METRIC

MIL-STD-1220B
23 September 1991
SUPERSEDING
MIL-STD-1220A
8 February 1975

MILITARY STANDARD

ALCOHOLS AND AMINES, TECHNICAL GRADE

AMSC N/A

FSC 6810

FOREWORD

1. This military standard is approved for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, U.S. Army Chemical Research, Development and Engineering Center, ATTN: SMCCR-PET-S, Aberdeen Proving Ground, MD 21010-5423, by using the self-addressed Standardization Document Improvement Proposal (DD1426) appearing at the end of this document or by letter.

3. This is the book format standard generated on esters and metal organics, technical grade. It is intended to provide design data relating to esters and metal organics, including safety, storage and disposal information useful to the Department of Defense. This is not a procurement document. This document is not intended to restrict any service in selecting new items required to support state-of-the-art changes.

4. The Revision B of this standard has added new safety, storage and disposal guidance for all materials, a Section 6 and an index and the following added compounds: n-Amyl Alcohol, p-tert-Butylphenol, Disodium, Trisodium and Tetrasodium Salts of Ethylenediaminetetraacetic Acid, Ethylene Glycol Monoethyl Ether Acetate, Hexylene Glycol, Isobutyl Alcohol, Isopropyl Alcohol, p-Nitrosodiphenylamine, Phenol, n-Phenylmorpholine, 1-,2-Propanediol, Quinonedioxime, Resorcinol and Tetraethylene Pentamine.

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1. SCOPE

1.1 Coverage. This standard is a presentation of nomenclature, formulas, physical and chemical properties, specification requirements, military and typical commercial uses, safety information, storage information and disposal information for aldehydes and ketones, technical grade. This standard does not include all of the items represented by the title or all those items which are commercially available. It does contain items preferred for use in the selection of aldehydes and ketones, technical grade, for application by the Department of Defense.

1.2 Application. Alcohols and amines, technical grade, are mainly used as chemical intermediate for making a variety of other organic chemical products, as solvents in coating and ink formulations, in explosive formulations, corrosion inhibitors, rubber compounding, absorbers of gases (carbon dioxide, sulfur dioxide, oxygen and the like) chelating agents, textile lubricants, anti-icing additives and in the production of propellants, dyes, rubber accelerators and photographic products.

1.3 Classification. The items in this standard are classified on the basis of chemical composition as alcohols and amines.

2. REFERENCED DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

O-C-940	Cyclohexylamine, Technical
O-D-1271	Diethylenetriamine, Technical
O-E-780	Ethylene Glycol Monomethyl Ether
O-G-491	Glycerol, Technical (High Gravity)
O-M-232	Methanol (Methyl Alcohol)
O-M-575	Morpholine, Technical
TT-I-735	Isopropyl Alcohol
TT-E-781	Ethylene Glycol Monoethyl Ether, Technical
PPP-C-2020	Chemicals, Liquid, Dry and Paste; Packaging of

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MIL-D-98	Diphenylamine, Technical
MIL-E-199	Ether, Diethyl, Technical
MIL-H-502	Hexamethylenetetramine, Technical
MIL-E-7125	Ethylene Glycol Monoethyl Ether Acetate, Technical
MIL-E-9500	Ethylene Glycol, Technical
MIL-A-10450	Aniline, Technical (Metric)
MIL-T-12014	Tributylamine, Normal (Metric)
MIL-D-20305	Dimethylaniline
MIL-R-22578	Resorcinol
MIL-D-23296	Diethylene Glycol
MIL-M-23573	Monoethanolamine Chelating Agent Solution
MIL-T-24494	Tetra-, Tri-, and Disodium Salts of Ethylenediaminetetraacetic Acid (EDTA) Water Treatment Chemicals, Boiler, Shipboard Use
MIL-N-47061	n-Phenylmorpholine
MIL-T-47064	Tetraethylenepentamine
MIL-E-50011	Ethanolamines (Monoethanolamine, Diethanolamine and Triethanolamine), Technical
MIL-Q-51093	Quinonedioxime, Commercial Grade
MIL-R-60864	Resorcinol
MIL-G-81239	Glycerol Monooleate
DOD-P-82670	Propanediol, 1-,2- (Metric)
MIL-P-83800	1-,2-Propanediol (Metric)

STANDARDS

FEDERAL

FED-STD-313	Material Safety Data Sheets, Preparation and the Submission of

MILITARY

MIL-STD-12	Abbreviations for Use on Drawings, Specifications, Standards and in Technical Documents

(Unless otherwise indicated, copies of federal and military specifications, standards and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this standard to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

PUBLIC LAW (PL)

94-580	Resource Conservation and Recovery Act

CODE OF FEDERAL REGULATIONS (CFR)

Title 29	Department of Labor, Occupational Safety and Health Administration
Title 40	Protection of the Environment; Environmental Protection Agency
Title 49	Department of Transportation; Hazardous Materials Regulations

DEPARTMENT OF DEFENSE (DOD)

DODISS	Department of Defense Index of Specifications and Standards
DOD 4145.19-R-1	Storage and Materials Handling
DOD 4160.21-M	Defense Utilization and Disposal Manual
DOD 6050.5	DOD Hazardous Materials Information System, Hazardous Item Listing
TB MED 506	Occupational and Environmental Health Occupational Vision
TM 38-250	Packaging, Materials Handling - Preparation of Hazardous Materials for Military Air Shipment

GOVERNMENT PRINTING OFFICE (GPO)

Style Manual

(Application for copies should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

Registry of Toxic Effects of Chemical Substances
Recommendation for Environmental Exposure Limits

(Application for copies should be addressed to NIOSH, 4676 Columbia Parkway, Cincinnati, OH 46226-1998.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation.

AMERICAN CONFERENCE OF GOVERNMENT INDUSTRIAL HYGIENISTS (ACGIH)

TLVs® Threshold Limit Values for Chemical Substances in the Work Environment Adopted by American Conference of Government Industrial Hygienists (ACGIH) with Intended Changes.

(Application for copies should be addressed to American Conference of Governmental Industrial Hygienists, 6500 Glenway Avenue, Bldg D-7, Cincinnati, OH 45211.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

Z87.1 Occupational and Educational Eye and Face Protection

(Application for copies should be addressed to American National Standards Institute, 1430 Broadway, New York, New York 10018.)

AMERICAN SOCIETY FOR TESTING AND MATERIAL (ASTM)

D 304	Standard Specification for n-Butyl Alcohol
D 319	Standard Specification for Amyl Alcohol (Synthetic)
D 330	Standard Specification for 2-Butoxyethanol
D 331	Standard Specification for 2-Ethoxyethanol
D 770	Standard Specification for Isopropyl Alcohol
D 1007	Standard Specification for sec-Butyl Alcohol
D 1152	Standard Specification for Methyl Alcohol
D 1257	Standard Specification for High Gravity Glycerin
D 1719	Standard Specification for Isobutyl Alcohol
D 2439	Standard Specification for Refined Phenol-405
D 2636	Standard Specification for Hexylene Glycol
D 2691	Standard Specification for Diethylene Glycol
D 2693	Standard Specification for Ethylene Glycol
D 2695	Standard Specification for Propylene Glycol
D 2696	Standard Specification for Dipropylene Glycol
D 2871	Standard Specification for p-tert-Butylphenol 98
D 3128	Standard Specification for 2-Methoxyethanol
D 3622	Standard Specification for n-Propyl Alcohol (1-Propanol)
E 380	Metric Practice

(Application for copies should be addressed to American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

National Fire Codes

(Application for copies should be addressed to National Fire Protection Association, Battery March Park, Quincy, MA 02269.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS

Abbreviations: (Abbreviations conform to the GPO Style Manual and as shown hereinafter.)

n_D^{20} - Refractive index at 20°C. The superscript indicates the temperature in degrees Celsius. The subscript indicates the wavelength for sodium light.

bp_{760} - Boiling point at 760 mm of mercury. The subscript indicating the pressure in millimeters of mercury.

cps - Centipoise (viscosity)

d_{20}^{20} - Specific gravity at 20°C and 20°C. The superscript indicating the temperature of the measured liquid, and the subscript indicating the temperature of water, viz. This example is 20 degrees Celsius for the liquid under consideration and 20 degrees is the comparative liquid water at 20 degrees Celsius.

dp_{760} - Dry point at 760 mm of mercury. The subscript indicating the pressure in millimeters of mercury.

% by wt - Percent by weight.

PEL - Permissible Exposure Limits.

LD_{50} - Lethal dose where the subscript indicates the percent of the population who do not survive.

TCLP - Toxicity Characteristics Leaching Procedures.

TWA - Time weighted average is the employee's average airborne exposure in any 8-hour work shift of a 40-hour work week, which shall not be exceeded.

Pt/Co scale - Platinum-Cobalt scale for color.

cal/g-deg - Specific heat in calories per gram per Celcius degree.

4. GENERAL REQUIREMENTS

4.1 Packaging data and labeling. All chemicals included in this standard shall be packaged in accordance with Federal Specification PPP-C-2020 and all applicable documents referenced therein. Shipping containers shall be labeled in accordance with current Department of Transportation (DOT) Hazardous Materials Regulations applicable to each chemical. When shipping by military aircraft the requirements of TM 38-250 shall apply. In addition, each item shall be packaged and labeled as specified in the applicable contract or order. All labels shall also comply with Hazard Communication Standard, 29 CFR 1910.1200(f).

4.2 Hazardous materials information. DOD 6050.5, DOD Hazardous Materials Information System (HMIS) acquires, reviews, stores, and disseminates Material Safety Data Sheet (MSDS) information for all hazardous materials used by DOD. The contractual acquisition of a MSDS is accomplished through use of Federal Acquisition Regulation, paragraph 52.223-3, Hazardous Material Identification and Material Safety Data. The MSDS is prepared in accordance with the instructions of FED-STD-313; and shall comply with requirements of Hazard Communication Standard, 29 CFR 1910.1200(g).

4.3 Safety.

4.3.1 Personal protective measures. The necessary respiratory, eye and skin protection to be used when handling chemicals shall be prescribed by the responsible installation industrial hygiene, medical and safety authorities.

4.3.1.1 Respiratory protection. Use of respirators is allowed under very specific circumstances to include: when effective engineering controls are not feasible or while being instituted. Respirators shall be approved by the National Institute for Occupational Safety (NIOSH) or by the Mine Safety and Health Administration (MSHA). Respiration protection programs shall be established. Employees shall be medically cleared, trained and fit tested prior to using respirator protection. Respirators shall be selected based on hazard.

4.3.1.2 Skin protection. Personnel using these compounds shall be provided with and required to use protective gloves, sleeves, aprons, and boots whenever indicated. Selection of protective clothing shall be based on evaluation of compounds and their use. Supporting safety or industrial hygiene personnel should be contacted to ensure proper selection of protective clothing. Protective creams and ointments commonly known as "barrier creams" may be of value in certain cases. However, barrier creams shall not be used to replace protective clothing. In case of contact with the skin, wash affected areas thoroughly with water. Eye lavages and emergency showers shall be located within 50 feet of where there is a potential for direct contact with harmful chemicals. Emergency showers and eye lavages shall meet minimum requirements of ANSI Standard Z87.1 Access to showers and eye lavages shall not be obstructed. When transferring chemicals, eye lavages and emergency showers shall be within 50 feet of the transfer point. Emergency showers shall be equipped with a valve that will fully open with one pull and deliver 30 gallons of water per minute.

4.3.1.3 Face and eye protection. Personnel using these compounds shall be provided with and required to wear chemical splash-proof safety goggles. In addition, face shields shall be provided and worn over the goggles if splashing could occur. In case of contact with the eyes, immediately irrigate with copious

amounts of clean, potable water for at least 20-30 minutes, open eyelids during irrigation, and obtain medical attention immediately, continue eye irrigation during transport. (Refer to TB MED 506.)

4.3.1.4 Training. Employers shall provide employees with training and information including MSDS on all chemical items in their work area, in accordance with 29 CFR 1910.1200(h), to ensure that employees know potential hazards of the chemicals with which they come in contact and the symptoms of exposure as well as how these chemicals affect the body and bodily functions. Employees shall be adequately trained to render first aid.

4.3.1.5 Exercise. Participation in training exercises shall be stressed to demonstrate skills in the use of personal protective equipment and emergency response equipment.

4.3.2 Storage conditions. DOD 4145.19-R-1 describes general storage practices and requirements for hazardous materials in the DOD supply system. Specific requirements provided in the following paragraphs are supplementary in nature and shall be observed in consonance with the DOD storage regulations.

4.3.2.1 Flammable, combustible, pyrophoric and ignitable materials. A flammable material is generally any solid, liquid, vapor or gas that ignites easily and burns rapidly. Combustible materials are generally those that are difficult to ignite and burn slowly. The DOT, in Part 173, Subpart D, Section 173.115 of 49 CFR, defines a flammable liquid as one having a closed cup flash point below 100°F (37.8°C). A combustible liquid is defined, by DOT in the above reference, as one having a closed cup flash point at or above 100°F and below 200°F (93.3°C). A pyrophoric liquid is defined, by DOT in the above reference, as one that ignites spontaneously in dry or moist air at or below 130°F (54.4°C). Materials with flash points of 200°F or higher are not considered to be nonflammable or noncombustible, but are to be considered as burnable. The Environmental Protection Agency (EPA), in Part 261, Subpart C, Section 261.21 of 40 CFR (refers only to materials that have become waste materials), designates the criteria for flammable and combustible materials and oxidizers that exhibit the characteristic of ignitability (I). Liquids with closed cup flash points of less than 140°F (60°C) are defined by EPA as ignitable. The autoignition point (temperature) of a substance is generally defined as the minimum temperature required to initiate or cause self-sustained combustion in the absence of a spark or flame. Materials that ignite easily under normal industrial conditions are considered to be dangerous fire hazards. Such Materials shall be stored in a manner to prevent ignition and combustion. Easily ignitable substances, such as reducing agents, shall be kept away from strong oxidizing agents. All containers shall be tightly sealed. It is important to provide adequate ventilation in storage areas, and to locate the storage areas of these items away from fire hazards. Ample fire control equipment shall be easily accessible. Storage buildings, rooms and cabinets shall comply with provisions of the National Fire Codes. The building shall be electrically grounded and signs posted to prevent the lighting of matches or smoking in the area. Flammable storage areas shall be equipped with smoke or fire detection equipment.

4.3.2.2 Water-sensitive fire and explosive hazardous materials. These are materials that react on contact with water or steam to ignite or evolve heat or explosive gases. Such materials exhibit the characteristic of reactivity (R) as designated by the EPA in Section 261.23 of the above reference. (Refers only to

materials that have become waste materials.) These materials shall be stored in well-ventilated, cool, dry areas. All containers shall be tightly sealed. These materials are a fire hazard in contact with water or moisture; therefore, it is essential that no sprinkler be used. Otherwise, the building shall conform to that required for storage of flammable materials. The building shall be waterproof, located on high ground, and separated from other storage areas.

4.3.2.3 Incompatible materials. Materials that are chemically incompatible shall be segregated in the storage of both serviceable and unserviceable items. The degree of segregation will depend upon DOD 4145.19-R-1 and local supplementary requirements that insure safe storage conditions. Hazardous storage compatibility codes are provided in the HMIS referred to in 4.2.

4.3.3 Chemical hazardous exposure limits. Chemical hazardous exposure limits for airborne concentrations of substances are obtained from the current TLVs• Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, adopted by the American Conference of Government Industrial Hygienists (ACGIH); current Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PEL), 29 CFR, Section 1910.1000; and NIOSH Recommendation for Environmental Exposure Limits. Such information is also shown in MSDSs and the HMIS referred to in 4.2. Carcinogenic substances are listed by OSHA in Category I for confirmed carcinogens, and in Category II for suspected carcinogens. Category I substances have standard exposure limits set at the lowest possible levels. Category II substances have standard exposure limits set to prevent acute or chronic effects. The latest information should be provided by consulting competent professionals for values and cautions necessary in handling chemicals described herein.

4.3.4 Toxicity. Toxicity information for chemical compounds is available from various publications and from MSDSs, which are collected in DOD 6050.5 Hazardous Materials Information System.

