Chapter II
Screen Reclamation Chemicals

Introduction

Chapter 2, in which the characteristics of individual chemicals are detailed, is intended for use as a reference section. The specific information concerning each chemical was developed to support the risk assessment of screen reclamation products. Such information includes physical/chemical properties, industrial synthesis, aquatic toxicity, environmental fate, and a hazard summary. Tables II-4 through II-6 detail aquatic toxicity and hazard summary data for the chemicals in the screen reclamation use cluster. The preface to these exhibits explains the technical language and abbreviations used throughout the exhibits.

The regulatory status of a chemical was also provided as a ready reference; Table II-3 lists those chemicals used in screen reclamation which trigger federal environmental regulations. In addition, market profile information was developed to assess the overall production of the chemical, and its use in screen reclamation. Originally, if it was determined that more than 5 percent of the U.S. production volume of a chemical was used in screen reclamation, an analysis of the bulk chemical production, including occupational and population exposure assessments, would be undertaken. However, due to the lack of information on the quantity of specific chemicals used in screen reclamation, the latter analysis was not developed for any one chemical. Instead, economists at EPA developed a methodology for estimating the quantity of specific chemicals used in screen reclamation; this methodology is outlined in Chapter 3.

The chemicals that are discussed in this chapter comprise the screen reclamation use cluster; Table II-1 lists all of the chemicals in the screen reclamation use cluster, as well as their particular function in screen reclamation. Table II-1 also provides the page number on which information about a specific chemical can be found. Table II-2 is a generic categorization of some of the screen reclamation chemicals that was developed to protect the proprietary nature of the alternative screen reclamation products submitted by manufacturers. In Chapters 4 and 5, specific chemicals in ink removers, emulsion removers and haze removers are occasionally not identified by name, but by a generic category. For example, the product category "propylene glycol series ethers" might refer to the presence of tripropylene glycol methyl ether, propylene glycol methyl ether and methoxypropanol acetate. Although this categorization was developed to protect proprietary formulations, the risk assessment conducted for each type of screen reclamation product details the hazard and risk associated with only those chemicals that occur in the actual product formulation.

Table II-1
Summary of Screen Reclamation Chemicals and Their Functions

Chemical	CAS Number	Ink Remover	Emulsion Remover	Haze Remover	Possible Substitutes	Page Number
Acetone	67-64-1	X	X	X		II-7
Alcohols, C_8-C_{10}, ethoxylated	71060-57-6	X				II-8
Alcohols, C_{12}-C_{14}, ethoxylated	68439-50-9	X				II-10
Benzyl alcohol	100-51-6	X				II-11
2-Butoxyethanol	111-76-2	X				II-13
Butyl Acetate	123-86-4	X	X			II-14
Butyrolactone	96-48-0	X	X			II-16
Cyclohexanol	108-93-0	X				II-17
Cyclohexanone	108-94-1	X	X	X		II-19
Diacetone alcohol	123-42-2	X	X			II-20
Dichloromethane	75-09-2	X				II-22
Diethyl adipate	141-28-6				X	II-23
Diethyl glutarate	818-38-2				X	II-25
Diethylene glycol	111-46-6	X				II-26
Diethylene glycol monobutyl ether	112-34-5	X	X	X		II-28
Diethylene glycol butyl ether acetate	124-17-4	X	X	X		II-29
Diisopropyl adipate	6938-94-9				X	II-31
Dimethyl adipate	627-93-0	X		X		II-32
Dimethyl glutarate	1119-40-0	X		X		II-34
Dimethyl succinate	106-65-0	X		X		II-35
Dipropylene glycol methyl ether	34590-94-8	X	X			II-36
Dodecyl benzene sulfonic acid, triethanol amine salt	27323-41-7			X		II-39

Table II-1
Summary of Screen Reclamation Chemicals and Their Functions

Chemical	CAS Number	Ink Remover	Emulsion Remover	Haze Remover	Possible Substitutes	Page Number
Ethyl acetate	141-78-6	X	X			II-41
Ethyl lactate	97-64-3				X	II-42
Ethyl oleate	111-62-6				X	II-44
Ethoxylated castor oil	61791-12-6	X		X		II-45
Ethoxylated nonylphenol (np 4-9.5)	9016-45-9	X	X	X		II-47
Ethoxypropanol	52125-53-8	X				II-48
Ethoxypropyl acetate	54839-24-6	X				II-50
Furfuryl alcohol	98-00-0			X		II-51
Isobutyl isobutyrate	97-85-8	X				II-53
Isobutyl oleate	10024-47-2				X	II-54
Isopropanol	67-63-0	X	X			II-55
d-Limonene	5989-27-5	X				II-57
Methanol	67-56-1	X				II-58
Methoxypropanol acetate	84540-57-8	X				II-60
Methyl ethyl ketone	78-93-3	X	X			II-61
Methyl lactate	547-64-8				X	II-62
Mineral spirits (straight run naphtha)	64741-41-9	X		X		II-64
Mineral spirits (light hydrotreated)	64742-47-8	X		X		II-66
N-methylpyrrolidone	872-50-4	X	X	X		II-68
2-Octadecanamine, N,N-dimethyl-, N-oxide	71662-60-7	X				II-69
Periodic acid	13444-71-8		X			II-70

Table II-1
Summary of Screen Reclamation Chemicals and Their Functions

Chemical	CAS Number	Ink Remover	Emulsion Remover	Haze Remover	Possible Substitutes	Page Number
Phosphoric acid, mixed ester w/ispropanol and ethoxylated tridecanol	68186-42-5			X		II-72
Potassium hydroxide	1310-58-3	X	X	X		II-73
Propylene carbonate	108-32-7				X	II-75
Propylene glycol	57-55-6	X		X		II-76
Propylene glycol methyl ether	107-98-2 1320-67-8	X	X			II-78
Propylene glycol methyl ether acetate	108-65-6	X	X			II-79
Silica	7631-86-9		X			II-81
Silica, fumed (amorphous, crystalline-free)	112945-52-5		X			II-82
Sodium bisulfate	10034-88-5		X			II-84
Sodium hexametaphosphate	10124-56-8		X	X		II-85
Sodium hydroxide	1310-73-2	X	X	X		II-87
Sodium hypochlorite	7681-52-9		X			II-88
Sodium lauryl sulfate	151-21-3			X		II-90
Sodium metasilicate	6834-92-0			X		II-91
Sodium periodate	7790-28-5		X			II-93
Sodium salt, dodecyl benzene sulfonic acid	25155-30-0			X		II-94
Solvent naphtha (petroleum), light aliphatic	64742-89-8	X				II-96
Solvent naphtha (petroleum), light aromatic	64742-95-6	X				II-98
Solvent naphtha (petroleum), heavy aromatic	64742-94-5	X				II-100
Tall oil, special	68937-42-5			X		II-101

Table II-1
Summary of Screen Reclamation Chemicals and Their Functions

Chemical	CAS Number	Ink Remover	Emulsion Remover	Haze Remover	Possible Substitutes	Page Number
Terpineols	8000-41-7	X	X			II-103
Tetrahydrofurfuryl alcohol	97-99-4			X		II-104
Toluene	108-88-3	X				II-106
1,1,1-Trichloroethane	71-55-6	X				II-107
1,2,4-trimethylbenzene	95-63-6	X				II-109
Tripropylene glycol methyl ether	25498-49-1	X		X		II-110
Trisodium phosphate	7601-54-9	X	X			II-112
Xylenes (dimethyl benzene)	1330-20-7	X		X		II-114

Categorization of Screen Reclamation Chemicals

In order to maintain confidentiality among the formulators and to simplify the evaluation of the different screen reclamation systems, some of the constituent chemicals were categorized. When a category is referred to (e.g., dibasic esters), that formulation includes one or more of the chemicals in that category (e.g., diethyl adipate, diethyl glutarate, diisopropyl adipate, etc.)

Table II-2.
Categorization of Screen Reclamation Chemicals for Use in Alternative System Formulations

Category	Chemicals from Screen Reclamation Use Cluster in Category
Alkali/caustic	Sodium hydroxide Potassium hydroxide
Alkyl benzyl sulfonates	Dodecyl benzene sulfonic acid, triethanol amine salt Sodium salt, dodecyl benzene sulfonic acid
Aromatic solvent naphtha	Solvent naphtha (petroleum), light aromatic Solvent naphtha (petroleum), heavy aromatic
Derivatized plant oil	Tall oil, special Ethoxylated castor oil
Dibasic esters	Diethyl adipate Diethyl glutarate Diisopropyl adipate Dimethyl adipate Dimethyl glutarate Dimethyl succinate
Diethylene glycol series ethers	Diethylene glycol butyl ether Diethylene glycol butyl ether acetate
Fatty alcohol ethers	Alcohols, C_8-C_{10}, ethoxylated Alcohols, C_{12}-C_{14}, ethoxylated
Phosphate salt	Sodium hexametaphosphate Trisodium phosphate
Propylene glycol series ethers	Dipropylene glycol methyl ether Propylene glycol methyl ether Tripropylene glycol methyl ether Propylene glycol methyl ether acetate Dipropylene glycol methyl ether acetate Ethoxypropanol Ethoxypropyl acetate Methoxypropanol acetate

Information on Individual Printing Chemicals

The following pages provide information on individual chemicals used in the screen printing industry for screen reclamation.

Acetone

Chemical Properties and Information	
Acetone [dimethyl ketone, 2-propanone] CAS# 67-64-1 Molecular weight: 58.079 Melting Point: -95.4 to -94°C (M) Water Solubility: Miscible Vapor Pressure: 185 mm Hg (20°C) Log K_{ow}: -0.24 (M) Henry's Law Constant: 3.97×10^{-5} atm-m^3/mole (M) Chemistry of Use: Solvent	C_3H_6O Structure: CH_3COCH_3 Boiling Point: 56.2°C (M) Density: 0.7908_4^{20} g/ml (M) Flash Point: -18°C (M) K_{oc}: 2 (E)

Above data are either measured (M) or estimated (E)

Acetone is the simplest and most important of the ketones. It is a colorless, flammable liquid with a mildly pungent, somewhat aromatic odor. It shows typical reactions of aliphatic saturated ketones. It undergoes many condensation reactions; condensation with amines yields Schiff bases, and various esters condense readily with acetone in the presence of amine or ammonia. It is stable to many of the usual oxidants. Acetone is highly flammable and has a threshold limit value of 2400 mg/m^3.

The two common methods of manufacturing acetone are 1) cumene hydroperoxide cleavage and 2) the dehydrogenation of isopropyl alcohol. In the first process, benzene is alkylated to cumene, which is oxidized to cumene hydroperoxide, which, in turn, is cleaved to phenol and acetone. Acetone is a coproduct of this process, which is used to produce a large fraction of phenol produced in the U.S.. In the second process, which is endothermic, isopropanol is dehydrogenated catalytically, with a variety of possible catalysts, including copper, silver, platinum, and palladium metal; sulfides of transition metals, as well as zinc oxide-zirconium oxide, copper-chromium oxide, and copper-silicon dioxide combinations.

Market Profile

In 1992, total U.S. production was 230 million gallons. Imports were 9 million gallons and exports were 27 million gallons. Total U.S. quantity estimated for use in screen reclamation was 6.92 million gallons.

Regulatory Status

See Table II-3 and accompanying summary.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released on soil, acetone will volatilize into the air or leach into the ground where it will probably biodegrade. Photolysis will be important on terrestrial surfaces and in surface waters exposed to sunlight. If released to water, acetone may also be lost due to volatilization (estimated half-life 20 hr from a model river) and biodegradation. Bioconcentration in aquatic organisms and adsorption to sediment should not be important transport processes in water. In the atmosphere, acetone will be lost by photolysis and reaction with photochemically produced hydroxyl radicals. Half-life estimates from these combined processes average 22 days and are shorter in summer and longer in winter. In air, acetone may also be washed out by rain. Using a rapid and a moderate biodegradation rate for acetone in the STP fugacity model results in 97 and 84 percent, respectively, predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Alcohols, C_8-C_{10}, Ethoxylated

Chemical Properties and Information	
Alcohols, C_8-C_{10}, ethoxylated [ethoxylated fatty alcohols] CAS# 71060-57-6 Molecular weight: 150-220 Melting Point: <20°C (E) Water Solubility: Dispersable (n=3 to 10) (E) Vapor Pressure: <0.1 mm Hg (at 20°C) (E) Log K_{ow}: Not available Henry's Law Constant: Not available Chemistry of Use: Surfactant	Molecular formula varies Structure: R $(O\text{-}CH_2\text{-}CH_2)_nOH$, R = C_8 to C_{10} Boiling Point: Decomposes (E) Density: 1.02 g/cm^3 (E) Flash Point: >100°C (E) K_{oc}: Not available

Above data are either measured (M) or estimated (E)

These chemicals will exhibit surfactant-like properties for n=3 to 10. When n>10, they will behave as mild surfactants. Melting point, boiling point, and flash point will increase as n or R increases. They are soluble in alcohol and ether.

These chemicals are prepared by ethoxylation of alcohols with ethylene oxide.

Market Profile

Production volumes for C_8-C_{10} Ethoxylated Alcohols were not available. However, in 1992, total U.S. consumption of alcohol ethoxylates (including both C_8-C_{10} and C_{12}-C_{14}) was 386 million pounds. In 1988, 29 million pounds of this chemical was exported. Data for imported amounts was not available. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Alcohols, C_8-C_{10}, ethoxylated do not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, C_8-C_{10} ethoxylated alcohols are expected to rapidly biodegrade. Two factors influencing biodegradation are the number of ethylene oxide units in the hydrophilic moiety and the structure of the hydrophobic moiety. Studies have shown that the linearity of the hydrophobic moiety has a more pronounced effect on biodegradability than the hydrophobic chain length, point of attachment of the polyglycol chain (i.e., whether alcohol moiety is primary or secondary), or degree of ethoxylation. Biodegradation occurs by the β-oxidation of the alkyl chain, scission of the hydrophobic and hydrophic moieties and step-wise removal of ethoxylate groups, forming more hydrophobic metabolites. The C_8-C_{10} ethoxylated alcohols will be highly mobile in soil with the mobility increasing with increasing number of ethoxylate groups. Volatilization from soil to the atmosphere is not expected to occur. Studies have shown that C_8-C_{10} ethoxylated alcohols undergo rapid biodegradation in river water; degradation is essentially complete in about a week. Shorter chain ethoxylates may also partition to sediment and particulate matter in the water column. Volatilization of C_8-C_{10} ethoxylated alcohols to the atmosphere is not expected to occur. If released to the atmosphere, C_8-C_{10} ethoxylated alcohols will be associated with aerosols and will be removed by wet and dry deposition. Using a rapid biodegradation rate in the STP fugacity model results in 100 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Alcohols, C_{12}-C_{14}, ethoxylated

Chemical Properties and Information	
Alcohols, C_{12}-C_{14}, ethoxylated [ethoxylated fatty alcohols] CAS# 68439-50-9 Molecular weight: >200 Melting Point: <50°C (E) Water Solubility: Dispersable (n=3 to 10) (E)Vapor Pressure: <0.01 mm Hg (E) Log K_{ow}: Not available Henry's Law Constant: Not available Chemistry of Use: Surfactant	Molecular formula varies Structure: R $(O\text{-}CH_2\text{-}CH_2)_nOH$, R = C_{12} to C_{14} Boiling Point: Decomposes (E) Density: 0.95 g/cm^3 (E) Flash Point: >100°C (E) K_{oc}: Not available

Above data are either measured (M) or estimated (E)

These chemicals will exhibit surfactant-like properties for n=3 to 10. When n>10, they will behave as mild surfactants. Melting point, boiling point, and flash point will increase as n or R increases. They are miscible in organic solvents.

These chemicals are prepared by ethoxylation of alcohols with ethylene oxide.

Market Profile

Production volumes for C_{12}-C_{14} ethoxylated alcohols were not available. However, in 1992, total U.S. consumption of alcohol ethoxylates (including both C_8-C_{10} and C_{12}-C_{14}) was 386 million pounds. In 1988, 29 million pounds of this chemical was exported. Data for imported amounts was not available. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Alcohols, C_{12}-C_{14}, ethoxylated do not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, C_{12}-C_{14} ethoxylated alcohols are expected to rapidly biodegrade. Two factors influencing biodegradation are the number of ethylene oxide units in the hydrophilic moiety and the structure of the hydrophobic moiety. Studies have shown that the linearity of the hydrophobic moiety has a more pronounced effect on biodegradability than the hydrophobic chain length, point of attachment of the polyglycol chain (i.e., whether alcohol moiety is primary or secondary), or degree of ethoxylation. Biodegradation occurs by the β-oxidation of the alkyl chain, scission of the hydrophobic and hydrophic moieties and step-wise removal of ethoxylate groups, forming more hydrophobic metabolites. The C_{12}-C_{14} ethoxylated alcohols will be highly mobile in soil with the mobility increasing with increasing number of ethoxylate groups. Volatilization from soil to the atmosphere is not expected to occur. Studies have shown that C_{12}-C_{14} ethoxylated alcohols undergo rapid biodegradation in river water; degradation is essentially complete in about a week. Shorter chain ethoxylates may also partition to sediment and particulate matter in the water column. Volatilization of C_{12}-C_{14} ethoxylated alcohols to the atmosphere is not expected to occur. If released to the atmosphere, C_{12}-C_{14} ethoxylated alcohols will be associated with aerosols and will be removed by wet and dry deposition. Using a rapid biodegradation rate in the STP fugacity model results in 100 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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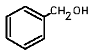
Benzyl Alcohol

Chemical Properties and Information	
Benzyl alcohol [Benzenemethanol, Benzene carbinol, α-Hydroxy toluene] CAS# 100-51-6 Molecular weight: 108.13 Melting Point: -15.19°C (M) Water Solubility: 40 g/L (M) Vapor Pressure: 0.048 mm Hg (at 20°C) (E) 1 mm Hg (at 58°C) (M) Log K_{ow}: 1.10 (M) Henry's Law Constant: 2.1×10^{-7} atm-m^3/mole (E) Chemistry of Use: Solvent	C_7H_8O Structure:  Boiling Point: 204.7°C (M) Density: 1.045 g/cm^3 (M) Flash Point: 101°C (closed cup) (M) 104°C (open cup) (M) K_{oc}: 5 - 16 (M)

Above data are either measured (M) or estimated (E)

This chemical has a faint aromatic odor and sharp burning taste. It is miscible with alcohol, ether, chloroform, acetone.

Benzyl alcohol is produced by reaction of sodium or potassium carbonate with benzyl chloride.

Market Profile

In 1988, total U.S. production was 4.8 million gallons; an additional 1.6 million gallons was imported. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Benzyl alcohol does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, benzyl alcohol is expected to display high mobility. Volatilization from moist soil to the atmosphere is not expected to be important, although it may slowly volatilize from dry soils. Microbial degradation in soil may be rapid, especially in acclimated soils. If released to water, benzyl alcohol is expected to undergo microbial degradation under aerobic conditions. Biodegradation may be rapid under acclimated conditions. It is also expected to slowly biodegrade under anaerobic conditions. Neither volatilization to the atmosphere, chemical hydrolysis, direct photolytic degradation, chemical oxidation, bioconcentration in fish and aquatic organisms, nor adsorption to sediment and suspended organic matter are expected to be significant processes in environmental waters. If released to the atmosphere, benzyl alcohol is expected to undergo a gas-phase reaction with photochemically produced hydroxyl radicals; the estimated half life for this process is 16 hours. Its water solubility indicates that benzyl alcohol may also undergo atmospheric removal by wet deposition processes; however, its short atmospheric residence time suggests that wet deposition may be of limited importance. Using a rapid biodegradation rate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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2-Butoxyethanol

Chemical Properties and Information	
2-Butoxyethanol [Glycol ether EB; butyl Cellosolve; Dowanol EB; Poly-Solv EB; glycol butyl ether, ethylene glycol monobutyl ether] CAS# 111-76-2 Molecular weight: 118.18 Melting Point: -75°C (M) Water Solubility: Miscible (E) Vapor Pressure: 3 mm Hg (25°C)(E) Log K_{ow} = 0.57 (E) Henry's Law Constant: 2.1×10^{-8} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_6H_{14}O_2$ Structure: $CH_3CH_2CH_2CH_2OCH_2CH_2OH$ Boiling Point: 171.2°C (M) Density: 0.902 g/ml (M) Flash Point: Open cup: 74°C (M) Closed cup: 68°C (M) K_{oc}: 49 (E)

Above data are either measured (M) or estimated (E)

The physical state of 2-butoxyethanol is an oily, colorless liquid with mild rancid odor. Glycol ethers are both ethers and alcohols. Their hydroxyl groups can be etherified, esterified, chlorinated, or otherwise modified.

The reaction of ethylene oxide and alcohols gives a mixture of glycol monoethers and monoethers of the lower polyethylene glycols.

Market Profile

In 1991, total U.S. production was 350 million gallons. In 1991, imports were 2.8 million gallons and in 1988, exports were 73.1 million gallons. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

See Table II-3 and accompanying summary. The generic category of glycol ethers are also listed as Hazardous Air Pollutants in the Clean Air Act.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

2-butoxyethanol is not expected to undergo hydrolysis or direct photolysis in the environment. In water, volatilization, adsorption to sediments and suspended solids, and bioconcentration in aquatic organisms are not expected to be important transport processes for

2-butoxyethanol. Aqueous screening test data indicate that biodegradation is likely to be the most important removal mechanism of 2-butoxyethanol from aerobic soil and water. If released to soil, 2-butoxyethanol is expected to display very high mobility. Volatilization from dry soil surfaces will be important. In the atmosphere, 2-butoxyethanol is expected to exist almost entirely in the gas-phase and reactions with photochemically produced hydroxyl radicals should be fast (estimated half-life of 5.6 hrs). Using a rapid biodegradation rate for 2-butoxyethanol in the STP fugacity model results in 97 percent predicted removal from wastewater treatment plants; a moderate rate corresponds to 83 percent predicted removal.

Health Hazard

See Table II-6 and accompanying summary

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Butyl Acetate

Chemical Properties and Information	
Butyl acetate [*n*-butyl acetate; butyl ethanoate] CAS# 123-86-4 Molecular weight: 116 Melting Point: -77°C (M) Water Solubility: 10 g/l (E) Vapor Pressure: 12.8 mm Hg (25°C)(M) Log K_{ow} = 1.82 (M) Henry's Law Constant: 2.81 x 10^{-4} atm-m^3/mole (M) Chemistry of Use: Solvent	$C_6H_{12}O_2$ Structure: $CH_3COOCH_2CH_2CH_2CH_3$ Boiling Point: 125-6°C (M) Density: 0.883 g/ml (M) Flash Point: 29°C (M) K_{oc}: 23 (E) Physical state: Liquid

Above data are either measured (M) or estimated (E)

Butyl acetate is a colorless, flammable liquid with a pleasant, fruity odor. It is miscible with most organic solvents. The threshold limit value for air is 150 ppm. The vapors are irritating to the eyes and respiratory tract. Synthetic esters are generally prepared by reaction of an alcohol with an organic acid in the presence of a catalyst such as sulfuric acid or *p*-toluene sulfonic acid. Butyl acetate thus may be prepared by the reaction of butanol and acetic acid.

Market Profile

In 1992, total U.S. production was 250 million gallons. In 1991, imports were less than 100,000 million gallons. In 1992, exports were 127.5 million gallons. Total U.S. production quantity for use in screen reclamation was estimated to be 1.92 million gallons.

Regulatory Status

See Table II-3 and accompanying summary

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, butyl acetate is expected to rapidly biodegrade. Chemical hydrolysis is not expected to occur in moist soils although it may occur in alkaline soils (pH greater than 8). Butyl acetate is expected to display high mobility. Volatilization of butyl acetate to the atmosphere from both dry and moist soil surfaces may be significant. If released to water, butyl acetate is expected to biodegrade under aerobic conditions as 5-day theoretical BODs of 23-58 percent using a sewage seed, 21 percent in river water, and 40 percent in salt water have been reported. Volatilization to the atmosphere is also expected to be important. The hydrolysis half-lives of butyl acetate at pHs 7.0, 8.0, and 9.0 are about 3.1 years, 114 days and 11.4 days, respectively, at 20 °C indicating that hydrolysis will be important only in very alkaline environmental waters. Adsorption to sediment and suspended organic matter and bioconcentration in fish and aquatic organisms are not expected to be significant processes. If released to air, butyl acetate will exist almost entirely in the gas-phase in the ambient atmosphere. It may undergo atmospheric removal by the gas-phase reaction with photochemically produced hydroxyl radicals with an estimated half-life of 2.5 days for this process. Butyl acetate may also undergo atmospheric removal by wet deposition processes; however, its short atmospheric residence time suggests that this process may be of limited importance. Using a rapid biodegradation rate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Butyrolactone

Chemical Properties and Information	
Butyrolactone [γ-Butyrolactone; dihydro-2(3H)-furanone; 1,2-butanolide; 1,4-butanolide; γ-hydroxybutyric acid lactone; 3-hydroxybutyric acid lactone; 4-hydroxybutanoic acid lactone] CAS# 96-48-0 Molecular weight: 86 Melting Point: -44°C (M) Water Solubility: miscible (M) Vapor Pressure: 3.2 mm Hg (25° C)(M) Log K_{ow} = -0.640 (M) Henry's Law Constant: 1.81×10^{-5} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_4H_6O_2$ Structure: Boiling Point: 204°C (M) Density: 1.125 g/ml (M) Flash Point: Open cup: 98°C (M) K_{oc}: 53 (E) Physical state: Liquid

Above data are either measured (M) or estimated (E)

Butyrolactone undergoes characteristic γ-lactone reactions including ring openings and reactions wherein oxygen is replaced by another ring heteroatom. There is also a marked reactivity of the alpha hydrogen atoms. Butyrolactone is soluble in methanol, ethanol, acetone, ether and benzene.

Two routes are used for commercial production: the dehydrogenation of butanediol, and hydrogenation of maleic anhydride to tetrahydrofuran and butyrolactone. In the former, the exothermic dehydrogenation is carried out in a fixed bed at atmospheric pressure with preheated butyrolactone over a copper-on-silica catalyst at 230 to 250°C. The yield of butyrolactone, purified by distillation, is approximately 90 percent.

Market Profile

In 1990, total U.S. production was 67 million gallons. Data for imported and exported amounts were not available. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Butyrolactone does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary
See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

In aqueous solutions butyrolactone is in dynamic equilibrium with its free acid and under basic conditions the acid form may predominate. If released to soil, butyrolactone may volatilize from both dry and moist soil to the atmosphere. It is expected to display moderate to high mobility in soil. In basic soils, the free acid form may predominate which may alter both the rate at which butyrolactone volatilizes from soil and the degree to which it adsorbs. Biodegradation in acclimated aerobic soils is expected. If released to water, butyrolactone may volatilize from water to the atmosphere. The estimated half-life for volatilization from a model river is 1.5 days. Butyrolactone is not expected to bioconcentrate in fish and aquatic organisms, nor is it expected to adsorb to sediment and suspended organic matter. Biodegradation under aerobic conditions is expected. If released to the atmosphere, butyrolactone is expected to undergo a gas-phase reaction with photochemically produced hydroxyl radicals; the estimated half life for this process is 4.4 days. Butyrolactone may also undergo atmospheric removal by both wet and dry deposition processes. Using a rapid biodegradation rate for butyrolactone in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants. If a moderate biodegradation rate is used in this model, 83 percent predicted total removal may be achieved.

Health Hazard

See Table II-6 and accompanying summary

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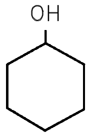
Cyclohexanol

Chemical Properties and Information	
Cyclohexanol [hexahydrophenol, hexalin] CAS# 108-93-0 Molecular weight: 100.16 Melting Point: 23 - 25°C (M) Water Solubility: 36 g/l (at 20°C) (M) Vapor Pressure: 0.8 torr (at 20°C) (M) Log K_{ow}: 1.23 (M) Henry's Law Constant: $1.02X10^{-4}$ atm-m^3/mole (M) Chemistry of Use: Solvent	$C_6H_{12}O$ Structure:  Boiling Point: 161°C (M) Density: 0.962 g/cm^3 (at 20°C) (M) Flash Point: 68°C (closed cup) (M) K_{oc}: 111 and 13 (E)

Above data are either measured (M) or estimated (E)

This chemical exists as hygroscopic crystals and has a camphor-like odor. Cyclohexanol is moderately flammable. It is miscible with ethanol, ethyl acetate, linseed oil, petroleum solvent, and aromatic hydrocarbons.

Cyclohexanol is formed either by oxidation of cyclohexane, or hydrogenation of phenol.

