acid	Maleic Anhydride	60
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Heavy Oxo Ends	Heavy Oxo Ends	47
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Hydrogen	Hydrogen	50
Hydrogen Acid	Hydrogen Cyanide	52
Hydrogen Chloride	Hydrogen Chloride	51
Hydrogen Cyanide	Hydrogen Cyanide	52
Hydrogen Iodide	Hydrogen Iodide	53
Hydroquinol	Hydroquinone	54
Hydroquinone	Hydroquinone	54
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4-Hydroxy Anisole	Methyl Ether of Hydroquinone	64
Hydroxybenzene	Phenol	70
alpha-Hydroxy Isobutyronitrile	Acetone Cyanohydrin	10
2-Hydroxy Propanenitrile	Lactonitrile	58
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Iodine	Iodine	55
Iodomethane	Methyl Iodide	65
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Maleic Anhydride	Maleic Anhydride	60
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Methoxymethane	Dimethyl Ether	41
p-Methoxyphenol	Methyl Ether of Hydroquinone	64
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Methyl Benzene	Toluene	81
Methyl Cyanide	Acetonitrile	11
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Phenol	Phenol	70
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Toluene	Toluene	81
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