4.3.4.1 EPA toxic (T). Some chemical compounds have been designated by the EPA as toxic (T) in accordance with the criteria shown in Part 261, Subpart B, Section 261.11(a)(3) of 40 CFR. (Refers only to materials that have become waste materials.) Some commercial chemical products are listed as toxic under Subpart D, Section 261.33(f).

4.3.4.2 EPA acute hazardous toxicity (H). Some chemical compounds have been designated by the EPA as acute hazardous (H) in toxicity in accordance with the criteria shown in Subpart B, Section 261.11(a)(2) of the above reference, which refers only to materials that have become waste materials. Some commercial chemical products are listed as acute hazardous in toxicity under Subpart D, Section 261.33(e).

4.4 Pollution and disposal.

4.4.1 Pollution potential. All items described in this standard shall be assumed to have a pollution potential. However, to minimize this potential, the proper use, storage and disposal methods shall be strictly followed.

4.4.2 Disposal of excess or unserviceable material. To minimize disposal problems, it is recommended that no more than a one year's supply of each item listed in this standard be stocked. When stocks have been declared excess or

unserviceable, they will be disposed of in accordance with the Defense Utilization and Disposal Manual, DOD 4160.21-M, and applicable DOD Policy Memoranda. Guidance can be obtained from your servicing Defense Reutilization and Marketing Office (DRMO) on procedures required for proper reporting and turn-in.

4.4.3 Disposal and storage of hazardous wastes. Items are classified and managed as hazardous wastes as defined by the Resource Conservation and Recovery Act (RCRA) (Public Law 94-580). Items have been identified as meeting the characteristics (i.e., ignitable, corrosive, reactive or TCLP) or are listed (i.e., toxic or acute hazardous) according to Identification and Listing of Hazardous Waste, Part 261; 40 CFR; or have been determined to be hazardous wastes by declaration of the Defense Reutilization and Marketing Service (DRMS) in accordance with procedures set forth in DOD 4160.21-M. Disposal of such items shall be managed in accordance with the Installation Environmental Office, the DRMO, or the Safety and Health Office to insure proper reporting of disposal and treatment actions to the US EPA and State; and shall be managed in accordance with Federal, State and local laws. The three main disposal methods are turn-in to the DRMO, on-post disposal by installation personnel, or disposal by commercial contract. Hazardous wastes that cannot be used, or disposed of as stated in 4.4.3.2, shall be stored under environmentally safe conditions until suitable methods of disposal are determined. Short-term storage (less than 90 days) requires proper containment (i.e., packaging and facilities) in accordance with Section 262.34, Part 262 of the above reference. Long-term storage (greater than 90 days) requires permitting by the EPA or by the State under Public Law 94-580 (RCRA), in compliance with the requirements of 40 CFR Parts 264 and 265. Physical custody will be accomplished by the activity with conforming storage or most nearly conforming storage. When physical custody is in question, the Post Commander will make the final decision. In all cases where the wastes are to be collected, stored, transported and disposed of at a State or local permitted disposal facility, the identity and description of the waste shall be maintained and recorded in accordance with Part 262 of the above reference. Transportation of the waste shall be in accordance with Part 263 of the above reference, Standards Applicable to Transporters of Hazardous Waste.

4.4.3.1 Cleanup of liquid spills. To control the migration of spilled or leaking liquids, dike around the item with an inert, dry absorbent (e.g., clay, sawdust or vermiculite) or follow installations spill plans (Spill Prevention Control and Countermeasure Plan and Installations Spill Contingency Plan). Control entry to the spill site and segregate salvageable materials away from the spill area. Initiate waste cleanup operations immediately in accordance with local procedures. The residue shall be safely handled and transported to an approved or permitted disposal or storage facility. Packaging, labeling, transportation and record-keeping requirements for this waste material are determined by the appropriate Federal and State agencies and local procedures. It is recommended that all activities involving disposal preparation and transportation to commercial facilities be properly coordinated with the appropriate Federal and State agencies responsible for health and environmental aspects of hazardous materials. It is imperative that the proper description of waste accompany the packaged item at all times. Final disposal of the waste item shall be accomplished by reutilization, transfer, donation or sales by DRMS in accordance with DOD 4160.21-M or by ultimate disposal as described in 4.4.3.2. Spill residue, including contaminants, to be turned in to the DRMO shall first be properly identified, containerized, and labeled. For large scale spills that grossly contaminate the environment, the Chemical Transportation Emergency Center (CHEM-

TREC), can be called for assistance. Applicable procedures of the local spill control plan shall be followed. Necessary respiratory, eye, and skin protection measures are to be used while performing cleanup operations.

4.4.3.2 Ultimate disposal. Ultimate disposal shall be accomplished at a permitted or approved hazardous waste treatment or disposal facility designated by the Installation Environmental Office, DRMO, or Safety and Health Offices.

4.4.4 DISCLAIMER. RECOMMENDED DISPOSAL INSTRUCTIONS ARE FORMULATED FOR USE BY ELEMENTS OF THE DEPARTMENT OF DEFENSE. THE UNITED STATES OF AMERICA IN NO MANNER WHATSOEVER EITHER EXPLICITLY OR IMPLICITLY WARRANTS, STATES, OR INTENDS SAID INSTRUCTION, TO HAVE ANY APPLICATION, USE OR VIABILITY BY OR TO ANY PERSON OR PERSONS CONTRACTING OUTSIDE THE DEPARTMENT OF DEFENSE OR ANY PERSON OR PERSONS CONTRACTING WITH ANY INSTRUMENTALITY OF THE UNITED STATES OF AMERICA AND DISCLAIMS ALL LIABILITY FOR SUCH USE. ANY PERSON USING THESE INSTRUCTIONS WHO IS NOT A MILITARY OR CIVILIAN EMPLOYEE OF THE UNITED STATES OF AMERICA SHOULD SEEK COMPETENT PROFESSIONAL ADVICE TO VERIFY AND ASSUME RESPONSIBILITY FOR THE SUITABILITY OF THESE INSTRUCTIONS TO THEIR PARTICULAR SITUATION REGARDLESS OF SIMILARITY TO A CORRESPONDING DEPARTMENT OF DEFENSE OR OTHER GOVERNMENT SITUATION.

5. DETAILED REQUIREMENTS

5.1 Name. n-AMYL ALCOHOL $CH_3(CH_2)_4OH$ FW 88.15
n-Butyl Carbinol
1-Pentanol
Pentyl Alcohol
Amyl Alcohol (Synthetic)

5.1.1 Technical description. n-Amyl alcohol is soluble in methyl and ethyl alcohols and has characteristics shown in Table I.

TABLE I. Characteristics of n-Amyl Alcohol.

Property	Characteristics
Refractive index, n_D^{20}	1.4103
Boiling point, bp_{760}, °C	137.5
Melting point, °C	-79
Flash point (closed cup), °C (°F)	38 (100)
Solubility in water, gm/100 ml	2.7

5.1.2 Specifications. ASTM D319, Standard Specification for Amyl Alcohol (Synthetic).

5.1.2.1 Requirements. n-Amyl alcohol conforms to Table II.

TABLE II. Physical and Chemical Properties of n-Amyl Alcohol.

Property	Requirements	
	Min	Max
Apparent specific gravity		
d_{20}^{20}	0.812	0.820
d_{25}^{25}	0.809	0.817
Color, Pt/Co scale	---	15
Distillation range		
bp_{760}, °C	127.5	---
dp_{760}, °C	---	139.0
Water, % by wt	---	0.3 1/
Acidity (free acid as acetic acid), % by wt	---	0.01 2/

1/ This quantitative water limit ensures that the material is miscible without turbidity with 19 volumes of 99 percent heptane at 20°C.
2/ Equivalent to 0.093 mg of KOH per gram of sample.

5.1.3 Use. n-Amyl alcohol is used in organic synthesis, and as a solvent.

5.1.4 Safety.

5.1.4.1 Health hazard. n-Amyl alcohol is a skin irritant, as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. LD_{50} orally in rats is 3.03 g/kg. (Refer to 4.3.1)

5.1.4.2 Fire and explosion hazard. n-Amyl alcohol is a combustible liquid that can produce explosive vapor mixtures in air.

5.1.4.3 Reactivity. n-Amyl alcohol is reactive with inorganic acids, anhydrides, oxides and oxidizing compounds.

5.1.5 Storage. n-Amyl alcohol is stored in the original container (1-gallon jar, 5-gallon carboy and 55-gallon drum). Storage space is away from heat and open flame and where the temperature is below 100°F (38°C). The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.1.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills shall be absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills shall be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazard. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.2 Name. tert-AMYL ALCOHOL $CH_3CH_2COH(CH_3)_2$ MW 88.15
Dimethyl Ethyl Carbinol
2-Butanol-2-methyl (IUPAC)
Amylene hydrate
tert-Pentanol
tert-Pentyl Alcohol (SOCMA)

5.2.1 Technical description. tert-Amyl alcohol is an isomer of amyl alcohol. It is a colorless liquid, with a camphor odor and a burning taste. Slightly soluble in water, miscible with an alcohol and ether. Solutions are neutral to litmus. It is derived from the fractional distillation of mixed alcohols resulting from the chlorination and alkaline hydrolysis of pentanes. tert-Amyl alcohol conforms to Table III.

TABLE III. Quantitative Requirements of tert-Amyl Alcohol.

Characteristic	Requirements	
	Min	Max
Specific gravity, d_{20}^{20}	---	0.81
Vapor pressure (mm Hg) at 68°F	8	---
Vapor density (Air = 1.0)	3.0	---
Distillation data:		
Distillate at 100°C, % by vol.	---	5
Distillate at 103°C, % by vol.	95	---
Flash point (open cup), °C (°F)	15.5 (59)	---

5.2.2 Specifications. None.

5.2.2.1 Requirements. Refer to 5.2.1.

5.2.3 Use. tert-Amyl alcohol is used as a solvent in coatings.

5.2.4 Safety.

5.2.4.1 Health hazard. tert-Amyl alcohol is a skin irritant, as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. LD_{50} orally in rats is 3.03 g/kg. (Refer to 4.3.1)

5.2.4.2 Fire and explosion hazard. tert-Amyl alcohol is a combustible liquid that can produce explosive vapor mixtures in air.

5.2.4.3 Reactivity. tert-Amyl alcohol is reactive with inorganic acids, anhydrides, oxides and oxidizing compounds.

5.2.5 Storage. tert-Amyl alcohol is stored in the original container (1-gallon jar, 5-gallon carboy and 55-gallon drum). Storage space is away from heat and open flame and where the temperature is below 100°F (38°C). The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.2.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills shall be absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills shall be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazard. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.3 Name. sec-AMYL ALCOHOL $CH_3CH_2CH_2CHOHCH_3$ FW 88.15
1-Methylbutyl Alcohol
Methyl Propyl Carbinol
2-Pentanol (IUPAC) (SOCMA)
di-sec-Amyl Alcohol

5.3.1 Technical description. sec-Amyl Alcohol is an isomer of Amyl Alcohol. It is a colorless liquid, slightly soluble in water; miscible with alcohol and ether. It is derived from fractional distillation of mixed alcohols resulting from the chlorination and hydrolysis of pentanes. sec-Amyl Alcohol is free from sediment and suspended matter, has no residual odor after drying from filter paper for two hours, is miscible without turbidity with 19 volumes of 10° heptane. sec-Amyl Alcohol conforms to the requirements shown in Table IV.

TABLE IV. Quantitative requirements of sec-Amyl Alcohol.

Characteristic	Requirements	
	Min	Max
Specific gravity, d_{20}^{20}	0.810	0.820
Nonvolatile matter	---	0.005
Acidity mg g KOH per gram of sample	---	0.06
Distillation:		
bp_{760}, °C	113	---
Distillate below 114°C % by vol.	---	5
Distillate below 120°C % by vol.	96	---
dp_{760}, °C	---	125
Color (Pt/Co scale)	---	20
Flash point °C (°F)	38.75 (100)	43.30 (110)

5.3.2 Specifications. None.

5.3.2.1 Requirements. Refer to 5.3.1.

5.3.3 Use. Secondary amyl alcohol is intended for military use in organic coatings such as lacquers and paints; pharmaceutical intermediate.

5.3.4 Safety.

5.3.4.1 Health hazard. sec-Amyl alcohol is a skin irritant, as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. The PEL is 125 ppm (650 mg/m^3) and the IDLH is 9000 ppm. LD_{50} orally in rats is 3.03 g/kg. (Refer to 4.3.1)

5.3.4.2 Fire and explosion hazard. sec-Amyl alcohol is a combustible liquid that can produce explosive vapor mixtures in air.

5.3.4.3 Reactivity. sec-Amyl alcohol is reactive with inorganic acids, anhydrides, oxides and oxidizing compounds.

5.3.5 Storage. sec-Amyl alcohol is stored in the original container (1-gallon jar, 5-gallon carboy and 55-gallon drum). Storage space is away from heat and open flame and where the temperature is below 100°F (38°C). The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.3.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills shall be absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills shall be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazard. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.4 Name. ANILINE (SOCMA) $C_6H_5NH_2$ MW 93.13
Aminobenzene
Aminophen
Aniline Oil
Benzeneamine
Blueoil
Kyanol
Phenylamine

5.4.1 Technical description. Aniline is a colorless, oily liquid when it is freshly distilled. When exposed to air, it will rapidly turn to a brown color. It has a characteristic odor and a burning taste. It is soluble in cold water and miscible with hot water, alcohol, ether, and benzene. One gram dissolves in 28.6 ml of water. It reacts with most acids to form salts. When reacted with alkaline-earth metals or alkali, it forms anilides with the evolution of hydrogen. Aniline is one of the most important organic bases and is the parent substance for many dyes and drugs. The physical properties of aniline are as shown in Table V.

TABLE V. Physical constants of Aniline, Technical.

Property	Nominal Value
Autoignition temperature, °C	617
Boiling point, bp_{760}, °C	184.2
Flash point	
(closed cup), °C (°F)	70 (156)
(open cup), °C (°F)	76 (169)
Melting point, °C	-6.2
Refractive index, n_D^{20}	1.5863
Wt/gal (20°C)	8.52
pH, 0.2 molar aqueous solution	8.1

5.4.2 Specifications. Military, MIL-A-10450, Aniline, Technical.

5.4.2.1 Requirements. Aniline conforms to the requirements shown in Table VI.

TABLE VI. Chemical and physical requirements of Aniline, Technical.

Characteristics	Requirements	
	Min	Max
Moisture, % by vol	---	0.25
Nitrobenzene, % by vol	---	0.2
Purity, % by vol	99.5	---
Specific gravity at d_4^{25}	1.015	1.019

5.4.3 Use. Aniline is intended for military use in rocket fuels and explosives. Typical commercial applications include use in the preparation of dye intermediates and synthetic organic products used in perfumes and drugs. It is also used in photographic chemicals and petroleum refining.

5.4.4 Safety. Aniline is a highly toxic substance. In case of contact with the skin, flush affected areas with water. In case of inhalation, obtain medical attention immediately. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. The PEL is 5.0 ppm (19 mg/m^3), the IDLH is 100 ppm, and the TWA is 0.5 mg/m^3. LD_{50} orally in rates is 0.44 g/kg. Intoxication may occur from inhalation, ingestion or cutaneous absorption. Acute exposure results in cyanosis, methemoglobinemia, vertigo, headache and mental confusion. Chronic exposure results in anemia, anorexia, weight loss and cutaneous lesions. (Refer to 4.3.1)

5.4.5 Storage. Aniline is stored in original containers (55-gallon drums) away from light, fire hazards, open flame and oxidizing materials. If fire occurs in the vicinity of this material, care should be taken to avoid breathing the fumes. Under these storage conditions and in unopened containers, the shelf life of aniline is indefinite. If the container has been opened, aniline has a maximum shelf life of six months from date of opening. Containers should be checked every six months for deterioration.

5.4.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is listed in 40 CFR as U012 and as a Poison B with an identification number UN1547 in accordance with 49 CFR, Section 172.101.