Market Profile

In 1992, total U.S. production for both cyclohexanol and cyclohexanone was 2.1 billion gallons. Data for imported and exported amounts were not available. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Cyclohexanol does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, cyclohexanol will be expected to exhibit high to very high mobility in soil. It will not hydrolyze in moist soil, but it may be subject to volatilization from near surface soil. It may be subject to biodegradation in soil based upon results observed in laboratory aqueous screening tests. If released to water, it will not be expected to adsorb to sediment or suspended particulate matter or to bioconcentrate in aquatic organisms. It will not be expected to hydrolyze or directly photolyze in water. It may be subject to biodegradation in natural waters based upon results observed in laboratory biodegradation aqueous aerobic screening tests using sewage and activated sludge inocula. It will be subject to volatilization from surface waters with estimated half-lives of 23 hr for volatilization from a model river and 10.6 days for volatilization from a model pond, respectively. If released to the atmosphere, it can be expected to exist mainly in the vapor-phase in the ambient atmosphere based on its vapor pressure. The estimated half-life for vapor-phase reaction with photochemically produced hydroxyl radicals is 22 hr at an atmospheric concentration of $5X10^4$ hydroxyl radicals per cm^3. Cyclohexanol will not be expected to directly photolyze in the atmosphere. Using a rapid biodegradation rate for cyclohexanol in the STP fugacity model, 97 percent removal can be predicted from wastewater treatment plants. Using a moderate biodegradation rate for cyclohexanol in the STP fugacity model, 84 percent removal can be predicted from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Cyclohexanone

Chemical Properties and Information	
Cyclohexanone [ketohexamethylene, pimelic ketone, cyclohexyl ketone, Hytrol O, Anone, Nadone] CAS# 108-94-1 Molecular weight: 98 Melting Point: -47°C (M) Water Solubility: 100 g/l (E) Vapor Pressure: 3.975 mm Hg (M) (20°C) Log K_{ow} = 0.81 (M) Henry's Law Constant: 9×10^{-6} atm-m^3/mole (M) Chemistry of Use: Solvent	$C_6H_{10}O$ Structure: Boiling Point: 156.7°C (M) Density: 0.9478 g/ml (M) Flash Point: Closed cup: 42°C (M) K_{oc}: 10 (E)

Above data are either measured (M) or estimated (E)

Cyclohexanone is a colorless liquid with an odor suggestive of peppermint and acetone. Cyclohexanone is miscible with methanol, ethanol, acetone, benzene, *n*-hexane, nitrobenzene, dimethyl ether, naphtha, xylene, ethylene, glycol, isoamyl acetate, diethylamine, and most organic solvents.

Cyclohexanone may be produced by the catalytic hydrogenation of phenol, by the catalytic air oxidation of cyclohexanol, by the catalytic dehydrogenation of cyclohexanol, or by the oxidation of cyclohexanol. The hydrogenation of phenol, which is best carried out in the liquid phase, catalyzed by palladium on carbon, is the most efficient route.

Market Profile

In 1992, total U.S. production for both cyclohexanol and cyclohexanone was 2.1 billion gallons. Imports were 0.6 million gallons and exports were 48.5 million gallons. Total U.S. production quantity of cyclohexanone for use in screen reclamation was estimated to be 270,000 gallons.

Regulatory Status

See Table II-3 and accompanying summary

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to the atmosphere, cyclohexanone will degrade by reaction with sunlight produced hydroxyl radicals (half-life of about 1 day) and by direct photolysis (half-life of about 4.3 days). If released to water, cyclohexanone may degrade through biodegradation and photolysis. Volatilization from environmental waters will not be rapid except from rapidly moving, shallow streams. If released to soil, cyclohexanone will be susceptible to significant leaching. Volatilization and photodegradation will occur on soil surfaces. Using a rapid and a moderate biodegradation rate for cyclohexanone in the STP fugacity model results in about 97 and 83 percent, respectively, predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Diacetone Alcohol

Chemical Properties and Information	
Diacetone alcohol [4-hydroxy-4-methyl-2-pentanone, dimethylacetonylcarbinol, 2-methyl-2-pentanol-4-one; pyranton] CAS# 123-42-2 Molecular weight: 116 Melting Point: -44°C (M) Water Solubility: Miscible Vapor Pressure: 0.97 mm Hg (M) (20°C) Log K_{ow} = -0.34 (E) Henry's Law Constant: 1.4 x 10^{-9} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_6H_{12}O_2$ Structure: $(CH_3)_2C(OH)CH_2COCH_3$ Boiling Point: 164°C (M) Density: 0.9306 g/ml (M) Flash Point: Open Cup: -66°C (M) K_{oc}: 21 (E)

Above data are either measured (M) or estimated (E)

Technical grade diacetone alcohol contains up to 15 percent acetone. Diacetone alcohol is miscible with alcohol, ether, and other solvents. Its physical state is a colorless oily liquid with a faint pleasant odor.

Diacetone alcohol may be produced from acetone in the presence of a base such as barium hydroxide or calcium hydroxide. It can be isolated from the arctic bramble *Rubus articus*, from green algae and from the sleepy grass sp. *Stipa vaseyi.*

Market Profile

In 1990, total U.S. production volume was 18 million gallons. In 1992, imports were 0.5 million gallons and exports were 1.8 million gallons. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Diacetone alcohol does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, diacetone alcohol will be expected to exhibit very high mobility. Although no data were located regarding its biodegradation in soil, the compound may be subject to biodegradation in soil based upon results observed in laboratory biodegradation aqueous aerobic screening tests. It should not be subject to volatilization from moist near-surface soil. However, it may volatilize from dry near-surface soil and other dry surfaces. In water, it will not be expected to adsorb to sediment or suspended particulate matter or bioconcentrate in aquatic organisms. Diacetone alcohol has been demonstrated to biodegrade in aqueous aerobic screening tests. The compound may be subject to biodegradation in natural waters. It should not be subject to volatilization from surface waters. Hydrolysis should not be an important removal process. If released to the atmosphere, gas-phase diacetone alcohol will react with photochemically produced hydroxyl radicals; the estimated half-life is 8 days (12-hr daylight day). Diacetone alcohol may be susceptible to direct photolysis in the atmosphere based upon its possible absorption of light at wavelengths greater than 290 nm. The compound may be susceptible to removal from the atmosphere by washout because of its high water solubility. Using a moderate biodegradation rate for diacetone alcohol in the STP fugacity model, 83 percent total removal can be predicted from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Dichloromethane

Chemical Properties and Information	
Dichloromethane [methylene chloride; methylene dichloride; Freon 30; DCM] CAS# 75-09-2 Molecular weight: 84.93 Melting Point: -97°C (M) Water Solubility: 17 g/l (M) Vapor Pressure: 340 mm Hg (20°C) (M) Log K_{ow} = 1.25 (M) Henry's Law Constant: 3.25×10^{-3} atm-m^3/mole (M) Chemistry of Use: Solvent	CH_2Cl_2 Structure: CH_2Cl_2 Boiling Point: 40-41°C (M) Density: 1.33_4^{15} g/ml (M) Flash Point: -96.8°C (M) K_{oc}: 67 (M) Physical state: Clear, colorless volatile liquid

Above data are either measured (M) or estimated (E)

Methylene chloride is nonflammable, and stable under normal laboratory storage conditions. It is soluble in ether. Methylene chloride may form explosive mixtures with certain materials.

Methylene chloride is produced industrially by (1) first reacting hydrogen chloride and methanol in the vapor phase with the aid of a catalyst to give methyl chloride, and then chlorinating, (the predominant method) or (2) directly reacting excess methane with chlorine at high temperature (≅ 485-510°C), which produces multiple coproducts.

Market Profile

In 1991, total U.S. production was 240 million gallons. Imports were 5.6 million gallonsss and exports were 79.0 million gallons. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

See Table II-3 and accompanying summary

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, dichloromethane is expected to display high mobility. It may rapidly volatilize from both moist and dry soil to the atmosphere. Aerobic biodegradation may be important for dichloromethane in acclimated soils. If released to water, volatilization to the atmosphere is expected to be a rapid process. Neither bioconcentration in fish and aquatic organisms nor adsorption to sediment and suspended organic matter are expected to be significant. Dichloromethane has been found to slowly biodegrade under aerobic conditions. It is also expected to slowly biodegrade under anaerobic conditions in sediment and groundwater. If released to the atmosphere, dichloromethane is expected to persist for long periods of time. The estimated half-life for the gas-phase reaction of dichloromethane with hydroxyl radicals is approximately 88 days. Direct photolytic degradation is not expected to occur. Dichloromethane may undergo atmospheric removal by wet deposition processes although any removed by this processes is expected to rapidly re-volatilize to the atmosphere. Using a slow biodegradation rate for dichloromethane in the STP fugacity model, 64 percent total removal can be predicted from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Diethyl Adipate

Chemical Properties and Information	
Diethyl adipate [Diethyl ester adipic acid]	$C_{10}H_{18}O_4$
CAS# 141-28-6	Structure: $(C_2H_5O)CO(CH_2)_4OC(OC_2H_5)$
Molecular weight: 202.25	Boiling Point: 245°C (M)
Melting Point: -19.8°C (M)	Density: 1.002 g/ml (M)
Water Solubility: 0.1 g/L (E)	Flash Point: 110°C (M)
Vapor Pressure: 0.8 mm Hg (25°C)(E)	K_{oc}: 44 (E)
Log K_{ow} = 2.37 (E)	Physical state: Colorless liquid
Henry's Law Constant: 2.3×10^{-7} atm-m^3/mole (E)	
Chemistry of Use: Lubricant, Plasticizer	

Above data are either measured (M) or estimated (E)

Diethyl adipate is soluble in alcohol and ether. When heated to decomposition, it emits acrid smoke and fumes. The production of adipic acid esters is second only to the production of adipic acid polyamides. These esters are marketed as plasticizers.

Diethyl adipate is the esterification product of adipic acid and ethanol. Adipic acid is produced by the oxidation with air and nitric acid, separately, of cyclohexane. Diethyl adipate, along with other esters, is produced in the mother liquor during adipic acid manufacturing. Diethyl adipate is produced along with other esters, and is subsequently separated and refined by distillation.

Market Profile

In 1991, total U.S. production of adipate plasticizers was 35 million pounds. Data specific to diethyl adipate was not available; nor were data for imported and exported amounts. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Diethyl adipate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, diethyl adipate is expected to display high mobility. Biodegradation in aerobic soils may be rapid. Volatilization of diethyl adipate from both moist and dry soil to the atmosphere is expected to be very slow. Chemical hydrolysis of the ester group is not expected to be significant except for highly basic soils (pH greater than8). If released to water, aerobic biodegradation may be rapid. Diethyl adipate is not expected to bioconcentrate in fish and aquatic organisms or adsorb to sediment and suspended organic matter. Volatilization of diethyl adipate from water to the atmosphere will be very slow. Chemical hydrolysis may occur in highly basic waters. If released to the atmosphere, diethyl adipate may undergo oxidation by the gas-phase reaction with hydroxyl radicals with an estimated half-life of approximately 1.9 days. It may also undergo atmospheric removal by both wet and dry deposition processes; however, its short atmospheric residence time suggests that wet deposition is of limited importance. Using a rapid biodegradation rate for diethyl adipate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants. If a moderate biodegradation rate is used in this model, 85 percent predicted total removal may be achieved.

Health Hazard

See Table II-6 and accompanying summary

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Diethyl Glutarate

Chemical Properties and Information	
Diethyl glutarate [Diethyl ester glutaric acid; diethyl pentanedioic acid] CAS# 818-38-2 Molecular weight: 188.2 Melting Point: -24.1°C (M) Water Solubility: 8.8 g/L (at 20° C) (M) Vapor Pressure: 0.1 mm Hg (25°C)(E) Log K_{ow} = 1.88 (E) Henry's Law Constant: 1.65×10^{-7} atm-m^3/mole (E) Chemistry of Use: Plasticizer	$C_9H_{16}O_4$ Structure: $(C_2H_5O)CO(CH_2)_3CO(OC_2H_5)$ Boiling Point: 237°C (M) Density: 1.022 g/ml (M) Flash Point: 96°C (M) K_{oc}: 20 (E) Physical state: Colorless liquid

Above data are either measured (M) or estimated (E)

Diethyl glutarate is incompatible with acids, bases, oxidizing agents, and reducing agents. It is soluble in alcohol and ether. Diethyl glutarate can be isolated from the water extracts of crude wool.

Diethyl glutarate is produced by the oxidation of cyclopentanol or cyclopentanone. The resulting glutaric acid is then reacted with ethanol to give the product diethyl glutarate. Esterification of glutaric acid followed by distillation gives adequate results.

Market Profile

In 1991, total U.S. production for glutarate plasticizers was 3 million pounds. This category includes both diethyl glutarate and dimethyl glutarate, among others. Data specific to Diethyl Glutarate were not available; nor were data for imported and exported amounts. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Diethyl glutarate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, diethyl glutarate is expected to display very high mobility. Biodegradation in acclimated aerobic soils may be rapid. Volatilization of diethyl glutarate from moist soil to the atmosphere is expected to be very slow although volatilization from dry soil may be significant. Chemical hydrolysis of the ester group is not expected to be significant except for highly basic soils (pH greater than8). If released to water, aerobic biodegradation may be rapid especially in acclimated waters. Diethyl glutarate is not expected to appreciably bioconcentrate in fish and aquatic organisms or adsorb to sediment and suspended organic matter. Volatilization of diethyl glutarate from water to the atmosphere will likely be very slow. Hydrolysis may occur in highly basic waters. If released to the atmosphere, diethyl glutarate may undergo oxidation by the gas-phase reaction with hydroxyl radicals with an estimated half-life of approximately 2.5 days. It may also undergo atmospheric removal by both wet and dry deposition processes. Using a rapid biodegradation rate for diethyl glutarate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants. If a moderate biodegradation rate is used in this model, 84 percent predicted total removal may be achieved.

Health Hazard

See Table II-6 and accompanying summary

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Diethylene Glycol

Chemical Properties and Information	
Diethylene glycol [2,2'-oxybisethanol, 2,2'-oxydiethanol, diglycol, ß,ß'-dihydroxydiethyl ether, dihydroxyethyl ether, ethylene diglycol, 3-oxa-1,5-pentanediol, DEG, Dicol, bis(2-hydroxyethyl) ether, diglycol] CAS# 111-46-6 Molecular weight: 106.12 Melting Point: -6.5°C (M) Water Solubility: Miscible Vapor Pressure: <0.0013 mm Hg at 25°C (M) Log K_{ow}: -1.47 (E) Henry's Law Constant: 2.03X10^{-9} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_4H_{10}O_3$ Structure: $HOCH_2CH_2OCH_2CH_2OH$ Boiling Point: 245.8°C (M) Density: 1.11 (M) Flash Point: 138°C (M) K_{oc}: 4 (E)

Above data are either measured (M) or estimated (E)

Diethylene glycol is readily esterified with mono- and dicarboxylic acids to yield plasticizers and resins. Diethylene glycol is similar in many respects to ethylene glycol but contains an ether group. 1,4-Dioxane is prepared directly from diethylene glycol. It is miscible with water and other polar solvents.

Diethylene glycol is a co-product when ethylene glycol is produced by ethylene oxide hydrolysis. The acid-catalyzed hydrolysis reaction is conducted in a large excess of water at moderate temperatures. This reaction yields approximately 9 to 10 percent diethylene glycol as the primary by-product.

Market Profile

In 1991, total U.S. production was 369.2 million gallons. Imports in 1992 were about 99 million gallons; exports were about 25 million gallons. Total U.S. production quantity for use in screen reclamation was estimated to be 122,000 gallons.

Regulatory Status

Diethylene glycol does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, diethylene glycol is expected to biodegrade under aerobic conditions and it may be rapid if acclimated organisms are present. It is expected to display high mobility, although rapid biodegradation will decrease its potential to leach through soil. Volatilization of diethylene glycol from both moist and dry soil to the atmosphere is not expected to be important. If released to water, diethylene glycol is expected to biodegrade under aerobic conditions and it may be rapid if acclimated organisms are present. Diethylene glycol is also expected to slowly degrade under anaerobic conditions. Neither bioconcentration in fish and aquatic organisms, adsorption to sediment and suspended organic matter, nor volatilization to the atmosphere are expected to be important. If released to the atmosphere, diethylene glycol is degraded rapidly by reaction with photochemically produced hydroxyl radicals (typical half-life of 6.2 hours). Physical removal by wet deposition processes may also occur because of its substantial water solubility; however, its short atmospheric residence time suggests that wet deposition may be of limited importance. Using a rapid biodegradation rate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants; a moderate rate corresponds to 84 percent predicted removal.

Health Hazard

See Table II-6 and accompanying summary

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Diethylene Glycol Monobutyl Ether

Chemical Properties and Information	
Diethylene glycol monobutyl ether [2-(2-butoxyethoxy) ethanol; butyl ethyl Cellosolve; diethylene glycol butyl ether; butyl Carbitol; Dowanol DB; Poly-Solv DB; butoxydiglycol, butyl digol, butyl diicinol] CAS# 112-34-5 Molecular weight: 162.2 Melting Point: -68°C (M) Water Solubility: Miscible (E) Vapor Pressure: 0.02 mm Hg (E) (20° C) Log K_{ow} = 0.29 (E) Henry's Law Constant: 1.5×10^{-9} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_8H_{18}O_3$ Structure: $C_4H_9OCH_2CH_2OCH_2CH_2OH$ Boiling Point: 231° C (M) Density: 0.954 g/ml (M) Flash Point: Open cup: 110°C (M) Closed cup: 78°C (M) K_{oc}: 34 (E)

Above data are either measured (M) or estimated (E)

Glycol ethers are both ethers and alcohols. Their hydroxyl groups can be etherified, esterified, chlorinated, or otherwise modified. Diethylene glycol monobutyl ether is miscible in many organic solvents. It is a colorless liquid with a mild pleasant odor.

The reaction of ethylene oxide and alcohols gives a mixture of glycol monoethers and monoethers of the lower polyethylene glycols.

Market Profile

In 1991, total U.S. production was 100 million gallons. Data for imported and exported amounts were not available. Total U.S. production quantity for use in screen reclamation was estimated to be 420,000 gallons.

Regulatory Status

Diethylene glycol monobutyl ether does not trigger any federal environmental regulations. However, the generic category of glycol ethers is listed as Hazardous Air Pollutants in the Clean Air Act.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

Diethylene glycol monobutyl ether is not expected to undergo hydrolysis or direct photolysis in the environment. Volatilization, adsorption and bioconcentration are not important transport processes of diethylene glycol monobutyl ether in water. Aqueous screening test data indicate that biodegradation may be an important removal mechanism of diethylene glycol monobutyl ether from aerobic soil and water. If released to soil, diethylene glycol monobutyl ether is expected to display very high mobility. Volatilization from dry soil surfaces will be important. In the atmosphere, diethylene glycol monobutyl ether is expected to exist almost entirely in the gas-phase and reactions with photochemically produced hydroxyl radicals should be fast (estimated half-life of 3.5 hours). Physical removal of diethylene glycol monobutyl ether from air by wet deposition may occur due to its high water solubility; however, its short atmospheric residence time suggests that wet deposition is of limited importance. Using a rapid biodegradation rate for diethylene glycol monobutyl ether in the STP fugacity model results in 97 percent predicted removal from wastewater treatment plants; a moderate rate corresponds to 83 percent predicted removal.

Health Hazard

See Table II-6 and accompanying summary

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Diethylene Glycol Butyl Ether Acetate

Chemical Properties and Information	
Diethylene glycol butyl ether acetate [2-(2-butoxyethoxy) ethanol acetate; butyl diethylene glycol acetate; diglycol monobutyl ether acetate] CAS# 124-17-4 Molecular weight: 204.26 Melting Point: -32.2°C (M) Water Solubility: 65 g/l (M) Vapor Pressure: <0.01 mm Hg (M) (20° C) Log K_{ow} = 1.3 (E) Henry's Law Constant: 9.9 x 10^{-8} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_{10}H_{20}O_4$ Structure: $C_4H_9(OC_2H_4)_2OOCCH_3$ Boiling Point: 246.7°C (M) Density: 0.9810 g/ml (M) Flash Point: Open cup: 115.6°C (M) K_{oc}: 15 (E)

Above data are either measured (M) or estimated (E)

Diethylene glycol monobutyl ether acetate is soluble in ethanol, ether, acetone, and other organic solvents. It is a liquid with a mild, not unpleasant odor. Its fire potential is moderate; when exposed to heat or flame it emits degradation products, it can react with oxidizing materials.

Diethylene glycol butyl ether acetate is manufactured by the esterification of diethylene glycol monobutyl ether with acetic acid or acetic anhydride.

Market Profile

In 1991, total U.S. production of "other" E-series glycol ethers was 500,000 pounds. This category includes diethylene glycol butyl ether acetate, as well as other minor E-series glycol ethers. Data for imported and exported amounts were not available. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Diethylene glycol butyl ether acetate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

Diethylene glycol butyl ether acetate is not expected to undergo hydrolysis or direct photolysis in the environment. In water, volatilization, adsorption to sediments and suspended solids, and bioconcentration in aquatic organisms are not expected to be important transport processes for diethylene glycol butyl ether acetate. Biodegradation is likely to be the most important removal mechanism of diethylene glycol butyl ether acetate from aerobic soil and water based on a 4-week BOD of 100 percent of theoretical. If released to soil, diethylene glycol butyl ether acetate is expected to display very high mobility. Volatilization from dry soil surfaces will be important. In the atmosphere, diethylene glycol butyl ether acetate is expected to exist almost entirely in the gas-phase and reactions with photochemically produced hydroxyl radicals should be fast (estimated half-life of 3.8 hrs). Physical removal of diethylene glycol butyl ether acetate from air by wet deposition may occur due to its high water solubility; however, its short atmospheric residence time suggests that wet deposition is of limited importance. Using a rapid biodegradation rate for diethylene glycol butyl ether acetate in the STP fugacity model results in 97 percent predicted removal from wastewater treatment plants; a moderate rate corresponds to 83 percent predicted removal.

Health Hazard

See Table II-6 and accompanying summary

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Diisopropyl Adipate

Chemical Properties and Information	
Diisopropyl adipate [Disopropyl adipate; 2,3-dimethylbutyl adipate; adipic acid diisopropyl ester] CAS# 6938-94-9 Molecular weight: 230.34 Melting Point: -1.1°C (M) Water Solubility: 1 g/L (E) Vapor Pressure: 0.02 mm Hg (25°C)(E) Log K_{ow} = 3.2 (E) Henry's Law Constant: 1.3×10^{-6} atm-m^3/mole (E) Chemistry of Use: Lubricant, Plasticizer	$C_{12}H_{22}O_4$ Structure: -i-$C_3H_7O_2C(CH_2)_4CO_2$-i-C_3H_7 Boiling Point: 257°C (at 760 mm Hg) (E) Density: 0.9569 g/ml (M) Flash Point: 116°C (M) K_{oc}: 1311 (E) Physical state: Colorless, odorless liquid

Above data are either measured (M) or estimated (E)

Diisopropyl adipate is soluble in alcohol, ether, acetone and acetic acid. When heated to decomposition, it emits acrid smoke and fumes. The largest consumption of adipic acid after polyamides is the production of esters. These esters are marketed as plasticizers.

Diisopropyl adipate is the result of the esterification of adipic acid. Acid catalysts are normally used, but the reaction will proceed at elevated temperatures if water is removed during the reaction. Diisopropyl adipate, along with other esters, is produced in the mother liquor during adipic acid manufacturing. Diisopropyl adipate is subsequently separated and refined by distillation.

Market Profile

In 1991, total U.S. production of adipate plasticizers was 35 million pounds. This category includes diisopropyl adipate, diethyl adipate, dimethyl adipate, and possibly others. Data for imported and exported amounts were not available. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Diisopropyl adipate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, diisopropyl adipate is expected to display low mobility. Biodegradation in acclimated aerobic soils may be rapid. Volatilization of diisopropyl adipate from moist soil to the atmosphere is expected to be very slow although volatilization from dry soil may occur. Chemical hydrolysis of the ester group is not expected to be important except for highly basic soils (pH greater than 8). If released to water, aerobic biodegradation may be rapid especially in acclimated waters. Diisopropyl adipate is not expected to appreciably bioconcentrate in fish and aquatic organisms although it may adsorb to sediment and suspended organic matter. Volatilization of diisopropyl adipate from water to the atmosphere will likely be very slow. Chemical hydrolysis may occur in highly basic waters. If released to the atmosphere, diisopropyl adipate may undergo oxidation by the gas-phase reaction with hydroxyl radicals with an estimated half-life of approximately 1 day. Using a rapid biodegradation rate for diisopropyl adipate in the STP fugacity model results in 98 percent predicted total removal from wastewater treatment plants. If a moderate biodegradation rate is used in this model, 88 percent predicted total removal may be achieved.

Health Hazard

See Table II-6 and accompanying summary

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Dimethyl Adipate

Chemical Properties and Information	
Dimethyl adipate [Dimethyl hexanedioate; methyl adipate; dimethyl ester adipic acid] CAS# 627-93-0 Molecular weight: 174.25 Melting Point: 8°C (M) Water Solubility: 0.1 g/L (E) Vapor Pressure: 0.06 mm Hg (25°C)(E) Log K_{ow} = 1.39 (E) Henry's Law Constant: 1.3×10^{-7} atm-m^3/mole (E) Chemistry of Use: Lubricant, Plasticizer	$C_8H_{14}O_4$ Structure: $(CH_3O)CO(CH_2)_4CO(OCH_3)$ Boiling Point: 193.7°C (at 760 mm Hg)(E) Density:1.063 g/ml (M) Flash Point: 107°C (M) K_{oc}: 136 (E) Physical state: Colorless, odorless liquid

Above data are either measured (M) or estimated (E)

Dimethyl adipate is soluble in alcohol, ether and acetic acid. It is incompatible with acids, bases, oxidizing agents and reducing agents. When heated to decomposition, it emits acrid smoke and irritating fumes.

Dimethyl adipate is the result of the esterification of adipic acid. Adipic acid is produced by the oxidation of cyclohexane first with air, then with nitric acid. The adipic acid is then methylated to produce the dimethyl adipate.

Market Profile

In 1991, total U.S. production of adipate plasticizers was 35 million pounds. This category includes diisopropyl adipate, diethyl adipate, dimethyl adipate, and possibly others. Data for imported and exported amounts were not available. Total U.S. production quantity of dimethyl adipate for use in screen reclamation was estimated to be 304,000 gallons.

Regulatory Status

Dimethyl adipate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, dimethyl adipate is expected to display moderate to high mobility. Biodegradation in acclimated aerobic soils may be rapid. Volatilization of dimethyl adipate from moist soil to the atmosphere is expected to be very slow although volatilization from dry soil may be significant. Chemical hydrolysis of the ester group is not expected to be important except in highly basic soils (pH greater than8). If released to water, aerobic biodegradation may be rapid especially in acclimated waters. Dimethyl adipate is not expected to appreciably bioconcentrate in fish and aquatic organisms or adsorb to sediment and suspended organic matter. Volatilization of dimethyl adipate from water to the atmosphere will be very slow. Chemical hydrolysis may occur in highly basic waters. If released to the atmosphere, dimethyl adipate may undergo oxidation by the gas-phase reaction with hydroxyl radicals with an estimated half-life of approximately 3.3 days. It may also undergo atmospheric removal by wet deposition processes because of its moderate water solubility. Using a rapid biodegradation rate for dimethyl adipate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants. If a moderate biodegradation rate is used in this model, 85 percent predicted total removal may be achieved.

Health Hazard

See Table II-6 and accompanying summary

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Dimethyl Glutarate

Chemical Properties and Information	
Dimethyl glutarate [glutaric acid, dimethyl ester; pentanedioic acid, dimethyl ester] CAS# 1119-40-0 Molecular weight: 160.17 Melting Point: -42.5°C (M) Water Solubility: 1 g/L (E) Vapor Pressure: 0.1 mm Hg (E) Log K_{ow}: 0.90 (E) Henry's Law Constant: $9.1X10^{-8}$ atm-m^3/mole (E) Chemistry of Use: Solvent	$C_7H_{12}O_4$ Structure: $CH_3O_2C(CH_2)_3CO_2CH_3$ Boiling Point: 214°C (M) Density: 1.088 g/cm^3 (M) Flash Point: 100°C (E) K_{oc}: 6 (E)

Above data are either measured (M) or estimated (E)

This chemical has a faint, agreeable odor. It is soluble in alcohols and ether.

This chemical is synthesized by the reaction of methanol with glutaric acid.

Market Profile

In 1991, total U.S. production of glutarate plasticizers was 3.4 million pounds. This category includes both dimethyl glutarate and diethyl glutarate, among others. Total U.S. production quantity of dimethyl glutarate for use in screen reclamation was estimated to be 609,000 gallons.

Regulatory Status

Dimethyl glutarate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, dimethyl glutarate is expected to readily biodegrade especially if acclimated organisms are present. In moist, highly alkaline soils, chemical hydrolysis may also occur. It has a very low estimated adsorptivity to soil and therefore should be highly mobile in soil. Volatilization from soil should not be important. If released to water, dimethyl glutarate is expected to biodegrade. Since its estimated alkaline hydrolysis half-life is 60 days at pH 8, chemical hydrolysis may contribute to its loss in alkaline waters (pH greater than8). Volatilization, bioconcentration in aquatic organisms, and adsorption to sediment and suspended organic matter are not expected to be important. If released to the atmosphere, dimethyl glutarate will degrade by reaction with photochemically-produced hydroxyl radicals (estimated half-life of 9 days). Using a rapid biodegradation rate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Dimethyl Succinate

Chemical Properties and Information	
Dimethyl succinate [succinic acid, dimethyl ester; butanedioic acid, dimethyl ester; methyl succinate] CAS# 106-65-0 Molecular weight: 146.14 Melting Point: 19°C (M) Water Solubility: 8.3 g/L (M) Vapor Pressure: 0.1 mm Hg (E) Log K_{ow}: 0.19 (M) Henry's Law Constant: 5.8×10^{-6} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_6H_{10}O_4$ Structure: $CH_3O_2C(CH_2)_2CO_2CH_3$ Boiling Point: 196.4°C (M) Density: 1.12 g/cm^3 (M) Flash Point: 100°C (E) K_{oc}: 3 (E)

Above data are either measured (M) or estimated (E)

This is a colorless liquid. It is soluble in alcohols, acetone and ether. This chemical is synthesized by the reaction of methanol with succinic acid.

Market Profile

Data for total U.S. production of this chemical is unknown. Total U.S. production quantity for use in screen reclamation was estimated to be 304,000 gallons.

Regulatory Status

Dimethyl succinate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, dimethyl succinate is expected to biodegrade and this process may be rapid if acclimated organisms are present. In moist, highly alkaline soils, chemical hydrolysis may also occur. It is expected to be highly mobile in soil. Volatilization of dimethyl succinate from both moist and dry surface soil to the atmosphere may contribute to its loss. If released to water, dimethyl succinate it is expected to biodegrade. Neither bioconcentration in fish and aquatic organisms nor adsorption to sediment and suspended organic matter are expected to be important. Volatilization from water may contibute to its loss from bodies of water with a strong current or wind; the estimated half-life in a model river is 8 days. The estimated alkaline hydrolysis half-life at pH 8 is 85 days and therefore chemical hydrolysis may occur in alkaline environmental media (pH greater than 8). If released to the atmosphere, dimethyl succinate will degrade by reaction with photochemically-produced hydroxyl radicals (estimated half-life of 37 days). Using a rapid biodegradation rate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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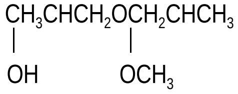
Dipropylene Glycol Methyl Ether

Chemical Properties and Information	
Dipropylene glycol methyl ether [Glycol ether DPM; Dowanol DPM] CAS# 34590-94-8 Molecular weight: 148.2 Melting Point: -80°C (M) Water Solubility: Miscible (E) Vapor Pressure: 0.4 mm Hg (M) (25° C) Log K_{ow} = -0.35 (E) Henry's Law Constant: 1.15 x 10^{-9} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_7H_{16}O_3$ Structure: $CH_3CHOHCH_2OCH_2CH(OCH_3)CH_3$ or  $CH_3\underset{OH}{\underset{\vert}{C}}HCH_2OCH_2\underset{OCH_3}{\underset{\vert}{C}}HCH_3$ Boiling Point: 188.3°C (M) Density: 0.951 g/ml (M) Flash Point: 75°C (M) K_{oc}: 15 (E) Physical state: liquid

Above data are either measured (M) or estimated (E)

Glycol ethers are both ethers and alcohols. Their hydroxyl group can be etherified, esterified, chlorinated, or otherwise modified. Dipropylene glycol methyl ether is miscible in many organic solvents. It is a liquid with a mild, not unpleasant odor.

Glycol ethers are prepared by reacting propylene oxide with methanol.

Market Profile

In 1991, total U.S. production was 22 million pounds. Imports were less than 100,000 million gallons and exports were 0.6 million gallons. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Dipropylene glycol methyl ether does not trigger any federal environmental regulations. However, the generic category of glycol ethers is listed as Hazardous Air Pollutants in the Clean Air Act.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

In water, dipropylene glycol methyl ether would not be expected to sorb to sediments or to bioconcentrate in fish and aquatic organisms. The main degradation mechanism in water is expected to be biodegradation. Unpublished data support this, with 34 percent and 72.9 percent of theoretical being observed in two screening tests (Strum test and OECD Screening Test, respectively) and 93.7 percent of theoretical in a Zahn-Wellens test. Photolysis and hydrolysis are probably not important removal processes for dipropylene glycol methyl ether in water. Volatilization from water will not be important. In the atmosphere, dipropylene glycol methyl ether will react with photochemically produced hydroxyl radicals (half-life of approximately 3.4 hours). In soil, dipropylene glycol methyl ether will be highly mobile and may leach to groundwater. In soil biodegradation will probably be the primary removal mechanism; however, this process may require an acclimation period. Dipropylene glycol methyl ether may volatilize from dry soil surfaces. Using a rapid biodegradation rate for dipropylene glycol methyl ether in the STP fugacity model, 97 percent removal can be predicted from wastewater treatment plants. Using a moderate biodegradation rate for dipropylene glycol methyl ether in the STP fugacity model, 83 percent removal can be predicted from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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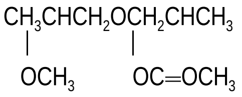
Dipropylene Glycol Methyl Ether Acetate

Chemical Properties and Information	
Dipropylene glycol methyl ether acetate [Dowanol DPMA; Acrosolv DPMA] CAS# 88917-22-0 Molecular weight: 190 Melting Point: -90°C (M) Water Solubility: Miscible (E) Vapor Pressure: 0.02 mm Hg (E) (25° C) Log K_{ow} = 0.66 (E) Henry's Law Constant: 7.5 x 10^{-8} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_9H_{18}O_4$ Structure:  $CH_3\underset{OCH_3}{\underset{\vert}{CH}}CH_2OCH_2\underset{OC=OCH_3}{\underset{\vert}{CH}}CH_3$ Boiling Point: 200°C (E) Density: 0.90 g/ml (E) Flash Point: 60°C (M) K_{oc}: 5 (E) Physical state: liquid

Above data are either measured (M) or estimated (E)

Dipropylene glycol methyl ether acetate is a glycol derivative that is both an ether and an ester. Dipropylene glycol methyl ether acetate is soluble in organic solvents.

Dipropylene glycol methyl ether acetate is produced by the esterification of dipropylene glycol methyl ether.

Market Profile

In 1991, total U.S. production of "other" P-series glycol ethers was 1 million pounds. This category includes dipropylene glycol methyl ether acetate, ethoxypropanol, ethoxypropyl acetate, and propylene glycol methyl ether acetate, among possibly others. Data for imported and exported amounts were not available. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Dipropylene glycol methyl ether acetate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

Dipropylene glycol methyl ether acetate is not expected to undergo hydrolysis or direct photolysis in the environment. In water, volatilization, adsorption to sediments and suspended solids, and bioconcentration in aquatic organisms are not expected to be important transport processes for dipropylene glycol methyl ether acetate. Biodegradation is likely to be an important removal mechanism of dipropylene glycol methyl ether acetate from aerobic soil and water based on screening studies from structurally similar glycol ether compounds. If released to soil, dipropylene glycol methyl ether acetate is expected to display very high mobility. Volatilization from dry soil surfaces will be important. In the atmosphere, dipropylene glycol methyl ether acetate is expected to exist almost entirely in the gas-phase and reactions with photochemically produced hydroxyl radicals should be fast (estimated half-life of 3.4 hrs). Using a rapid biodegradation rate for dipropylene glycol methyl ether acetate in the STP fugacity model results in 97 percent predicted removal from wastewater treatment plants; a moderate rate corresponds to 83 percent predicted removal.

Health Hazard

See Table II-6 and accompanying summary

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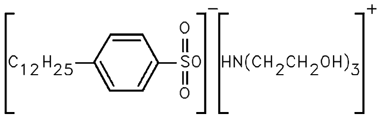
Dodecyl Benzene Sulfonic Acid, Triethanol Amine Salt

Chemical Properties and Information	
Dodecyl benzene sulfonic acid, triethanol amine salt [benzenesulfonic acid, dodecyl-, compd. with 2,2',2''-nitrilotris[ethanol](1:1)] CAS# 27323-41-7 Molecular weight: 475.5 Melting Point: Not available Water Solubility: Low Solubility (E) Vapor Pressure: <10^{-5} mm Hg (E) Log K_{ow}: -1.49 (E) Henry's Law Constant: Not applicable Chemistry of Use: Surfactant	$C_{24}H_{45}NO_6S$ Structure:  Boiling Point: Not available Density: 1.09 g/cm^3 (M) Flash Point: Not available K_{oc}: 10,000 (E)

Above data are either measured (M) or estimated (E)

This chemical exists in a pale yellow, slightly viscous paste, and has a bland odor.

This chemical is synthesized by reacting dodecyl benzene sulfonic acid with triethanolamine.

Market Profile

In 1990, total U.S. production was 8.2 million pounds. Imports and exports of this chemcial are unknown. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

See Table II-3 and accompanying summary.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, dodecyl benzene sulfonic acid, triethanol amine salt, is expected to biodegrade under aerobic conditions, especially when acclimated organisms are present. Although dodecyl benzene sulfonic acid, triethanol amine salt is an ionic compound, studies have shown that dodecyl benzene sulfonic acid salts strongly adsorb to soil and that the force dominating this process is the hydrophobic nature of the non-polar tail of the molecule. Volatilization of dodecyl benzene sulfonic acid, triethanol amine salt from surface soil will not be significant. If released to water, dodecyl benzene sulfonic acid, triethanol amine salt is expected to biodegrade. It will also adsorb to sediment and particulate matter in the water column. Volatilization of dodecyl benzene sulfonic acid, triethanol amine salt from water should be insignificant. Experimental data indicate that similar dodecyl benzene sulfonic acids do not bioconcentrate in fish and aquatic organisms. If released to the atmosphere, triethanol amine salt, dodecyl benzene sulfonic acid will be associated with aerosols and be removed by gravitational settling. Using a rapid biodegradation rate for the parent acid in the STP fugacity model results in 97 percent predicted total removal for dodecyl benzene sulfonic acid, triethanol amine salt from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Ethyl Acetate

Chemical Properties and Information	
Ethyl acetate [Acetic ester] CAS# 141-78-6 Molecular weight: 88 Melting Point: -83.6°C (M) Water Solubility: 77 g/l (E) Vapor Pressure: 90 mm Hg (M) (25°C) Log K_{ow} = 0.730 (M) Henry's Law Constant: 1.34×10^{-4} atm-m^3/mole (M) Chemistry of Use: Solvent	$C_4H_8O_2$ Structure: $CH_3COOCH_2CH_3$ Boiling Point: 77.1°C (M) Density: 0.884 g/ml (M) Flash Point: -4.4°C (M) K_{oc}: 9 (E) Physical state: volatile liquid

Above data is either measured (M) or estimated (E)

Ethyl acetate is a volatile, flammable liquid with a characteristic fruity odor. It is found in cereal crops, radishes, fruit juices, beer, and wine. The threshold limit value for air is 440 ppm. Ethyl acetate is miscible with most organic solvents.

Ethyl acetate occurs naturally, and recovery can be accomplished by steam distillation, extraction or pressing, or a combination of these. Synthetic esters are generally prepared by reaction of an alcohol and an organic acid in the presence of a catalyst such as sulfuric acid or *p*-toluene sulfonic acid. Ethyl acetate thus may be prepared synthetically by the catalyzed reaction of ethanol and acetic acid.

Market Profile

In 1991, total U.S. production was 245 million gallons. Imports were 12.3 million gallons and exports were 96.2 million gallons. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

See Table II-3 and accompanying summary

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, ethyl acetate is expected to display high mobility. Biodegradation in both aerobic and anaerobic soils is expected to be rapid. Volatilization of ethyl acetate from both moist and dry soil to the atmosphere is expected to occur. If released to water, ethyl acetate is expected to rapidly degrade under both aerobic and anaerobic conditions. Five-day theoretical BODs of 50 percent and 53 percent using an activated sludge seed and in seawater, respectively, have been observed. Under anaerobic conditions using a water/sediment aquifer slurry obtained from under a municipal landfill, 94 percent conversion to methane was observed. Ethyl acetate is not expected to appreciably bioconcentrate in fish and aquatic organisms or adsorb to sediment and suspended organic matter. Volatilization of ethyl acetate from water to the atmosphere may also occur. If released to the atmosphere, ethyl acetate may undergo oxidation by the gas-phase reaction with hydroxyl radicals with an estimated half-life of approximately 8 days. It may also undergo atmospheric removal by wet deposition processes because of its high water solubility. A pilot plant activated sludge system removed 100 percent of the 167 mg/L of influent ethyl acetate with 93 percent lost through biodegradation and 7 percent lost though stripping.

Health Hazard

See Table II-6 and accompanying summary

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Ethyl Lactate

Chemical Properties and Information	
Ethyl lactate [(*S*)-Ethyl lactate; ethyl-2-hydroxypropanate; Acytol] CAS# 97-64-3 Molecular weight: 118.13 Melting Point: -26°C (M) Water Solubility: Miscible Vapor Pressure: 5 mm Hg (E) (25°C) Log K_{ow} = -0.180 (E) Henry's Law Constant: 5.8 x 10^{-6} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_5H_{10}O_3$ Structure: $CH_3CH(OH)COOCH_2CH_3$ Boiling Point: 154°C (M) Density: 1.042 g/ml (M) Flash Point: 48°C (M) K_{oc}: 8 (E) Physical state: Colorless, odorless liquid

Above data are either measured (M) or estimated (E)

Ethyl lactate is incompatible with oxidizing agents, bases and acids. It is miscible with alcohols, ketones, esters, hydrocarbons and oils. Ethyl lactate is combustible. Ethyl lactate has a fruity, buttery taste when used as a flavoring.

Ethyl lactate is primarily derived from lactonitrile by the esterification of lactic acid with ethanol. It is also produced by combining acetaldehyde with hydrogen cyanide to form acetaldehyde cyanohydrin, which is converted to ethyl lactate by treatment with ethanol and an inorganic acid.

Market Profile

Market information for this chemical is not available.

Regulatory Status

Ethyl lactate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, ethyl lactate is expected to display very high mobility. Biodegradation in acclimated aerobic soils may be rapid. Volatilization of ethyl lactate from the upper layers of dry soil to the atmosphere may be significant although volatilization from moist soil may be relatively slow. In basic soil with a pH greater than8, chemical hydrolysis of ethyl lactate may occur. If released to water, aerobic biodegradation may be rapid especially in acclimated waters. Ethyl lactate is not expected to bioconcentrate in fish and aquatic organisms nor adsorb to sediment and suspended organic matter. Volatilization of ethyl lactate from water to the atmosphere may occur at a moderate rate. In basic waters, ethyl lactate may undergo chemical hydrolysis with an estimated half-life of approximately 7 days at pH 8. If released to the atmosphere, ethyl lactate may undergo oxidation by the gas-phase reaction with hydroxyl radicals with an estimated half-life of approximately 6.4 days. It may also undergo atmospheric removal by wet deposition processes. Using a rapid biodegradation rate for ethyl lactate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Ethyl Oleate

Chemical Properties and Information

Ethyl oleate [9-octadecenoic acid; ethyl ester oleic acid]
CAS# 111-62-6
Molecular weight: 310.53
Melting Point: -32°C (M)
Water Solubility: 0.01g/l (E)
Vapor Pressure: 0.01 mm Hg (E) (25°C)
Log K_{ow} = 8.51 (E)
Henry's Law Constant: 1.0×10^{-2} atm-m^3/mole (E)
Chemistry of Use: Solvent

$C_{20}H_{38}O_2$
Structure: $CH_3(CH_2)_7CH{=}CH(CH_2)_6CH_2COOCH_2CH_3$
Boiling Point: 205-208°C (M)
Density: 0.870 g/ml (M)
Flash Point: 175°C (M)
K_{oc}: >10,000 (E)
Physical state: Colorless, oily liquid

Above data are either measured (M) or estimated (E)

Ethyl oleate is soluble in alcohol and ether. Ethyl oleate is combustible. It is incompatible with strong oxidizing agents and is light-sensitive and air-sensitive.

Ethyl oleate is produced from the esterification of oleic acid. Oleic acid is derived from fruits or plant seeds. Once refined, the fats are heated in the presence of a strong base, and esterification occurs at the glycerol hydroxides. The reaction occurs with the appropriate alcohol to provide the desired product.

Market Profile

In 1992, total U.S. production of salt and esters of oleic, linoleic, or linoleric acids was 36 million pounds. Greater specificity is not available due to the low number of companies producing these products. Data for imported and exported amounts were not available. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Ethyl oleate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment.

Environmental Fate

If released to soil, ethyl oleate is expected to be essentially immobile. Biodegradation in acclimated aerobic soils may be rapid. Chemical hydrolysis of the ester group is not expected to be significant except in highly basic soils (pH greater than8). Volatilization of ethyl oleate from moist soil to the atmosphere may be a significant process although it is likely to be relatively slow from dry soil. If released to water, aerobic biodegradation may be rapid especially in acclimated waters. Bioconcentration in fish and aquatic organisms and adsorption to sediment and suspended organic matter may also occur. Volatilization from water to the atmosphere may be rapid although its expected strong adsorption to sediment and suspended organic matter may significantly attenuate the rate of this process. Chemical hydrolysis may occur in highly basic waters. If released to the atmosphere, ethyl oleate may undergo rapid oxidation by the both the gas-phase reaction with hydroxyl radicals and ozone with estimated half-lives of approximately 1.5 and 1.4 hours for the trans isomer, respectively, with similar rates for the cis isomer. Using a either a rapid or moderate biodegradation rate for ethyl oleate in the STP fugacity model results in greater than99 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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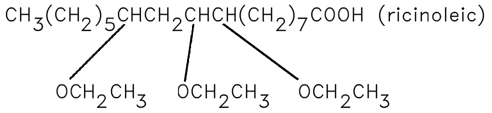
Ethoxylated Castor Oil

Chemical Properties and Information	
Ethoxylated castor oil [cosmetol, ricinus oil, neoloid CAS# 61791-12-6 Molecular weight: 298.47 (ricinoleic) + 135 (ethoxy) Melting Point: 5.5°C (M) Water Solubility: 0.003 g/L (E) Vapor Pressure: <0.1 mm Hg at 20°C (M) Log K_{ow}: Not available Henry's Law Constant: Not available Chemistry of Use: Drying/coating agent	$C_{18}H_{34}O_3$ (ricinoleic) + $(C_2H_5O)_3$ (ethoxy) Structure:  $CH_3(CH_2)_5CHCH_2CHCH(CH_2)_7COOH$ (ricinoleic) OCH_2CH_3 OCH_2CH_3 OCH_2CH_3 Boiling Point: 313°C (M) Density: 0.961 (M) Flash Point: 299°C (M) K_{oc}: Not available

Above data are either measured (M) or estimated (E)

Ethoxylated castor oil is derived from the bean of the castor plant. The composition of ethoxylated castor oil is ricinoleic acid, palmitic acid, stearic acids, oleic acids, and several ethoxy groups. Ricinoleic acid comprises nearly 90 percent of castor oil. Ethoxylated castor oil is a drying agent. It is soluble in ethyl alcohol and polar organic solvents.

Castor oil is recovered by use of hydraulic presses followed by solvent extraction. Oil taken from mechanical presses requires refining steps to remove toxic proteins, improve the color, and reduce the fatty acid content. Fatty acid content is reduced by treatment with caustic soda solution. In the polyethoxylation reaction the hydroxyl groups undergo alkylation to produce the polyethoxyl triglyceride fatty acid. Common catalysts for the dehydration procedure are sulfuric acid and its acid salts.

Market Profile

In 1992, total U.S. production was 22.3 million gallons. Imports and exports of this chemical are unknown. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Ethoxylated castor oil does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, ethoxylated castor oil is expected to rapidly biodegrade as do linear primarily alcohol ethoxylates. Biodegradation occurs by the β-oxidation of the alkyl chain, scission of the hydrophobic and hydrophic moeties and step-wise removal of ethoxylate groups to more hydrophobic metabolites. The mobility of ethoxylated castor oil will increase with increasing number of ethoxylate groups although the expected rapid biodegradation of the ethoxylate groups will reduce the importance of leaching. Volatilization from soil to the atmosphere is not expected to occur. If released to water, ethoxylated castor oil is expected to undergo rapid biodegradation. Experimental studies on other ethoxylated natural oils possessing 3-20 ethoxylate groups have resulted in five-day theoretical BODs of up to 100 percent and those containing 50 or more ethoxylate groups are also amenable to biodegradation. Shorter chain ethoxylates may also partition to sediment and particulate matter in the water column. Volatilization of ethoxylated castor oil to the atmosphere is not expected to occur. If released to the atmosphere by mechanical means, ethoxylated castor oil is expected to undergo removal by both wet and dry processes due to its appreciable water solubility and low expected vapor pressure, respectively. Using a rapid biodegradation rate in the STP fugacity model results in 100 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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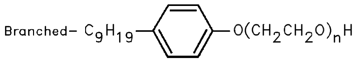
Ethoxylated Nonylphenol

Chemical Properties and Information	
Ethoxylated nonylphenol [poly(oxy-1,2-ethanediyl), α-(nonylphenyl)-Ω-hydroxy-; Antarox; polyethylene glycol mono (nonylphenyl) ether] CAS# 9016-45-9 Molecular weight: 630 (for n=9.5) (typical range 500 - 800) Melting Point: -20 to +10°C (E) Water Solubility: Soluble (M) Vapor Pressure: <10^{-6} mm Hg (E) Log K_{ow}: 3.93 (E) (np = 7) Henry's Law Constant: $1.81X10^{-22}$ atm-m^3/mole (E) (np = 7) Chemistry of Use: Nonionic surfactant	$C_{34}H_{62}O_{10}$ (for n=9.5) Structure:  n = 9.5 (for screen printing formulation product) Boiling Point: >300°C (E) (decomposes) Density: 0.8 g/cm^3 (E) Flash Point: 200 - 260°C (E) K_{oc}: 0.64 (E) (np = 7)

Above data are either measured (M) or estimated (E)

This chemical is colorless with a mild odor. It is stable under normal conditions. Its properties vary with degree of ethoxylation. It is soluble in oil, alcohols, and aromatic solvents.

This chemical is synthesized by reacting branched nonylphenol with ethylene oxide.

Market Profile

In 1992, total U.S. production was 394.7 million gallons. Imports and exports of this chemical are unknown. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Ethoxylated nonylphenol does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

Ethoxylated nonylphenol has a high primary biodegradation rate which has been demonstrated in wastewater treatment, river water, soil, and sediment. The rate of ultimate degradation of ethoxylated nonylphenol, however, is low. Biodegradation proceeds by the step-wise removal of ethoxylate groups, leading to the accumulation of more hydrophobic metabolites, namely mono- and diethoxylates, nonylphenol, and mono- and dicarboxylates. The mobility of ethoxylated nonylphenols varies with the number of ethoxy groups. Estimates based on molecular structure indicates that K_{oc} is 110 for four ethoxylate groups. Longer chain ethoxylates ($n \geq 4$) should therefore be fairly mobile in soil. The mobility of the mono- and diethoxylate should be low. If released to soil, ethoxylated nonylphenol is expected to leach into the soil and biodegrade. Volatilization from soil will be negligible. If released in water ethoxylated nonylphenol should undergo rapid primary biodegradation. Shorter chain ethoxylates may adsorb to sediment and particulate matter in the water column. Volatilization will not be significant. If released to the atmosphere, vapor-phase ethoxylated nonylphenol should degrade rapidly by reaction with photochemically-produced hydroxyl radicals (estimated half-life of approximately 3.7 hours). However, it is anticipated that ethoxylated nonylphenols will have very low vapor pressures and therefore would be associated with aerosols rather than in the vapor. Using a rapid primary biodegradation rate in the STP fugacity model results in 100 percent predicted removal in wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Ethoxypropanol

Chemical Properties and Information	
Ethoxypropanol [propylene glycol monoethyl ether] CAS# 52125-53-8 Molecular weight: 104.1 Melting Point: -100°C (M) Water Solubility: Completely miscible with water (M) Vapor Pressure: 7.2 mm Hg (at 25°C) (M) Log K_{ow}: 0.002 (E) Henry's Law Constant: 2.45×10^{-8} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_5H_{12}O_2$ Structure: $CH_3CH_2OCH_2CHOHCH_3$ Boiling Point: 132°C (M) Density: 0.895 g/cm^3 (at 25°C) (M) Flash Point: 43°C (open cup) (M) K_{oc}: 24 (E)

Above data are either measured (M) or estimated (E)

Glycol ethers are both ethers and alcohols. Their hydroxyl groups can be etherified, esterified, chlorinated, or otherwise modified. Miscible with acetone, benzene, carbon tetrachloride, ethyl ether, petroleum ether.

This chemical is synthesized by reaction of ethanol with propylene oxide.

Market Profile

In 1991, total U.S. production of "other" P-series glycol ethers was 1 million gallons. This category includes dipropylene glycol methyl ether acetate, ethoxypropanol, ethoxypropyl acetate, and propylene glycol methyl ether acetate, among possibly others. Imports and exports of this chemical are unknown. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Ethoxypropanol does not trigger any federal environmental regulations. However, the generic category of glycol ethers is listed as Hazardous Air Pollutants in the Clean Air Act.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, ethoxypropanol is expected to biodegrade under aerobic conditions and it may be rapid if acclimated organisms are present. It is expected to display high mobility; however, rapid biodegradation will decrease its potential of leaching through soil. Volatilization of ethoxypropanol from both moist and dry soil to the atmosphere is not expected to be important. If released to water, ethoxypropanol is expected to biodegrade under aerobic conditions and it may be rapid if acclimated organisms are present. Neither bioconcentration in fish and aquatic organisms, adsorption to sediment and suspended organic matter, nor volatilization to the atmosphere are expected to be important. If released to the atmosphere, ethoxypropanol is degraded rapidly by reaction with photochemically produced hydroxyl radicals (typical half-life of 6.2 hours). Physical removal by wet deposition processes may also occur because of its substantial water solubility; however, its short atmospheric residence time suggests that wet deposition may be of limited importance. Using a rapid biodegradation rate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants; a moderate rate corresponds to 84 percent predicted removal.

Health Hazard

See Table II-6 and accompanying summary

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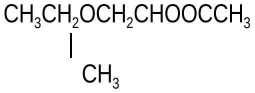
Ethoxypropyl Acetate

Chemical Properties and Information	
Ethoxypropyl acetate [propylene glycol, monoethyl ether acetate, 2-propanol, 1-ethoxy-, acetate] CAS# 54839-24-6 Molecular weight: 146.1 Melting Point: -100°C (E) Water Solubility: Miscible Vapor Pressure: 3.5 mm Hg (at 20°C) (E) Log K_{ow}: -0.46 (E) Henry's Law Constant: $9.09X10^{-12}$ atm-m^3/mole (E) Chemistry of Use: Solvent	$C_7H_{14}O_3$ Structure:  $CH_3CH_2OCH_2\underset{\substack{\vert \\ CH_3}}{CH}OOCCH_3$ Boiling Point: 153.2°C (E) Density: 1.0 g/cm^3 (E) Flash Point: 40°C (E) K_{oc}: 13 (E)

Above data are either measured (M) or estimated (E)

Ethoxypropyl acetate is a glycol derivative that is both an ether and an ester. It is soluble in organic solvents.

Ethoxypropyl acetate is prepared by hydrolysis of propylene oxide. Etherification is by reaction with ethanol. Esterification is accomplished by reaction with acetic acid.

Market Profile

In 1991, total U.S. production of "other" P-series glycol ethers was 1 million gallons. This category includes dipropylene glycol methyl ether acetate, ethoxypropanol, ethoxypropyl acetate, and propylene glycol methyl ether acetate, among possibly others. Imports and exports of this chemical are unknown. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Ethoxypropyl acetate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, ethoxypropyl acetate is expected to biodegrade under aerobic conditions and it may be rapid if acclimated organisms are present. It is expected to display high mobility; however, rapid biodegradation will decrease its potential of leaching through soil. Volatilization of ethoxypropyl acetate from moist soil to the atmosphere is not expected to be important although it may slowly volatilize from dry soil. If released to water, ethoxypropyl acetate is expected to biodegrade under aerobic conditions and it may be rapid if acclimated organisms are present. Chemical hydrolysis will be important only in very alkaline environmental media (pH greater than 8.5). Neither bioconcentration in fish and aquatic organisms, adsorption to sediment and suspended organic matter, nor volatilization to the atmosphere are expected to be important. If released to the atmosphere, ethoxypropyl acetate is degraded rapidly by reaction with photochemically produced hydroxyl radicals (typical half-life of 6.2 hours). Physical removal by wet deposition processes may also occur because of its substantial water solubility; however, its short atmospheric residence time suggests that wet deposition may be of limited importance. Using a rapid biodegradation rate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants; a moderate rate corresponds to 84 percent predicted removal.

Health Hazard

See Table II-6 and accompanying summary

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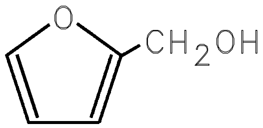
Furfuryl Alcohol

Chemical Properties and Information	
Furfuryl alcohol [2-Furanmethanol; 2-Furylcarbinol; 2-Hydroxymethylfuran] CAS# 98-00-0 Molecular weight: 98.1 Melting Point: Not available Water Solubility: Miscible (unstable) (M) Vapor Pressure: 0.45 mm Hg (at 20°C) (M) Log K_{ow}: 0.28 (M) Henry's Law Constant: 7.86×10^{-8} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_5H_6O_2$ Structure:  Boiling Point: 170°C (M) Density: 1.13 g/cm^3 (M) Flash Point: 75°C (M) K_{oc}: 8.5 (E)

Above data are either measured (M) or estimated (E)

Furfuryl alcohol has a faint burning odor and bitter taste. It is very soluble in alcohol and ether.

Furfuryl alcohol is prepared from furfural by the Cannizzaro reaction. It is prepared industrially by the catalytic reduction of furfural using nickel and Cu-CrO catalysts.

Market Profile

In 1992, total U.S. production was 39.2 million gallons. Imports and exports of this chemical are unknown. Total U.S. production quantity for use in sreen reclamation is unknown.