5.5 Name. n-BUTYL ALCOHOL $CH_3CH_2CH_2CH_2OH$ FW 74.12
Butanol
n-Butanol
1-Butanol (IUPAC)
Butyric Alcohol
Butyl Alcohol (SOCMA)
Propyl Carbinol

5.5.1 Technical description. n-Butyl alcohol is a colorless liquid with a wine-like odor. It is moderately soluble in water and miscible with alcohol or ether. This alcohol shall be miscible without turbidity with 19 volumes of 60° API gasoline at 20°C. n-Butyl alcohol is as shown in Table VII.

TABLE VII. Physical constants of n-Butyl Alcohol.

Property	Nominal Value
Autoignition temperature, °C (°F)	344 (650)
Boiling point, °C	117.7
Flash point (Tag open cup), °C	46.0
Heat of vaporization, cal/g	141.31
Melting point, °C	-89.0
Refractive index, n_D^{20}	1.3993
Specific heat (25°C), cal/g-deg	0.569

5.5.2 Specifications. ASTM D304, Standard Specification for n-Butyl Alcohol.

5.5.2.1 Requirements. n-Butyl alcohol meets the requirements shown in Table VIII.

TABLE VIII. Quantitative requirements of n-Butyl Alcohol, Technical.

Property	Requirements	
	Min	Max
Distillation:		
Initial boiling point, bp_{760}, °C	115	---
Dry point, dp_{760}, °C	---	118.5
Nonvolatile matter, gm per 100 ml	---	0.005
Specific gravity:		
d_{20}^{20}	0.810	0.815
d_{25}^{25}	0.807	0.810
Acidity (free acid as acetic acid), % by wt	---	0.005[1/]

1/ Equivalent to 0.047 mg of KOH per gram of sample.

5.5.3 Use. n-Butyl alcohol is intended for military use as a lubricant and a solvent, and is used in aircraft and diesel engine fuels. Typical commercial applications include use as a latent solvent in nitrocellulose lacquers, in pharmaceuticals, perfumes, photography, hydraulic fluids, cleaners, coatings, and as a general solvent.

5.5.4 Safety.

5.5.4.1 Health hazard. n-Butyl alcohol is a skin irritant, as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. The PEL is 100 ppm (300 mg/m^3). The final limits for STEL are 50 ppm (150 mg/m^3). LD_{50} orally in rats is 4.36 mg/kg. (Refer to 4.3.1)

5.5.4.2 Fire and explosion hazard. n-Butyl alcohol is a combustible liquid that can produce explosive vapor mixtures in air.

5.5.4.3 Reactivity. n-Butyl alcohol is reactive with inorganic acids, anhydrides, oxides and oxidizing compounds.

5.5.5 Storage. n-Butyl alcohol is stored in the original container (1-gallon jar, 5-gallon carboy and 55-gallon drum). Storage space is away from heat and open flame (flash point is 46.0 °C) and where the temperature is below 100°F (38°C). The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.5.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills shall be absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills shall be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazard. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

EPA Hazardous Waste Classification in CFR 40 is U031 and as a flammable liquid with an identification number NA1120 in accordance with CFR 49, Section 172.101.

5.6 Name. sec-BUTYL ALCOHOL (SOCMA) $CH_3CH_2CHOHCH_3$ FW 74.12
SBA
2-Butanol
Butylene Hydrate
2-Hydroxybutane
Methylethylcarbinol

5.6.1 Technical description. sec-Butyl alcohol is of the 98% grade only. It is a flammable liquid with a wine-like odor. It is moderately soluble in water and shall be miscible without turbidity with 19 volumes 10° heptane. sec-Butyl alcohol has properties shown in Table IX.

TABLE IX. Physical constants of sec-Butyl Alcohol, Technical.

Property	Nominal Value
Flash point:	
Open cup, °C (°F)	31 (88)
Closed cup, °C (°F)	23.85 (75)
Melting point, °C	114.7
Refractive index, n_D^{20}	1.3949
Wt/gal (20°C), lb	6.74

5.6.2 Specifications. ASTM D1007, Standard Specification for sec-Butyl Alcohol.

5.6.2.1 Requirements. sec-Butyl alcohol is as shown in Table X.

TABLE X. Chemical and physical requirements of sec-Butyl Alcohol, Technical.

Property	Requirements	
	Min	Max
Color (Pt/Co scale)	---	10
Distillation:		
bp_{760}, °C	98	---
dp_{760}, °C	---	101
Nonvolatile matter (in 100 ml), g	---	0.005
Specific gravity:		
d_{20}^{20}	0.807	0.809
d_{25}^{25}	0.804	0.806
Water, % by wt	---	0.5
Acidity (free acid as acetic acid)	---	0.002 1/

1/ Equivalent to 0.019 mg of KOH per gram of sample.

5.6.3 Use. sec-Butyl alcohol is intended for military use in organic protective coatings. Typical commercial applications include use as a general solvent.

5.6.4 Safety.

5.6.4.1 Health hazard. sec-Butyl alcohol is a skin irritant, as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. The PEL is 150 ppm (450 mg/m^3) and the final limits of TWA are 100 ppm (305 mg/m^3). LD_{50} orally in rats is 6.48 kg. (Refer to 4.3.1)

5.6.4.2 Fire and explosion hazard. sec-Butyl alcohol is a combustible liquid that can produce explosive vapor mixtures in air.

5.6.4.3 Reactivity. sec-Butyl alcohol is reactive with inorganic acids, anhydrides, oxides and oxidizing compounds.

5.6.5 Storage. sec-Butyl alcohol is stored in the original container (1-gallon jar, 5-gallon carboy and 55-gallon drum). Storage space is away from heat and open flame (flash point is 31.1°C) and where the temperature is below 75°F (24°C). The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.6.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills shall be absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills shall be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazard. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40 but has an identification number of NA1120 and is a flammable in accordance with CFR 49, Section 172.101.

5.7 Name. p-tert-BUTYLPHENOL $C_{10}H_{14}O$ FW 150.21
4-(1,1-Dimethylethyl) phenol
Butylphen

5.7.1 Technical description. p-tert-Butyl phenol is in the form of needles, is practically insoluble in cold water, soluble in alcohol and ether and has properties shown in Table XI.

TABLE XI. Physical constants of p-tert-Butyl Phenol.

Property	Nominal Value
Density, d_4^{114}	0.9081
Boiling point, bp_{760}, °C	237

5.7.2 Specifications. ASTM D2871, Standard Specification for p-tert-butylphenol 98.

5.7.2.1 Requirements. p-tert-Butylphenol meets the requirements shown in Table XII.

TABLE XII. Quantitative requirements of p-tert-Butylphenol.

Property	Requirements	
	Min	Max
Solidification point, °C	98.0	---
Molten color, (Pt/Co scale)	---	50

5.7.3 Use. p-tert-Butylphenol is used as an intermediate in the manufacture of varnish and lacquer resins, as an antioxidant, and an ingredient in soap, de-emulsifiers in oilfield use and in motor oil.

5.7.4 Safety. p-tert-Butylphenol is toxic and may cause eye and skin irritation. Its fumes are highly toxic when heated to decomposition releasing phenolic compounds. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. In case of inhalation, obtain medical attention immediately. In case of contact with the skin, flush affected areas with water. In case of inhalation of crystals or fumes, obtain medical attention immediately. The PEL is 100 ppm (300 mg/m^3) and the final limits of TWA are 100 ppm. (Refer to 4.3.1)

5.7.5 Storage. p-tert-Butylphenol shall be stored in original containers (1-pound bottles) away from light. If properly stored, this material has an indefinite shelf life. (Refer to 4.3.2)

5.7.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.8 Name. CYCLOHEXYLAMINE (SOCMA) $C_6H_{11}NH_2$ FW 99.18
Aminocyclohexane (IUPAC)
Cyclohexanamine
Hexahydroaniline

5.8.1 Technical description. Cyclohexylamine is a clear, nearly colorless liquid with a characteristic fishy amine odor. It is completely miscible with water and with common organic solvents, including alcohols, ethers, ketones, esters, aliphatic hydrocarbons, aromatic hydrocarbons, and their chlorinated derivatives. On distillation with water, cyclohexylamine forms an azeotropic mixture. Cyclohexylamine has properties as shown in Table XIII and Table XIV at 98 percent by weight purity.

TABLE XIII. Characteristics of Cyclohexylamine.

Characteristic	Value
Autoignition temperature, °C	260
Boiling point, bp_{760}, °C	134.5
Melting point, °C	-17.7
Vapor density (Air = 1.00)	3.42
Density, d_{25}^{25}	0.8647
Refractive index, n_D^{20}	1.4565
pH (0.01% aqueous solution)	10.5

TABLE XIV. Physical requirements of Cyclohexylamine, Technical.

Property	Requirements	
	Min	Max
Distillation range, bp_{760}, °C	132.0	---
95% (1-96 ml), °C	---	136.0
Flash point, °C	31.7	32.7
Specific gravity, d_{15}^{15}	.869	.873

5.8.2 Specifications. Federal, O-C-940, Cyclohexylamine, Technical.

5.8.2.1 Requirements. Cyclohexylamine, Type I, is not less than 98 percent by weight pure and Type II is not less than 60 percent by weight pure.

5.8.3 Use. Cyclohexylamine is intended for military use in low pressure heating plants where the air has not been removed from the feedwater. This compound, when added to the boiler water, will volatilize with the steam and circulate through the steam lines, returning with the condensate to the boiler. Typical commercial applications include use as a corrosion inhibitor, a petroleum

additive, a dye intermediate, sweetening agent, and emulsifying agent. It is also used in pharmaceuticals and insecticides.

5.8.4 Safety. Cyclohexylamine is a highly toxic substance. In case of contact with the skin, flush affected areas with water. In case of inhalation, obtain medical attention immediately. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. LD_{50} orally in rates is 71 ml/kg. Intoxication may occur from inhalation, ingestion or cutaneous absorption. Acute exposure results in cyanosis, methemoglobinemia, vertigo, headache and mental confusion. Chronic exposure results in anemia, anorexia, weight loss and cutaneous lesions. (Refer to 4.3.1)

5.8.5 Storage. Cyclohexylamine is stored in original containers (55-gallon drums) away from light, fire hazards, open flame and oxidizing materials. If fire occurs in the vicinity of this material, care should be taken to avoid breathing the fumes. Under these storage conditions and in unopened containers, the shelf life of cyclohexylamine is indefinite. If the container has been opened, cyclohexylamine has a maximum shelf life of six months from date of opening. Containers should be checked every six months for deterioration.

5.8.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in 40 CFR.

5.9 Name. DIETHANOLAMINE $(HOCH_2CH_2)_2NH$ MW 105.14
2,2-Iminodiethanol (IUPAC) (SOCMA)
Diethylolamine
bis (Hydroxyethyl) amine
2,2-Dihydroxydiethylamine
DEA

5.9.1 Technical description. Diethanolamine is colorless and viscous with a characteristic mild odor of ammonia when in the liquid state. At normal temperatures it exists in the solid state at which time it has a white, crystalline appearance. It is a strong, chemically active base, and very soluble in water and alcohol. Physical constants for diethanolamine are as shown in Table XV.

TABLE XV. Physical constants of Diethanolamine, Technical.

Property	Nominal Value
Boiling point, bp_{760}, °C	268.8
Autoignition temperature, °C	662.0
Flash point (open cup), °C (°F)	137.75 (300)
Freezing point, °C	28
Vapor density (Air = 1.00)	3.65
Density, lbs/gal at 30°C	9.09
Viscosity (at 30°) cps	351.9
Refractive index, n_D^{30}	1.4753

5.9.2 Specifications. Military, MIL-E-50011, Ethanolamines (Monoethanolamine, Diethanolamine and Triethanolamine), Technical.

5.9.2.1 Requirements. Diethanolamine conforming to MIL-E-50011, Type II, are as shown in Table XVI.

TABLE XVI. Chemical and physical characteristics of Diethanolamine.

Property	Requirements	
	Min	Max
Specific gravity, d_{20}^{30}	1.090	1.095
Color (Pt/Co scale)	---	40
Water content, % by wt	---	1.0
Monoethanolamine content, % by wt	---	1.0
Diethanolamine content, % by wt	98.0	---
Triethanolamine content, % by wt	---	1.5

5.9.3 Use. Diethanolamine, technical is intended for military use in the removal of carbon dioxide from air, other gases, and liquids by absorption and as a wetting agent. Typical commercial applications include use with cracking gases and coal or oil gases which contain carbonyl sulfide that would react with monoethanolamine; as rubber chemical intermediate; in the manufacture of surface active agents used in textile specialties, herbicides, petroleum demulsifiers; as emulsifier and dispersing agents in various agricultural chemicals, cosmetics, and pharmaceuticals; in the production of lubricants for the textile industry; as humectant and softening agent; and in organic synthesis.

5.9.4 Safety.

5.9.4.1 Health hazard. Diethanolamine is an irritant to the eyes, skin, and respiratory tract and can be toxic as an inhalant. In case of contact with the eyes or skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. The final limits of TWA are 3 ppm (15 mg/m^3). LD_{50} orally in rats is 12.76 g/kg. (Refer to 4.3.1)

5.9.4.2 Fire and explosion hazard. Diethanolamine is a combustible liquid and can produce explosive vapors. Fires are to be extinguished using dry chemical, alcohol foam or carbon dioxide. In fire conditions, personnel wear self-contained breathing apparatus.

5.9.4.3 Reactivity. Diethanolamine is reactive with oxidizing materials, inorganic acids, anhydrides and oxides.

5.9.5 Storage. Diethanolamine is stored in the original container (1-gallon bottles, 5-gallon composite steel pails and 55-gallon steel drums). Storage space is away from heat and open flame. The maximum shelf life in unopened containers is unlimited. If the container is opened, the shelf life is six months from the date of opening. (Refer to 4.3.2)

5.9.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed

containers for disposal. Large spills are to be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazard. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.10 Name. DIETHYLENE GLYCOL $HOCH_2CH_2OCH_2CH_2OH$ FW 106.12
2-,2'-Oxybisethanol
2-,2'-Oxydiethanol
2-,2'-Dihydroxydiethyl Ether

5.10.1 Technical description. Diethylene glycol is a colorless, hygroscopic practically odorless liquid with a sharply, sweetish taste. Diethylene glycol is insoluble in benzene, carbon tetrachloride and soluble in water, alcohol, ether, acetone and ethylene glycol. Diethylene glycol has physical characteristics as shown in Table XVII.

TABLE XVII. Characteristics of Diethylene Glycol.

Characteristic	Nominal Value
Refractive index, n_D^{20}	1.4475
Solidification, °C	-10.45
Melting point, °C	-65
Autoignition temperature, °C	229
Flash point	
Open cup, °C (°F)	143 (290)
Closed cup, °C (°F)	124 (252)

5.10.2 Specifications. Military, MIL-D-23296, Diethylene Glycol; ASTM D2691, Standard Specification for Diethylene Glycol.

5.10.2.1 Requirements. Diethylene glycol is as shown in Table XVIII.

TABLE XVIII. Physical and chemical properties of Diethylene Glycol.

Property	Requirements			
	MIL-D-23296		ASTM 2691	
	Min	Max	Min	Max
Specific gravity, d_{20}^{20}	1.1170	1.1200	1.1170	1.1200
d_{25}^{25}	---	---	1.1147	1.1177
Distillation				
bp_{760}, °C	242	---	240	---
dp_{760}, °C	---	250	---	250
Color (Pt/Co scale)	---	15	---	15
Water, % by wt	---	0.2	---	0.2
Ash, % by wt	---	0.005	---	---
Acidity (% by wt as acetic acid)	---	0.005	---	0.1 1/
Ethylene glycol, % by wt	---	---	---	0.5
Triethylene glycol, % by wt	---	---	---	1.0
Iron, ppm	---	---	---	1.0

1/ Equivalent to 0.093 mg of KOH per gram of sample.

5.10.3 Use. Diethylene glycol is used in antifreeze solutions for sprinkler systems, water seals for gas tanks (water with 40% diethylene glycol freezes at 18° (with 50% at 28°C), and as a lubricant and finishing agent for wool, worsted, cotton, rayon and silk, as a solvent for vat dyes, in composition corks, glues, gelatin, casein and pastes to prevent drying out. Typical commercial applications include use as a solvent for nitrocellulose and gums, as a softening agent for glue, tobacco and parchment paper. It also replaces ethylene glycol in the manufacture of explosives and textiles. Other primary uses are as an agent to remove moisture from natural gas, in organic synthesis, in cosmetics, and in herbicides.

5.10.4 Safety.

5.10.4.1 Health hazard. Diethylene glycol is a skin irritant, as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. LD_{50} orally in rats is 20.76 g/kg and 13.21 g/kg in guinea pigs. (Refer to 4.3.1)

5.10.4.2 Fire and explosion hazard. Diethylene glycol is a combustible liquid that can produce explosive vapor mixtures in air.

5.10.4.3 Reactivity. Diethylene glycol is reactive with inorganic acids, anhydrides, oxides and oxidizing compounds.

5.10.5 Storage. Diethylene glycol is stored in the original container (1-pint bottles and 1-gallon, 5-gallon cans and 55-gallon drums). Storage space is away from heat and open flame and where the temperature is below 100°F (38°C). The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.10.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills are to be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazards. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in 40 CFR.

5.11 Name. DIETHYLENETRIAMINE (SOCMA) $(NH_2C_2H_2)_2NH$ MW 103.17
Bis [B-aminoethyl] amine
2,2'-Diaminodiethylamine

5.11.1 Technical description. Diethylenetriamine is a clear, yellow liquid with a mild ammoniacal odor. It is strongly alkaline, hygroscopic, somewhat viscous liquid. It is soluble in water and hydrocarbons. Diethylenetriamine is corrosive to copper and its alloys and has characteristics as shown in Table XIX.

TABLE XIX. Physical constants of Diethylenetriamine, Technical.

Property	Nominal Value
Autoignition temperature, °C	398.85
Flash point, (open cup), °C	101.5
Melting point, °C	-79
Vapor density (Air = 1.00)	3.48
Vapor pressure at 20°C, mm Hg	0.22

5.11.2 Specifications. Federal, O-D-1271, Diethylenetriamine, Technical.

5.11.2.1 Requirements. Diethylenetriamine meets requirements shown in Table XX.

TABLE XX. Chemical and physical characteristics of Diethylenetriamine.

Property	Requirements	
	Min	Max
Purity, % by wt	97.0	---
Water content, % by wt	---	0.5
Specific gravity, d_{20}^{20}	0.950	0.958
Distillation range		
bp_{760}	185.0	---
dp_{760}	---	215.0
Volume of distillate below 210°C, %	93.0	---

5.11.3 Use. Diethylenetriamine is intended for military use in the manufacture of Decontaminating Agent, DS2. Typical commercial applications include use as a solvent for sulfur, acid gases, various resins, and dyes; as saponification agent for acidic materials, and for making derivatives.

5.11.4 Safety. Diethylenetriamine is a toxic substance and causes severe eye and skin burns. In case of contact with the eyes and skin, flush affected areas with water for 20 minutes. In case of inhalation or contact with the eyes, obtain medical attention immediately. (Refer to 4.3.1)

5.11.5 Storage. Diethylenetriamine is stored in the original containers (1-pint bottles and 55-gallon drums) away from light, direct sunlight, fire hazards, open flame and oxidizing materials. If fire occurs in the vicinity of this material, care should be taken to avoid breathing the fumes. Under these storage conditions and in unopened containers, the shelf life is indefinite. If the container is opened, diethylenetriamine has a maximum shelf life of six months from the date of opening. Containers should be checked every six months for deterioration. (Refer to 4.3.2)

5.11.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.12 Name. N,N-DIMETHYLANILINE (SOCMA) $C_6H_5N(CH_3)_2$ MW 121.18
Aminodianethylbenzene
N,N-Dimethylaminobenzene
N,N-Dimethylphenylamine
Dimethylaniline
Xylidine

5.12.1 Technical description. N,N-Dimethylaniline is a yellowish to brownish oily liquid. It is soluble in alcohol and ether, slightly soluble in water and has characteristics as shown in Table XXI.

TABLE XXI. Characteristics of N,N-Dimethylaniline.

Characteristic	Nominal Value
Specific gravity, d_{15}^{15}	0.96
Melting point, °C	2.5
Boiling point, bp_{760}, °C	193
Flash point (closed cup), °C	63
Autoignition temperature, °C	371

5.12.2 Specifications. Military, MIL-D-20305, Dimethylaniline.

5.12.2.1 Requirements. N,N-Dimethylaniline is yellow and as shown in Table XXII.

TABLE XXII. Physical and chemical properties of N,N-Dimethylaniline.

Property	Requirements	
	Min	Max
Freezing point, °C	1.9	---
Residue, % by wt	---	0.1
Solubility in H_2SO_4	100	---
Alkalinity (NaOH), %	---	0.005
Acidity (HCl), %	---	0.005
Aniline, % by wt	---	0.1

5.12.3 Use. N,N-Dimethylaniline is used in the manufacture of tetryl for military use. Commercial uses are in dyes, solvents, manufacture of vanillin and as a stabilizer (acid acceptor).

5.12.4 Safety. N,N-Dimethylaniline is a highly toxic substance. In case of contact with the skin, flush affected areas with water. In case of inhalation, obtain medical attention immediately. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. The PEL is 5 ppm for skin (TiF) and the final limits for TWA are 5 ppm. Intoxication may occur from inhalation, injestion or cutaneous absorption. Acute exposure results in cyanosis, methemoglobinemia, vertigo, headache and mental confusion. Chronic exposure results in anemia, anorexia, weight loss and cutaneous lesions. (Refer to 4.3.1)

5.12.5 Storage. N,N-Dimethylaniline is stored in original containers (55-gallon drums) away from light, direct sunlight, fire hazards, open flame and oxidizing materials. If fire occurs in the vicinity of this material, care should be taken to avoid breathing the fumes. Under these storage conditions and in unopened containers, the shelf life is indefinite. If the container has been opened, N,N-Dimethylaniline has a maximum shelf life of six months from date of opening. Containers should be checked every six months for deterioration. (Refer to 4.3.2)

5.12.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.13 Name. DIPHENYLAMINE (SOCMA) $C_{12}H_{11}N$ MW 169.22
Anilinobenzene
N-Phenylaniline
N-Phenyl-Benzamine

5.13.1 Technical description. Diphenylamine described herein is in flake form. It is very pale tan, which may darken on storage to no darker than a light brown color. It is soluble in carbon disulfide, benzene, alcohol, glacial acetic acid, carbon disulfide and ether. It is insoluble in water. It forms salts with acids and has characteristics shown in Table XXIII.

TABLE XXIII. Characteristics of Diphenylamine.

Characteristics	Nominal Value
Density, d_4^{20}	1.16
Melting point, °C	53
Boiling point, bp_{760}, °C	302
Flash point, °C	153

5.13.2 Specifications. Military, MIL-D-98, Diphenylamine, Technical.

5.13.2.1 Requirements. Diphenylamine meets the requirements shown in Table XXIV.

TABLE XXIV. Properties of Diphenylamine.

Characteristic	Requirements	
	Min	Max
Setting point, °C	51.7	53.0
Insoluble matter, % by wt	---	0.02
Moisture, % by wt	---	0.2
Acidity (as HCl)	---	0.005
Alkalinity (as NaOH)	---	0.005
Oxidizable material (as aniline), % by wt	---	0.1

5.13.3 Use. Diphenylamine is intended for use as a stabilizer in production of smokeless propellants. Commercial uses are in rubber anti-oxidants and accelerators, stabilizers for plastics, solid rocket propellants, tests for nitrates and nitrites, pesticides, explosives, dyes, and pharmaceuticals (anti-screw worn formulations).

5.13.4 Safety. Diphenylamine is a highly toxic substance. In case of contact with the skin, flush affected areas with water. In case of inhalation, obtain medical attention immediately. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. The final limits of TWA are 10 mg/m^3. LD_{50} orally in rats is 0.44 g/kg. Intoxication may occur from inhalation, injestion or cutaneous absorption. Acute exposure results in cyanosis, methemoglobinemia, vertigo, headache and mental confusion. Chronic exposure results in anemia, anorexia, weight loss and cutaneous lesions. (Refer to 4.3.1)

5.13.5 Storage. Diphenylamine is stored in original container (55-gallon drums) away from light, direct sunlight, fire hazards, open flame, acids and oxidizing materials. If fire occurs in the vicinity of this material, care should be taken to avoid breathing the fumes. Diphenylamine should be kept away from light. Under this storage conditions and in unopened containers, the shelf life of diphenylamine is indefinite. If the container has been opened, diphenylamine has a maximum shelf life of six months from date of opening. Containers should be checked every six months for deterioration. (Refer to 4.3.2)

5.13.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.14 Name. DIPROPYLENE GLYCOL $CH_3CHOHCH_2OCH_2CHOHCH_3$ FW 134.18
Carbitol®
2-(2-Ethoxyethoxy) Ethanol
Diethylethylene Glycol Monoethyl Ether
Ethyldigol

5.14.1 Technical description. Dipropylene glycol is a very hygroscopic liquid, miscible with acetone, benzene, chloroform, ethanol, ether, pyridine, and water. It has characteristics shown in Table XXV.

TABLE XXV. Characteristics of Dipropylene Glycol.

Property	Constants
Refractive index, n_D^{20}	1.4213
Flash point (open cup), °C	96

5.14.2 Specifications. ASTM D 2696, Standard Specification for Dipropylene Glycol.

5.14.2.1 Requirements. Dipropylene glycol conforms to Table XXVI.

TABLE XXVI. Physical and chemical requirements of Dipropylene Glycol.

Properties	Requirements	
	Min	Max
Specific gravity		
d_{20}^{20}	1.020	1.025
d_{25}^{25}	1.016	1.021
Distillation:		
bp_{760}, °C	228	---
dp_{760}, °C	---	236
Color (Pt/Co scale)	---	15
Water, % by wt	---	0.2
Acidity (% by wt as acetic acid)	---	0.01 1/
Propylene glycol, % by wt	---	1.0
Tripropylene glycol, % by wt	---	1.0
Iron, ppm	---	1.0

1/ Equivalent to 0.093 of KOH per gram of sample.

5.14.3 Use. Dipropylene glycol is used in the preparation of surface coatings, as a solvent for cellulose esters, in lacquers and thinner formulations, in quick-drying varnishes and enamels, for dye stuffs and wood stains.

5.14.4 Safety.

5.14.4.1 Health hazard. Dipropylene glycol is a skin irritant as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. Long term exposure has resulted in neurological damages. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. LD_{50} orally in rats is 8.69 g/kg. (Refer to 4.3.1)

5.14.4.2 Fire and explosion hazard. Dipropylene glycol is a combustible liquid that can produce explosive vapor mixtures in air.

5.14.4.3 Reactivity. Dipropylene glycol is reactive with inorganic acids, anhydrides and oxidizing compounds.

5.14.5 Storage. Dipropylene glycol is stored in original container (1-pint bottles, 5-gallon cans and 55-gallon drums). Storage space is away from heat and open flame and where the temperature is below 100°F (38°C). The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.14.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills are to be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazards. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in 40 CFR.

5.15 Name. ETHYLENEDIAMINETETRAACETIC ACID, DISODIUM SALT OF $C_{10}H_{14}N_2Na_2O_2$ FW 336.21

Cheladrate
Chelaplex III
Edentate Disodium
EDTA Disodium
Endrate Disodium
N,N'-1,2-Ethanediylbis [N-(Carboxymethyl) Glycine] Disodium Salt
(Ethylene Dinitrilo)-Tetraacetic Acid Disodium Salt
Sequestrene Cheladrate
Sequestrene NA_2
Sodium Versenate
Tetracemate Disodium
Titriplex III
Versene Disodium Salt

5.15.1 Technical description. Ethylenediaminetetraacetic disodium salt (disodium EDTA) is a white salt which is soluble in water, has characteristics of a weak acid by displacing carbon dioxide from carbonates and reacting with metals to form hydrogen. It has a melting point of 252°C.

5.15.2 Specifications. Military, MIL-T-24494, Tetra-, Tri- and Disodium Salts of Ethylenediaminetetraacetic Acid (EDTA) Water Treatment Chemicals, Boiler, Shipboard Use, Type III (Disodium EDTA).

5.15.2.1 Requirements. Disodium EDTA is $Na_2EDTA \cdot 2H_2O$ ($C_{10}H_{18}O_{10}N_2Na_2$). Disodium EDTA has physical and chemical characteristics shown in Table XXVII.

TABLE XXVII. Physical and chemical properties for Disodium EDTA.

Property	Requirements	
	Min	Max
Assay, % by wt	89.3	---
Water content, % by wt	9.7	---
Impurities (organic and inorganic), % by wt	1.0	---
Chelation activity		
Oxalate method, mg of $CaCO_3$/g of sample	267	---
pH	4.5	5.5

5.15.3 Use. Disodium EDTA is used for cleaning boilers and as a chelating agent. It is also a sequestering agent.

5.15.4 Safety. Disodium EDTA is nonflammable and nontoxic. Normal laboratory safety precautions are required when handling disodium EDTA. Trisodium is considered a nuisance particulate with a TLV of 10 mg/m^3 of total dust. Disodium EDTA shall be used with adequate ventilation. LD_{50} in rats is 2 g/kg. (Refer to 4.3.1)

Disodium EDTA reacts with acids to evolve carbon dioxide.

5.15.5 Storage. Disodium EDTA shall be stored in a cool, dry place in tightly closed containers away from acids. (Refer to 4.3.2)

5.15.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.16 Name. ETHYLENEDIAMINETETRAACETIC ACID, TRISODIUM SALT OF $C_{10}H_{13}N_2Na_3O_8$ FW 358.20
Edetate Trisodium
N,N'-1,2-Ethanediylbis [N-(Carboxymethyl) Glycine] Trisodium Salt
EDTA Trisodium
Ethylene Diaminetetraacetic Acid Trisodium Salt
Trisodium Ethylenediaminetetraacetate
Trisodium Edetate
Edetic Acid Trisodium Salt
Limclair
Versene-9
Sequestrene NA_3

5.16.1 Technical description. Ethylenediaminetetraacetic acid trisodium salt (Trisodium EDTA) is a white salt which is soluble in water and has a melting point of greater than 300°C.

5.16.2 Specifications. Military, MIL-T-24494, Tetra-, Tri- and Disodium Salts of Ethylenediaminetetraacetic Acid (EDTA) Water Treatment Chemicals, Boiler, Shipboard Use [Type II (Trisodium EDTA)].

5.16.2.1 Requirements. Trisodium EDTA is $Na_3EDTA \cdot 3H_2O$ ($C_{10}H_{19}O_{11}N_2Na_3$). Trisodium EDTA has physical and chemical characteristics shown in Table XXVIII.

TABLE XXVIII. Physical and chemical properties for Trisodium EDTA.

Property	Requirements	
	Min	Max
Assay, % by wt	86.2	---
Water content, % by wt	13.1	---
Impurities (organic and inorganic), % by wt	0.7	---
Chelation activity		
Oxalate method, mg of $CaCO_3$/g of sample	241	---
pH	8.5	9.5

5.16.3 Use. Trisodium EDTA is used for cleaning boilers and as a chelating agent. It is also a sequestering agent.

5.16.4 Safety. Trisodium EDTA is nonflammable and nontoxic. Normal laboratory safety precautions are required when handling trisodium EDTA. Trisodium EDTA is considered a nuisance particulate with a TLV of 10 mg/m^3 of total dust. Trisodium EDTA shall be used with adequate ventilation. LD_{50} in rats is 2 g/kg. (Refer to 4.3.1)

Trisodium EDTA reacts with acids to evolve carbon dioxide.

5.16.5 Storage. Trisodium EDTA shall be stored in a cool, dry place in tightly closed containers away from acids. (Refer to 4.3.2)

5.16.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.17 Name. ETHYLENEDIAMINETETRAACETIC ACID, TETRASODIUM SALT OF $C_{10}H_{12}N_2Na_4O_8$ FW 380.20

Edetate Sodium
N,N'-1,2-Ethanediylbis [N-(Carboxymethyl) Glycine] Tetrasodium Salt
(Ethylenedinitrilo) Tetraacetic Acid Tetrasodium Salt
Sodium Edetate
Tetrasodium Ethylenediaminetetraacetate
Ethylenebis (Iminodiacetic Acid) Tetrasodium Salt
Tetrasodium Ethylenebis (Iminodiacetate)
EDTA Tetrasodium
Edetic Acid Tetrasodium Salt
Tetracemate Tetrasodium
Tetrasodium Edetate
Tetracemin
Endrate Tetrasodium
Questex
Versene
Sequestrene
Tetrine
Kalex
Trilon B
Komplexon
Nullapon
Aquamollin
Complexone
Distol 8
Irgalon
Calsol
Syntes 12a
Tyclarosol
Nervanaid B

5.17.1 Technical description. Ethylenediaminetetraacetic acid tetrasodium salt (Tetrasodium EDTA) is a white salt which is soluble in water and has a melting point of greater than 300°C.