Regulatory Status

Furfuryl alcohol does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, furfuryl alcohol will be expected to exhibit very high mobility, based upon its estimated soil adsorption coefficient. It may be subject to biodegradation in soil based upon results observed in a laboratory aqueous biodegradation aerobic screening test using an activated sludge inoculum. No information was found regarding its rate of biodegradation in soil. Volatilization of furfuryl alcohol from moist soil should not be important. However, some volatilization would occur from dry surface soil and other dry surfaces. If furfuryl alcohol is released to water, it would be expected biodegrade according to results of laboratory screening studies. It should not adsorb to sediment or suspended particulate matter in the water column or to bioconcentrate in aquatic organisms. Furfuryl alcohol absorbs radiation greater than290 nm and therefore it may directly photolyze in surface waters. According to its estimated Henry's Law constant, volatilization from water will not be important. In the atmosphere, furfuryl alcohol will exist mainly in the vapor phase. It will be rapidly degraded by reaction with photochemically-produced hydroxyl radicals (typical half-life 3.7 hours). It may also undergo atmospheric degradation by direct photolysis. Physical removal by rain would occur because of its miscibility in water. Using a rapid biodegradation rate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Isobutyl Isobutyrate

Chemical Properties and Information	
Isobutyl isobutyrate [propanoic acid, 2-methyl-, 2-methylpropyl ester, isobutyric acid, isobutyl ester] CAS# 97-85-8 Molecular weight: 144.21 Melting Point: -81°C (M) Water Solubility: <1 g/L (M) Vapor Pressure: 3.2 mm Hg (at 20°C) (M) Log K_{ow}: 2.68 (E)Henry's Law Constant: 8.22×10^{-4}atm-m^3/mole (M) Chemistry of Use: Solvent	$C_8H_{16}O_2$ Structure: $(CH_3)_2CHCOOCH_2CH(CH_3)_2$ Boiling Point: 147°C (M) Density: 0.855 g/cm^3 (at 20°C) (M) Flash Point: 38°C (closed cup) (M) 44°C (open cup) (M) K_{oc}: 98 (E)

Above data are either measured (M) or estimated (E)

This is a slow evaporating solvent, and is blush resistant. It is miscible with alcohol and ether.

This chemical is prepared from the reaction of isobutyric acid and isobutyl alcohol.

Market Profile

Total U.S. production is unavailable. Imports and exports of this chemical are unknown. Total U.S. production quantity for use in screen reclamation was estimated to be 2.63 million gallons.

Regulatory Status

Isobutyl isobutyrate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, isobutyl isobutyrate is expected to biodegrade under aerobic conditions and it may be rapid in acclimated soils. It is expected to display high mobility in the absence of significant biodegradation. Volatilization of isobutyl isobutyrate from both moist and dry soil to the atmosphere may be important. If released to water, it is expected to biodegrade under aerobic conditions and it may be rapid if acclimated organisms are present. Neither bioconcentration in fish and aquatic organisms nor adsorption to sediment and suspended organic matter are expected to be important. Volatilization of isobutyl isobutyrate from water to the atmosphere may be relatively rapid. Chemical hydrolysis will be important only in very alkaline environmental media (pH greater than 8.5). If released to the atmosphere, isobutyl isobutyrate will degrade by reaction with photochemically produced hydroxyl radicals (estimated half-life of 2.3 days). Using a rapid biodegradation rate in the STP fugacity model results in 98 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Isobutyl Oleate

Chemical Properties and Information	
Isobutyl oleate [Isobutyl ester oleic acid]	$C_{22}H_{42}O_2$
CAS# 10024-47-2	Structure: $CH_3(CH_2)_7CH{=}CH(CH_2)_6CH_2COO\text{-}i\text{-}C_4H_{11}$
Molecular weight: 395	Boiling Point: 226°C (M)
Melting Point: -26°C (M)	Density: 0.86 g/ml (M)
Water Solubility: 0.001g/l (E)	Flash Point: 180°C (M)
Vapor Pressure: 0.01 mm Hg (E) (25°C)	K_{oc}: >10,000 (E)
Log K_{ow} = 9.42 (E)	Physical state: Oily liquid
Henry's Law Constant: 2.5×10^{-2} atm-m^3/mole (E)	
Chemistry of Use: Numerous	

Above data are either measured (M) or estimated (E)

Isobutyl oleate may be harmful if absorbed through the skin. Vapor and mist are irritating to the respiratory tract and eyes. Isobutyl oleate is soluble in ethanol.

Isobutyl oleate is produced from the esterification of oleic acid. Oleic acid is derived by mechanic means from the seeds of specific fruits and plants. Once refined, the oleate is heated in the presence of a strong base and an alcohol. Esterification occurs at the glycerol hydroxides of the oleic acid.

Market Profile

In 1992, total U.S. production of salt and esters of oleic, linoleic, or linoleric acids was 36 million pounds. Greater specificity is not available due to the low number of companies producing these products. Data for imported and exported amounts were not available. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Isobutyl oleate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, isobutyl oleate is expected to be essentially immobile. Biodegradation in acclimated aerobic soils may be rapid. Chemical hydrolysis of the ester group is not expected to be significant except for highly basic soils (pH greater than8) . Volatilization of isobutyl oleate from moist soil to the atmosphere may be a significant process although it is likely to be relatively slow from dry soil. If released to water, aerobic biodegradation may be rapid, especially in acclimated waters. Bioconcentration in fish and aquatic organisms and adsorption to sediment and suspended organic matter may also occur. Volatilization from water to the atmosphere may be rapid although its expected strong adsorption to sediment and suspended organic matter may attenuate the rate of this process. Chemical hydrolysis may occur in highly basic waters. If released to the atmosphere, isobutyl oleate may undergo rapid oxidation by the both the gas-phase reaction with hydroxyl radicals and ozone with estimated half-lives of approximately 1.5 and 1.3 hours for the trans isomer, respectively, with similar rates for the cis isomer. Using either a rapid or moderate biodegradation rate for isobutyl oleate in the STP fugacity model results in greater than99 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Isopropanol

Chemical Properties and Information

Isopropanol [Isopropyl alcohol; 2-propanol, dimethyl carbinol, *sec*-propyl alcohol]
CAS# 67-63-0
Molecular weight: 60.1
Melting Point: -88.5°C (M)
Water Solubility: Miscible
Vapor Pressure: 33 mm Hg (M) (20°C)
Log K_{ow} = 0.05 (M)
Henry's Law Constant: 8.1×10^{-6} atm-m^3/mole (M)
Chemistry of Use: Solvent

C_3H_8O
Structure: $(CH_3)_2CHOH$
Boiling Point: 164°C (M)
Density: 0.7849 g/ml (M)
Flash Point: Tag Open Cup: 17.2°C (M)
Closed Cup: 11.7° C (M)
K_{oc}: 25 (E)
Physical State: Colorless, volatile, flammable liquid

Above data are either measured (M) or estimated (E)

Isopropanol is a colorless, volatile, flammable liquid. Its odor is slight, resembling a mixture of ethyl alcohol and acetone. Isopropanol boils only 4°C higher than ethyl alcohol and possesses similar solubility properties, and thus the two products compete for many solvent applications. Because of its tendency to associate in solution, isopropanol forms azeotropes with compounds from a variety of chemical groups. As an alcohol, it can be dehydrogenated, oxidized, esterified, etherified, aminated, halogenated, or otherwise modified.

Indirect hydration is the common process for commercial manufacture of isopropanol in the United States. This two-step method involves: (1) formation of mono- and diisopropyl sulfates by reacting propylene with sulfuric acid, and (2) hydrolysis of the sulfates to isopropyl alcohol. The catalytic hydration process, increasingly used in Europe and Japan, uses superheated steam and high pressures to directly convert propylene to isopropanol:

$$CH_3CH = CH_2 + H_2O \leftrightarrow (CH_3)_2CHOH$$

catalyst

Market Profile

In 1991, total U.S. production was 1.4 billion gallons. In 1992, imports were 91.5 million gallons and exports were 416.9 million gallons. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

See Table II-3 and accompanying summary

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, biodegradation is expected to be an important removal process for isopropanol. Adsorption to soil will not be important. In water, biodegradation is expected to be fast, even under anaerobic conditions. Bioconcentration in fish, adsorption to sediment, photolysis, and hydrolysis will not be important for isopropanol. Volatilization from water is slow. In the atmosphere, isopropanol will photodegrade primarily by reaction with photochemically produced hydroxyl radicals with a half-life of 1-2 days. Using a rapid and a moderate biodegradation rate for isopropanol in the STP fugacity model results in about 97 and 83 percent, respectively, predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

d-Limonene

Chemical Properties and Information	
d-Limonene [1-methyl-4-(1-methylethenyl) cyclohexene; (+)-carvene; citrene; 1,8-*p*-menthadiene; 4-isopropenyl-1-methylcyclohexene cinene; cajeputene; kautschin] CAS# 5989-27-5 Molecular weight: 136 Melting Point: -74°C (M) Water Solubility: 0.014 g/L (M) Vapor Pressure: 5 mm Hg (E) (25°C) Log K_{ow} = 4.83 (E) Henry's Law Constant: 0.38 atm-m^3/mole (E) Chemistry of Use: Wetting and Dispersing Agent	$C_{10}H_{16}$ Structure: Boiling Point: 176°C (M) Density: 0.84 g/ml (M) Flash Point: 48°C (M) K_{oc}: 1,000 - 4,800 (E)

Above data are either measured (M) or estimated (E)

d-Limonene is a terpenoid in a group of closely related compounds called *p*-menthadienes. The *p*-menthadienes can all be hydrogenated to produce *p*-menthane, the hydroperoxide of which is useful in the rubber industry. Limonene isomerizes rather slowly to terpinolene, while the irreversible isomerization of terpinolene to α-terpinene is very rapid. The physical state of limonene is a liquid with a fresh, citrus odor and taste.

d-Limonene is naturally occurring and is obtained from lemon and orange peel, dill, cumin, neroli, bergamot, and caraway. The lemon oil that is obtained in 0.35 percent yield from lemon peel is approximately 80 percent limonene (*d* and *dl*). Nonetheless, the characteristic odor and flavor of lemon comes not from limonene, but from citral and other compounds.

Market Profile

In 1988, total U.S. production was 28 million pounds. Data for imported and exported amounts were not available. Total U.S. production quantity for use in screen reclamation was estimated to be 150,000 gallons.

Regulatory Status

d-Limonene does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, *d*-limonene is expected to exhibit low to slight mobility. It is expected to rapidly volatilize from both dry and moist soil surfaces and biodegrade at a moderate rate in soil. However, strong adsorption to soil may attenuate the rate of this process. If released to water, *d*-limonene may bioconcentrate in fish and aquatic organisms and it may adsorb to sediment and suspended organic matter. It is expected to rapidly volatilize from water to the atmosphere. The estimated half-life for volatilization of *d*-limonene from a model river is 3.4 hrs, although adsorption to sediment and suspended organic matter may attenuate the rate of this process. If released to the atmosphere, *d*-limonene is expected to rapidly undergo gas-phase oxidation reactions with photochemically produced hydroxyl radicals and ozone, and to react at night with nitrate radicals. Calculated half-lives for these processes are 2.3-2.6 hrs, 25-26 min and 3.1 min, respectively. Using a moderate biodegradation rate for d-limonene in the STP fugacity model results in greater than99 percent predicted total removal from wastewater treatment plants. Assuming no biodegradation in the STP fugacity model also results in greater than99 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Methanol

Chemical Properties and Information	
Methanol [methyl alcohol, carbinol, wood spirit, wood alcohol] CAS# 67-56-1 Molecular weight: 32.04 Melting Point: -97.8°C (M) Water Solubility: Miscible (M) Vapor Pressure: 93.7 mm Hg (at 20°C) (M) Log K_{ow}: -0.770 (M) Henry's Law Constant: 4.55X10^{-6} atm-m^3/mole (M) Chemistry of Use: Solvent	CH_4O Structure: CH_3OH Boiling Point: 64.7°C (M) Density: 0.792 g/cm^3 (M) Flash Point: 12°C (closed cup) (M) K_{oc}: not available

Above data are either measured (M) or estimated (E)

Pure methanol has a slight alcoholic odor, but more crude forms of methanol may have repulsive odors. Methanol is generally a better solvent than ethanol. Methanol is flammable and mobile. Methanol has an ignition temperature of 470°C. It is miscible with ethanol, ether, benzene, ketones, and most other organic compounds.

Methanol is usually manufactured from hydrogen and carbon monoxide at high pressure and temperature.

Market Profile

In 1992, total U.S. production of methanol was 1.4 billion gallons. About 521 million gallons were imported and 55 million gallons were exported. Total U.S. production quantity for use in screen reclamation was estimated to be 610,000 gallons.

Regulatory Status

See Table II-3 and accompanying summary.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, methanol is expected to rapidly biodegrade under aerobic conditions. Methanol is also expected to slowly biodegrade under anaerobic conditions in soil. It is expected to display very high mobility although its rapid rate of biodegradation limits its potential to leach through soil. Volatilization of methanol from moist soil to the atmosphere is not expected to occur although it may be important from dry soils. If released to water, methanol is expected to rapidly biodegrade under aerobic conditions. Slow biodegradation in anoxic sediments is also expected to occur. Neither volatilization to the atmosphere, bioconcentration in fish and aquatic organisms, adsorption to sediment and suspended organic matter, chemical hydrolysis, oxidation, nor photolysis are expected to occur. If released to the atmosphere, methanol is expected to undergo a gas-phase reaction with photochemically produced hydroxyl radicals; the estimated half life for this process is 11 days. Its substantial water solubility indicates that wet deposition may also be an important atmospheric removal process. Using a rapid biodegradation rate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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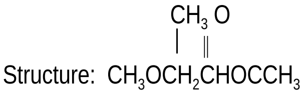
Methoxypropanol Acetate

Chemical Properties and Information	
Methoxypropanol acetate [propylene glycol methyl ether acetate] CAS# 84540-57-8 (also 108-65-6) Molecular weight: 132 Melting Point: -100°C (E) Water Solubility: 200 g/L (M) Vapor Pressure: 3.7 mm Hg (M) Log K_{ow}: 0.43 (M) Henry's Law Constant: $4.2X10^{-6}$ atm-m^3/mole (M) Chemistry of Use: Solvent	$C_6H_{12}O_3$  Structure: $CH_3OCH_2\overset{\overset{CH_3}{\mid}}{C}HO\overset{\overset{O}{\|}}{C}CH_3$ Boiling Point: 140°C (M) Density: 0.97 g/cm^3 (M) Flash Point: 45°C (setaflash) (M) K_{oc}: 0.36 (M)

Above data are either measured (M) or estimated (E)

Methoxypropanol acetate is a glycol derivative that is both an ether and an ester. It is combustible and has an ester like odor. It is soluble in organic solvents.

Propylene glycol methyl ether acetate is prepared by reacting propylene oxide with methyl alcohol and esterifying with acetic acid or acetic anhydride.

Market Profile

In 1991, total U.S. production was 67.1 million gallons. About 6.9 million gallons were exported. Total U.S. production quantity for use in screen reclamation was estimated to be 420,000 gallons.

Regulatory Status

Methoxypropanol acetate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, methoxypropanol acetate is expected to readily biodegrade. Methoxypropanol acetate has a very low soil adsorption coefficient and is expected to be highly mobile in soil. Volatilization of methoxypropanol acetate from dry surface soil and other surfaces may be important, but volatilization from moist surface soil will be minimal. If released to water, methoxypropanol acetate is expected to biodegrade. The estimated half-life resulting from base-catalyzed chemical hydrolysis at pH 8 is 88 days and therefore chemical hydrolysis would only be significant in highly alkaline water. The volatilization half-life of methoxypropanol acetate from a model river is 10 days and therefore volatilization may occur under some circumstances. Neither bioconcentration in aquatic organisms nor adsorption to sediment and suspended organic matter should be significant. If released to the atmosphere, methoxypropanol acetate is degraded by reaction with photochemically-produced hydroxyl radicals (estimated half-life 34 hours). Using a rapid biodegradation rate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Methyl Ethyl Ketone

Chemical Properties and Information	
Methyl ethyl ketone [2-Butanone; Ethyl methyl ketone; Methyl acetone; MEK] CAS# 78-93-3 Molecular weight: 72.11 Melting Point: -87°C (M) Water Solubility: 24 g/L (M) Flash Point: -7°C Log K_{ow} = 0.29 (M) Henry's Law Constant: 5.69×10^{-5} atm-m^3/mole (M) Chemistry of Use: Solvent	C_4H_8O Structure: $H_3CCH_2COCH_3$ Boiling Point: 79.6°C (M) Density: 0.8049_4^{20} g/ml (M) Vapor Pressure: 77.5 mm Hg (M) (20°C) (M) K_{oc}: 5 (E) Physical State: Clear colorless liquid

Above data are either measured (M) or estimated (E)

Methyl ethyl ketone is stable under normal laboratory conditions and is miscible in ethanol, benzene, and diethyl ether. It is highly flammable. Forms a constant-boiling mixture with water, b.p. 73.40° containing 11.3 percent water. Strong oxidizing agents can cause spontaneous ignition and violent reaction; ignition on reaction with potassium t-butoxide; can attack many plastics, resins, and rubber; incompatible with chlorosulfonic acid, chloroform, hydrogen peroxide, and nitric acid.

Methyl ethyl ketone is mainly produced from sec-butanol and butylene.

Market Profile

In 1992, total U.S. production was 510 million gallons. Imports were 56.6 million gallons and exports were 132.2 million gallons. Total U.S. production quantity for use in screen reclamation was estimated to be 3.72 million gallons.

Regulatory Status

See Table II-3 and accompanying summary

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil surfaces, methyl ethyl ketone will either volatilize into the atmosphere, directly photolyze, or leach into the ground where it will biodegrade. If methyl ethyl ketone leaches to groundwater, biodegradability studies in anaerobic systems suggest slow biodegradation after a long acclimation period. In surface waters, methyl ethyl ketone will volatilize, photolyze, or biodegrade. Chemical hydrolysis, adsorption to sediment, bioconcentration in aquatic organisms, and indirect photooxidation will not be important fate processes for methyl ethyl ketone in water. If released to the atmosphere, gas-phase methyl ethyl ketone will react with photochemically-produced hydroxyl radicals (estimated half-lives of less than 10 days). Methyl ethyl ketone may be removed from air via wet deposition. Using a rapid and a moderate biodegradation rate for methyl ethyl ketone in the STP fugacity model results in 97 and 84 percent, respectively, predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Methyl Lactate

Chemical Properties and Information	
Methyl lactate [2-Hydroxypropanoicacid methyl ester; lactic acid; methyl ester] CAS# 547-64-8 Molecular weight: 104 Melting Point: -66°C (M) Water Solubility: Miscible Vapor Pressure: 7.7 mm Hg (E) (25°C) Log K_{ow} = -0.67 (E) Henry's Law Constant: 8.5 x 10^{-9} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_4H_8O_3$ Structure: $CH_3CH(OH)COOCH_3$ Boiling Point: 145°C (M) Density: 1.0939 g/ml (M) Flash Point: 49°C (M) K_{oc}: 8 (E) Physical State: Colorless liquid

Above data are either measured (M) or estimated (E)

Methyl lactate is acetylated with acetic anhydride to produce the acetyl derivative. Methyl lactate is soluble in alcohol and ether. It is a dye solvent. A dye solvent has a high boiling point, it is practically nonvolatile and maintains the dye in the solution long enough to stain the wood. Methyl lactate decomposes in water.

Methyl lactate is a byproduct in the formation of lactic acid. Methyl lactate results from the esterification of lactic acid with methyl alcohol. The methyl lactate is distilled and hydrolyzed with a strong acid catalyst to produce semi-refined lactic acid. It is also produced by hydrolyzing lactonitrile with sulfuric acid and purifying with methanol to form methyl lactate.

Market Profile

Market information on this chemical is unavailable.

Regulatory Status

Methyl lactate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, methyl lactate is expected to display very high mobility. Biodegradation in acclimated aerobic soils may be rapid. Volatilization of methyl lactate from the upper layers of dry soil to the atmosphere may be significant although volatilization from moist soil will be very slow. In basic soil with a pH greater than8, chemical hydrolysis of methyl lactate may occur. If released to water, aerobic biodegradation may be rapid, especially in acclimated waters. Methyl lactate is not expected to bioconcentrate in fish and aquatic organisms nor is it expected to adsorb to sediment and suspended organic matter. Volatilization of methyl lactate from water to the atmosphere is expected to be very slow. In basic waters methyl lactate may undergo chemical hydrolysis with an estimated half-life of approximately 7 days at pH 8. If released to the atmosphere, methyl lactate may undergo oxidation by the gas-phase reaction with hydroxyl radicals with an estimated half-life of approximately 6 days. It may also undergo atmospheric removal by wet deposition processes. Using a rapid biodegradation rate for methyl lactate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

Mineral Spirits (Naphtha, Heavy Straight-run)

Chemical Properties and Information	
Mineral spirits [Many trade names by companies including Amsco, Apco, Epesol, Exxon, Phillips, Shell, etc., most of which include "mineral spirits" in the name] CAS# 64741-41-9 Molecular weight: 86 for n-hexane; 112 for ethycyclohexane, for example Melting Point: -60°C (E) Water Solubility: 0.001 g/L (E) Vapor Pressure: 1 mm Hg (E) (25°C) Log K_{ow} = 3.4 - >6 (E) Henry's Law Constant: 1.5×10^{-3} - 13 atm-m^3/mole (E) Chemistry of Use: Solvent	Molecular formula: C_nH_{2n+2} (paraffin) and C_nH_{2n} (cycloparaffin) Structure: Typical structures include normal paraffins, $CH_3(CH_2)_nCH_3$, branched paraffins, and cycloparaffins Boiling Point: 160-200°C (M) Density: 0.78 g/ml (M) Flash Point: 43°C (M) K_{oc}: 500 - >5000 (E) Physical State: Liquid

Above data are either measured (M) or estimated (E)

The term mineral spirits refers to a range of petroleum solvents consisting largely of saturated hydrocarbons, including both straight-chain and branched paraffins, and cycloparaffins, which may have alkyl side chains. Up to one-fourth of some mineral spirits consists of aromatic hydrocarbons. A typical boiling range for mineral spirits is 160-200°C. Mineral spirits are miscible with petroleum solvents.

Mineral spirits may be prepared by fractionation of straight-run, cracked, and reforming petroleum distillates or fractionation of crude petroleum. The naphtha streams are generally divided into heavy and light, and may then be further fractionated. The naphthas are usually treated (chemically, with lye or other compounds, or hydrotreated) to remove sulfur compounds and aromatic hydrocarbons, leaving the solvent consisting mostly of aliphatic hydrocarbons.

Market Profile

No information is available on the production volumes of the numerous specific naphtha fractions, excluding special naphthas. The production volume for all naphthas was 2.1 billion pounds in 1991. The vast majority of naphthas are used in the production of gasoline and other petroleum products and not directly as solvents. Data for imported and exported amounts is not available. Total U.S. production for both mineral spirits (naphtha, heavy-straight-run and distillates, hydrotreated light) use in screen reclamation was estimated to be 6.9 million gallons.

Regulatory Status

Mineral spirits does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

Naphtha, heavy straight-run is a mixture of components chiefly C_6-C_{12} cyclic and alicyclic hydrocarbons. If released to soil, naphtha, heavy straight-run is expected to biodegrade at a moderate rate under aerobic conditions, although some of the cycloalkanes may be resistant to biodegradation. Some components of naphtha, heavy straight-run are expected to adsorb very strongly to soil. Naphtha, heavy straight-run may rapidly volatilize from both moist and dry soils to the atmosphere, although strong adsorption may significantly attenuate the rate of this process. If released to water, naphtha, heavy straight-run is expected to biodegrade at a moderate rate under aerobic conditions with the exception of some cycloalkanes. Some components are expected to significantly bioconcentrate in fish and aquatic organisms and strongly adsorb to sediment and suspended organic matter. The estimated half-life for volatilization of naphtha, heavy straight-run components from a model river is approximately 1 hour while that from a model lake is greater than100 days; the former model does not account for the attenuating affect of strong adsorption. If released to the atmosphere, the dominant atmospheric removal process for naphtha, heavy straight-run is expected to be oxidation by hydroxyl radicals with an estimated half-life of 1-2 days. Using representative components that either biodegrade rapidly and display moderate sludge adsorption and those that are moderately biodegradable and display strong adsorption to sludge, the STP fugacity model indicates that greater than 94 percent total removal from wastewater treatment plants may be achieved.

Health Hazard

See Table II-6 and accompanying summary

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Mineral Spirits (Distillates, Hydrotreated Light)

Chemical Properties and Information

Mineral spirits [Many trade names by companies including Amsco, Apco, Epesol, Exxon, Phillips, Shell, etc., most of which include "mineral spirits" in the name]
CAS# 64741-47-8
Molecular weight: 86 for n-hexane; 112 for ethycyclohexane, for example
Melting Point: -60°C (E)
Water Solubility: 0.001 g/L (E)
Vapor Pressure: 0.5-1 mm Hg (E) (25°C)
Log K_{ow} = 4.76 - 8.25 (E)
Henry's Law Constant: 0.2 - 3.4 atm-m^3/mole (E)
Chemistry of Use: Solvent

Molecular formula: C_nH_{2n+2} (paraffin) and C_nH_{2n} (cycloparaffin)
Structure: Typical structures include normal paraffins, $CH_3(CH_2)_nCH_3$, branched paraffins, and cycloparaffins
Boiling Point: 140-180°C (M)
Density: 0.78 g/ml (M)
Flash Point: <43°C (M)
K_{oc}: 220 - >5000 (E)
Physical State: Liquid

Above data are either measured (M) or estimated (E)

The term mineral spirits refers to a range of petroleum solvents consisting largely of saturated hydrocarbons, including both straight-chain and branched paraffins, and cycloparaffins, which may have alkyl side chains. Up to one-fourth of some mineral spirits consists of aromatic hydrocarbons. A typical boiling range for mineral spirits is 160-200°C. Mineral spirits are miscible with petroleum solvents.

Mineral spirits may be prepared by fractionation of straight-run, cracked, and reforming petroleum distillates or fractionation of crude petroleum. The naphtha streams are generally divided into heavy and light, and may then be further fractionated. The naphthas are usually treated (chemically, with lye or other compounds, or hydrotreated) to remove sulfur compounds and aromatic hydrocarbons, leaving the solvent consisting mostly of aliphatic hydrocarbons.

Market Profile

No information is available on the production volumes of the numerous specific naphtha fractions, excluding special naphthas. The production volume for all naphthas was 2.1 billion pounds in 1991. The vast majority of naphthas are used in the production of gasoline and other petroleum products and not directly as solvents. Data for imported and exported amounts were not available. Total U.S. production quantity for both mineral spirits (naphtha, heavy-straight-run and distillates, hydrotreated light) use in screen reclamation was estimated to be 6.9 million gallons.

Regulatory Status

Mineral spirits does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

Distillates, hydrotreated light is a mixture of components, chiefly C_9-C_{16} cyclic and alicyclic alkanes. If released to soil, distillates, hydrotreated light is expected to biodegrade at a moderate rate under aerobic conditions although some cyclic paraffins may be resistant to biodegradation. Some components of distillates, hydrotreated light may adsorb very strongly to soil and some may rapidly volatilize from both moist and dry soils to the atmosphere although strong adsorption may significantly attenuate the rate of this process. If released to water, distillates, hydrotreated light is expected to biodegrade at a moderate rate under aerobic conditions although some components may be resistant. Some components may significantly bioconcentrate in fish and aquatic organisms and strongly adsorb to sediment and suspended organic matter. The estimated half-life for volatilization of distillates, hydrotreated light components from a model river is approximately 1.5 hours while that from a model lake is greater than100 days; the former model does not account for the attenuating affect of strong adsorption. If released to the atmosphere, the dominant atmospheric removal process for distillates, hydrotreated light is expected to be oxidation by hydroxyl radicals with an estimated half-life of less than 1 day. Using representative components that either biodegrade rapidly and display moderate sludge adsorption and those that are moderately biodegradable and display strong adsorption to sludge, the STP fugacity model indicates that greater than 99 percent total removal from wastewater treatment plants may be achieved.

Health Hazard

See Table II-6 and accompanying summary

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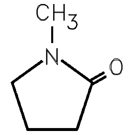
N-Methylpyrrolidone

Chemical Properties and Information	
N-methylpyrrolidone [1-methyl-2-pyrrolidone; 1-methylazacyclopentan-2-one; N-methyl-γ-butyrolactam] CAS# 872-50-4 Molecular weight: 99.13 Melting Point: -17 to -23°C (M) Water Solubility: Miscible (M) Vapor Pressure: 0.334 mm Hg (E) (25°C) Log K_{ow} = -0.73 (E) Henry's Law Constant: 1.56×10^{-8} atm-m^3/mole (E) Chemistry of Use: Solvent	C_5H_9NO Structure:  Boiling Point: 202°C (M) Density: 1.03 g/ml (M) Flash Point: 96°C (M) K_{oc}: 10 (E) Physical State: Colorless liquid with mild amine odor

Above data are either measured (M) or estimated (E)

N-Methylpyrrolidone is a dipolar aprotic solvent. It is steam volatile and forms hydrates. It dissolves many organic and inorganic compounds. N-methylpyrrolidone is soluble in ether and acetone, miscible in castor oil, miscible with lower alcohols and ketones, ethyl acetate, chloroform and benzene, and moderately soluble in aliphatic hydrocarbons.

N-Methylpyrrolidone is an N-substituted heterocycle. In addition to its chemical synthesis, it may be a naturally occurring compound as it has been identified as a volatile component of roasted nuts.

Market Profile

Total U.S. production in 1991 was 55 million gallons. In 1992, exports were 14.8 million gallons. Data for imported amounts was not available. Total U.S. production quantity for use in screen reclamation was estimated to be 38,000 gallons.