5.17.2 Specifications. Military, MIL-T-24494, Tetra-, Tri- and Disodium Salts of Ethylenediaminetetraacetic Acid (EDTA) Water Treatment Chemicals, Boiler, Shipboard Use [Type I (Tetrasodium EDTA)].

5.17.2.1 Requirements. Tetrasodium EDTA is $Na_4EDTA \cdot 4H_2O$ ($C_{10}H_{20}O_{12}N_2Na_4$). Tetrasodium EDTA has physical and chemical characteristics shown in Table XXIX.

TABLE XXIX. Physical and chemical properties for Tetrasodium EDTA.

Property	Requirements	
	Min	Max
Assay, % by wt	83.2	---
Water content, % by wt	15.8	---
Impurities (organic and inorganic), % by wt	1.0	---
Chelation activity		
Oxalate method, mg of $CaCO_3$/g of sample	219	---
pH	10.5	11.5

5.17.3 Use. Tetrasodium EDTA is used for cleaning boilers and as a chelating agent. It is also a sequestering agent.

5.17.4 Safety. Tetrasodium EDTA is nonflammable and nontoxic. Normal laboratory safety precautions are required when handling tetrasodium EDTA. Tetrasodium EDTA is considered a nuisance particulate with a TLV of 10 mg/m^3 of total dust. Tetrasodium EDTA shall be used with adequate ventilation. LD_{50} in rats is 2 g/kg. (Refer to 4.3.1)

Tetrasodium EDTA reacts with acids to evolve carbon dioxide.

5.17.5 Storage. Tetrasodium EDTA shall be stored in a cool, dry place in tightly closed containers away from acids. (Refer to 4.3.2)

5.17.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.18 Name. ETHYLENE GLYCOL (SOCMA) $HOCH_2CH_2OH$ FW 62.07
1,2-Ethanediol (IUPAC)
Ethylene Alcohol
Glycol
Glycol Alcohol

5.18.1 Technical description. Ethylene glycol is the simplest polyhydric alcohol. It is a clear, colorless, syrupy, sweet-tasting, extremely hygroscopic liquid absorbing twice its weight of water at a relative humidity of 100 percent. It is soluble in water, alcohol, or ether, and lowers the freezing point of water. Ethylene glycol has characteristics as shown in Table XXX.

TABLE XXX. Characteristics of Ethylene Glycol.

Characteristic	Nominal Value
Specific gravity	
d_4^0	1.1274
d_4^{10}	1.1204
d_4^{20}	1.1135
d_4^{30}	1.1065
Weight, lb/gal	9.3
Melting point, °C	-13.5
Boiling point	
bp_{760}, °C	197.6
bp_{97}, °C	140
bp_{18}, °C	100
$bp_{3.0}$, °C	70
$bp_{0.06}$, °C	20
Refractive index,	
n_D^{15}	1.43312
n_D^{25}	1.43063
Viscosity	
T=15°C, cps	26.0
T=20°C, cps	21.0
T=25°C, cps	17.3
Dielectric constant 20°C & 150m wl	38.66
Dipole moment	2.20
Specific heat, cal/g, °C	0.561
Heat of formation, kcal/mol	-108.1
Heat of fusion, cal/g	44.7
Heat of vaporization, cal/g	191.0
Heat of solution, cal/g[1/]	-6.5
Parachor	148.9
Surface tension (20°C) dynes/cm	48.4

[1/] Heat of solution when 37 parts are mixed with 63 parts H_2O (W/W).

5.18.2 Specifications. Military, MIL-E-9500, Ethylene Glycol, Technical and ASTM D 2693, Standard Specification for Ethylene Glycol.

5.18.2.1 Requirements. Ethylene glycol is as shown in Table XXXI.

TABLE XXXI. Physical and chemical properties of Ethylene Glycol.

Property	Requirements			
	MIL-E-9500		ASTM D 2693	
	Min	Max	Min	Max
Acidity (free acid as acetic acid, % by wt	---	0.01	---	0.005[1/]
Ash content, g per 100 ml	---	0.005	---	---
Distillation range				
bp_{760}	192	---	193	---
95% distilled, °C	---	200	---	---
dp_{760}	---	208	---	204
Flash point (open cup) °C	115	---	---	---
(°F)	(240)	---	---	---
Specific gravity				
d_{20}^{20}	1.1151	1.1156	1.1151	1.1156
d_{25}^{25}	---	---	1.1129	1.1134
Total glycols, % by wt	99.5	---	---	---
Diethylene glycol, % by wt	---	---	---	0.1
Water, % by wt	---	0.5	---	1.0
Color (Co/Pt scale)	---	15	---	15
Iron, ppm	---	---	---	1.0

[1/] Equivalent to 0.047 mg of KOH/g of sample.

5.18.3 Use. Ethylene glycol, technical is intended for military use as a coolant in aircraft engines, as an antifreeze in automobile engines, and as a de-icer in de-icing kits. Typical commercial applications include use in manufacture of explosives and as a solvent in waxes, printing inks, wood stains, glue mixtures, brake fluid, ingredient in electrolytic condense where it serves as a solvent for boric acid and borates, stabilizers for soybean foam used to extinguish oil and gasoline fires. It is used in the synthesis of safety explosives, glyoxal, unsaturated ester type alkyd resins, plasticizers, elastomers, synthetic fibers (Terylene, Dacron) and synthetic waxes.

5.18.4 Safety.

5.18.4.1 Health hazard. Ethylene glycol is a skin irritant as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. Long term exposure has resulted in neurological damage. When ingested, a lethal dose in humans is about 1.4 ml/kg or 100 ml. In case of contact with skin or eyes, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. LD_{50} orally in rats, guinea pigs is 8.54 and 6.61 g/kg, respectively.

5.18.4.2 Fire and explosive hazard. Ethylene glycol is a combustible liquid that can produce explosive vapor mixtures in dry air.

5.18.4.3 Reactivity. Ethylene glycol is a reactive with inorganic acids, anhydrides and oxidizing compounds.

5.18.5 Storage. Ethylene glycol is stored in the original container (1-gallon jar, 5-gallon carboy and 55-gallon drum). Storage space is away from heat and open flame. The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.18.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills are to be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazards. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in 40 CFR.

5.19 Name. ETHYLENE GLYCOL MONOBUTYL ETHER $C_4H_9OCH_2CH_2OH$ MW 118.17
2-Butoxyethanol (IUPAC) (SOCMA)
Butyl Cellosolve

5.19.1 Technical description. Ethylene glycol monobutyl ether is a synthetically prepared solvent. It is a colorless liquid with a mild odor and a low rate of evaporation. It is clear and free from sediment, suspended matter, hydrogen sulfide and sulfur dioxide. Ethylene glycol monobutyl ether is soluble in mineral oils, most solvents and water. In general, it is an inert solvent and has properties described in Table XXXII.

TABLE XXXII. Physical constants of Ethylene Glycol Monobutyl Ether, Technical.

Property	Nominal Value
Autoignition temperature, °C	244.0
Flash point	
(closed cup), °C (°F)	60.5 (141)
(open cup), °C (°F)	73.85
Freezing point, °C	-74.8
Refractive index, n_D^{20}	1.4196
Viscosity (20°C), centipoise, cps	6.42

5.19.2 Specifications. ASTM D 330, Standard Specification for 2-Butoxyethanol.

5.19.2.1 Requirements. Ethylene glycol monobutyl ether meets the requirements shown in Table XXXIII.

TABLE XXXIII. Quantitative requirements of Ethylene Glycol Monobutyl Ether, Technical.

Property	Requirements	
	Min	Max
Color (Pt/Co scale)	---	15
Distillation range:		
bp_{760}, %	165	---
dp_{760}	---	173
Nonvolatile matter (in 100 ml) (gram)	---	0.005
Specific gravity:		
d_{20}^{20}	0.900	0.905
d_{25}^{25}	0.898	0.901
Water, % by wt	---	0.1
Acidity (free acid as acetic acid), % by wt	---	0.01[1/]

[1/] Equivalent to 0.093 mg KOH per gram of sample.

5.19.3 Use. Ethylene glycol monobutyl ether is intended for military use as a solvent in inorganic protective coatings, particularly cellulose lacquers, lacquer thinners, and quick-drying varnishes and enamels. Typical commercial applications include use as a solvent for nitrocellulose resins; spray lacquers; brushing lacquers of the four-hour type; varnish removers; textiles (preventing spotting in printing or dyeing); mutual solvent for "soluble" mineral oils to hold soap in solution and to improve the emulsifying properties.

5.19.4 Safety. Ethylene glycol monobutyl ether is a flammable liquid with a flash point of 140°F. It is an irritant to the skin, eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush affected areas with water. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. In case of inhalation, obtain medical attention immediately. There are no TLV or PEL referenced for ethyl glycol monobutyl ether. The LD_{50} orally in rats is 2.67 g/kg. (Refer to 4.3.1)

5.19.5 Storage. Ethylene glycol monobutyl ether shall be stored in original containers (1-gallon cans, 5-gallon cans and 55-gallon drums). The material shall be kept away from heat and open flames. The storage area shall have adequate ventilation and shall be kept under 120°F. If stored as recommended, the shelf life of this material is indefinite. (Refer to 4.3.2)

5.19.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.20 Name. ETHYLENE GLYCOL MONOETHYL ETHER $C_2H_5OCH_2CH_2OH$ MW 90.12
2-Ethoxyethanol (IUPAC) (SOCMA)
Cellosolve
Oxitol

5.20.1 Technical description. Ethylene glycol monoethyl ether is a colorless, practically odorless liquid which is miscible with water, alcohol, ether, acetone and liquid esters. It also dissolves many oils, resins, waxes and the like materials and has characteristics shown in Table XXXIV.

TABLE XXXIV. Characteristics of Ethylene Glycol Monoethyl Ether.

Characteristic	Nominal Value
Autoignition temperature, °C	237.75
Refractive index n_D^{25}	1.4060
Viscosity, centistokes (25°C)	2.00
Viscosity, centistokes (60°C)	1.60
Weight per gallon (20°C)	7.74
Melting point, °C	-70
Flash point	
Open cup, °C (°F)	49 (120)
Closed cup, °C (°F)	44 (112)

5.20.2 Specifications. Federal, TT-E-781, Ethylene Glycol Monoethyl Ether, Technical and ASTM D 331, Standard Specification for 2-Ethoxyethanol.

5.20.2.1 Requirements. Ethylene glycol monoethyl ether is as shown in Table XXXV.

TABLE XXXV. Physical and chemical properties of Ethylene Glycol Monoethyl Ether.

Property	Requirements			
	TT-E-781		ASTM D 331	
	Min	Max	Min	Max
Specific gravity, d_{20}^{20}	0.929	0.932	0.929	0.932
d_{25}^{25}	---	---	0.926	0.929
Color (Pt/Co scale)	---	15	---	15
Distillation range				
bp_{760}, °C	134.0	---	134.0	---
dp_{760}, °C	---	136.0	---	136.0
Nonvolatile matter, mg/100 ml	---	5	---	5
Water, % by wt	---	0.1	---	0.1
Acidity (% by wt as acetic acid)	---	0.01	---	0.01 1/
Flash point	38	---	---	---
Evaporation rate (n-butyl acetate = 1.0)	---	0.34	---	---

1/ Equivalent to 0.10 mg of KOH per gram of sample.

5.20.3 Use. Ethylene glycol monoethyl ether is intended for military use in the manufacture of organic protective coatings. Typical commercial applications include use as a solvent for nitrocellulose, natural and synthetic resins; mutual solvent for the formulation of soluble oils; in lacquers and lacquer thinners, dyeing and printing textiles, varnish removers, cleaning solutions, leather, and as an anti-icing additive for jet fuel.

5.20.4 Safety.

5.20.4.1 Health hazard. Ethylene glycol monoethyl ether is a skin irritant, as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. It is a known neurological poison acting over a long period of exposure. LD_{50} orally in rats is 3 g/kg. (Refer to 4.3.1)

5.20.4.2 Fire and explosion hazard. Ethylene glycol monoethyl ether is a combustible liquid that can produce explosive vapor mixtures in air.

5.20.4.3 Reactivity. Ethylene glycol monoethyl ether is reactive with inorganic acids, anhydrides, oxides and oxidizing compounds.

5.20.5 Storage. Ethylene glycol monoethyl ether is stored in the original container (1-gallon jar, 5-gallon carboy and 55-gallon drum). Storage space is away from heat and open flame and where the temperature is below 100°F (38°C). The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.20.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills are to be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazards. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is listed in 40 CFR as U359 and as a flammable liquid with an identification number UN1171 in accordance with CFR 49, Section 172.101.

5.21 Name. ETHYLENE GLYCOL MONOMETHYL ETHER $CH_3OCH_2CH_2OH$ MW 76.09
2-Methoxyethanol (IUPAC) (SOCMA)
Methyl Cellosolve

5.21.1 Technical description. Ethylene glycol monomethyl ether is a colorless liquid with a mild agreeable odor. It is miscible with water, alcohol, ether, glycerol, acetone and dimethyl formamide, and has characteristics as shown in Table XXXVI.

TABLE XXXVI. Characteristics of Ethylene Glycol Monoethyl Ether.

Property	Nominal Value
Autoignition temperature, °C	288.3
Flash point, °C (°F)	46.1 (115)
Freezing point, °C	-85.1
Refractive index, n_D^{20}	1.4024

5.21.2 Specifications. Federal, O-E-780, Ethylene Glycol Monomethyl Ether, Technical and ASTM D 3128, Standard Specification for 2-Methoxy Ethanol.

5.21.2.1 Requirements. Physical and chemical characteristics of Ethylene Glycol Monomethyl Ether is as shown in Table XXXVII.

TABLE XXXVII. Physical and chemical characteristics of Ethylene Glycol Monomethyl Ether.

Property	Requirements			
	O-E-780		ASTM D 3128	
	Min	Max	Min	Max
Specific gravity				
d_{20}^{20}	---	---	0.963	0.967
d_{25}^{25}	0.961	0.967	0.960	0.964
Viscosity (25°C), cps	1.50	1.50	---	---
Water content, % by wt	---	0.1	---	0.2
Distillation range				
bp_{760}	123.5	---	123.0	---
dp_{760}	---	128.0	---	126.0
Distillate below 127°C, % by wt	99.0	---	---	---
Acidity (free acid as acetic acid, % by wt	---	---	---	0.01[1/]

[1/] Equivalent to 0.093 mg of KOH/g of sample.

5.21.3 Use. Ethylene glycol monomethyl ether is intended for military use as a general laboratory reagent, a solvent and an ingredient in Decontaminating Agent DS2. Typical commercial applications include use as a solvent for nitrocellulose, cellulose acetate, alcohol-soluble dyes, and natural and synthetic resins; in solvent mixtures; in enamels, varnishes, and lacquers; as a perfume fixative; in wood stains; for sealing moisture-proof cellophane, nail polish formulations and dyeing of leather.

5.21.4 Safety.

5.21.4.1 Health hazard. Ethylene glycol monomethyl ether is a skin irritant, as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. LD_{50} orally in rats is 2.46 g/kg; lethal concentrations for rats in air is 1500 ppm. (Refer to 4.3.1)

5.21.4.2 Fire and explosion hazard. Ethylene glycol monomethyl ether is a combustible liquid that can produce explosive vapor mixtures in air.

5.21.4.3 Reactivity. Ethylene glycol monomethyl ether is reactive with inorganic acids, anhydrides and oxidizing compounds.

5.21.5 Storage. Ethylene glycol monomethyl ether is stored in the original containers (1-gallon jar, 5-gallon carboy and 55-gallon drum). Storage space is away from heat and open flame and where the temperature is below 100°F (38°C). The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.21.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills are to be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazard. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.22 Name. ETHYLENE GLYCOL MONOETHYL ETHER ACETATE FW 132.16

$C_2H_5OCH_2CH_2OOCCH_3$

EGMEEA
Carbitol Acetate®
2-Ethoxyethyl Acetate
2-Ethoxyethanol Acetate

5.22.1 Technical description. Ethylene glycol monoethyl ether acetate (EGMEEA) is a very hygroscopic liquid, miscible with acetone, benzene, chloroform, ethanol, ether, pyridine and water. It has characteristics shown in Table XXXVIII.

TABLE XXXVIII. Characteristics of Ethylene Glycol Monoethyl Ether Acetate.

Characteristic	Nominal Value
Refractive index, n_D^{20}	1.4213
Melting point, °C	-25
Density, d_{20}^{20}	1.0114
Flash point (tag open cup), °C	56
(°F)	(134)

5.22.2 Specifications. Military, MIL-E-7125, Ethylene Glycol Monoethyl Ether Acetate, Technical.

5.22.2.1 Requirements. Ethylene glycol monoethyl ether acetate is as shown in Table XXXIX.

TABLE XXXIX. Chemical and physical characteristics of Ethylene Glycol Monoethyl Acetate.

Characteristics	Requirements	
	Min	Max
Color (Pt/Co scale)	---	15
Specific gravity, d_{20}^{20}	0.973	0.976
Acidity, (% by wt as acetic acid)	---	0.02
Water, % by wt	---	0.10
Assay, % by wt	99.0	---
Alcohol, % by wt (as 2-ethoxy ethanol)	---	0.5
Distillation range		
bp_{760}	150	---
dp_{760}	---	160

5.22.3 Use. Ethylene glycol monoethyl acetate is for use in the manufacture and application of organic protective coatings used on aircraft. It is also used in automobile lacquers to retard evaporation and impart high gloss.

5.22.4 Safety.

5.22.4.1 Health hazard. Ethylene glycol monoethyl acetate is a skin irritant, as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. Long term exposure has resulted in neurological damage. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. LD_{50} orally in rats is 5.1 g/kg. (Refer to 4.3.1)

5.22.4.2 Fire and explosion hazard. Ethylene glycol monoethyl acetate is a combustible liquid that can produce explosive vapor mixtures in air.

5.22.4.3 Reactivity. Ethylene glycol monoethyl acetate is reactive with inorganic acids, anhydrides and oxidizing compounds.

5.22.5 Storage. Ethylene glycol monoethyl acetate is stored in the original container (1-gallon bottles, 5-gallon cans and 55-gallon drums). Storage space is away from heat and open flame and where the temperature is below 100°F (38°C). The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.22.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills are to be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor

ignition hazard. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.23 Name. ETHYL ETHER (SOCMA) $CH_3CH_2OCH_2CH_3$ MW 74.12
1,1-Oxybisethane
Diethyl Ether
Ethoxyethane (IUPAC)
Ether
Ethyl Oxide
Diethyl Oxide
Sulfuric Ether
Anesthetic Ether

5.23.1 Technical description. Ethyl Ether is a very mobile, highly volatile and flammable liquid. It is heavier than air and has a characteristic, sweetish, pungent odor, with a burning taste. It tends to form explosive peroxides under the influence of air and light, particularly when evaporation to dryness is attempted. Peroxides may be removed from ether by shaking with 5 percent by weight aqueous ferrous sulfate solution. Naphthols, polyphenols, aromatic amines and aminophenols may be added to ether for stabilization if the intended use is not affected. Ethyl ether has characteristics shown in Table XL.

TABLE XL. Characteristics of Ethyl Ether.

Characteristics	Nominal Value
Specific gravity:	
d_4^0	0.7364
d_4^{10}	0.7249
d_4^{20}	0.7134
d_4^{30}	0.7019
Vapor density (Air = 1.0)	2.55
Melting point:	
Stable crystal, °C	-116.3
Metastable crystal, °C	-123.3
Boiling point	
bp_{760}	34.6
bp_{400}	17.9
bp_{200}	2.2
bp_{100}	-11.5
bp_{10}	-48.1
$bp_{1.0}$	-74.3
Saturated vapor pressure:	
0°C, mm	184.9
10°C, mm	290.8
20°C, mm	439.8
50°C, mm	1276.0
70°C, mm	2304.0

TABLE XL. Characteristics of Ethyl Ether (Continued).

Characteristics	Nominal Value
Critical temperature, °C	192.7
Critical pressure, atmospheres	36.6
Flash point (closed cup), °C (°F)	-45 (-49)
Autoignition temperature, °C	180 - 190
Refractive index, n_D^{15}	1.35555
Dielectric constant (at 26.9°C and 85.8 kWertz)	4.197
Surface tension at 20°C, dynes/cm	17.06
Viscosity at 20°C, cp	0.2448
Heat of vaporization at 30°C, cal/g	89.80
Heat of formation, cal/g	-907
Heat of combustion, Kcal/g	-8.807

5.23.2 Specifications. Military, MIL-E-199, Ether, Diethyl, Technical.

5.23.2.1 Requirements. Requirements are as shown in Table XLI.

TABLE XLI. Chemical and physical properties of Ethyl Ether.

Characteristic	Requirements	
	Min	Max
Specific gravity, d_{20}^{20}	0.712	0.733
Nonvolatile residue, % by wt	---	0.002
Acidity (as acetic acid), %	---	0.006
Acetylene, % by wt	---	0.001
Peroxides	---	None
Chlorides	---	None
Aldehydes	---	None
Color (Pt/Co scale)	---	20

5.23.3 Use. Ethyl ether is used as an anesthetic, in the manufacture of gun powder, a cleaning agent for optical lenses and to start diesel engines. It is used also as a solvent for waxes, fats, oils, perfumes, alkaloids, gums, nitrocellulose (when mixed with ethyl alcohol). It is an important reagent in organic syntheses as a Grignard and Wurtz type reactions.

5.23.4 Safety.

5.23.4.1 Health hazard. Ethyl ether is mildly irritating to the skin, mucous membranes and eyes. Inhalation of high concentrations causes narcosis and unconsciousness. Death may occur due to respiratory paralysis. Upon exposure, obtain medical attention immediately. Permissible exposure limit is 400 ppm or 1200 mg/m^3. (Refer to 4.3.1)

5.23.4.2 Fire and explosion hazard. When shaken under absolutely dry conditions, ether can generate enough static electricity to start a fire. Air-ether mixtures containing more than 1.85 volume percent of ether vapor are explosive hazards. Explosions may result when ether is brought into contact with anhydrous nitric acid. ETHER IS AN EXPLOSION HAZARD.

5.23.4.3 Reactivity. Ether reacts with magnesium and zinc to form organic metallic compounds that react violently with water. Ether reacts violently with oxidizing materials.

5.23.5 Storage. Ethyl ether is stored in the original container. Storage space is away from heat and open flame. The storage temperature is below 90°F. Open containers pick up moisture and the contents should be inspected to determine suitability for use. (Refer to 4.3.2)

5.23.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is listed in CFR 40 as U117 and as a flammable liquid with an identification number UN1155 in accordance with CFR 49, Section 172.101.

5.24 Name. GLYCEROL (SOCMA) $HOCH_2CHOHCH_2OH$ MW 92.10
Glycerin
Glycerine
1,2,3-Propanetriol (IUPAC)
Trihydroxypropane
Incorporation Factor
IFP
Ophthalgan

5.24.1 Technical description. Glycerol is a syrup liquid with a sweet warm taste (about 0.6 times as sweet as cane sugar). It absorbs moisture as well as sulfur dioxide, hydrogen sulfide, and hydrogen cyanide (acid gases). Glycerol is miscible with water and alcohol. It is insoluble in benzene, chloroform, carbon tetrachloride, carbon disulfide, petroleum ether and oils. Glycerol has characteristics shown in Table XLII.

TABLE XLII. Characteristics of Glycerol.

Property	Constants
Melting point, °C	17.8
Boiling point:	
bp_{760} (decomposes), °C	290.0
bp_{400}, °C	263.0
bp_{200}, °C	240.0
bp_{100}, °C	221.1
bp_{60}, °C	208.0
bp_{20}, °C	182.2
bp_{10}, °C	167.2
bp_{5}, °C	153.8
bp_{1}, °C	125.5
Refractive index:	
n_D^{15}	1.4758
n_D^{20}	1.4746
n_D^{25}	1.4730
Density:	
d_{15}^{15}	1.26557
d_{20}^{20}	1.26362
d_{25}^{25}	1.26201
Flash point, °C (°F)	176 (350)
Specific gravity (aqueous solution):	
95%: d_{15}^{15}	1.24910
90%: d_{15}^{15}	1.23950
d_{20}^{20}	1.23755
d_{25}^{25}	1.23585
80%: d_{15}^{15}	1.213
70%: d_{15}^{15}	1.185
60%: d_{15}^{15}	1.157
50%: d_{15}^{15}	1.129
20%: d_{15}^{15}	1.049
5%: d_{15}^{15}	1.0122
Viscosity (20°C) (aqueous solutions):	
5%	1.143
10%	1.311
25%	2.095
50%	6.050
60%	10.96
70%	22.94
83%	111.0
Freezing points (aqueous solutions:	
10%, °C	-1.6
30%, °C	-9.6
50%, °C	-23.0
66.7%, °C	-46.5
80%, °C	-20.3
90%, °C	-1.6

5.24.2 Specifications. Federal, O-G-491, Glycerol, Technical (High Gravity) and ASTM D 1257, Standard Specification for High Gravity Glycerin.

5.24.2.1 Requirements. The material is free from suspended matter and is clear and there is no precipitation formed in 10 minutes in the presence of a 10.0 percent aqueous solution of silver nitrate. Glycerol has physical and chemical properties shown in Table XLIII.

TABLE XLIII. Physical and chemical properties of Glycerol.

Property	Requirements			
	O-G-491		ASTM D 1257	
	Min	Max	Min	Max
Color (Pt/Co Scale)	---	20	---	20
Specific gravity:				
d_{25}^{25}	1.2587	---	1.2587	---
$d_{15.6}^{15.6}$	---	---	1.2620	---
Ash, % by wt	---	1.0	---	---
Chlorides (as Cl), % by wt	---	0.1	---	---
Saponification number, % by wt	---	0.5	---	---
Sulfate ash, % by wt	---	---	---	0.1
Acid value	---	0.3	---	0.3 1/

1/ 0.281 mg of KOH per g of sample.

5.24.3 Use. Glycerol is intended for military use in the manufacture of explosives [nitroglycerol (dynamite)] and in other applications where high gravity glycerol is required. Glycerol is used in cosmetics, liquid soaps, liqueurs, confectioneries, blacking, printing and copying inks, lubricants, elastic glues, lead oxide cements; to keep fabrics pliable; to preserve printing on cotton; for printing rollers and hectographs; to keep frost from windshields; as antifreeze in automobiles, gas meters and hydraulic jacks in shock absorber fluids, in fermentation nutrients in the production of antibiotics and as a humectant in the tobacco industry, pharmaceutic aid, cellophane and cork.

5.24.4 Safety.

5.24.4.1 Health hazard. Glycerol is a skin irritant as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. LD_{50} orally in rats is >20 ml/kg. (Refer to 4.3.1)

5.24.4.2 Fire and explosion hazard. Glycerol is a combustible liquid that can produce explosive mixtures. CAUTION: Contact with strong oxidizing agents, such as chromium trioxide, potassium chlorate or potassium permanganate may produce an explosion.

5.24.4.3 Reactivity. Glycerol is reactive with inorganic acids, anhydrides, oxides and oxidizing agents.

5.24.5 Storage. Glycerol is stored in original container (1-pint bottles, 1-gallon jar, 5-gallon carboys and 55-gallon drums). Storage space is away from heat and open flame. The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.24.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills are to be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazards. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in 40 CFR.

5.25 Name. GLYCERYL MONOOLEATE $C_{17}H_{33}COOCH_2CHOHCH_2OH$ FW 356.55
Glycerol Monooleate
2;3-Dihydroxypropyl Oleate
1-Monoolein

5.25.1 Technical description. Glyceryl monooleate is a yellowish soft solid with a melting point of 35°C when pure, but the melting point can be as low as 25°C because of impurities. It has an iodine number of 65 to 80, is insoluble in water, slightly soluble in alcohol and most organic solvents.

5.25.2 Specifications. Military, MIL-G-81239, Glycerol Monooleate.

5.25.2.1 Requirements. The physical and chemical characteristics are as shown in Table XLIV.

TABLE XLIV. Physical and chemical properties of Glyceryl Moncoleate.

Property	Requirements	
	Min	Max
Acid number	---	5.1
Saponification number	160	170
Specific gravity, d_{25}^{25}	0.930	0.970
Solidification point, °C	12	17
Color (Gardner scale)	---	10

5.25.3 Use. Glyceryl monooleate is used as an ingredient of a wetting agent for rocket motor propellants. It is also used in some formulations of alkyd oil base paints.

5.25.4 Safety. Glyceryl monooleate is an irritant to the skin, eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush area with water. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. In case of inhalation, obtain medical attention immediately. There are no TLV or PEL referenced for glyceryl monooleate. (Refer to 4.3.1)

5.25.5 Storage. Glyceryl monooleate shall be stored in approved containers (cans containing 7 or 35-pounds or drums containing 380-pounds of materials). The storage area shall be well ventilated, and there shall be no open flames or areas of definite fire hazard nor nearby powerful oxidizing agents. (Refer to 4.3.2)

5.25.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.26 Name. HEXAMETHYLENETETRAMINE (SOCMA) $C_{16}H_{12}N_4$ MW 140.19
Aminoform
Ammoform
Ammonioformaldehyde
Cystamin
Cystogen
Formin
Hexamine
HMT
HMTA
Methenamine
1,3,5,7-Tetraazotricyclo[3.3.1.$1^{3,7}$]-decane
1,3,5,7-Tetraazaadamantane
Uritone
Urotropin

5.26.1 Technical description. Hexamethylenetetramine is a white crystalline powder or colorless lustrous crystals and practically odorless. The specific gravity is 1.27 at 25°C. It is soluble in water, alcohol, and chloroform, but insoluble in ether. It sublimes at 263°C, partly decomposing. In contact with flame, it burns with smokeless flame.

5.26.2 Specifications. Military, MIL-H-502, Hexamethylenetetramine, Technical.

5.26.2.1 Requirements. Hexamethylenetetramine is completely soluble without turbidity in glacial acetic acid and has chemical characteristics shown in Table XLV. Not less than 98 percent by weight of the chemical shall pass through U.S. Sieve Size No. 8 screen.

TABLE XLV. Chemical characteristics of Hexamethylenetetramine.

Characteristics	Requirements	
	Min	Max
	% By Wt	% By Wt
Assay	99.0	---
Formaldehyde	---	0.0
Ammonia	---	0.02
Chloride	---	0.02
Ash	---	0.1
Water content	---	0.5
Insoluble matter	---	0.05

5.26.3 Use. Hexamethylenetetramine is intended for military use in the manufacture of cyclonite and homocyclonite and as a stabilizer. It is used in adhesives, coatings, and sealing compounds; in the chemical detection of metals; in the preservation of hides; as a cross-linking agent for hardening phenol-formaldehyde resin and rubber; as a corrosion inhibitor for steel; as a dye fixative; as fuel tablets in camping stoves; as a stabilizer for lubricating and insulating oils; and with sodium phenate and sodium hydroxide as an absorber of poisonous gases.

5.26.4 Safety. Hexamethylenetetramine is an irritant to the skin, eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush area with water. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. In case of inhalation, obtain medical attention immediately. There are no TLV or PEL referenced for hexamethylenetetramine. (Refer to 4.3.1)

5.26.5 Storage. Hexamethylenetetramine shall be stored in approved containers (50-pound Kraft bags). The storage area shall be well ventilated, and there shall be no open flames or areas of definite fire hazard nor nearby powerful oxidizing agents. (Refer to 4.3.2)

5.26.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

In accordance with CFR 49, 171.01, Hexamethylenetetramine is in hazard class "FORBIDDEN", meaning that a "FORBIDDEN" material may not be transported. An EPA Hazardous Waste Classification is not listed in CFR 40.