Regulatory Status

N-Methylpyrrolidone does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, N-methylpyrrolidone has the potential to biodegrade under aerobic conditions. It is expected to display very high mobility in soil. N-Methylpyrrolidone may slowly volatilize from dry soil to the atmosphere, but it is not expected to volatilize from moist soil. If released to water, screening studies indicate that N-methylpyrrolidone will biodegrade under aerobic conditions after a short lag period. N-Methylpyrrolidone is not expected to bioconcentrate in fish and aquatic organisms nor is it expected to adsorb to sediment or suspended organic matter. N-Methylpyrrolidone is not expected to volatilize from water to the atmosphere. The estimated half-life for volatilization of N-methylpyrrolidone from a model river is greater than2,000 days. If released to the atmosphere, N-methylpyrrolidone is expected to undergo a gas-phase reaction with photochemically produced hydroxyl radicals with an estimated half-life of 5.2 hrs. It may undergo atmospheric removal by wet deposition processes; however, its short atmospheric residence time suggests that wet deposition is of limited importance. Using a fast biodegradation rate for N-methylpyrrolidone in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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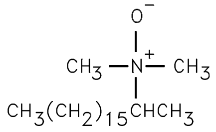
2-Octadecanamine, N,N-dimethyl-, N-oxide

Chemical Properties and Information	
2-Octadecanamine, N,N-dimethyl-, N-oxide [2-Octadecyldimethylamine oxide] CAS# 71662-60-7 Molecular weight: 313.22 Melting Point: >200°C (decomposes) (E) Water Solubility: Soluble (<10 g/L) / Dispersable (E) Vapor Pressure: <10^{-6} mm Hg (E) Log K_{ow}: 9.2 (E) Henry's Law Constant: 3.62X10^{-4} atm-m^3/mole (E) Chemistry of Use: Surfactant	$C_{20}H_{43}NO$ Structure:  Boiling Point: Not applicable Density: Not available Flash Point: Not available K_{oc}: 890,000 (E)

Above data are either measured (M) or estimated (E)

This chemical is a surfactant. It is soluble in polar solvents.

This chemical is synthesized via oxidation of alkyl dimethyl amine.

Market Profile

No market information was available for this chemical.

Regulatory Status

2-Octadecanamine, N,N-dimethyl-, N-oxide does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

Long chain dimethyl amine oxides degrade completely and rapidly in screening studies and therefore, if released to soil, 2-octadecanamine, N,N-dimethyl-, N-oxide would be expected to rapidly biodegrade. It would adsorb strongly to soil because of its long hydrophobic alkyl chain. If released in water, 2-octadecanamine, N,N-dimethyl-, N-oxide would be expected to rapidly biodegrade based on results of screening tests on analogous long chain dimethyl amine oxides. Initially it would be expected to strongly adsorb to sediment and particulate matter in the water column. Volatilization of 2-octadecanamine, N,N-dimethyl-, N-oxide to the atmosphere should be important (estimated half-life from a model river 4.7 hours). If released to the atmosphere, 2-octadecanamine, N,N-dimethyl-, N-oxide will be associated with aerosols and will be removed by gravitational settling. Using a rapid biodegradation rate in the STP fugacity model results in 100 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Periodic Acid

Chemical Properties and Information	
Periodic Acid [Metaperiodic acid] CAS# 13444-71-8 Molecular weight: 191.9 Melting Point: 130° C (M) decomposes Water Solubility: 3,700 g/l (M) Vapor Pressure: Negligible (E) Chemistry of Use: Oxidizing agent	HIO_4 Structure: HIO_4 Boiling Point: Not applicable Density: 3.0 g/ml (E) Flash Point: Not applicable Physical State: White crystals

Above data are either measured (M) or estimated (E)

Periodic acid is a powerful oxidant especially in acid solution. It undergoes a potentially explosive reaction with DMSO. It is soluble in alcohol and slightly soluble in ether.

Periodic acid is prepared by electrolytic oxidation of iodic acid in a diaphragm cell. Alternatively, an alkaline solution of sodium iodate is oxidized with chlorine and the resulting sodium periodate is converted to the acid via the barium salt.

Market Profile

The total U.S. production is unknown. Imports and exports for this chemical are unknown. Total U.S. quantity for use in screen reclamation is estimated to be 1.02 million pounds.

Regulatory Status

Periodic acid does not trigger any any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, the powerful oxidant periodic acid is expected to readily oxidize organic matter and will be short-lived. If released to water, oxidation of organic matter is expected to be sufficiently rapid to dominate all other potential fate pathways. If released to the atmosphere, periodic acid is expected to undergo removal by both wet and dry deposition processes. Depending on the composition of other components that may be present in the water droplets, periodic acid may be transformed by oxidizing either organic, inorganic, or metallic species present before deposition occurs. In wastewater treatment plants, periodic acid is expected to undergo complete removal through the oxidation of numerous organic, inorganic, or metallic species present in the wastewater.

Health Hazard

See Table II-6 and accompanying summary

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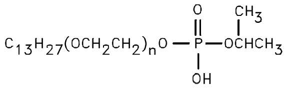
Phosphoric Acid, Mixed Ester with Isopropanol and Ethoxylated Tridecanol

Chemical Properties and Information

Phosphoric acid, mixed ester with isopropanol and ethoxylated tridecanol [poly (oxy-1,2-ethanediyl) α-tridecyl-ω-hydroxy-, 1-methylethyl phosphate]
CAS# 68186-42-5
Molecular weight: >540
Melting Point: Not available
Water Solubility: Soluble/Dispersable
Vapor Pressure: <10^{-6} mm Hg (E)
Log K_{ow}: Not available
Henry's Law Constant: Not available
Chemistry of Use: Surfactant

Varies
Structure:



$C_{13}H_{27}(OCH_2CH_2)_nO-\overset{\overset{\displaystyle O}{\|}}{\underset{\underset{\displaystyle OH}{|}}{P}}-O\overset{\overset{\displaystyle CH_3}{|}}{C}HCH_3$

n = 5 to 20

Boiling Point: High Boiling (E)
Density: Not available
Flash Point: Not available
K_{oc}: Not available

Above data are either measured (M) or estimated (E)

This chemical is a phosphate surfactant. It is soluble in polar solvents and alcohols

This chemical is synthesized via phosphorolation of ethoxylated alcohol.

Market Profile

Total U.S. production is unknown. The majority of this chemical was imported/exported. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Phosphoric acid, mixed ester with isopropanol and ethoxylated tridecanol, does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, phosphoric acid, mixed ester w/isopropanol and ethoxylated tridecanol would be expected to biodegrade. Studies on a series of phosphate esters and ethoxylate phosphates confirm that they are suseptible to primary biodegradation. Phosphoric acid, mixed ester w/isopropanol and ethoxylated tridecanol is expected to be immobile in soil because of the long hydrophobic alkyl group and because of complex formation with metal cations, especially calcium and iron. Volatilization to the atmosphere is not expected to occur. If released to water, phosphoric acid, mixed ester w/isopropanol and ethoxylated tridecanol would be expected to biodegrade. Initially, it would be expected to adsorb to sediment and particulate matter in the water column. It may bioconcentrate in aquatic organisms because of its low water solubility, but this may be attenuated due to rapid biodegradation. Volatilization from water would not be expected. If released to the atmosphere, phosphoric acid, mixed ester w/isopropanol and ethoxylated will be associated with aerosols and will be removed by gravitational settling. Using a rapid biodegradation rate in the STP fugacity model results in 100 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Potassium Hydroxide

Chemical Properties and Information	
Potassium hydroxide [caustic potash] CAS# 1310-58-3 Molecular weight: 56 Melting Point: 380°C (M) Water Solubility: 1500 g/L (E) Vapor Pressure: Not applicable Chemistry of Use: Caustic	KOH Structure: KOH Boiling Point: 1320-1324°C (M) Density: 2.0 g/ml (E) Flash Point: Not applicable Physical State: Solid, white or slightly yellow lumps, rods, pellets

Above data are either measured (M) or estimated (E)

Potassium hydroxide is strongly basic and highly caustic to tissue; a 0.1 M aqueous solution has a pH of 13.5. It is extremely corrosive and toxic via ingestion. Potassium hydroxide is soluble in 3 parts alcohol or 2.5 parts glycerol.

Potassium hyroxide is prepared industrially by electrolysis of potassium chloride. In diaphragm cells, the product liquor contains potassium hydroxide (10-15 weight percent) and potassium chloride. Most of the potassium chloride crystallizes during concentration by evaporation and subsequent cooling, which results in purification of the potassium hydroxide solution. The anode is constructed of titanium; the cathode is a flowing layer of metallic mercury. Feed to the cells consists of brine, which is saturated with potassium chloride at a moderate temperature. Water is added to the potassium-mercury amalgam that results, to form potassium hydroxide and hydrogen.

Market Profile

In 1990, total U.S. production was 3.6 billion pounds. Imports were 8,740.6 million pounds and exports were 1,140 million pounds. Total U.S. production quantity for use in screen reclamation was estimated to be 1.06 million pounds.

Regulatory Status

See Table II-3 and accompanying summary

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

The environmental fate of potassium hydroxide is that of its aqueous solution; the dominant fate of solid potassium hydroxide release will be its dissolution in water. In aqueous solution, potassium hydroxide will dissociate into potassium cations (K^+) and the hydroxide anion (OH^-). Potassium ions are naturally present in surface water, groundwater, and rainwater as are hydroxide ions due to the ionization of water. Given that the components of potassium hydroxide are naturally present and participate in the reactions of natural systems, their fate will be determined by both the amount released and the composition of the receiving medium. Depending on the size of the release and the buffering capacity of the receiving medium, which is in a large part determined by the amount of naturally occurring acids such as hydrogen sulfide, humic acids, and those produced from carbon dioxide (the carbonate system), silica, and inorganic phosphates, the resulting pH may either increase or remain constant. In those systems with limited buffering capacity, the increase in basicity with the increase in the hydroxide ion concentration may lead to the formation and precipitation of insoluble transition metal complexes such as iron, aluminum, and manganese hydroxides. In soils with limited buffering capacity or a low organic content, potassium hydroxide may display high mobility. Potassium hydroxide will not volatilize to the atmosphere but it or its aqueous solutions may be released to the atmosphere by mechanical means during its production, use, or transport. If released to the atmosphere, potassium hydroxide will undergo removal by either wet or dry deposition processes. In wastewater treatment plants, potassium hydroxide will undergo reactions similar to those described above with the net result being an increase in the potassium ion concentration of the effluent.

Health Hazard

See Table II-6 and accompanying summary

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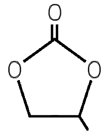
Propylene Carbonate

Chemical Properties and Information	
Propylene carbonate [1,2-Propylene carbonate; 4-methyl-1,3-dioxolane-2-one] CAS# 108-32-7 Molecular weight: 118 Melting Point: -55°C (M) Water Solubility: 100 g/L (E) Vapor Pressure: 0.44 mm Hg (E) (25°C) Log K_{ow} = 0.54 (E) Henry's Law Constant: 3.6×10^{-4} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_4H_6O_3$ Structure:  Boiling Point: 241.7°C (M) Density: 1.20 g/ml Flash Point: 132.2°C (M) K_{oc}: 6 (E) Physical State: Colorless, odorless liquid

Above data are either measured (M) or estimated (E)

Propylene carbonate is combustible. It has a high solubility for CO_2. This solubility makes propylene carbonate widely used for drying natural gas. Propylene carbonate is miscible with acetone, benzene, chloroform, ether and ethyl acetate.

Propylene oxide is reacted with carbon dioxide to yield propylene carbonate. Propylene carbonate can be further hydrolyzed to propylene glycol. The reaction is catalyzed by potassium iodide, calcium bromide or magnesium bromide.

Market Profile

In 1989, total U.S. production was 8.3 million gallons. Data for imported and exported amounts were not available. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Propylene carbonate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, propylene carbonate is expected to display very high mobility. Biodegradation in acclimated aerobic soils may be rapid. Volatilization of propylene carbonate from both moist and dry soil to the atmosphere is expected to occur at a moderate rate. If released to water, aerobic biodegradation may occur and it may be rapid in acclimated waters. Propylene carbonate is not expected to bioconcentrate in fish and aquatic organisms or to adsorb to sediment and suspended organic matter. Volatilization of propylene carbonate from water to the atmosphere is expected to be relatively rapid. If released to the atmosphere, propylene carbonate may undergo oxidation by the gas-phase reaction with hydroxyl radicals with an estimated half-life of approximately 2.5 days. It may also undergo atmospheric removal by wet deposition processes. Using a rapid biodegradation rate for propylene carbonate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants. If a moderate biodegradation rate is used in this model, 84 percent predicted total removal may be achieved.

Health Hazard

See Table II-6 and accompanying summary

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Propylene Glycol

Chemical Properties and Information	
Propylene glycol [1,2-propanediol, methyl glycol, 1,2-dihydroxypropane, methylethylene glycol, trimethyl glycol] CAS# 57-55-6 Molecular weight: 76.10 Melting Point: -60°C (M) Water Solubility: Miscible Vapor Pressure: 0.2 mm Hg at 20°C (M) Log K_{ow}: -.920 (M) Henry's Law Constant: 1.3×10^{-8}atm-m^3/mole (E) Chemistry of Use: Solvent	$C_3H_8O_2$ Structure: $HOCH(CH_3)CH_2OH$ Boiling Point: 187.3°C (M) Density: 1.038 (M) Flash Point: 101°C (M) K_{oc}: 7 (E)

Above data are either measured (M) or estimated (E)

Propylene glycol is practically odorless with a slight taste. More volatile than ethylene glycol, it is three times as viscous at room temperature. Although propylene glycol has a secondary hydroxyl group, its chemistry parallels that of ethylene glycol. It is miscible with water and other polar solvents.

Propylene glycol is produced by the hydrolysis of propylene oxide. The hydrolysis is carried out under pressure at high temperature without catalysts. The proportion of products is controlled by the ratio of water to propylene oxide.

Market Profile

In 1989, total U.S. production was 651 million gallons. In 1989, imports were 0.3 million gallons. In 1988, exports were 144.5 million gallons. Total U.S. production quantity for use in screen reclamation was estimated to be 203,000 gallons.

Regulatory Status

Propylene glycol does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, propylene glycol may rapidly degrade under aerobic conditions. It is expected to display very high mobility; however, its expected rapid biodegradation will decrease its potential of leaching through soil. Volatilization of propylene glycol from moist soil to the atmosphere will not be important although it may occur slowly from dry soils. If released to water, propylene glycol may biodegrade rapidly under aerobic conditions. It may also slowly degrade under anaerobic conditions. Neither volatilization to the atmosphere, bioconcentration in fish and aquatic organisms, adsorption to sediment and suspended organic matter, chemical hydrolysis, nor oxidation are expected to occur. If released to the atmosphere, propylene glycol is degraded rapidly by reaction with photochemically produced hydroxyl radicals (typical half-life of 11 hours). Physical removal by wet deposition processes may also occur because of its substantial water solubility; however, its short atmospheric residence time suggests that wet deposition may be of limited importance. Using a rapid biodegradation rate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Propylene Glycol Methyl Ether

Chemical Properties and Information	
Propylene glycol methyl ether [Glycol ether PM] CAS# 107-98-2 Molecular weight: 90.12 Melting Point: -95°C (M) Water Solubility: Miscible Vapor Pressure: 8.03 mm Hg (M) (20°C) Log K_{ow} = -0.49 (E) Henry's Law Constant: 1.8×10^{-8} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_4H_{10}O_2$ Structure: $CH_3OCH_2CH(CH_3)OH$ Boiling Point: 121°C (M) Density: 0.9234 g/ml (M) Flash Point: Open cup: 36°C (M) Closed Cup: 33°C (M) K_{oc}: 13 (E) Physical State: Liquid

Above data are either measured (M) or estimated (E)

Glycol ethers are both ethers and alcohols. Their hydroxyl groups can be etherified, esterified, chlorinated, or otherwise modified. Propylene glycol methyl ether is miscible with acetone, benzene, carbon tetrachloride, ethyl ether and petroleum ether. Glycol monoethers are prepared by conventional etherification procedures, including the reaction of an alkali metal glycolate with an alkyl halide, and reaction of propylene oxide with methanol.

Market Profile

In 1991, total U.S. production was 125 million gallons. Imports were less than 100,000 million gallons and exports were 28.7 million gallons. Total U.S. production quantity for use in screen reclamation was estimated to be 418,000 gallons.

Regulatory Status

Propylene glycol methyl ether does not trigger any federal environmental regulations. However, the generic category of glycol ethers is listed as Hazardous Air Pollutants in the Clean Air Act.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

Propylene glycol methyl ether is not expected to undergo hydrolysis or direct photolysis in the environment. In water, volatilization, adsorption to sediments and suspended solids, and bioconcentration in aquatic organisms are not expected to be important transport processes for propylene glycol methyl ether. Biodegradation is likely to be the most important removal mechanism of propylene glycol methyl ether from aerobic soil and water based on a 4-week

BOD of 88-92 percent of theoretical. If released to soil, propylene glycol methyl ether is expected to display very high mobility. Volatilization from dry soil surfaces will be important. In the atmosphere, propylene glycol methyl ether is expected to exist almost entirely in the gas-phase and reactions with photochemically produced hydroxyl radicals should be fast (estimated half-life of 8.2 hrs). Physical removal of propylene glycol methyl ether from air by wet deposition may occur; however, its short atmospheric residence time suggests that wet deposition is of limited importance. Using a rapid biodegradation rate for propylene glycol methyl ether in the STP fugacity model results in 97 percent predicted removal from wastewater treatment plants; a moderate rate corresponds to 83 percent predicted removal.

Health Hazard

See Table II-6 and accompanying summary

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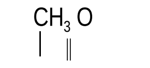
Propylene Glycol Methyl Ether Acetate

Chemical Properties and Information	
Propylene glycol methyl ether acetate[1-Methoxy-2-acetoxypropane; 1-Methoxy-2-propyl acetate; 2-Acetoxy-1-methoxypropane] CAS# 108-65-6 Molecular weight: 132 Melting Point: -100°C (E) Water Solubility: Miscible Vapor Pressure: 2 mm Hg (E) (25°C) Log K_{ow} = 0.56 (M) Henry's Law Constant: 4.26 x 10^{-6} atm-m^3/mole (M) Chemistry of Use: Solvent	$C_6H_{12}O_3$ Structure:  $CH_3OCH_2\overset{\overset{CH_3}{\vert}}{C}HO\overset{\overset{O}{\Vert}}{C}CH_3$ Boiling Point: 140°C (E) Density: 0.90 g/ml (E) Flash Point: 40°C (E) K_{oc}: 2 (M) Physical State: Liquid

Above data are either measured (M) or estimated (E)

Propylene glycol methyl ether acetate is a glycol derivative that is both an ether and an ester. Propylene glycol methyl ether acetate is soluble in organic solvents.

Propylene glycol methyl ether acetate is made by reacting propylene oxide with methanol followed by acetylation.

Market Profile

In 1991, total U.S. production of "other" P-series glycol ethers was 1 million pounds. This category includes dipropylene glycol methyl ether acetate, ethoxypropanol, ethoxypropyl acetate, and propylene glycol methyl ether acetate, among possibly others. Data for imported and exported amounts were not available. Total U.S. production quantity for use in screen reclamation was estimated to be 217,000 gallons.

Regulatory Status

Propylene glycol methyl ether acetate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, propylene glycol methyl ether acetate is expected to display very high mobility. Biodegradation in acclimated aerobic soils may be rapid. Hydrolysis of the ester group is not expected to be significant except for highly basic soils (pH greater than8). Volatilization of propylene glycol methyl ether acetate from dry soil to the atmosphere may be significant although it is likely to be a slow process from wet soil. If released to water, aerobic biodegradation is likely to be the dominant removal process with 20-day BODs of 61 percent of theoretical reported. Neither bioconcentration in fish and aquatic organisms, adsorption to sediment and suspended organic matter, hydrolysis, nor volatilization to the atmosphere are expected to be significant fate processes in surface water. If released to the atmosphere, propylene glycol methyl ether acetate may undergo oxidation by the gas-phase reaction with hydroxyl radicals with an estimated half-life of approximately 11 hours. It may also undergo atmospheric removal by wet deposition processes; however, its short atmospheric residence time suggests that wet deposition is of limited importance. Propylene glycol methyl ether acetate is listed as degradable in the Japanese MITI test which uses an acclimated sludge seed and it is expected to undergo significant removal in a wastewater treatment plant. Using a rapid biodegradation rate for propylene glycol methyl ether acetate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Silica

Chemical Properties and Information	
Silica [silicon dioxide] CAS# 7631-86-9 Molecular weight: 60 Melting Point: 1550°C (M) Water Solubility: Practically insoluble; vitreous form more soluble than quartz Vapor Pressure: (E) Log K_{ow}: Not applicable Henry's Law Constant: Not applicable Chemistry of Use: Anticaking/defoaming agent	SiO_2 Structure: Occurs as a variety of minerals including quartz; crystals are hexagonal Boiling Point: Density: 2.65 (quartz) (M); 2.2 (amorphous) Flash Point: (E) K_{oc}: Not applicable

Above data are either measured (M) or estimated (E)

Silica combines with many elements and oxides in the general realm of ceramic chemistry. It occurs in nature as agate, amethyst, chalcedony, cristobalite, flint, quartz, sand, tridymite, carnelian, onyx, and jasper; hydrated amorphous forms include opal, infusorial earth, and diatomaceous earth. A common vitreous form is obsidian. It is practically insoluble in acids, except aqueous HF, in which it readily dissolves, forming Si F_4 and H_2SiF_6.

It is naturally occurring.

Market Profile

In 1992, total U.S. production was 1.8 billion pounds. Imports and exports of this chemical are unknown. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Silica does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, silica is expected to be essentially immobile. Although silica slowly dissolves in water to a limited extent, adsorption to soil is expected through strong silica-soil interactions. Experimental data to assess the degree of adsorption of silica to soil are not available. Silica is not expected to biodegrade in soil nor volatilize to the atmosphere. Silica's ultimate fate in soil is expected to be chemical hydrolysis to silicic acid and participation in the natural silicon cycle although this process occurs on a geological time scale. If released to water, silica may slowly dissolve and may also undergo very slow chemical hydrolysis to silicic acid. Its dominant aquatic fate process is expected to be adsorption to sediment although ultimately it will enter the natural silicon cycle. Volatilization to the atmosphere, biodegradation, and bioconcentration in fish and aquatic organisms are not expected to occur. If released to the atmosphere as particulates, it is expected return to the earth via dry deposition and rain-out. Removal of silica from wastewater treatment plants is expected to be essentially complete due to its high degree of adsorption to sludge and complexation with metals.

Health Hazard

See Table II-6 and accompanying summary

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Silica, Fumed (amorphous, crystalline-free)

Chemical Properties and Information	
Silica, fumed [pyrogenic silica, aerosil, amorphous silica] CAS# 112945-52-5 Molecular weight: 60 Melting Point: 1550°C (E) Water Solubility: 0.1 g/L (E) Vapor Pressure: Not applicable Log K_{ow}: Not applicable Henry's Law Constant: Not applicable Chemistry of Use: Thickener/reinforcer	SiO_2 Structure: Lack of crystalline structure Boiling Point: 2950°C (E) Density: 2.16 g/cm^3 (M) Flash Point: Not available K_{oc}: Not applicable

Above data are either measured (M) or estimated (E)

Fumed silica is an extremely pure form of silica. It is insoluble in all acids except HF (M).

Fumed silica is made by burning $SiCl_4$ with H_2 and O_2 at 1000°C.

Market Profile

In 1992, total U.S. production was 48.6 million pounds. In 1992, about 2.6 million pounds were imported and 2.0 million pounds were exported. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Silica, fumed, does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, fumed silica is expected to be essentially immobile. Although fumed silica slowly dissolves in water to a limited extent, adsorption to soil is expected through strong silica-soil interactions. Experimental data to assess the degree of adsorption of fumed silica to soil are not available. Fused silica is not expected to biodegrade in soil nor volatilize to the atmosphere. Fumed silica's ultimate fate in soil is expected to be chemical hydrolysis to silicic acid and participation in the natural silicon cycle although this process will occur on a geological time scale. If released to water, fumed silica may slowly dissolve and may also undergo very slow chemical hydrolysis to silicic acid. Its dominant aquatic fate process is expected to be adsorption to sediment although ultimately it will enter the natural silicon cycle. Volatilization to the atmosphere, biodegradation, and bioconcentration in fish and aquatic organisms are not expected to occur. If released to the atmosphere as particulates, it is expected return to the earth via dry deposition and rain-out. Removal of fumed silica from wastewater treatment plants is expected to be essentially complete due to its high degree of expected adsorption to sludge and complexation with metals.

Health Hazard

See Table II-6 and accompanying summary

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Sodium Bisulfate

Chemical Properties and Information	
Sodium bisulfate [sulfuric acid, monosodium salt, monohydrate] CAS# 10034-88-5 Molecular weight: 138 Melting Point: Decomposes (M) Water Solubility: 1250 g/L (M) Vapor Pressure: Not applicable Log K_{ow}: Not applicable Henry's Law Constant: Not applicable Chemistry of Use: Salt	H_3NaO_5S Structure: $HOSO_3Na{\cdot}H_2O$ Boiling Point: Not Applicable Density: >2 g/cm^3 (E) Flash Point: Not applicable K_{oc}: Not applicable

Above data are either measured (M) or estimated (E)

This chemical changes to pyrosulfate when strongly heated. This chemical exists as colorless, odorless crystals. This chemical is corrosive and its aqueous solution is strongly acidic. It decomposes in alcohol.

This chemical is made by crystallization from an aqueous solution containing $NaHSO_4$.

Market Profile

No information on production volumes of sodium bisulfate was available. In 1990, total U.S. production of sodium sulfate was 812 million pounds. In 1991, about 34.6 million pounds of sodium sulfate were imported and about 250 million pounds of sodium sulfate were exported. Total U.S. production of sodium bisulfate for use in screen reclamation was estimated to be 2.35 million pounds.

Regulatory Status

Sodium bisulfate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

The environmental fate of sodium bisulfate is that of its aqueous solution; the dominant fate of solid sodium bisulfate release will be its dissolution in water. In aqueous solution, sodium bisulfate will ionize to sodium cations (Na^+) and the bisulfate anion (HSO_4^-). In water, the bisulfate ion will rapidly dissociate to the sulfate ion (SO_4^{-2}) and a hydronium ion (H_3O^+). Sodium ions are naturally present in surface water, groundwater, and rainwater as are sulfate ions. Sulfate ions are also important components of the sulfur cycle. Depending on the size of the sodium bisulfate release and the buffering capacity of the receiving medium, the resulting pH may either decrease or remain constant. In soil and water systems with limited buffering capacity, the increase in acidity with the increase in hydronium ion concentration may lead to the solubilization of metal complexes of phosphate, magnesium, calcium, iron, and aluminum. Sodium bisulfate will not volatilize to the atmosphere but it may be released to the atmosphere by mechanical means during its production, use, or transport. If released to the atmosphere, sodium bisulfate will undergo removal by either wet deposition due to its appreciable water solubility or dry deposition due to settling. In wastewater treatment plants, sodium bisulfate will undergo rapid ionization and subsequent dissociation and will pass through the treatment plant as the ions.

Health Hazard

See Table II-6 and accompanying summary

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Sodium Hexametaphosphate

Chemical Properties and Information	
Sodium hexametaphosphate [Metaphosphoric acid, hexasodium salt; sodium polymetaphosphate; Graham's salt; glassy sodium metaphosphate] CAS# 10124-56-8 Molecular weight: 611.17 Melting Point: 628°C (M) Water Solubility: Very Soluble Vapor Pressure: Not applicable Log K_{ow}: Not applicable Henry's Law Constant: Not available Chemistry of Use: Corrosion inhibitor/dispersant	$(NaPO_3)_6$ Structure: 12 member ring with alternating P and O atoms $Na^{+1}_6(P_6O_{18})^{-6}$ Boiling Point: Not available Density: 2.4 g/cm^3 (E) Flash Point: Not available K_{oc}: Not applicable

Above data are either measured (M) or estimated (E)

This chemical appears as a clear, hygroscopic glass. Sodium hexametaphosphate is a mixture of polymeric metaphosphates, and is not a hexamer. It depolymerizes in aqueous solution to form sodium trimetaphosphate and sodium ortho phosphates.

Sodium hexametaphosphate is prepared by rapidly chilling molten sodium metaphosphate.

Market Profile

In 1989, total U.S. production was 88 million pounds. Imports and exports of this chemical are unknown. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

See Table II-3 and accompanying summary.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, sodium hexametaphosphate is expected to be essentially immobile due to the formation of insoluble complexes with metal salts, particularly calcium and iron. Sodium hexametaphosphate is expected to be unstable in soils and will eventually degrade to orthophosphate. Degradation rates increase in clay containing soils resulting from metal catalyzed processes. Volatilization to the atmosphere is not expected to occur. If released to water, sodium hexametaphosphate will undergo slow chemical hydrolysis to orthophosphate with a half-life of approximately 1 month at 40 °C at neutral pH. If organisms containing phosphatase enzymes are present, sodium hexametaphosphate will undergo rapid hydrolysis in environmental waters. In the absence of rapid hydrolysis, adsorption to sediment and suspended organic matter may occur initially, followed by chemical degradation. Neither volatilization to the atmosphere or bioconcentration in fish and aquatic organisms are expected. If released to a wastewater treatment plants, complete removal of sodium hexametaphosphate is expected from hydrolysis due to the relatively high local phosphatase concentration. Available data indicate that metaphosphates in raw sewage are predominately hydrolyzed to orthophosphate before they even reach the treatment plant

Health Hazard

See Table II-6 and accompanying summary

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Sodium Hydroxide

Chemical Properties and Information

Sodium hydroxide [caustic soda; lye; sodium hydrate; soda lye]
CAS# 1310-73-2
Molecular weight: 39.9
Melting Point: 323°C (M)
Water Solubility: 1,180 g/L (E)
Vapor Pressure: Negligible (E)
1 mm Hg (M) (739°C)
Chemistry of Use: Caustic

NaOH
Structure: NaOH
Boiling Point: 1390°C (M)
Density: 2.13 g/ml (M)
Flash Point: Not applicable
Physical State: Deliquescent orthorhombic white powder

Above data are either measured (M) or estimated (E)

Sodium hydroxide is an important industrial alkali. It readily reacts with atmospheric CO_2 to form Na_2CO_3. It reacts with all the mineral acids to form the corresponding salts. Sodium hydroxide is very soluble in ethanol and soluble in glycerol. It is insoluble in diethyl ether and acetone.