5.27 Name. HEXYLENE GLYCOL $C_6H_{14}O_2$ FW 118.17
2-Methyl-2,4-pentanediol
α,α,-α-Trimethyltrimethyleneglycol
Pinakon

5.27.1 Technical description. Hexylene glycol is a liquid with a mild sweet odor. It is soluble in water, ether and lower molecular weight aliphatic hydrocarbons; and has characteristics shown in Table XLVI.

TABLE XLVI. Physical and Chemical Characteristics of Hexylene Glycol.

Characteristics	Nominal Value
Boiling point, bp_{760}, °C	198
bp_{10}, °C	97
Flash point, °C (°F)	-93 (200)
Refractive index, n_D^{20}	1.4276
Dipole moment	2.8
Viscosity (at 20°C), cps	34

5.27.2 Specifications. ASTM D 2636, Standard Specification for Hexylene Glycol.

5.27.2.1 Requirements. The properties of hexylene glycol are as shown in Table XLVII.

TABLE XLVII. Physical and chemical properties of Hexylene Glycol.

Property	Requirements	
	Min	Max
Specific gravity:		---
d_{20}^{20}	0.921	---
d_{25}^{25}	0.918	
Color (Pt/Co scale)	---	---
Distillation, °C	197.1[1/]	
Acidity (free acid as acetic acid), % by wt	---	0.005[2/]
Water, % by wt	---	0.1

[1/] The entire sample shall distill within 3.0°C including 197.1°C.
[2/] Equivalent to 0.047 mg of KOH per gram of sample.

5.27.3 Use. Hexylene glycol is used as a coupling agent to castor oil in hydraulic brake fluids and also in the formulation of cosmetics.

5.27.4 Safety.

5.27.4.1 Health hazard. Hexylene glycol is a skin irritant, as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. LD_{50} orally in rats is 4.70 g/kg. (Refer to 4.3.1)

5.27.4.2 Fire and explosion hazard. Hexylene glycol is a combustible liquid that can produce explosive vapor mixtures in air.

5.27.4.3 Reactivity. Hexylene glycol is reactive with inorganic acids, anhydrides, oxides and oxidizing compounds.

5.27.5 Storage. Hexylene glycol is stored in the original container (1-gallon jar, 5-gallon carboy and 55-gallon drum). Storage space is away from heat and open flame. The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.27.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills are to be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazard. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.28 Name. ISOBUTYL ALCOHOL $C_4H_{10}O$ FW 74.12
2-Methyl-1-propanol
Isopropylcarbinol
1-Hydroxymethylpropane
Fermentation Butyl Alcohol

5.28.1 Technical description. Isobutyl alcohol is a colorless refractive liquid and is as shown in Table XLVIII.

TABLE XLVIII. Characteristics of Isobutyl Alcohol.

Characteristic	Nominal Value
Specific gravity, d_{15}^{15}	0.806
Boiling point, bp_{760}, °C	108
Melting point, °C	-108
Flash point (closed cup), °C (°F)	28 (82)
Refractive index, n_D^{15}	1.3978

5.28.2 Specifications. ASTM D 1719, Standard Specification for Isobutyl Alcohol.

5.28.2.1 Requirements. Isobutyl alcohol is as shown in Table XLIX.

TABLE XLIX. Chemical and physical properties of Isobutyl Alcohol.

Property	Requirements	
	Min	Max
Specific gravity:		
d_{20}^{20}	0.802	0.804
d_{25}^{25}	0.794	0.801
Color (Co/Pt scale)	---	10
Distillation, °C	107.9[1/]	
Nonvolatile matter, g/100 ml	---	0.005
Water, % by wt	---	0.2[2/]
Acidity (free acid as acetic acid), % by wt	---	0.003[3/]

1/ The sample shall entirely distill within 2°C range which shall include 107.9°C.
2/ This quantitative water limit ensures that the material is miscible without turbidity with 19 volumes of 99 percent heptane at 20°C.
3/ Equivalent to 0.028 mg KOH per gram of sample.

5.28.3 Use. Isobutyl alcohol is used as a solvent in paint and varnish removers and also in the manufacture of esters for fruit flavoring essences.

5.28.4 Safety.

5.28.4.1 Health hazard. Isobutyl alcohol is a skin irritant as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. In case of contact with skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. The permissible exposure limit is 100 ppm or 300 mg/m^3 and the IDLH is 8000 ppm. LD_{50} orally in rats is 2.46 g/kg.

5.28.4.2 Fire and explosive hazard. Isobutyl alcohol is a combustible liquid that can produce explosive vapor mixtures in air.

5.28.4.3 Reactivity. Isobutyl alcohol is a reactive with inorganic acids, anhydrides, oxides and oxidizing compounds.

5.28.5 Storage. Isobutyl alcohol is stored in the original container (1-pint, 1-quart, 1-gallon bottles, 5-gallon carboy and 55-gallon drum). Storage space is away from heat and open flame and where the temperature is below 100°F (38°C). The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.28.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills are to be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazards. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is listed in 40 CFR as U140.

5.29 Name. ISOPROPYL ALCOHOL C_3H_8O FW 60.09
IPA
2-Propanol
Isopropanol
Secondary Propyl Alcohol
Dimethyl Carbinol
Petrohol

5.29.1 Technical description. Isopropyl alcohol is a flammable liquid and has characteristics shown in Table L.

TABLE L. Physical and chemical characteristics of Isopropyl Alcohol.

Characteristics	Nominal Value
Melting point, °C	-88.5
Freezing point, °C	-89.5
Boiling point:	
bp_{760}, °C (°F)	82.5 (180)
bp_{400}, °C	67.8
bp_{200}, °C	53.0
bp_{100}, °C	39.5
bp_{60}, °C	30.5
bp_{40}, °C	23.8
bp_{20}, °C	12.7
bp_{10}, °C	2.4
bp_{5}, °C	-7.0
bp_{1}, °C	-26.1
Specific gravity:	
d_4^{20}	0.78505
d_4^{25}	0.78084
d_4^{83}	0.728
Flash point (closed cup), °C (°F)	12 (53)
Lower explosive limit in air (U/V), %	2.5
Refractive index:	
n_D^{8}	1.3852
n_D^{15}	1.3802
n_D^{20}	1.37723
n_D^{25}	1.3749

5.29.2 Specifications. Federal, TT-I-735, Isopropyl Alcohol and ASTM D 770, Standard Specification for Isopropyl Alcohol.

5.29.2.1 Requirements. Isopropyl alcohol has properties shown in Table LI.

TABLE LI. Properties of Isopropyl Alcohol.

Property	Requirements					
	TT-I-735				ASTM D 770	
	Grade A		Grade B			
	Min	Max	Min	Max	Min	Max
Acidity (% as acetic acid)	---	0.002	---	0.002	---	0.002[1/]
Distillation, °C	---	---	---	---	82.3[2/]	
bp_{760}, °C	81.8	---	81.8	---	---	---
dp_{760}, °C	---	83.0	---	83.0	---	---
Nonvolatile matter (g/100 ml)	---	0.002	---	0.002	---	0.002
Specific gravity:						
d_{20}^{20}	0.7862	0.7870	0.7862	0.7878	0.785	0.787
d_{25}^{25}	---	---	---	---	0.782	0.784
Water content, % by wt	---	0.10	---	0.40	---	0.20
Color (Pt/Co scale)	---	10	---	10	---	10

[1/] Equivalent to 0.019 mg of KOH per gram of sample.
[2/] Isopropyl alcohol shall distill entirely within a 1.5°C range which shall include 82.3°C.

5.29.3 Use. Isopropyl alcohol under TT-I-735, Grade A, is used as an intermediate in the manufacture of chemicals. Isopropyl alcohol TT-I-735, Grade B, is used in organic coatings, anti-icing fluid and ordnance material. Isopropyl alcohol conforming to D 770 may be used in organic coating formulations and anti-icing fluids. In general, isopropyl alcohol is used in antifreeze formulations, as solvent for gums, shellac, and essential oils; in the extradition of alkaloids; in quick drying oils; in quick drying inks; in denaturing ethyl alcohol; in body rubs; hand lotions, aftershave and similar cosmetics. It is also used as a solvent for creosol, resins, and gums, as well as the manufacture of acetone, glycerol and isopropyl acetate.

5.29.4 Safety.

5.29.4.1 Health hazard. Isopropyl alcohol is a skin irritant, as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. The permissible exposure limit is 400 ppm or 980 mg/m^3, and the IDLH level is 20,000 ppm. (Refer to 4.3.1)

5.29.4.2 Fire and explosion hazard. Isopropyl alcohol is a combustible liquid that can produce explosive vapor mixtures in air.

5.29.4.3 Reactivity. Isopropyl alcohol is reactive with inorganic acids, anhydrides, oxides and oxidizing compounds.

5.29.5 Storage. Isopropyl alcohol is stored in the original container (1-pint, 1-quart and 1-gallon bottles, 5-gallon pail and 55-gallon drums). Storage space is away from heat and open flame and where the temperature is below 100°F

(38°C). The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.29.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills are to be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazard. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

In accordance with CFR 49, 172.101, isopropyl alcohol is listed as a flammable liquid with an identification number of UN1219. An EPA Hazardous Waste Classification is not listed in CFR 40.

5.30 Name. METHANOL (IUPAC) (SOCMA) CH_3OH FW 32.04
Carbinol
Methyl Alcohol
Wood Alcohol
Wood Spirit

5.30.1 Technical description. Methanol is the simplest of alcohols. It is a clear, volatile, colorless, flammable, mobile liquid which is free of foreign odors. It is miscible with water, alcohol, ether, ketones, and most organic solvents. It burns with non-luminous, bluish flame. It is usually a better solvent than ethanol since it dissolves many inorganic salts. Methanol has characteristics shown in Table LII.

TABLE LII. Physical and chemical characteristics of Methanol.

Characteristic	Nominal Value
Specific gravity:	
d_4^0	0.8100
d_4^{15}	0.7960
d_4^{20}	0.7915
d_4^{25}	0.7866
Melting point, °C	-97.8
Boiling point,	
bp_{760}, °C	64.7
bp_{400}, °C	49.9
bp_{200}, °C	34.8
bp_{100}, °C	21.2
bp_{60}, °C	12.1
bp_{40}, °C	5.0
bp_{20}, °C	-6.0
bp_{10}, °C	-16.2
bp_5, °C	-25.3
$bp_{1.0}$, °C	-44.0
Vapor density (air = 1)	1.11

TABLE LII. Physical and chemical characteristics of Methanol (Continued).

Characteristic	Nominal Value
Refractive index:	
n_D^{15}	1.33066
n_D^{20}	1.3292
Flash point	
(Closed cup), °C (°F)	12 (54)
(Open cup), °C (°F)	15.5 (61)
Ignition temperature, °C (°F)	470 (878)
Explosive limits (% vol in air)	
Lower	6.0
Upper	36.5
Critical temperature, °C	240
Critical pressure, atmosphere	78.5
Specific heat (20°C), cal/g	0.595
Dipole moment	1.69
Viscosity (20°C), cps	5.93

5.30.2 Specifications. Federal, O-M-232, Methanol (Methyl Alcohol) and ASTM D 1152, Standard Specification for Methyl Alcohol.

5.30.2.1 Requirements. Methanol furnished under O-M-232 comes in Grade A as described in Table LIII, Grade AA as described in Table LIII and Grade C for use as a denaturant. Methanol furnished under ASTM D 1152 is as described in Table LIII. The appearance is free from opalescence, suspended matter and sediment.

TABLE LIII. Chemical and physical properties of Methanol.

Properties	Requirements					
	O-M-232				ASTM D 1152	
	Grade A		Grade AA			
	Min	Max	Min	Max	Min	Max
Acetone, % by wt	---	0.003	---	0.003	---	0.003
Acidity (as acetic acid), % by wt	---	0.003	---	0.003	---	0.003[1/]
Color (Pt/Co scale), Carborizable impurities (H_2SO_4 Tes)	---	30	---	30	---	50
Distillation, °C	64.6[2/]		64.6[2/]		64.6[2/]	
Ethanol, % by wt	---	---	---	0.001	---	---
Nonvolatile matter, mg/100 ml	---	10	---	10	---	5
Permanganate time, minutes	---	30	---	30	---	50
Specific gravity:						
d_{25}^{20}	---	0.7928	---	0.7928	0.7920	0.7930
d_{25}^{25}	---	---	---	---	0.7883	0.7893
Water, % by wt	---	0.15	---	0.10	---	0.10
Color (Pt/Co scale)	---	5	---	5	---	5

[1/] Equivalent to 0.028 mg KOH per gram of sample.
[2/] Range is not more than 1.0°C including 64.6°C.

5.30.3 Use. Methanol is intended for military use as a general solvent and for the generation of hydrogen and carbon dioxide. It is used as an industrial solvent, a raw material for making formaldehyde and methyl esters of organic and inorganic acids, an antifreeze for automotive radiators and air brakes; an ingredient of gasoline and diesel oil antifreezes; an octane booster in gasoline; a fuel for picnic stoves and soldering torches; to denature ethanol, a softening agent for pyroxylin plastics; a solvent and solvent adjuvant for polymers and a solvent in the manufacture of cholesterol, streptomycin, vitamins, hormones and other pharmaceuticals.

5.30.4 Safety.

5.30.4.1 Health hazard. Methanol is a skin irritant, as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. Poisoning may occur from ingestion, inhalation or percutaneous absorption. Acute affects are headache, fatigue, nausea, visual impairment or complete blindness (may be permanent), acidosis, convulsions, mydriasis, circulatory collapse, respiratory failure and death. Death has resulted from ingestion of less than 30 ml; usual fatal dose is 100 to 250 ml. Medical attention should be obtained upon exposure. The permissible exposure limit is 200 ppm or 260 mg/m^3. The IDLH is 25,000 ppm. (Refer to 4.3.1)

5.30.4.2 Fire and explosion hazard. Methanol is a combustible liquid that can produce explosive vapor mixtures in air. (Refer to Table LII)

5.30.4.3 Reactivity. Methanol is reactive with organic and inorganic acids, anhydrides, oxides and oxidizing compounds.

5.30.5 Storage. Methanol is stored in the original container (1-quart bottles, 1-gallon jars, 5-gallon carboy and 55-gallon drum). Storage space is away from heat and open flame and where the temperature is below 100°F (38°C). The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.30.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills are to be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazards. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

In accordance with CFR 49, 172.101, methanol is listed as a flammable liquid having a transportation number of UN1230. An EPA Hazardous Waste Classification is listed in 40 CFR as U154.

5.31 Name. MONOETHANOLAMINE $HOCH_2CH_2NH_2$ FW 61.08
2-Aminoethanol (IUPAC) (SOCMA)
b-Aminoethanol
ß-Amino Ethyl Alcohol
Colamine
Ethanolamine
2-Hydroxyethylamine
ß-Hydroxyethylamine
MEA

5.31.1 Technical description. Monoethanolamine is a colorless, moderately viscous liquid with a characteristic odor of ammonia. It is a strong, chemically active base, miscible with water; soluble in alcohol, chloroform, and carbon tetrachloride and has characteristics shown in Table LIV.

TABLE LIV. Physical and chemical characteristics of Monoethanolamine.

Characteristics	Nominal Value
Specific gravity (see Table LV for requirement):	
d_4^{25}	1.0117
d_4^{40}	0.9998
d_4^{60}	0.9844
Viscosity, at 25°C, cps	18.95
at 60°C, cps	5.03
Melting point, °C	10.3
Boiling point:	
bp_{760}	170.8
bp_{12}	71.0
pH (25% aqueous solution)	12.1
pH (0.1 N aqueous solution)	12.05
Refractive index, n_D^{20}	1.4539
Dipole moment	2.27
Flash point, °C (°F)	93.3 (195)

5.31.2 Specifications. Military, MIL-E-50011, Ethanolamines (Monoethanolamine, Diethanolamine, and Triethanolamine), Type I - Monoethanolamine.

5.31.2.1 Requirements. Monoethanolamine is free from suspended matter and is as shown in Table LV.

TABLE LV. Chemical and physical properties of Monoethanolamine.