Sodium hydroxide is manufactured either by electrolysis of brine (Castner-Kellner process) or by treatment of Na_2CO_3 or $NaHCO_3$ with CaO or $Ca(OH)_2$. It can also be prepared from sodium metal and water vapor at low temperature.

Market Profile

In 1991, total U.S. production was 25 billion pounds. In 1992, imports were 1,138 million pounds and in exports were 2,536 million pounds. Total U.S. production quantity for use in screen reclamation was estimated to be 1.45 million pounds.

Regulatory Status

See Table II-3 and accompanying summary.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

The environmental fate of sodium hydroxide is that of its aqueous solution; the dominant fate of solid sodium hydroxide release will be its dissolution in water. In aqueous solution, sodium hydroxide will dissociate into sodium cations (Na^+) and the hydroxide anion (OH^-). Sodium ions are naturally present in surface water, groundwater, and rainwater as are hydroxide ions due to the ionization of water. Given that the components of sodium hydroxide are naturally present and participate in the reactions of natural systems, their fate will be determined by both the amount released and the composition of the receiving medium. Depending on the size of the release and the buffering capacity of the receiving medium, which is in a large part determined by the amount of naturally occurring acids such as hydrogen sulfide, humic acids, and those produced from carbon dioxide (the carbonate system), silica, and inorganic phosphates, the resulting pH may either increase or remain constant. In those systems with limited buffering capacity, the increase in basicity with the increase in the hydroxide ion concentration may lead to the formation and precipitation of insoluble transition metal complexes such as iron, aluminum, and manganese hydroxides. In soils with limited buffering capacity or a low organic content, sodium hydroxide may display high mobility. Sodium hydroxide will not volatilize to the atmosphere but it or its aqueous solutions may be released to the atmosphere by mechanical means during its production, use, or transport. If released to the atmosphere, sodium hydroxide will undergo removal by either wet or dry deposition processes. In wastewater treatment plants, sodium hydroxide will undergo reactions similar to those described above with the net result being an increase in the sodium ion concentration of the effluent.

Health Hazard

See Table II-6 and accompanying summary

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Sodium Hypochlorite

Chemical Properties and Information	
Sodium hypochlorite [chloric(I) acid, sodium salt; hypochlorous acid, sodium salt; Clorox, Dazzle, Eau de Labarraque] CAS# 7681-52-9 Molecular weight: 74.4 Melting Point: 18° C (M) crystals decompose Water Solubility: 260 g/l (M) Vapor Pressure: Not applicable Chemistry of Use: Oxidizing agent	NaOCl Structure: NaOCl Boiling Point: Not applicable Density: 1.21 g/ml (M) Flash Point: Not applicable

Above data are either measured (M) or estimated (E)

Sodium hypochlorite is a strong oxidizing agent usually stored and used in solution. There is a fire risk in contact with organic materials. It is highly reactive. The physical state of sodium hypochlorite is a greenish yellow liquid (in solution) with a disagreeable sweetish odor.

Sodium hypochlorite is synthesized by bubbling Cl_2 through aqueous NaOH in the presence of CO_2. It is manufactured by the electrolysis of brine.

Market Profile

In 1990, total U.S. production was 380 million gallons. In 1991, imports and exports were believed to be negligible. Total U.S. production quantity for use in screen reclamation was estimated to be 69,000 gallons.

Regulatory Status

See Table II-3 and accompanying summary

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

The environmental fate of sodium hypochlorite is essentially that of its aqueous solutions; the dominant fate of solid sodium hypochlorite release will be its dissolution in water. If released to soil, sodium hypochlorite is expected to readily oxidize organic matter and is likely to be short-lived. If released to water, sodium hypochlorite is expected to be short-lived although its aquatic fate is partially dependent on the pH of receiving water. Sodium hypochlorite is expected to dissociate to hypochlorous acid which may, in the presence of additional chloride ions under acidic conditions, form chlorine. At pH 7.5, the hypochlorite ion and hyperchlorous acid are at approximately equal concentrations; at pH 8.5, only 10 percent of the added sodium hypochlorite would exist as hypochlorous acid. Hypochlorous acid and, if formed, chlorine may undergo significant volatilization to the atmosphere. Sodium hypochlorite itself is not expected to volatilize from water. Chlorine, hypochlorous acid, as well as sodium hypochlorite are expected to readily oxidize organic compounds. Hypochlorous acid, which is always in equilibrium with the hypochlorite ion, may also oxidize sulfur compounds, nitrate ions, and certain metals such as Fe(II) an Mn(II). Hypochlorous acid may also decompose under the influence of UV light. Reduction is ultimately expected to be the dominant removal process for sodium hypochlorite in water. Sodium hypochlorite will not volatilize to the atmosphere but it or its aqueous solutions may be released to the atmosphere by mechanical means during its production, use, or transport. If released to the atmosphere, sodium hypochlorite is expected to removed by both wet and dry deposition processes. Depending on the composition of other components that may be present in the water droplets, sodium hypochlorite may be transformed by oxidizing organics, certain metals, and some inorganic species (such as nitrate ions) before deposition occurs. In activated sludge wastewater treatment plants, sodium hypochlorite is expected to undergo rapid and complete removal via the reductive pathways discussed above.

Health Hazard

See Table II-6 and accompanying summary

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Sodium Lauryl Sulfate

Chemical Properties and Information	
Sodium lauryl sulfate [sulfuric acid monododecyl ester sodium salt; sodium dodecyl sulfate; SDS; irium] CAS# 151-21-3 Molecular weight: 288.38 Melting Point: Decomposes Water Solubility: 100 g/L (M) Vapor Pressure: Not applicable Log K_{ow}: L7 (E) Henry's Law Constant: Not available Chemistry of Use: Detergent	$C_{12}H_{25}NaO_4S$ Structure: $CH_3(CH_2)_{11}OSO_3^-Na^+$ Boiling Point: Decomposes Density: 1 g/cm^3 (E) Flash Point: Not applicable K_{oc}: 80,000 (E)

Above data are either measured (M) or estimated (E)

Sodium lauryl sulfate has a mild fatty odor. It is an anionic detergent and lowers the surface tension of aqueous solutions. It is soluble in alcohols and ethers.

Sodium lauryl sulfate is synthesized by sulfation of lauryl alcohol, followed by neutralization with sodium carbonate.

Market Profile

No market information was available for this chemical.

Regulatory Status

Sodium lauryl sulfate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, sodium lauryl sulfate is expected to readily biodegrade under aerobic conditions. The first step in the biodegradation pathway is believed to be hydrolysis to the alcohol and inorganic sulfate. Sodium lauryl sulfate is chemically stable in neutral and alkaline solutions, but readily hydrolyses in the presence of acids. Since the sodium bisulfate produced in the hydrolysis is strongly acidic, once hydrolysis starts it is autocatalytic. Although sodium lauryl sulfate is ionic, studies have shown that long chain alkyl sulfates strongly adsorb to soil and that the force dominating this process is the hydrophobic nature of the non-polar tail of the molecule. Volatilization of sodium lauryl sulfate from surface soil will not be significant. If released to water, sodium lauryl sulfate is expected to rapidly biodegrade. It should also adsorb to sediment and particulate matter in the water column. Volatilization of sodium lauryl sulfate from water should be insignificant. Experimental data on similar long-chain alkyl sulfates indicate that bioconcentration in fish and aquatic organisms is not an important process. If released to the atmosphere, sodium lauryl sulfate will be associated with aerosols and be removed by gravitational settling. Using a rapid biodegradation rate in the STP fugacity model results in 100 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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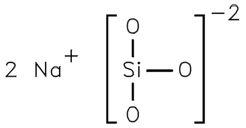
Sodium Metasilicate

Chemical Properties and Information	
Sodium metasilicate [waterglass] CAS# 6834-92-0 Molecular weight: 122.08 Melting Point: 1089°C (decomposes) (M) Water Solubility: Completely soluble in cold water (M) Vapor Pressure: $<10^{-8}$ torr (E) Log K_{ow}: Not applicable Henry's Law Constant: Not applicable Chemistry of Use: Corrosion inhibitor	Na_2O_3Si Structure:  Boiling Point: Not applicable Density: 2.614 g/cm^3 (M) Flash Point: Not available K_{oc}: Not applicable

Above data are either measured (M) or estimated (E)

This chemical is usually obtained as a glass, and sometimes as orthorhombic crystals. It is hydrolyzed in hot water. It is insoluble in organics and alcohols. Sodium metasilicate is prepared from sand (SiO_2) and soda ash (Na_2CO_3) by fusion.

Market Profile

In 1992, total U.S. production was 106 million pounds. In 1992, for all metasilicates, about 3,062 million pounds were imported and 23,058 million pounds were exported. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Sodium metasilicate does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, sodium metasilicate's mobility is likely dependent on both the silicate species present and the type of soil. Highly polymerized forms of sodium metasilicate are not expected to be mobile due to surface complexation with either active sites in soil via ion exchange reactions or adsorption onto insoluble metal oxides. Mono and oligomeric silicates are expected to display increased mobility yet may adsorb strongly onto clay soils due to silicate-metal interactions. Experimental data to assess the degree of adsorption to soil are not available. Sodium metasilicate is not expected to biodegrade nor volatilize to the atmosphere. Alkaline earth silicates are one part of the natural buffer system of environmental waters and if released to water, sodium metasilicate is expected to undergo typical acid/base reactions of silicate buffers which, depending upon the pH of the receiving water, may include proton exchange, polymerization, or depolymerization reactions. Volatilization to the atmosphere, biodegradation, and bioconcentration in fish and aquatic organisms are not expected to occur. The degree in which sodium metasilicate adsorbs to sediment is dependent on the same factors influencing its adsorption to soil. The degree to which sodium metasilicate is removed from wastewater treatment plants is also dependent on the nature of the silicates and the water being treated. Highly polymerized soluble silicates are used in water treatment to precipitate metal oxides and metal ions and these silicates are expected to be efficiently removed from wastewater treatment plants via complexation with metals and adsorption to sludge. Mono and oligomeric sodium metasilicates may not undergo significant removal in wastewater treatment plants. Removal by biodegradation and volatilization of sodium metasilicate from wastewater treatment plants is expected to be negligible.

Health Hazard

See Table II-6 and accompanying summary

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Sodium Periodate

Chemical Properties and Information	
Sodium periodate [sodium metaperiodate; sodium iodate(VII); Iodic(VII) acid, sodium salt; periodic acid, sodium salt] CAS# 7790-28-5 Molecular weight: 213.8 Melting Point: 300° C (M) decomposes Water Solubility: 140 g/l (M) Vapor Pressure: Negligible (E) Chemistry of Use: Oxidizing agent	$NaIO_4$ Structure: $Na^+ IO_4^-$ Boiling Point: Not applicable Density: 3.865 g/ml (M) Flash Point: Not applicable Physical State: Colorless tetragonal crystals

Above data are either measured (M) or estimated (E)

Sodium metaperiodate is a strong oxidizer; contact with combustible or flammable materials can cause fire or explosion. It is soluble in acetic acid. Sodium metaperiodate is synthesized by direct oxidation of $NaIO_3$ using O_2 in the presence of an alkali at 300°C and 34 atm. It is also a product of the thermal decomposition of $NaH_4IO_6 \bullet H_2O$.

Market Profile

The total U.S. production is unknown. Total U.S. quantity for use in screen reclamation was estimated to be 11.7 million pounds.

Regulatory Status

Sodium periodate does not trigger any federal environmental regulations

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

The environmental fate of sodium periodate is that of its aqueous solution; the dominant fate of solid sodium periodate release will be its dissolution in water. If released to soil, sodium periodate is expected to readily oxidize organic matter and will be short-lived. If released to water, oxidation of organic matter is expected to be sufficiently rapid to dominate all other potential fate pathways. If released to the atmosphere, sodium periodate is expected to undergo removal by both wet and dry deposition processes. Depending on the composition of other components that may be present in the water droplets, sodium periodate may be transformed by oxidizing either organic, inorganic, or metallic species present before deposition occurs. In wastewater treatment plants, sodium periodate is expected to undergo complete removal through the oxidation of numerous organic, inorganic, or metallic species present in the wastewater.

Health Hazard

See Table II-6 and accompanying summary

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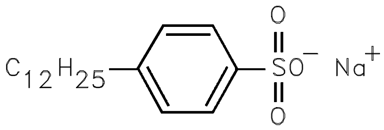
Sodium Salt, Dodecyl Benzene Sulfonic Acid

Chemical Properties and Information	
Sodium salt, dodecyl benzene sulfonic acid [Sodium dodecylbenzenesulfonate; Conoco C-50; Santomerse #1] CAS# 25155-30-0 Molecular weight: 348.49 Melting Point: Not available Water Solubility: Low Solubility (E); dispersible (E) Vapor Pressure: $<10^{-5}$ mm Hg (E) Log K_{ow}: 1.96 (M) Henry's Law Constant: Not available Chemistry of Use: Surfactant	$C_{18}H_{29}NaO_3S$ Structure:  Boiling Point: Not available Density: 0.5 g/cm^3 (E) Flash Point: Not available K_{oc}: 100,000 (M)

Above data are either measured (M) or estimated (E)

This chemical is synthesized by reacting dodecyl benzene sulfonic acid with sodium carbonate.

Market Profile

In 1990, total U.S. production was 224.6 million pounds. Imports and exports of this chemical are unknown. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

See Table II-3 and accompanying summary.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, sodium salt, dodecyl benzene sulfonic acid is expected to biodegrade under aerobic conditions, especially when acclimated organisms are present. Although sodium salt, dodecyl benzene sulfonic acid is ionic, studies have shown that dodecyl benzene sulfonic acid salts strongly adsorb to soil and that the force dominating this process is the hydrophobic nature of the non-polar tail of the molecule. Volatilization of sodium salt, dodecyl benzene sulfonic acid from surface soil will not be significant. If released to water, sodium salt, dodecyl benzene sulfonic acid is expected to biodegrade. It will also adsorb to sediment and particulate matter in the water column. Volatilization of sodium salt, dodecyl benzene sulfonic acid from water should be insignificant. Experimental data indicate that bioconcentration in fish and aquatic organisms is not an important processes. If released to the atmosphere, sodium salt, dodecyl benzene sulfonic acid will be associated with aerosols and be removed by gravitational settling. Using a rapid biodegradation rate for the parent acid in the STP fugacity model results in 97 percent predicted total removal of sodium salt, dodecyl benzene sulfonic acid from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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Solvent Naphtha, Petroleum, Light Aliphatic (VM&P Naptha)

Chemical Properties and Information	
Solvent naphtha, petroleum, light aliphatic [VM&P #66; lacolene; rubber solvent; petroleum ether; naphtha; varnish makers' and painters' solvent; VM&P Naphtha] CAS# 64742-89-8 Molecular weight: 86 for n-hexane; 112 for ethycyclohexane, for example Melting Point: <-80°C (M) Water Solubility: 0.001 g/L (E) Vapor Pressure: 20 mm Hg (E) (25°C) Log K_{ow} = 3.27 - > 6 (E) Henry's Law Constant: 8.0×10^{-3} - 5 atm-m^3/mole (E) Chemistry of Use: Solvent	Molecular Formula: C_nH_{2n+2} (paraffin) and C_nH_{2n} (cycloparaffin) Structure: Typical structures include normal paraffins, $CH_3(CH_2)_nCH_3$, branched paraffins, and cycloparaffins Boiling Point: 35-160°C (M) Density: 0.7 g/ml (E) Flash Point: 0°C (E) K_{oc}: 200 - >5,000 (E) Physical State: Liquid

Above data are either measured (M) or estimated (E)

These commercial products are all light aliphatic solvent naphthas with similar compositions and properties. Most consist of 80 to 90 percent paraffins most of which are straight- or branched-chain alkanes in the range of C_5 through C_{10}. Up to 10 percent is typically aromatics, with only a fraction of this being C_8 and above. They are miscible with petroleum solvents.

Solvent naphthas are prepared by fractionation of straight-run, cracked, and reforming distillates, or by fractionation of crude petroleum or natural gasoline. The naphtha streams are divided into heavy and light, and may be further fractionated. The naphthas are usually treated to remove sulfur, either chemically, with lye or other compounds, or by hydrotreating processes. Aromatic hydrocarbons are also removed by solvent extraction or by destructive hydrogenation.

Market Profile

Based on boiling range and other evidence, it has been assumed that this naphtha fraction corresponds to "special naphthas." The 1990 production volume for this naphtha was 4.2 billion pounds. Data for imported and exported amounts were not available. Total U.S. production quantity for use in screen reclamation was estimated to be 12.6 million pounds.

Regulatory Status

Solvent naphtha (petroleum), light aliphatic, does not trigger any federal environmental regulations

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

Solvent naphtha, light aliphatic is a mixture of components, chiefly C5-C10 alkanes typically with up to 10 percent aromatics. If released to soil, solvent naphtha, light aliphatic is expected to biodegrade at a fast to moderate rate under aerobic conditions. Some components of solvent naphtha, light aliphatic may adsorb very strongly to soil. Solvent naphtha, light aliphatic may rapidly volatilize from both moist and dry soils to the atmosphere although strong adsorption may significantly attenuate the rate of this process. If released to water, solvent naphtha, light aliphatic is expected to biodegrade at a fast to moderate rate under aerobic conditions. Some components may significantly bioconcentrate in fish and aquatic organisms and strongly adsorb to sediment and suspended organic matter. The estimated half-life for volatilization of solvent naphtha, light aliphatic components from a model river is approximately 1 hour while that from a model lake is greater than100 days; the former model does not account for the attenuating affect of strong adsorption. If released to the atmosphere, the dominant atmospheric removal process for solvent naphtha, light aliphatic is expected to be oxidation by hydroxyl radicals with an estimated half-life of 1-3 days. Using representative components that either biodegrade rapidly and display moderate sludge adsorption or are moderately biodegradable and display strong adsorption to sludge, the STP fugacity model indicates that greater than 94 percent total removal from wastewater treatment plants may be achieved.

Health Hazard

See Table II-6 and accompanying summary

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Solvent Naphtha, Petroleum, Light Aromatic

Chemical Properties and Information	
Solvent naphtha, petroleum, light aromatic [Comsolv 100] CAS# 64742-95-6 Molecular weight: 128 for naphthalene Melting Point: -80°C (E) Water Solubility: 0.03 g/L (M) for naphthalene Vapor Pressure: 0.5 mm Hg (E) (25°C) Log K_{ow} = 3.0 - 3.5 (E) Henry's Law Constant: 4.8 x 10^{-4} - 8 x 10^{-3} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_{10}H_8$ for naphthalene Structure: Consist chiefly of aromatic hydrocarbons, including small fused-ring compounds such as naphthalene Boiling Point: 135-210°C (E) Density: 0.87 g/ml (E) Flash Point: 38°C (E) K_{oc}: 500 - 2,000 (E) Physical State: Liquid

Above data are either measured (M) or estimated (E)

The light aromatic solvent naphtha products are a complex combination of hydrocarbons that consists chiefly of C_8 through C_{10} aromatics, but they also may contain up to 30 percent paraffins and cycloparaffins

Solvent naphthas are prepared by fractional distillation of petroleum. Sulfur compounds are most commonly removed or converted to a harmless form by chemical treatment with lye or other agent, or by hydrorefining processes.

Market Profile

No information is available on the production volumes of the numerous specific naphtha fractions, excluding special naphthas. The production volume for all naphthas was 2,100 million pounds in 1991. The vast majority of naphthas are used in the production of gasoline and other petroleum products and not directly as solvents. Data for imported and exported amounts were not available. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Solvent naphtha (petroleum), light aromatic, does not trigger any federal environmental regulations

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

Solvent naphtha, light aromatic is a mixture of components, chiefly C8-C10 aromatics. If released to soil, solvent naphtha, light aromatic is expected to biodegrade at a moderate rate under aerobic conditions. Some components of solvent naphtha, light aromatic may adsorb strongly to soil. Solvent naphtha, light aromatic may rapidly volatilize from both moist and dry soils to the atmosphere although adsorption may significantly attenuate the rate of this process. If released to water, solvent naphtha, light aromatic is expected to biodegrade at a moderate rate under aerobic conditions. Some components may significantly bioconcentrate in fish and aquatic organisms and adsorb to sediment and suspended organic matter. The estimated half-life for volatilization of solvent naphtha, light aromatic components from a model river is approximately 2 hours while that from a model lake is greater than100 days; the former model does not account for the attenuating affect of adsorption. If released to the atmosphere, the dominant atmospheric removal process for solvent naphtha, light aromatic is expected to be oxidation by hydroxyl radicals with an estimated half-life of 0.5-2 days. Using representative components that biodegrade either at a rapid or moderate rate and display moderate sludge adsorption, the STP fugacity model indicates that greater than 92 percent total removal from wastewater treatment plants may be achieved.

Health Hazard

See Table II-6 and accompanying summary

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Solvent Naphtha, Petroleum, Heavy Aromatic (Aromatic 150)

Chemical Properties and Information	
Solvent naphtha, petroleum, heavy aromatic [Aromatic 150; Comsolv 150] CAS# 64742-94-5 Molecular weight: 128 for naphthalene Melting Point: -80°C (E) Water Solubility: 0.03 g/L (M) for naphthalene Vapor Pressure: 0.5 mm Hg (E) (25°C) Log K_{ow} = 3.5 - >5 (E) Henry's Law Constant: 8×10^{-4} - 8×10^{-3} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_{10}H_8$ for naphthalene Structure: Consist chiefly of aromatic hydrocarbons, including small fused-ring compounds such as naphthalene Boiling Point: 150-290°C (E) Density: 0.87 g/ml (E) Flash Point: 38°C (E) K_{oc}: 700 - >5,000 (E) Physical State: Liquid

Above data are either measured (M) or estimated (E)

The heavy aromatic solvent naphtha products consist chiefly of C_8 through C_{16} aromatics, but they also may contain up to 30 percent paraffins and cycloparaffins. It is soluble in petroleum solvents and other organics.

Solvent naphthas are prepared by fractional distillation of petroleum. Sulfur compounds are most commonly removed or converted to a harmless form by chemical treatment with lye or other agent, or by hydrorefining processes.

Market Profile

No information is available on the production volumes of the numerous specific naphtha fractions, excluding special naphthas. The production volume for all naphthas was 2.1 billion pounds in 1991. The vast majority of naphthas are used in the production of gasoline and other petroleum products and not directly as solvents. Data for imported and exported amounts were not available. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Solvent naphtha (petroleum), heavy aromatic does not trigger any federal environmental regulations

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

Solvent naphtha, heavy aromatic is a mixture of components, chiefly C9-C16 aromatic hydrocarbons. If released to soil, solvent naphtha, heavy aromatic is expected to biodegrade at a moderate rate under aerobic conditions. Most components of solvent naphtha, heavy aromatic are expected to adsorb strongly to soil. Solvent naphtha, heavy aromatic may volatilize from both moist and dry soils to the atmosphere although its expected strong adsorption may significantly attenuate the rate of this process. If released to water, solvent naphtha, heavy aromatic is expected to biodegrade at a moderate rate under aerobic conditions. Most components are expected to bioconcentrate in fish and aquatic organisms and strongly adsorb to sediment and suspended organic matter. The estimated half-life for volatilization of solvent naphtha, heavy aromatic components from a model river is approximately 2 hours while that from a model lake is greater than100 days; the former model does not account for the attenuating affect of strong adsorption. If released to the atmosphere, the dominant atmospheric removal process for solvent naphtha, heavy aromatic is expected to be oxidation by hydroxyl radicals with an estimated half-life of 1-2.5 days. Using representative components that biodegrade at a moderate to slow rate and display strong adsorption to sludge, the STP fugacity model indicates that greater than 96 percent total removal from wastewater treatment plants may be achieved.

Health Hazard

See Table II-6 and accompanying summary

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Tall Oil, Special

Chemical Properties and Information

Tall oil, special [fatty acids, C_{18} and C_{18}-unsatd., me esters, methyl stearate, methyl oleate]
CAS# 68937-81-5
Molecular weight: 296-298
Melting Point: 36-39°C (E)
Water Solubility: Insoluble (M) (<0.1 g/L) (E)
Vapor Pressure: $<10^{-3}$ mm Hg (E)
Log K_{ow}: Not available
Henry's Law Constant: Not available
Chemistry of Use: Solvent

$C_{19}H_{36}O_2$ and $C_{19}H_{38}O_2$
Structure: $CH_3(CH_2)_{16}COOCH_3$
and $CH_3(CH_2)_7CH{=}CH(CH_2)_7COOCH_3$
Boiling Point: 325°C (E)
Density: 0.88 g/cm^3 (E)
Flash Point: 200°C (E)
K_{oc}: Not available

Above data are either measured (M) or estimated (E)

This chemical exists as white crystals. It is soluble in alcohol and ether. The methyl oleate portion of this mixture is made by refluxing oleic acid with p-toluene sulfonic acid in methanol.

Market Profile

In 1987, total U.S. production of all tall oil was 1.892 million pounds. Information specific to special tall oil was not available. Imports and exports of this chemical are unknown. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Tall oil (special) does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

The long chain unsaturated acids and rosin acids that are the principal components of special tall oil will adsorb strongly to soil because of their long hydrophobic alkyl chain. They readily biodegrade by β-oxidation. Henry's Law constants estimated for the principal components of special tall oil range from 2×10^{-5} to 7×10^{-6} atm-m^3/mole. If released to soil, special tall oil would initially be expected to adsorb strongly to soil and readily biodegrade. If released in water, special tall oil would be expected to rapidly biodegrade based on results of screening tests on its principal components and tall oil soaps. Initially it would be expected to strongly adsorb to sediment and particulate matter in the water column. Volatilization of special tall oil to the atmosphere may be significant (estimated half-lives of principal components from a model river range from 3 to 12 days). If released to the atmosphere, special tall oil will be associated with aerosols and be removed by gravitational settling. Using a rapid biodegradation rate in the STP fugacity model results in 100 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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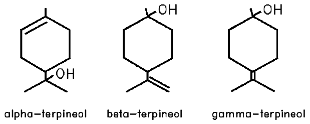
Terpineols

Chemical Properties and Information	
Terpineols [r-Butyrolactone; dihydro-2(3H)-furanone, terpineol 318] CAS# 8000-41-7 Molecular weight: 154 Melting Point: NA Water Solubility: 2 g/L (M) Vapor Pressure: 0.023 mm Hg (M) (20°C) Log K_{ow} = 3.33 - 3.46 (E) Henry's Law Constant: 3×10^{-6} atm-m^3/mole (E) Chemistry of Use: Cleaner/Disinfectant	$C_{10}H_{18}O$ Structure: α-terpineol β-terpineol γ-terpineol (98-55-5) (1380-87-4) (586-81-2)  Boiling Point: 218°C (M) Density: 0.9412 g/ml (M) Flash Point: 75°C (E) K_{oc}: 60 - 1,800 (E) Physical State: Pure α-isomer is white, crystalline powder

Above data are either measured (M) or estimated (E)

The terpineols are 10-carbon alcohols of the structures shown above that are included in a class of oxygenated isoprene derivatives called terpenes or terpenoids. Many of these compounds, including terpineols, occur naturally in essential oils. All pine oils contain α-terpineol as the main oxygenated component. Terpineols are soluble in propylene glycol and are soluble in 1:8 proportion or more in 50 percent alcohol.

Terpineols are the major constituents in pine oils, which may be obtained in three ways: (1) by steam distillation of the extract from aged pine stumps in the southeastern U.S.; (2) by fractionation of crude sulfate turpentine; or (3) synthetically, by the acid-catalyzed hydration of pinene, followed by distillation. High-grade perfumery α-terpineol is made by partial dehydration of terpin hydrate under weakly acidic conditions. It may also be prepared from isoprene and methyl vinyl ketone, using methyl magnesium iodide.

Market Profile

In 1991, total U.S. production for α-terpineols was 2.4 million pounds. In 1989, imports were 0.8 million pounds. Data for exported amounts were not available. Terpineols are important constituents of a number of chemical products, such as pine oils and lime oils; 1991 U.S. synthetic pine oil production, of which terpineol is a chief constituent, totaled 71 million pounds. Thus, although unknown, the total volume of terpineols produced may be significantly higher than the cited volume.

Total U.S. production quantity for use in screen reclamation was estimated to be 1.1 million pounds.

Regulatory Status

Terpineols do not trigger any federal environmental regulations

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to the atmosphere, gas-phase terpineol is expected to degrade by reaction with photochemically produced hydroxyl radicals (estimated half-life of 4 hours). Reaction with ozone molecules may also be an important fate process for terpineol in air. If released to soil, terpineol is expected to exhibit low adsorption potential. One biological treatment study suggests that biodegradation may be fast in soil and water; however, data are limited. In water, hydrolysis, adsorption to sediment, and bioconcentration in aquatic organisms are not expected to be important for terpineol. Volatilization half-lives for α-terpineol of 15 and 110 days have been estimated for a model river (one meter deep) and a model environmental lake, respectively. Using a fast biodegradation rate for terpineol in the STP fugacity model results in 99 percent predicted total removal from wastewater treatment plants; a moderate biodegradation rate results in 92 percent total removal.

Health Hazard

See Table II-6 and accompanying summary

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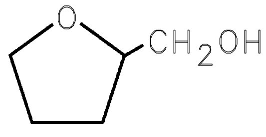
Tetrahydrofurfuryl Alcohol

Chemical Properties and Information	
Tetrahydrofurfuryl alcohol [2-furanmethanol, tetrahydro, aliphatic ether alcohol] CAS# 97-99-4 Molecular weight: 102.13 Melting Point: <-80°C (M) Water Solubility: Miscible with water (M) Vapor Pressure: 0.64 mm Hg (20°C) (E) Log K_{ow}: -0.11 (E) Henry's Law Constant: 4.09X10^{-9} atm-m^3/mole (E) Chemistry of Use: Solvent	$C_5H_{10}O_2$ Structure:  Boiling Point: 178°C (M) Density: 1.0543 g/cm^3 (M) Flash Point: 84°C (open cup) (M) K_{oc}: 0.5 (E)

Above data are either measured (M) or estimated (E)

This chemical is a hygroscopic and is colorless. It is flammable in air. It is miscible with alcohol, ether, acetone, chloroform, benzene. Tetrahydrofurfuryl alcohol is manufactured by catalytic hydrogenation of furfural or furfuryl alcohol.

Market Profile

In 1992, total U.S. production was 14.2 million gallons. In 1992, about 0.1 million gallons were imported and 4.4 million gallons were exported. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

Tetrahydrofurfuryl alcohol does not trigger any federal environmental regulations.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, tetrahydrofurfuryl alcohol will be expected to exhibit very high mobility, based upon its estimated soil adsorption coefficient. Two biodegradation screening studies have found tetrahydrofurfuryl alcohol to be readily biodegradable and biodegradation should be the dominant degradative process in soil. Volatilization of tetrahydrofurfuryl alcohol from moist soil should not be important, however, some volatilization would occur from dry surface soil and other dry surfaces. Biodegradation is expected to be the dominant environmental fate process for tetrahydrofurfuryl alcohol in water. Chemical hydrolysis, volatilization, adsorption to sediment, and bioconcentration are not expected to be environmentally important. In the atmosphere, tetrahydrofurfuryl alcohol is expected to exist almost entirely in the vapor phase. It will degrade in the ambient atmosphere by reaction with photochemically-produced hydroxyl radicals (estimated half-life of 13 hours). Physical removal from air via wet deposition is probable since tetrahydrofurfuryl alcohol is miscible in water. Using a rapid biodegradation rate in the STP fugacity model results in 97 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

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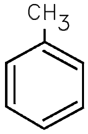
Toluene

Chemical Properties and Information	
Toluene [Methylbenzene, Phenylmethane, Toluol] CAS# 108-88-3 Molecular weight: 92.14 Melting Point: -95.0 to -93°C (M) Water Solubility: 0.5 g/L (M) Vapor Pressure: 55 mm Hg (M) (25°C) Log K_{ow} = 2.73 (M) Henry's Law Constant: 6.64 x 10^{-3} atm-m^3/mole (M) Chemistry of Use: Solvent	C_7H_8 Structure:  Boiling Point: 110.6°C (M) Density: 0.8660_4^{20} g/ml (M) Flash Point: 4°C (M) K_{oc}: 38 - 300 (M) Physical State: Clear, colorless liquid

Above data are either measured (M) or estimated (E)

Chemical derivatives of toluene are formed by substitution of the hydrogen atoms of the methyl group, by substitution of the hydrogen atoms of the ring, and by addition to the double bonds of the ring. Toluene can also undergo a disproportionation reaction in which two molecules react to yeld one molecule of benzene and one of xylene. Toluene has a TLV of 375. It is highly flammable, and reacts violently with oxidants. It is stable under normal laboratory storage conditions. Toluene is miscible in ethanol, chloroform, diethyl ether, acetone, and acetic acid.

Toluene is generally produced along with benzene, xylenes and C_9 aromatics by the catalytic reforming of straight-run naphthas. The resulting crude reformate is extracted, most frequently with sulfolane, to yield a mixture of benzene, toluene, xylenes and C_9 aromatics, which are then separated by fractionation. The catalyst may be Pt-Al_2O_3-based, or bimetallic, containing both platinum and rhenium. Toluene was formerly produced from coke ovens and coal-tar products.

Market Profile

In 1990, total U.S. production was 6 billion gallons. In 1991, imports were 520.8 million gallons and exports were 438.8 million gallons. Total U.S. production quantity for use in screen reclamation was estimated to be 2.67 million gallons.

Regulatory Status

See Table II-3 and accompanying summary

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If toluene is released to soil, it will be lost by evaporation from near-surface soil and is expected to be very mobile. Biodegradation occurs at a moderate to rapid rate in soil and may occur in acclimated groundwater, but at high concentrations, toluene may be toxic to microorganisms. The presence of acclimated microbial populations may allow rapid biodegradation in aerobic soil and water. It will not hydrolyze in soil or water under normal environmental conditions. If toluene is released into water, its concentration will decrease due to evaporation and biodegradation. This removal can be rapid or take several weeks, depending on temperature, mixing conditions, and acclimation of microorganisms. It may adsorb to sediment, but should not bioconcentrate in aquatic organisms. If toluene is released to the atmosphere, it will degrade by reaction with photochemically produced hydroxyl radicals (half-life 3 hr to slightly over 1 day) or be washed out in rain. It will not be subject to direct photolysis. Using a fast biodegradation rate for toluene in the STP fugacity model results in 98 percent predicted total removal from wastewater treatment plants; a moderate biodegradation rate corresponds to 92 percent predicted total removal.

Health Hazard

See Table II-6 and accompanying summary

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1,1,1-Trichloroethane

Basic Chemical Properties	
1,1,1-Trichloroethane [methyl chloroform; solvent 111; TCA; chlorothene] CAS# 71-55-6 Molecular weight: 133.42 Melting Point: -30.4°C (M) Water Solubility: 4.4 g/L (M) Vapor Pressure: 127 mm Hg (M) (25°C) Log K_{ow} = 2.49 (M) Henry's Law Constant: 1.72×10^{-2} atm-m^3/mole (M) Chemistry of Use: Solvent	$C_2H_3Cl_3$ Structure: CCl_3CH_3 Boiling Point: 74.2°C (M) Density: 1.33 g/ml (M) Flash point: Not applicable K_{oc}: 107 (M) Physical State: Liquid with sweetish, chloroform-like odor

Above data are either measured (M) or estimated (E)

Releases of 1,1,1-trichloroethane in water and soil volatilize or leach out. Releases to air can travel long distances. Common routes of exposure are air and drinking water. Soluble in acetone, benzene, methanol and carbon tetrachloride.

1,1,1-Trichloroethane is prepared by action of chlorine on 1,1-dichloroethane, or by catalytic addition of hydrogen chloride to 1,1-dichloroethylene. It can be produced by chlorination of vinyl chloride derived from 1,2-dichloroethane; hydrochlorination of vinylidene chloride derived from 1,2-dichloroethane; or thermal chlorination of ethane.

Market Profile

In 1990, total U.S. production was 500 million gallons. In 1991, imports were 2.41 million gallons and exports were 101.8 million gallons. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

See Table II-3 and accompanying summary

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

If released to soil, 1,1,1-trichloroethane is expected to rapidly volatilize from both moist and dry soil to the atmosphere. Biodegradation may occur slowly in both aerobic and anaerobic soils. It has a high potential to leach into soil. If released to water, volatilization to the atmosphere is expected to be the dominant fate process. Neither bioconcentration in fish and aquatic organisms nor adsorption to sediment and suspended organic matter are expected to be significant. The biodegradation of 1,1,1-trichloroethane in water has been well studied and removal under aerobic conditions has not occurred to any significant extent. Experimental half-lives for the anaerobic degradation of 1,1,1-trichloroethane in water or water/sediment systems range from 1 day to 16 weeks; high concentrations (greater than 1 mg/L) were found to be toxic to microorganisms. 1,1-Dichloroethane has been identified as the primary anaerobic degradation product of 1,1,1-trichloroethane. If released to the atmosphere, 1,1,1-trichloroethane is expected to persist for long periods of time. Half-lives for the gas-phase reaction of 1,1,1-trichloroethane with hydroxyl radicals ranging from 2 to 6 years have been reported. Direct photolytic degradation of 1,1,1-trichloroethane in the troposphere does not occur to any significant extent. It may undergo atmospheric removal by wet deposition processes, although any 1,1,1-trichloroethane removed by this processes is expected to rapidly re-volatilize to the atmosphere. In experimental studies using a model wastewater treatment system, 1,1,1-trichloroethane underwent 99 percent removal due entirely to volatilization and not biodegradation.

Health Hazard

See Table II-6 and accompanying summary

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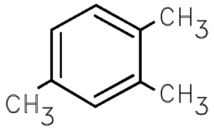
1,2,4-Trimethyl Benzene

Chemical Properties and Information	
1,2,4-Trimethyl benzene [pseudocumene, trimethyl benzene, asymmetrical trimethyl benzene] CAS# 95-63-6 Molecular weight: 120.19 Melting Point: -43.78°C (M) Water Solubility: 0.02 g/l (E) Vapor Pressure: 10.34 torr (at 54.4°C) (M) Log K_{ow}: 3.78 (M) Henry's Law Constant: $6.16X10^{-3}$ atm-m^3/mole (M) Chemistry of Use: Solvent	C_9H_{12} Structure:  Boiling Point: 169 -171°C (M) Density: 0.876 g/cm^3 (M) Flash Point: 54.4°C (M) K_{oc}: 440-2,700 (E)

Above data are either measured (M) or estimated (E)

This chemical occurs naturally in coal tar and in many petroleums. It is soluble in alcohols, benzene, and ether.

1,2,4-Trimethyl benzene is synthesized by extraction from C_9 hydrocarbon reformate by superfractionation.

Market Profile

In 1992, total U.S. production of alkylbenzenes was 1.2 billion pounds. Information specific to 1,2,4-trimethyl benzene was not available. Imports and exports of this chemical are unknown. Total U.S. production quantity for use in screen reclamation is unknown.

Regulatory Status

See Table II-3 and accompanying summary.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

In the atmosphere, gas-phase 1,2,4-trimethyl benzene will degrade by reaction with photochemically produced hydroxyl radicals (estimated half-life of 7 hours). Removal from air via wet deposition may also occur. If released to soil, 1,2,4-trimethyl benzene would have a high adsorption potential and exhibit slight to medium soil mobility. Biodegradation should be important in soil and water; however, this removal process may be hindered by high adsorption. On terrestrial surfaces, volatilization will be an important removal process. In surface waters, volatilization is expected to be the primary transport process with estimated half-lives of 1.2 and 105 hours from a model river (1 meter deep) and a model lake, respectively. Adsorption to sediment will also be important. Hydrolysis and photolysis are not expected to be important fate processes for 1,2,4-trimethylbenzene in water. Bioconcentration in fish may be important. Assuming a fast biodegradation rate for 1,2,4-trimethylbenzene in the STP fugacity model results in greater than99 percent predicted total removal from wastewater treatment plants; a moderate rate corresponds to 97 percent removal.

Health Hazard

See Table II-6 and accompanying summary

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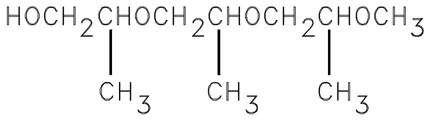
Triprpylene Glycol Methyl Ether

Chemical Properties and Information	
Tripropylene glycol methyl ether [propanol, [2-(2-methoxy-methylethoxy) methylethoxy]-, 2, 2, 2, Methoxypropoxy propoxy propanol] CAS# 25498-49-1 Molecular weight: 206.3 Melting Point: Not available Water Solubility: Completely miscible in water (E) Vapor Pressure: 0.022 torr (at 75°C) (E) 0.002 torr (at 20°C) (E) Log K_{ow}: 0.56 (E) Henry's Law Constant: 2.02×10^{-9}atm-m^3/mole (E) Chemistry of Use: Solvent	$C_{10}H_{22}O_4$ Structure:  $\mathrm{HOCH_2\underset{CH_3}{\underset{\mid}{C}}HOCH_2\underset{CH_3}{\underset{\mid}{C}}HOCH_2\underset{CH_3}{\underset{\mid}{C}}HOCH_3}$ Boiling Point: 242.4°C (at 1 atm) (E) Density: 0.96 g/cm^3 (E) Flash Point: 260°C (open cup) (E) K_{oc}: 48 (E

Above data are either measured (M) or estimated (E)

The chemical properties were estimated by comparing this chemical to tripropylene glycol monoethyl ether (2-Propanol, 1-[2-(2-methoxy-1-methyl ethoxy)-1-methyl ethoxy]-), which has CAS number 20324-33-8. It is miscible with organics.

This chemical is synthesized by the addition of three moles of propylene oxide to methanol.

Market Profile

In 1991, total U.S. production was about 4.3 million gallons. Of this quantity, 1.6 million gallons were exported. Total U.S. production quantity for use in screen reclamation was estimated to be 623,000 gallons.

Regulatory Status

Tripropylene glycol methyl ether does not trigger any federal environmental regulations. However, the generic category of glycol ethers is listed as Hazardous Air Pollutants in the Clean Air Act.

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

Dipropylene glycol isopropyl ether is not expected to undergo hydrolysis or direct photolysis in the environment. In water, volatilization, adsorption to sediments and suspended solids, and bioconcentration in aquatic organisms are not expected to be important transport processes for dipropylene glycol isopropyl ether. Biodegradation is likely to be the most important removal mechanism of dipropylene glycol isopropyl ether from aerobic soil and water based on screening studies of other glycol ether compounds. If released to soil, dipropylene glycol isopropyl ether is expected to display very high mobility. Volatilization from dry soil surfaces will be important. In the atmosphere, dipropylene glycol isopropyl ether is expected to exist almost entirely in the gas-phase and reactions with photochemically produced hydroxyl radicals should be fast (estimated half-life of 2.5 hrs). Using a rapid biodegradation rate for dipropylene glycol isopropyl ether in the STP fugacity model results in 97% predicted removal from wastewater treatment plants; a moderate rate corresponds to 83% predicted removal.

Health Hazard

See Table II-6 and accompanying summary

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Trisodium Phosphate

Basic Chemical Properties	
Trisodium phosphate [phosphoric acid, trisodium salt; sodium phosphate; tribasic sodium phosphate; trisodium orthophosphate; TSP; Oakite] CAS# 7601-54-9 Molecular weight: 163.9 Melting Point: 75°C (M) Water Solubility: 145 g/L (M) Vapor Pressure: Negligible (E) Chemistry of Use: Caustic	$Na_3(PO_4)$ Structure: $Na_3(PO_4)$ Boiling Point: 1583°C (M) Density: 2.5 g/ml (M) Flash point: Not applicable Physical State: Colorless crystals

Above data are either measured (M) or estimated (E)

Trisodium phosphate behaves as a moderately strong alkali; many of its applications are based on this property. Trisodium phosphate commercially contains excess sodium hydroxide. It readily forms a variety of double salts with other sodium compounds. Trisodium phosphate is insoluble in alcohol and carbon disulfide.

Trisodium phosphate is synthesized from solid state reactions such as $Na_4P_2O_7 + Na_2CO_3$ at 800° or $Na_2HPO_4 + Na_2CO_3$ at 600°, which provide the high-temperature form initially. It is also manufactured by mixing soda ash and phosphoric acid in proper proportions to form disodium phosphate and then adding caustic soda.

Market Profile

In 1991, total U.S. production was 46 million pounds. In 1989, imports were 2.8 million pounds and in 1991, exports were 3.6 million pounds. Total U.S. production quantity for use in screen reclamation was unknown.

Regulatory Status

See Table II-3 and accompanying summary

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

Phosphorous is an essential nutrient for all organisms and trisodium phosphate is expected to participate in the biological assimilation and mobilization inherent in the natural phosphorous cycle. If released to soil, trisodium phosphate is expected to be quickly sorbed and converted to less soluble metal salts which will become essentially immobile. The use of phosphate as a soil fertilizer has shown that this fixation processes is appreciable in all but very coarse-textured soils and that only one fourth of the applied phosphate is usable by plants with the rest being lost to the occluded soil fraction. Trisodium phosphate may also be removed from soil during its assimilation as a nutrient in the metabolism of other organic compounds. Trisodium phosphate loss by volatilization to the atmosphere is expected to be negligible. If released to water, trisodium phosphate will dissociate into $H_2PO_4^-$, HPO_4^{-2}, and PO_4^{-3} ions depending on the pH of the receiving medium. In seawater (pH = 8), 87 percent of inorganic phosphate exists as HPO_4^{-2}, 12 percent as PO_4^{-3}, and 1 percent as $H_2PO_4^-$ and these species can complex with metals other than sodium. There are significant bodies of data indicating that inorganic phosphates are responsible for algal blooms; however, uptake by aquatic plants may not remove phosphate from the aquatic system as it is available to microorganisms in decaying alga. Dependent on the medium, insoluble salts of iron, calcium, and aluminum may form resulting in the phosphate being deposited on sediment. If released to the atmosphere, particulate trisodium phosphate is likely to undergo removal by both wet and dry deposition processes. If released to a wastewater treatment plants, essentially complete removal of trisodium phosphate by precipitation is expected when aluminum and iron salts are added.

Health Hazard

See Table II-6 and accompanying summary

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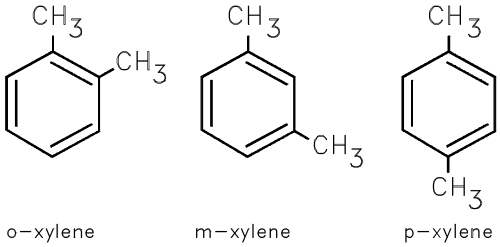
Xylene

Basic Chemical Properties

Xylene [Dimethylbenzene; methyltoluene; xylol]
CAS# 1330-20-7
Molecular weight: 106.2
Vapor Pressure: 10 mm Hg (E) (25°C)
Water Solubility: 0.1 g/L (E)
Melting Point: o: -25°C (M)
m: -48°C (M)
p: 13°C (M)
Log K_{ow} = 3.12 - 3.20 (M)
Henry's Law Constant: 5.18×10^{-3} - 7.53×10^{-3} atm-m^3/mole (M)
Chemistry of Use: Solvent

C_8H_{10}
Structure: o-xylene m-xylene p-xylene



Boiling Point: 137-140°C (M)
Density: 0.864 g/ml (M)
Flash Point: o: 17°C (M)
m: 29°C (M)
p: 27°C (M)
K_{oc}: 25 - 166 (M)
Physical State: Colorless liquid

Above data are either measured (M) or estimated (E)

The commercial product "mixed xylenes" is a technical product generally containing approximately 40 percent m-xylene and 20 percent each of o-xylene, p-xylene, and ethylbenzene, as well as small quantities of toluene. Xylene is produced in large quantities and is an agent of major chemical and occupational significance. Xylene is miscible with absolute alcohol, ether, and many other organic liquids.

Xylene is recovered from petroleum-derived catalytic reformate or pyrrolyis of gasoline. It is recovered from crude light oil, a by product of coke manufacture. It is also synthesized by the disproportionation of toluene.

Market Profile

In 1992, total U.S. production was 5.5 billion gallons. Imports were 305 million gallons and exports were 318.8 million gallons. Total U.S. production quantity for use in screen reclamation was estimated to be 6.88 million gallons.

Regulatory Status

See Table II-3 and accompanying summary

Hazard Summary

Aquatic Toxicity

See Table II-4, Table II-5 and accompanying summary

See Appendix M for the comprehensive methodology for this assessment

Environmental Fate

In the atmosphere, xylenes will degrade by reaction with photochemically produced hydroxyl radicals. Half-lives for this reaction in air are typically 1-16 hours. Photolysis and reaction with ozone will not be important. If released to water or soil surfaces, volatilization to the ambient atmosphere will be the dominant removal process. Hydrolysis and bioconcentration in aquatic organisms will not be important fate processes for xylenes in water. Xylenes may partition from the water column to sediment. In soil, xylenes exhibit moderate adsorption potential. Biodegradation will be important in soil and water where volatilization does not occur. Xylenes are readily degradable in standard aerobic biodegradability tests using a variety of inocula including sewage, activated sludge, and seawater. Under anaerobic conditions, an acclimation period may be required for significant biodegradation. Using a moderate biodegradation rate for xylenes in the STP fugacity model results in 94 percent predicted total removal from wastewater treatment plants.

Health Hazard

See Table II-6 and accompanying summary

Federal Environmental Regulations that Affect Screen Reclamation Chemicals

This section describes the federal environmental regulations that affect the use of screen reclamation chemicals. Discharges of screen reclamation chemicals may be restricted by air, water and solid waste regulations; in addition, facilities may be required to report releases of some reclamation products subject to the federal toxic release inventory program. Table II-3 identifies federal regulations that govern releases of specific screen reclamation chemicals; in addition, emissions or disposal of some chemicals may be regulated under general provisions.

Table II-3
Screen Reclamation Use Cluster Chemicals Which Trigger Federal Environmental Regulations[a]

Chemical	CAS#	CWA Reportable Quantity (lbs)	CWA Priority Pollutant	CAA Hazardous Air Pollutant[b]	CERCLA Reportable Quantity (lbs)	SARA 313 (TRI)	RCRA Hazardous Waste Code
Acetone	67-64-1				5,000	X	U002
Butylacetate	123-86-4	5,000			5,000		
Cyclohexanone	108-94-1				5,000		U057
Dichloromethane	75-09-2		X	X	1,000	X	U080
Ethyl acetate	141-78-6				5,000		U112
Isopropanol	67-63-0					X	
Methanol	67-56-1			X	5,000	X	U154
Methyl ethyl ketone	78-93-3			X	5,000	X	U159 D035[c]
Potassium hydroxide	1310-58-3	1,000			1,000		
Sodium hexametaphosphate	10124-56-8	5,000			5,000		
Sodium hydroxide	1310-73-2	1,000			1,000		
Sodium hypochlorite	7681-52-9	100			100		
Sodium salt, dodecyl benzene sulfonic acid	25155-30-0	1,000			1,000		
1,1,1-Trichloroethane	71-55-6		X	X	1,000	X	U208
Triethanol amine salt, dodecyl benzene sulfonic acid	27323-41-7	1,000			1,000		
1,2,4-Trimethylbenzene	95-63-6					X	
Trisodium phosphate	7601-54-9	5,000			5,000		
Toluene	108-88-3	1,000	X	X	1,000	X	U220
Xylene	1330-20-7	1,000		X	1,000	X	U239

[a] See following pages for a description of each acronym and regulation.

[b] The generic category of glycol ethers are also listed as Hazardous Air Pollutants in the Clean Air Act Amendments.

[c] In addition to being listed as a U waste, methyl ethyl ketone also exhibits a characteristic of toxicity which causes it to be considered hazardous waste.

CWA

The Clean Water Act (CWA) is the basic Federal law governing water pollution control in the United States today.

Part 116 of the Federal Water Pollution Control Act (FWPCA) designates hazardous substances under Section 311(b)(2)(a) of the Clean Water Act, and Part 117 of the FWPCA establishes the *Reportable Quantity* (RQ) for each substance listed in Part 116. When an amount equal to or in excess of the RQ is discharged, the facility must provide notice to the Federal government of the discharge, following Department of Transportation requirements set forth in 33 Code of Federal Regulations (CFR) 153.203. This requirement does not apply to facilities that discharge the substance under an National Permit Discharge Elimination System (NPDES) Permit or a Part 404 Wetlands (dredge and fill) Permit, or to a Publicly Owned Treatment Works (POTW), as long as any applicable effluent limitations or pretreatment standards have been met.

The National Permit Discharge Elimination System permit program contains regulations governing the discharge of pollutants to waters of the United States. The NPDES program requires permits for the discharge of "pollutants" from any "point source" into "navigable waters". The Clean Water Act defines all of these terms broadly, and a source will be required to obtain an NPDES permit if it discharges almost anything directly to surface waters. A source that sends its wastewater to a publicly owned treatment works (POTW) will not be required to obtain an NPDES permit, but may be required to obtain an industrial user permit from the POTW to cover its discharge.

In addition to other permit application requirements, facilities in the industrial category of Printing and Publishing, and/or in Photographic Equipment and Supplies, will need to test for all 126 *priority pollutants* listed in 40 CFR 122 Appendix D. Each applicant also must indicate whether it knows or has reason to believe it discharges any of the other hazardous substances, or non-conventional pollutants located at 40 CFR 122 Appendix D. Quantitative testing is not required for the other hazardous pollutants; however, the applicant must describe why it expects the pollutant to be discharged and provide the results of any quantitative data about its discharge for that pollutant. Quantitative testing is required for the non-conventional pollutants if the applicant expects them to be present in its discharge.

For the purpose of reporting on effluent characteristics in permit applications, there exists a small business exemption (40 CFR 122.21 (g)(8)) for all applicants for NPDES permits with gross total annual sales averaging less than $100,000 per year (in second quarter 1980 dollars). This exempts the small business from submitting quantitative data on certain organic toxic pollutants (see 40 CFR 122.21 Table II, Appendix D). However, the small business must still provide quantitative data for other toxic pollutants (metals and cyanides) and total phenols, as listed in 40 CFR 122.21 Table III, Appendix D. The same regulations apply to the small business concerning the other hazardous pollutants and non-conventional pollutants as for the larger facilities (see previous paragraph).

CAA

The Clean Air Act (CAA), with its 1990 amendments, sets the framework for air pollution control. Part 112 of the Clean Air Act establishes requirements that directly restrict the emission of 189 hazardous air pollutants. The EPA is authorized to establish Maximum

Achievable Control Technology (MACT) standards for source categories that emit at least one of the pollutants on the list. Currently, there is no MACT standard scheduled for proposal in the commercial screen printing industry.

CERCLA

Comprehensive Environmental Response, Compensation and Liability Act (also known as CERCLA, or more commonly as Superfund). CERCLA is the Act that created the Superfund and set up a variety of mechanisms to address risks to public health, welfare, and the environment caused by hazardous substance releases.

Substances deemed hazardous by CERCLA are listed in 40 Code of Federal Regulations (CFR) 302.4. Based on criteria that relate to the possibility of harm associated with the release of each substance, CERCLA assigns a substance-specific reportable quantity (RQ); RQs are either 1, 10, 100, 1000, or 5000 pounds (except for radionuclides). Any person in charge of a facility (or a vessel) must immediately notify the National Response Center as soon as a person has knowledge of a release (within a 24-hour period) of an amount of a hazardous substance that is equal to or greater than its RQ.[1] There are some exceptions to this requirement, including exceptions for certain continuous releases and for Federally permitted releases.

SARA 313

CERCLA was enacted in 1980 and, among other amendments, was amended in 1986 by Title I of the Superfund Amendments and Reauthorization Act (SARA). Under SARA 313, a facility that has more than 10 employees and that manufactures, processes or otherwise uses more than 10,000 or 25,000 pounds per year of any toxic chemical listed in 40 Code of Federal Regulations (CFR) 372.65 must file a toxic chemical release inventory (TRI) reporting form (EPA Form R) covering releases of these toxic chemicals (including those releases specifically allowed by EPA or State permits) with the EPA and a State agency. The threshold for reporting releases is 10,000 or 25,000 pounds, depending on how the chemical is used (40 CFR 372.25). Form R is filed annually, covers all toxic releases for the calendar year, and must be filed on or before the first of July of the following year. Table II-3 lists chemicals used by facilities in screen reclamation that are listed in the Toxic Release Inventory (TRI). Individual facilities may use other chemicals which are listed in the TRI, but are not in Table II-3.

RCRA

One purpose of the Resource Conservation and Recovery Act (RCRA) of 1976 (as amended in 1984) is to set up a cradle-to-grave system for tracking and regulating hazardous waste. The EPA has issued regulations, found in 40 CFR Parts 260-299, which implement the Federal statute. These regulations are Federal requirements. As of March 1994, 46 States have been authorized to implement the RCRA program and may include more stringent requirements in their authorized RCRA programs. In addition, non-RCRA-authorized States (Alaska, Hawaii, Iowa and Wyoming) may have State laws that set out hazardous waste

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[1] The national toll-free number for the National Response Center is (800)-424-8802; in Washington, D.C., call (202)-426-2675.

management requirements. A facility should always check with the State when analyzing which requirements apply to their activities.

Assuming the material is a solid waste, the first evaluation to be made is whether it is also considered a hazardous waste. Part 261 of 40 Code of Federal Regulations (CFR) addresses the identification and listing of hazardous waste. The waste generator has the responsibility for determining whether a waste is hazardous, and what classification, if any, may apply to the waste. The generator must examine the regulations and undertake any tests necessary to determine if the wastes generated are hazardous. Waste generators may also use their own knowledge and familiarity with the waste to determine whether it is hazardous. Generators may be subject to enforcement penalties for improperly determining that a waste is not hazardous.

Wastes can be classified as hazardous either because they are listed by EPA through regulation and appear in the 40 CFR Part 261 or because they exhibit certain characteristics. Listed wastes are specifically named, e.g., discarded commercial toluene, spent non-halogenated solvents. Characteristic wastes are defined as hazardous if they "fail" a characteristic test, such as the RCRA test for ignitability.

There are four separate lists of hazardous wastes in 40 CFR 261. If any of the wastes from a printing facility is on any of these lists, the facility is subject to regulation under RCRA. The listing is often defined by industrial processes, but all wastes are listed because they contain particular chemical constituents (these constituents are listed in Appendix VII to Part 261). Section 261.31 lists wastes from non-specific sources and includes wastes generated by industrial processes that may occur in several different industries; the codes for such wastes always begin with the letter "F." The second category of listed wastes (40 CFR 261.32) includes hazardous wastes from specific sources; these wastes have codes that begin with the letter "K." The remaining lists (40 CFR 261.33) cover commercial chemical products that have been or are intended to be discarded; these have two letter designations, "P" and "U." Waste codes beginning with "P" are considered acutely hazardous, while those beginning with "U" are simply considered hazardous. Listed wastes from chemicals that are commonly used in the screen reclamation are shown in Table II-3. While these exhibits are intended to be as comprehensive as possible, individual facilities may use other chemicals and generate other listed hazardous wastes that are not included in Table II-3. Facilities may wish to consult the lists at 40 CFR 261.31-261.33.[2]

Generator status defines how to dispose of a listed or characteristic waste. The hazardous waste generator is defined as any person, by site, who creates a hazardous waste or makes a waste subject to RCRA Subtitle C. Generators are divided into three categories:

○ Large Quantity Generators -These facilities generate at least 1000 kg (approximately 2200 lbs.) of hazardous waste per month, or greater than 1 kg (2.2 lbs) of acutely hazardous waste[3] per month.

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[2] Lists of the "F, P, K and U" hazardous wastes can also be obtained by calling the EPA RCRA/Superfund/EPCRA Hotline at (800) 424-9346.

[3] The provisions regarding acutely hazardous waste are not likely to affect printers. Acutely hazardous waste includes certain "F" listed wastes that do not apply to printers, and "P" listed wastes, none of which were identified as in use in the commercial screen printing industry. (See 40 CFR 261.31-33 for more information).

○ Small Quantity Generators (SQG) — These facilities generate greater than 100 kg (approx. 220 lbs.) but less than 1000 kg of hazardous waste per month, and up to 1 kg (2.2 lbs) per month of acutely hazardous waste.

○ Conditionally exempt small quantity generators (CESQG) — These facilities generate no more than 100 kg (approx. 220 lbs) per month of hazardous waste and up to 1 kg (2.2 lbs) per month of acutely hazardous waste.

Large and small quantity generators must meet many similar requirements. 40 CFR 262 provides that SQGs may accumulate up to 6000 kg of hazardous waste on-site at any one time for up to 180 days without being regulated as a treatment, storage, or disposal (TSD) facility and thereby having to apply for a TSD permit. The provisions of 40 CFR 262.34 (f) allow SQGs to store waste on-site for 270 days without having to apply for TSD status provided the waste must be transported over 200 miles. Large quantity generators have only a 90-day window to ship wastes off-site without needing a RCRA TSD permit. Keep in mind that most provisions of 40 CFR 264 and 265 (for hazardous waste treatment, storage and disposal facilities) do not apply to generators who send their wastes off-site within the 90- or 180-day window, whichever is applicable.

Hazardous waste generators that do not meet the conditions for conditionally exempt small quantity generators must (among other requirements such as record keeping and reporting):

○ Obtain a generator identification number;

○ Store and ship hazardous waste in suitable containers or tanks (for storage only);

○ Manifest the waste properly;

○ Maintain copies of the manifest, a shipment log covering all hazardous waste shipments, and test records;

○ Comply with applicable land disposal restriction requirements; and

○ Report releases or threats of releases of hazardous waste.

Summary of the Environmental Hazard Assessment for the Screen Reclamation Chemicals

The chemicals in screen reclamation are divided into three groups: (1) discrete organic chemicals, (2) petroleum products, and (3) inorganic chemicals. While the assessment process is the same for all three groups, the methodology used to provide estimates of the aquatic toxicity of the chemicals varies.

Methodology

The Environmental Effects Branch uses a standard assessment process (see Appendix M) for assessing the hazards of chemicals to the aquatic environment. The process has been described and published in several publications, both inside and outside the Agency. A summary of the hazard assessment process and references are in Appendix M. The methodology involves the development of a standard hazard profile for each chemical consisting of three acute toxicity values and three chronic values for aquatic species. The standard hazard profile consists of the following toxicity values:

- ○ Fish acute value (Usually a Fish 96-hour LC_{50} value)
- ○ Aquatic invertebrate acute value (Usually a Daphnid 48-hour LC_{50} value)
- ○ Green Algal Toxicity value (Usually an Algal 96-hour EC_{50} value)
- ○ Fish Chronic value (Usually a Fish 28-day early life stage no effect concentration (NEC).
- ○ Aquatic Invertebrate Chronic value (Usually a Daphnid 21-day NEC.
- ○ Algal Chronic value (Usually a Algal 96 hour NEC value for biomass)

The toxicity values may be obtained from the results of standard toxicity tests reported to the Agency, published in the literature, or estimated using predictive techniques. For this study, discrete organic chemicals were assessed using predictive equations called Structure Activity Relationships (SARs) to estimate the inherent toxicity of these chemicals to aquatic organisms.

The petroleum products such as mineral spirits and solvent naphtha are mixtures and do not lend themselves readily to the standard hazard assessment process using SARs. The chemical constituents and the percentage of each in the mixture varies. The constituents in these products include linear and branched paraffins, cyclic paraffins with the total number of carbons varying between 5 and 16. The toxicity of the petroleum products were determined by estimating the toxicity of each individual constituent and then evaluating the potential hazard of the product.

The estimates of toxicity for the inorganic chemicals was either based on information extracted from a report by the U.S. Atomic Energy Commission (1973) or assessed using actual data and nearest analog information taken from open literature.

Environmental Hazard Ranking

For the purpose of an overall assessment, the listed chemicals can be ranked according to the estimated chronic value. This ranking is based on scoring the chemicals as High, Moderate or Low concern for chronic effects according to the following criteria:

$\leq$ 0.1 mg/L	High
$\geq$ 0.1 to $\leq$ 10 mg/L	Moderate
> 10 mg/L	Low

See Appendix M for the basis and citations supporting these criteria.

The results of this ranking are summarized in Table II-5. The chemicals are ranked from the highest hazard potential to the lowest based on lowest of the three estimated chronic values for each chemical. The petroleum products are rated as high hazard to aquatic organisms and the concern is for chronic effects. Also included in the high hazard category are periodic acid and sodium periodate, both which are strong oxiding agents and highly reactive. The concern for trisodium phosphate is for phosphorus enrichment of receiving waters leading to algal blooms.

This relative ranking of toxicity, provides guidance to the selection and use of chemicals that are less hazardous to aquatic organisms.

A search for toxicity data in the AQUIRE database (AQUatic toxicity Information REtrieval database) has been completed. The search indicates that some data were available for 22 of the chemicals being assessed in the data set. These data were evaluated and the measured toxicity values compared favorably with the predicted values.

Results

The toxicity values for acute and chronic effects to aquatic organisms were estimated using predictive equations based on SARs, except for the inorganic chemicals. The values for inorganic chemicals were obtained from published reports. The results are summarized in Table II-4. The chemicals are listed alphabetically. For each chemical, the estimated toxicity values in mg/L (ppm) for acute and chronic effects of fish, daphnid and algae are given. The last column shows the concern concentration set for the chemical in the water. This value is derived by dividing the lowest of the three chronic values by a factor of 10. If the discharge of a chemical to the aquatic environment results in a concentration equal to or greater than the concern concentration set, then the chemical would be hazardous to aquatic organisms.

To assess the potential hazard of the petroleum products, toxicity values were estimated for the individual components, i.e., C_5 to C_{16} linear and branched paraffins and cyclic paraffins. To estimate the toxicity of a product, the assumption is made that each component is present as an equal percentage in the product and the geometric mean of the range of estimates provides the best estimate of the toxicity. For example, for a C_9 to C_{12} linear paraffin, the estimated chronic values for the Daphnid Chronic are 0.019, 0.008, 0.004 and 0.002 mg/L and the geometric mean is 0.006 mg/L. Based on these procedures the hazard potential of the various products are discussed in the following paragraphs.

Mineral Spirits

Mineral spirits consist of linear and branched paraffins and cyclo paraffins. Based on the information provided, the assessment was based on the estimated toxicity for n-hexane and ethylcyclohexane. The linear form of n-hexane is approximately two times more toxic than cyclic hexane. The lowest chronic value for n-hexane is 0.004 mg/L for fish and the lowest chronic value for ethylcylohexane is 0.09 mg/L for fish.

Naphtha Solvents

The monomers associated with the various naphtha mixtures include linear and branched paraffins, cyclic paraffins and aromatics such as naphthalene. The carbon chain lengths vary from product to product and spans range from 5 to 16.

Inorganics

The toxicity values for the hydroxides of sodium and potassium are based on the inherent toxicity of the compounds at pH 7.0. Sodium hypochlorite is a bleaching agent and the best estimate of toxicity indicates acute toxicity values to fish and daphnids at or below 2 mg/L. Periodic acid and sodium periodate are highly reactive and strong oxidizing agents and as such are expected to be highly toxic at 1 mg/L or less. All estimates on the remaining inorganic chemicals (sodium bisulfate, sodium hexametaphosphate, silica, silica (fumed), and trisodium phosphate) were based on pH 7.0 test conditions. Fumed silica and silica were considered the same and showed no effects at their aqueous water solubility limits.

Table II-4
Estimated Aquatic Toxicity Values
(Values in mg/L)

Chemical	Fish Acute	Daphnid Acute	Algal Acute	Fish Chronic	Daphnid Chronic	Algal Chronic	Concern Conc.[a]
Acetone	>1000	>1000	>1000	490	100	76	7.6
Alcohols, C_8-C_{10}, Ethoxylated	24	24	24	2.4	2.4	2.4	0.24
Alcohols, C_{12}-C_{14}, Ethoxylated	2.2	2.2	2.2	0.22	0.22	0.22	0.020
Benzyl alcohol	56.6	13.5	33.0	8.2	6.07	2.0	0.20
2-Butoxyethanol	>1000	>1000	620	120	33	32	0.32
Butyl Acetate	25	160	1.9	2.5	16	1.4	0.14
Butyrolactone	140	>1000	>1000	14	>100	7.5	0.75
Cyclohexanol†							1.4
Cyclohexanone	950	950	550	100	29	28	2.8
d-Limonene	0.86	1.1	0.76	0.16	0.14	0.27	0.014
Diacetone alcohol	>1000	>1000	>1000	745	154	124	12.4
Dichloromethane	320	320	190	36	12	13	1.2
Diethyl adipate	44	295	3.4	4.4	29.5	2.6	0.26
Diethyl glutarate	78	830	6.0	7.8	83	4.6	0.46
Diethylene glycol	>1000	>1000	>1000	>1000	>1000	656	70.0
Diethylene glycol monobutyl ether	>1000	>1000	760	140	41	40	4.0
Diethylene gylcol butyl ether acetate	41	263	3.2	4.1	26.3	3.1	0.31
Diisopropyl adipate	24	94	1.9	2.4	9.4	1.5	0.15
Dimethyl adipate	140	>1000	11	14	>100	8.4	0.84

[a] Concern concentration is derived by dividing the lowest chronic value (in mg/L) by 10.

† Data will be inserted in the final version.

Table II-4 (cont.)
Estimated Aquatic Toxicity Values
(Values in mg/L)

Chemical	Fish Acute	Daphnid Acute	Algal Acute	Fish Chronic	Daphnid Chronic	Algal Chronic	Concern Conc.[a]
Dimethyl glutarate	246	>1000	18.3	25.0	650	13.6	1.0
Dimethyl succinate	165	>1000	12.4	17.0	530	9.2	1.0
Dipropylene glycol methyl ether	>1000	>1000	>1000	184	149	877	14.9
Dipropylene glycol methyl ether acetate	674	>1000	49	67.4	>100	36	3.6
Dodecyl benzene sulfonic acid	2.6	2.6	0.5	0.4	0.4	0.13	0.01
Ethyl acetate	64	>1000	4.8	6.4	>100	3.6	0.36
Ethyl lactate	143	>1000	11	14.3	>100	8	0.8
Ethyl oleate	N.E.S.	N.E.S.[b]	N.E.S.	N.E.S.	N.E.S.	N.E.S.	N.E.S.
Ethoxylated castor oil	0.07	0.10	0.08	0.02	0.03	0.07	0.002
Ethoxylated nonylphenol (np 4-9.5)	2.0	2.0	2.0	0.2	0.2	0.5	0.02
Ethoxypropanol	>1000	>1000	>1000	>1000	311	227	20.0
Ethoxypropyl acetate	80.0	>1000	6.1	8.0	102	4.5	0.5
Furfuryl alcohol	>1000	>1000	>100	147	31.6	25.9	3.0
Isobutyl isobutyrate	12.7	45.6	1.03	1.3	4.6	0.8	0.08
Isobutyl oleate	N.E.S.	N.E.S.[b]	N.E.S.	N.E.S.	N.E.S.	N.E.S.	N.E.S.

[a] Concern concentration is derived by dividing the lowest chronic value (in mg/L) by 10.

[b] N.E.S. - No Adverse Effects expected in a saturated solution during the specified exposure period.

[c] Estimated toxicity at pH 7.0.

[d] Toxicity of Power Plant Chemicals to Aquatic Life. WASH-1249, United States Atomic Energy Commission, June 1973. (Environmental Effects Files)

† Data will be inserted in the final version.

Table II-4 (cont.)
Estimated Aquatic Toxicity Values
(Values in mg/L)

Chemical	Fish Acute	Daphnid Acute	Algal Acute	Fish Chronic	Daphnid Chronic	Algal Chronic	Concern Conc.[a]
Isopropanol	>1000	.1000	>1000	285	62	51	5.1
Methanol	>1000	>1000	>1000	777	128	90.0	9.0
Methoxypropanol acetate	305	>1000	22.4	30.5	>1000	16.6	2.0
1-Methyl-4-(1-methyl-ethenyl) cyclohexane (limonene)	0.86	1.1	0.76	0.16	0.14	0.27	0.014
Methyl ethyl ketone	>1000	>1000	>1000	224	53	45	4.5
Methyl lactate	243	>1000	18	24.3	>100	13	1.3
Mineral spirits (straight run naptha) C_{10} Linear	N.E.S.	N.E.S.	0.02	0.004	0.008	0.021	0.001
Mineral spirits (light hydrotreated) C_{10} Linear	N.E.S.	N.E.S.	0.02	0.004	0.008	0.008	0.001
N-methylpyrrolidone	>1000	>1000	>1000	>1000	373	265	26.5
2-Octadecanamine, N,N-dimethyl N-oxide†							0.002
Periodic Acid	≤1	≤1	≤1	<0.1	≤0.1	≤0.1	≤0.01
Phosphoric Acid, mixed ester, with isopropanol and ethoxylated tridecanol†							0.018
Potassium hydroxide[c,d]	>1000	>1000	>1000	>100	>100	>100	>10

[a] Concern concentration is derived by dividing the lowest chronic value (in mg/L) by 10.

[b] Estimated toxicity at pH 7.0.

[c] Toxicity of Power Plant Chemicals to Aquatic Life. WASH-1249, United States Atomic Energy Commission, June 1973. (Environmental Effects Files)

† Data will be inserted in the final version.

Table II-4 (cont.)
Estimated Aquatic Toxicity Values
(Values in mg/L)

Chemical	Fish Acute	Daphnid Acute	Algal Acute	Fish Chronic	Daphnid Chronic	Algal Chronic	Concern Conc.[a]
Propylene carbonate	177	>1000	13	17.7	>100	10	1.0
Propylene glycol	>1000	>1000	>1000	>1000	495	329	30.0
Propylene glycol methyl ether	>1000	>1000	>1000	>1000	210	158	15.8
Propylene glycol methyl ether acetate	304	>1000	22	30.4	>100	17	1.7
Silica	NES	NES	NES	NES	NES	NES	NES
Silica, fumed	NES	NES	NES	NES	NES	NES	NES
Sodium bisulfate	>100	>100	>100	10.0	10.0	10.0	1.0
Sodium hexameta-phosphate	>100	>100	<1.0	0.1	>10.0	0.06	0.006
Sodium hydroxide[b,c]	>1000	>1000	>1000	>100	>100	>100	>10
Sodium hypochlorite[b,c]	<1.7	<2.0	<2.0	<0.17	<0.2	<0.2	<0.02
Sodium lauryl sulfate	2.6	2.6	0.5	0.4	0.4	0.13	0.01
Sodium metasilicate†							[d]
Sodium periodate	≤1	≤1	≤1	≤0.1	≤0.1	≤0.1	≤0.01
Sodium salt, dodecyl benzene sulfonic acid	2.6	2.6	0.5	0.4	0.4	0.13	0.01
Solvent Naphtha light aliphatic C_5 - C_{10}	0.64	0.86	0.23	0.05	0.05	0.11	0.005

[a] Concern concentration is derived by dividing the lowest chronic value (in mg/L) by 10.

[b] Estimated toxicity at pH 7.0.

[c] Toxicity of Power Plant Chemicals to Aquatic Life. WASH-1249, United States Atomic Energy Commission, June 1973. (Environmental Effects Files)

[d] No adverse effects expected in a saturated solution during prescribed test duration.

† Data will be inserted in the final version.

Table II-4 (cont.)
Estimated Aquatic Toxicity Values
(Values in mg/L)

Chemical	Fish Acute	Daphnid Acute	Algal Acute	Fish Chronic	Daphnid Chronic	Algal Chronic	Concern Conc.[a]
Solvent Naphtha light aromatic C_8 - C_{10}	5.6	6.7	4.5	0.9	0.6	1.0	
Solvent Naphtha heavy aromatic C_8 - C_{16}	5.6	6.7	4.5	0.9	0.6	1.0	0.06
Tall oil, special†							[d]
Terpineols (Mixed Isomers)	28	31	20	4.0	2.1	3.0	0.21
Tetrahydrofurfuryl alcohol	>1000	>1000	>1000	268	64.6	56.7	6.0
Toluene	14	16	10	2.0	1.1	1.6	0.11
1,1,1-Trichloroethane	34	38	24	4.8	2.4	3.2	0.24
1,2,4-trimethylbenzene†							0.015
Trisodium phosphate[b]	>100	>100	<1	.10	>10	0.06	0.006
Xylenes, (mixed isomers)	3.5	4.1	2.8	0.57	0.40	0.64	0.04

[a] Concern concentration is derived by dividing the lowest chronic value (in mg/L) by 10.

[b] Estimated toxicity at pH 7.0.

[c] Toxicity of Power Plant Chemicals to Aquatic Life. WASH-1249, United States Atomic Energy Commission, June 1973. (Environmental Effects Files)

† Data will be inserted in the final version.

Table II-5
Ecological Hazard Ranking of Screen Reclamation Chemicals Based on the Estimated Chronic Values

Chemical	Lowest Value (mg/L)	Chronic Eco Hazard Rank
Solvent naphtha (light aliphatic)	0.004	H
Mineral spirits (light hydrotreated)	0.004	H
Mineral spirits (straight run)	0.004	H
Trisodium phosphate	0.06	H
2-Octadecanamine, N,N-dimethly N-oxide	0.02	H
Alcohols, ethoxylated C_{12}-C_{14}	0.1	H
Periodic acid	0.10	H
Sodium periodate	0.10	H
Phosphoric Acid, mixed ester, with isopropanol and ethoxylated tridecanol	0.18	H
1-methyl-4-(1-methylethenyl) cyclohexane (limonene)	0.14	M
1,2,4-trimethylbenzene	0.15	M
Sodium hypochlorite	0.17	M
Xylenes	0.40	M
Solvent naphtha (light aromatic)	0.60	M
Solvent naphtha (heavy aromatic)	0.60	M
Toluene	1.1	M
Butyl acetate	1.4	M
Diisopropyl adipate	1.5	M
Terpineols	2.1	M
1,1,1-trichloroethane	2.4	M
Alcohols, ethoxylated, C_8-C_{10}	2.5	M
Diethyl adipate	2.6	M
Diethylene glycol butyl ether acetate	3.1	M
Ethyl acetate	3.6	M
Diethyl glutarate	4.6	M
Butyrolactone	7.5	M
Ethyl lactate	8.0	M
Dimethyl adipate	8.4	M
Propylene carbonate	10	M
Dichloromethane	12	L

Table II-5
Ecological Hazard Ranking of Screen Reclamation Chemicals Based on the Estimated Chronic Values

Chemical	Lowest Value (mg/L)	Chronic Eco Hazard Rank
Methyl lactate	13	L
Cyclohexanone	28	
Cyclohexanol	14	L
Propylene glycol methyl ether acetate	17	L
2-Butoxyethanol	32	L
Dipropylene glycol methyl ether acetate	36	L
Diethylene glycol monobutyl ether	40	L
Methyl ethyl ketone	45	L
Isopropanol	51	L
Acetone	76	L
Sodium hydroxide	100	L
Potassium hydroxide	100	L
Tripropylene glycol methyl ether	120	L
Diacetone alcohol	124	L
Dipropylene glycol methyl ether	149	L
Propylene glycol methyl ether acetate	158	L
N-methylpyrrolidone	265	L
Isobutyl oleate	[a]	L
Ethyl oleate	[a]	L
Sodium metasilicate	[a]	L
Tall oil, special	[a]	L

[a] No adverse effects expected in a saturated solution during prescribed test duration.

Summary of Human Hazard Information for Screen Reclamation Chemicals

Table II-6 summarizes toxicity information obtained, to date, on the chemicals used in screen reclamation. Initial literature searches were limited to secondary sources such as EPA's Integrated Risk Information System (IRIS) and the National Library of Medicine's Hazardous Substances Data Bank.

Explanation of Table II-6

The "TOX ENDPOINT" column lists adverse toxicological effects that have been reported in the literature. This is simply a qualitative listing of reported effects and does not imply anything about the severity of the effects nor the doses at which the effects occur. Furthermore, an entry in this column does not necessarily imply that EPA has reviewed the reported studies or that EPA concurs with the authors' conclusions. Toxicological effects are abbreviated as follows:

- car = carcinogenicity
- dev = developmental toxicity, i.e. adverse effects on the developing embryo, fetus, or newborn
- repro = reproductive toxicity, i.e. adverse effects on the ability of either males or females to reproduce
- gene = genetic toxicity, such as point mutations or chromosomal aberrations
- neur = adverse neurological effects; includes a wide range of effects from serious neuropathology to transient CNS depression commonly seen with high exposures to solvents
- chron = chronic effects not otherwise listed; commonly includes target organ toxicity such as liver and kidney effects.

"RfD/RfC" is the EPA Reference Dose or Reference Concentration. The RfD is an estimate of a daily exposure to the human population that is likely to be without an appreciable risk of deleterious noncancer effects during a lifetime. The RfD is usually expressed as an oral dose in mg/kg/day. The RfC is an analogous value for continuous inhalation exposure, usually expressed in mg/m^3.

"NOAEL/LOAEL" is the no-observed-adverse-effect level or the lowest-observed-adverse-effect level, respectively. The NOAEL is an exposure level at which there are no statistically or biologically significant increases in the frequency or severity of adverse effects in the exposed population. The LOAEL is the lowest exposure level at which adverse effects have been shown to occur.

"SLOPE/UNIT RISK" is a measure of cancer potency derived from the dose-response curve from a carcinogenicity study (usually an animal study). The slope factor is expressed as risk per mg/kg-daily dose. Unit risk is a similar measure for air or water exposure levels and is expressed as risk per ug/m^3 in air or as risk per ug/l in water.

"WOE" refers to the EPA weight-of-evidence classification for carcinogens. The WOE categories are as follows:

- Group A -- human carcinogen
- Group B -- probable human carcinogen. B1 indicates limited human evidence; B2 indicates sufficient evidence in animals and inadequate or no evidence in humans.
- Group C -- possible human carcinogen

- Group D -- not classifiable as to human carcinogenicity
- Group E -- evidence of noncarcinogenicity for humans

Table II-6
Human Health Hazard Effects

Chemical Name	Cas No.	Tox Endpoint	RfD/RfC	NOAEL/ LOAEL	Slope/ Unit Risk	WOE	Comment
Acetone	67-64-1	neur, chron	~0.1 mg/kg/day (kidney)			D	
Alcohols, ethoxylated C8-C10	71060-57-6						no data found
Alcohols, ethoxylated C12-C14	68439-50-9						
Benzyl alcohol	100-51-6	dev, neur, chron	0.3 mg/kg/day (forestom. hyperplasia)				not carc in NTP study;not mutag. in several tests
2-Butoxyethanol	111-76-2	dev, chron	RfC in review				NTP carcinogenicity study in review
Butyl acetate	123-86-4	dev, neur, chron					
Butyrolactone	96-48-0	dev*, repro, neur, chron					
Cyclohexanol	108-93-0	dev, repro, neur, chron					
Cyclohexanone	108-94-1	gene,dev,repro,neur,chron	5 mg/kg/day (decreased wt gain)	1000 ppm-N,650 ppm-N			1000 ppm NOAEL for repro tox, 650 ppm NOAEL for dev tox
Diacetone alcohol	123-42-2	neur, chron					

Table II-6 (cont.)
Human Health Hazard Effects

Chemical Name	Cas No.	Tox Endpoint	RfD/RfC	NOAEL/ LOAEL	Slope/ Unit Risk	WOE	Comment
Dichloromethane	75-09-2	car, gene, dev, neur, chron	0.06 mg/kg/day (liver)		4.7E-7/ug/ m3	B2	RfC in review
Diethyl adipate	141-28-6	gene, dev					
Diethyl glutarate	818-38-2						
Diethylene glycol	111-46-6	dev, neur, chron					negative in Salmonella mutagenicity test
Diethylene glycol monobutyl ether	112-34-5	dev, chron		51 mg/kg/day-L, 2000 mg/kg/day-N			LOAEL for chronic, dermal NOAEL for dev tox
Diethylene glycol butyl ether acetate	124-17-4	dev, chron					RfC in review, sec. 4 data
Diisopropyl adipate	6938-94-9						
Dimethyl adipate	627-93-0	dev, chron					chron, repro(- result) studies on mixture of dibasic esters
Dimethyl glutarate	1119-40-0	chron					chron, dev(- result), repro(-) studies on mixture of dibasic esters

Table II-6 (cont.)
Human Health Hazard Effects

Chemical Name	Cas No.	Tox Endpoint	RfD/RfC	NOAEL/ LOAEL	Slope/ Unit Risk	WOE	Comment
Dimethyl succinate	106-65-0	chron					chron, dev(- result), repro(-) studies on mixture of dibasic esters
Dipropylene glycol methyl ether	34590-94-8	neur, chron					health effects at high concentrations
Dipropylene glycol methyl ether acetate	88917-22-0						
Dodecyl benzene sulfonic acid, TEA salt	27323-41-7						only acute toxicity data found
Ethoxylated castor oil	61791-12-6						very little data
Ethoxylated nonylphenol	9016-45-9						
Ethoxypropanol	52125-53-8	dev, chron	0.7 mg/kg/day				dev tox at high doses
Ethoxypropyl acetate	54839-24-6						
Ethyl acetate	141-78-6	neur, chron					health effects at high dose
Ethyl lactate	97-64-3	neur*					
Ethyl oleate	111-62-6						
Ethylene glycol propyl ether	2807-30-9	dev, chron					
Furfuryl alcohol	98-00-0	neur					NIOSH 40 mg/m3 TWA; 60 mg/m3 STEL (skin); NTP carc in progress

Table II-6 (cont.)
Human Health Hazard Effects

Chemical Name	Cas No.	Tox Endpoint	RfD/RfC	NOAEL/ LOAEL	Slope/ Unit Risk	WOE	Comment
Isobutyl isobutyrate	97-85-8						no effects in subchronic rat study up to 1000 mg/kg/day
Isobutyl oleate	10024-47-2						
Isopropanol	67-63-0	dev, neur, chron					limited chronic data
d-Limonene	5989-27-5	dev, chron		150 mg/kg/day LOAEL			LOAEL on kidney effect
Methanol	67-56-1	gene, dev, neur, chron	0.5 mg/kg/day (liver)				in review at NTP
Methyl ethyl ketone	78-93-3	dev, neur, chron	0.6 mg/kg/day, 1.0mg/m3			D	RfD/RfC on developmental toxicity
Methyl lactate	547-64-8						
Mineral spirits (straight run naphtha)	64741-41-9						
Mineral spirits (light hydrotreated)	64742-47-8						
N-methylpyrrolidone	872-50-4	dev, repro, chron		175 mg/kg/day NOAEL			NOAEL on developmental toxicity
2-Octadecanamine, N,N-dimethyl, N-oxide	71662-60-7						

Table II-6 (cont.)
Human Health Hazard Effects

Chemical Name	Cas No.	Tox Endpoint	RfD/RfC	NOAEL/ LOAEL	Slope/ Unit Risk	WOE	Comment
Periodic acid	13444-71-8						oxidizer
Phosphoric acid, mixed ester w/isopropanol and ethoxilated tridecanol	68186-42-5						
Potassium hydroxide	1310-58-3	corrosive					
Propylene carbonate	108-32-7						CTFA assess; tech grade may contain propylene oxide, a carcinogen
Propylene glycol	57-55-6	chron	20 mg/kg/day				negative Genetox for SCE and cell transformation
Propylene glycol methyl ether	107-98-2	dev, neur	RfD 0.7 mg/kg/day, RfC 2.0 mg/m3	3000 ppm-L			LOAEL on dev, RfC on neur, RfD on liver, kidney
Propylene glycol methyl ether acetate	108-65-6						
Silica	7631-86-9	carc, chron					crystalline silica is IARC 2A carcinogen
Silica, fumed	112945-52-5						
Sodium bisulfate	10034-88-5	corrosive					

Table II-6 (cont.)
Human Health Hazard Effects

Chemical Name	Cas No.	Tox Endpoint	RfD/RfC	NOAEL/ LOAEL	Slope/ Unit Risk	WOE	Comment
Sodium hexametaphosphate	10124-56-8	chron					not mutagenic in Salmonella or S. cerevisiae; chron effects at high doses
Sodium hydroxide	1310-73-2	corrosive					
Sodium hypochlorite	7681-52-9	gene, dev, chron					oxidizer
Sodium lauryl sulfate	151-21-3	dev, chron		300 mg/kg/day, 400 mg/kg/day-N			NOAELS are 300 mg/kg/day dev't tox and 400 mg/kg/day chronic tox
Sodium metasilicate	6834-92-0	dev, corrosive					
Sodium periodate	7790-28-5						oxidizer
Naphtha, light aliphatic	64742-89-8						
Naphtha, light aromatic	64742-95-6	dev					developmental toxicity data on C9 fraction
Sodium salt, dodecyl benzenesulfonic acid	25155-30-0						
Solvent naphtha, heavy aromatic	64742-94-5						
Tall oil, special	68937-81-5						