Property	Requirements	
	Min	Max
Distillation range between 165 to 175°C, % by vol.	90	---
Color (Pt/Co scale)	---	20
Monoethanolamine, % by wt	98	---
Diethanolamine, % by wt	---	1.5
Triethanolamine, % by wt	---	1.0
Water content, % by wt	---	1.0
Specific gravity, d_{20}^{20}	1.017	1.021

5.31.3 Use. Monoethanolamine, technical is intended for military use in the removal of carbon dioxide from air, other gases, and liquids by absorption; and as a wetting agent, a solution solvent, corrosion inhibitor and a metalworking lubricant. Typical commercial applications include use in shampoos, waxes, detergents, polishes, paints, agricultural sprays, and pharmaceutical softeners.

5.31.4 Safety.

5.31.4.1 Health hazard. Monoethanolamine is an irritant to the eyes, skin, and respiratory tract and can be toxic as an inhalant. In case of contact with the eyes or skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. The final limits of TWA are 3 ppm (15 mg/m^3). The LD_{50} orally in rats is 10.20 g/kg. (Refer to 4.3.1)

5.31.4.2 Fire and explosion hazard. Monoethanolamine is a combustible liquid and can produce explosive vapors. Fires are to be extinguished using dry chemical, alcohol foam or carbon dioxide. In fire conditions, personnel wear self-contained breathing apparatus.

5.31.4.3 Reactivity. Monoethanolamine is reactive with oxidizing materials, inorganic acids, anhydrides and oxides.

5.31.5 Storage. Monoethanolamine is stored in the original containers (1-gallon bottles, 5-gallon composite steel pails and 55-gallon steel drums). Storage space is away from heat and open flame. The maximum shelf life in unopened containers is unlimited. If the container is opened, the shelf life is six months from the date of opening. (Refer to 4.3.2)

5.31.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills are to be diked to prevent spreading and

transferred to salvage containers. Water spray can be used to reduce vapor ignition hazard. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

In accordance with CFR 49, 172.101, monoethanolamine is listed as a corrosive liquid having a transportation number of UN2491. An EPA Hazardous Waste Classification is not listed in CFR 40.

5.32 Name. MONOETHANOLAMINE, CHELATING AGENT SOLUTION FW N/A
Formula - None

5.32.1 Technical description. Monoethanolamine is a colorless, moderately viscous liquid with a characteristic odor of ammonia formulated with chelating agent (monosodium salt of N,N'-dihydroxyethyl glycine).

5.32.2 Specifications. Military, MIL-M-23573, Monoethanolamine, Chelating Agent Solution.

5.32.2.1 Requirements. The monoethanolamine, chelating agent solution is a homogenous solution of monoethanolamine and the chelating agent, monosodium salt of N,N'-dihydroxyethyl glycine which contains approximately 22 parts by weight of monoethanolamine to one part of the chelating agent. The solution meets the requirements shown in Table LVI.

TABLE LVI. Properties of Monoethanolamine Chelating Agent Solution.

Property	Requirements	
	Min	Max
Alkalinity, milliequivalents per gram (mg/g)	14.5	15.5
Nitrogen, mg/g	14.0	15.0
Iron, ppm	---	15
Chelating capacity:		
Against $Pb(NO_3)_2$, millimoles per gram (mmol/g)	0.16	0.19
Against $CaCl_2$, ml	---	0.5
Color (Pt/Co scale)	---	20

5.32.3 Use. Chelating monoethanolamine is intended for military use in scrubbing equipment for the removal of carbon dioxide from the air.

5.32.4 Safety.

5.32.4.1 Health hazard. Monoethanolamine is an irritant to the eyes, skin, and respiratory tract and can be toxic as an inhalant. In case of contact with the eyes or skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. The final limits of TWA are 3 ppm (15 mg/m^3). The LD_{50} orally in rats is 10.20 g/kg. (Refer to 4.3.1)

5.32.4.2 Fire and explosion hazard. Monoethanolamine is a combustible liquid and can produce explosive vapors. Fires are to be extinguished using dry chemical, alcohol foam or carbon dioxide. In fire conditions, personnel wear self-contained breathing apparatus.

5.32.4.3 Reactivity. Monoethanolamine is reactive with oxidizing materials, inorganic acids, anhydrides and oxides.

5.32.5 Storage. Monoethanolamine is stored in the original containers (1-gallon bottles, 5-gallon composite steel pails and 55-gallon steel drums). Storage space is away from heat and open flame. The maximum shelf life in unopened containers is unlimited. If the container is opened, the shelf life is six months from the date of opening. (Refer to 4.3.2)

5.32.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills are to be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazard. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

In accordance with CFR 49, 172.101, monoethanolamine is listed as a corrosive liquid having a transportation number of UN2491. An EPA Hazardous Waste Classification is not listed in CFR 40.

5.33 Name. MORPHOLINE (SOCMA) C_4H_9NO MW 87.12
Diethylene Imide Oxide
Diethylene Imidoxide
Diethylene Oximide
Tetrahydro-2H-1, 4-oxazine
Tetrahydro-p-oxazine

5.33.1 Technical description. Morpholine is a colorless, hygroscopic liquid, with an amine-like odor. It is a mild base, soluble in water and organic solvents and has characteristics shown in Table LVII.

TABLE LVII. Characteristics of Morpholine.[1/]

Characteristics	Nominal Value
Melting point, °C	-4.9
Boiling point:	
bp_{760}, °C (°F)	128.9 (263)
bp_6, °C	20.0
Specific gravity, d_4^{20}	1.007
Refractive index, n_D^{20}	1.4540
Flash point:	
Open cup, °C (°F)	38 (100)
Closed cup, °C (°F)	35 (95)
Surface tension (at 20°C) dynes/cm	37.5
Viscosity (at 20°C) cp	2.23
Dipole moment	1.58
Strong base, pKb	5.6

[1/] Physical properties of morpholine as given in O-M-575 for information is as shown in Table LVIII.

TABLE LVIII. Physical properties of Morpholine.

Property	O-M-575		
	Class 1	Class 2	Class 3
Specific gravity, d_{20}^{20}	1.002	1.022	1.032
Freezing point, °C	-3	-18	-27
Flash point, open cup, °C	38	46	88

5.33.1.1 O-M-575, Class 3. Information suitable for design using O-M-575, Class 3, Morpholine is as shown in Table LIX.

TABLE LIX. Design information for O-M-575, Class 3, Morpholine.

Property	Value	
	Min	Max
Specific gravity, d_{20}^{20}	1.030	1.034
Distillation range:		
bp_{760}	100.0	---
dp_{760}	---	130
Color (Pt/Co scale)	---	15

5.33.2 Specifications. Federal, O-M-575, Morpholine, Technical.

3.1 First Article. When specified (see 6.2), a sample shall be submitted to

5.33.2.1 Requirements. Under O-M-575, morpholine is supplied in the following classes with the minimum purity as shown in Table LX.

TABLE LX. Purity of Morpholine.

Purity	Class		
	1	2	3
Assay, % by wt	99.0	91.0	40.0

5.33.3 Use. Morpholine is used in either high pressure or low pressure heating plants where feed water is deaerated. The material when added to the boiler water will volatilize with the steam and circulate through the steam lines, returning with the condensate to the boiler. Where boiler feed water has been deaerated, morpholine is preferred to cyclohexylamine since more CO_2 is purged from the feed water and morpholine is less alkaline. Where feed water for low pressure heating plants (under 15 pounds psig) has not been deaerated, cyclohexylamine, conforming to O-C-940, is preferred.

5.33.4 Safety.

5.33.4.1 Health hazard. Morpholine is a skin irritant, as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. The permissible exposure limit is 20 ppm or 70 mg/m^3 and the IDLH level is 8000 ppm. LD_{50} in rats is 1.05 g/kg. (Refer to 4.3.1)

5.33.4.2 Fire and explosion hazard. Morpholine is a combustible liquid that can produce explosive vapor mixtures in air.

5.33.4.3 Reactivity. Morpholine is reactive with inorganic acids, anhydrides, oxides and oxidizing compounds.

5.33.5 Storage. Morpholine is stored in the original container (1-gallon jar, 5-gallon pail and 55-gallon drum). Storage space is away from heat and open flame and a temperature above -4°C (23°F). The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.33.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills are to be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazard. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

In accordance with CFR 49, 172.101, morpholine is listed as a flammable liquid having a transportation number of UN2054. An EPA Hazardous Waste Classification is not listed in CFR 40.

5.34 Name. p-NITROSODIPHENYLAMINE $C_{12}H_{10}N_2O$ FW 198.22
Dinitromethylaniline
4-Nitroso-N-phenyl benzamine

5.34.1 Technical description. p-Nitrosodiphenylamine is a solid in the form of green plates with a blue lustre. It is slightly soluble in water or petroleum ether and freely soluble in alcohol, ether, chloroform and benzene. It dissolves in sulfuric acid. p-Nitrosodiphenylamine has a melting point of 144°C.

5.34.2 Specifications. None.

5.34.2.1 Requirements. Refer to 5.34.1.

5.34.3 Use. p-Nitrosodiphenyl amine is used as an accelerator in vulcanizing rubber.

5.34.4 Safety. p-Nitrosodiphenylamine is a suspected carcinogen. In case of contact with the skin or eyes, flush affected areas with water for 20 minutes and obtain medical attention. In case of inhalation of crystals or fumes, obtain medical attention immediately. (Refer to 4.3.1)

5.34.5 Storage. p-Nitrosodiphenylamine is stored in original containers (1-pound jars and 5-pound fiberboard drums). The containers should be kept away from light, direct sunlight, fire hazards, open flames and oxidizing materials. Care should be taken to avoid breathing dust. Under these storage conditions and in unopened containers, the shelf life is indefinite.

5.34.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in 40 CFR.

5.35 Name. OCTADECYLAMINE (IUPAC) (SOCMA) $CH_3(CH_2)_{17}NH_2$ FW 269.52
1-Aminooctadecane
Stearylamine

5.35.1 Technical description. Octadecylamine is insoluble in water and soluble in alcohol, ether, acetone and benzene. It is furnished as a powder or paste and is as shown in Table LXI.

TABLE LXI. Properties of Octadecylamine.

Property	Requirement			
	Powder		Paste	
	Min	Max	Min	Max
Color	off-white	tan	gray-white	---
Melting range, °C	45	53	---	---
Boiling point (°C):				
bp_{32}	230	234	---	---
bp_2	171	181	---	---
Flash point (open cup) °C (°F)	---	---	93.3 (200)	98.3 (210)
Pour point (ASTM) °C (°F)	---	---	5.20 (41)	9.20 (49)
Specific gravity, d_{15}^{15}	---	---	1.201	1.203
Viscosity (23.5°C), centistokes	---	---	4000	6000

5.35.2 Specifications. None.

5.35.2.1 Requirements. Refer to 5.35.1

5.35.3 Use. Octadecylamine is intended for use as a filming amine-type corrosion inhibitor used in liquid cooling systems. Commercial uses are the same.

5.35.4 Safety.

5.35.4.1 Health hazard. Octadecylamine is a skin irritant, as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. (Refer to 4.3.1)

5.35.4.2 Fire and explosion hazard. Octadecylamine is a combustible solid.

5.35.4.3 Reactivity. Octadecylamine is reactive with organic and inorganic acids, anhydrides, oxides and oxidizing compounds.

5.35.5 Storage. Octadecylamine is stored in the original container (30-gallon drums for powder and 50-gallon drums for paste). Storage space is away from heat and open flame. The shelf life is limited to 5 years for powder and 1 year for paste in closed, sealed containers. (Refer to 4.3.2)

5.35.6 Disposal. Use protective clothing, such as chemical gloves and goggles when handling octadecylamine. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.36 Name. PHENOL C_6H_6O FW 94.11
Carbolic Acid
Phenic Acid
Phenylic Acid
Phenyl Hydroxide
Hydroxy Benzene
Oxybenzene

5.36.1 Technical description. Phenol is colorless, acicular crystals or crystalline mass having a characteristic pungent odor. It reddens on exposure to air and light and has characteristics shown in Table LXII. One gram dissolves in 15 ml of water and is soluble in alcohol, chloroform, ether, glycerol, carbon disulfide, petroleum, volatile and fixed oils and aqueous alkali hydroxides.

TABLE LXII. Characteristics of Phenol.

Characteristic	Nominal Value
Boiling point, bp_{760}, °C (°F)	182 (359)
Flash point (closed cup), °C (°F)	79 (175)
Refractive index, n_D^{41}	1.5425
pKa (at 25°C)	10
pH (of aqueous solutions)	~6

5.36.2 Specifications. ASTM D 2439, Standard Specification for Refined Phenol-405.

5.36.2.1 Requirements. Phenol is as shown in Table LXIII.

TABLE LXIII. Properties of Phenol.

Property	Requirements	
	Min	Max
Solidification point (anhydrous), °C	40.5	---
Molten color	---	1/
Water content, % by wt	---	0.20

1/ Refined phenol as produced is essentially colorless. Depending upon both the nature and duration of subsequent handling, it may discolor. Therefore, a rigid specification for color is impractical and for many uses it may be unnecessary. In those cases where such a specification is required, its magnitude will vary widely with the intended usage.

5.36.3 Use. Phenol is used as a general disinfectant, either in solution or mixed with slaked lime, and similar materials for toilets, stables, cesspools, floors, drains and the like. It is also used for the manufacture of colorless or light-colored artificial resins, many medical and industrial organic compounds and dyes and as a reagent in chemical analysis.

5.36.4 Safety.

5.36.4.1 Health hazard. Phenol is a skin irritant, as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. Average fatal dose is 15 grams but 1 gram has been known to cause death. The permissible exposure limit is 5 ppm or 19 mg/m^3, and the IDLH level is 100 ppm.

5.36.4.2 Fire and explosion hazard. Phenol is a combustible liquid that can produce explosive vapor mixtures in air.

5.36.4.3 Reactivity. Phenol is reactive with inorganic acids, anhydrides, oxides and oxidizing compounds.

5.36.5 Storage. Phenol is stored in the original container (1-pound and 5-pound jars, 30-pound and 400-pound drums). Keep away from light and air. The shelf life is unlimited in closed sealed containers. (Refer to 4.3.2)

5.36.6 Disposal. Small amounts of phenol are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

In accordance with CFR 49, 172.101, phenol is listed as POISON B having a transportation number of UN1671. An EPA Hazardous Waste Classification is listed in CFR 40 as U188.

5.37 Name. n-PHENYLMORPHOLINE $C_6H_5N(C_2H_4)_2O$ FW 163.11

5.37.1 Technical description. n-Phenylmorpholine is a white solid with a boiling point of 266 ± 1°C. It is slightly soluble in water.

5.37.2 Specifications. Military, MIL-N-47061, n-Phenylmorpholine.

5.37.2.1 Requirements. n-Phenylmorpholine is as shown in Table LXIV.

TABLE LXIV. Chemical analysis of n-Phenylmorpholine.

Characteristic	Requirements	
	Min	Max
n-Phenylmorpholine, total alkalinity, % by wt	99.0	---
n-Phenylmorpholine, tertiary amine, % by wt	98.0	---
Chlorine, % by wt	---	0.10
Melting point, °C	50	54
Moisture, % by wt	---	0.10

5.37.3 Use. n-Phenylmorpholine is intended to be used as a stabilizer in ammonium-nitrate-based solid propellants. It is used as an intermediate in the manufacture of dyes, rubber accelerators and photographic developers.

5.37.4 Safety. n-Phenylmorpholine is a flammable organic compound and may be considered toxic when ingested or inhaled. Allergic dermatitis may result from skin contact. In case of contact with the skin, flush with water for at least 20 minutes and obtain medical attention immediately. n-Phenylmorpholine shall be used with adequate ventilation. (Refer to 4.3.1)

5.37.5 Storage. n-Phenylmorpholine shall be stored in a cool, dry place in tightly closed containers away from acids and alkalis. (Refer to 4.3.2)

5.37.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.38 Name. 1-,2-PROPANEDIOL $C_3H_8O_2$ FW 76.09
Propylene Glycol
Methyl Glycol
1,1-Dihydroxypropane

5.38.1 Technical description. 1-,2-Propanediol is a viscous liquid and miscible with water, acetone and chloroform and ether. It has characteristics as shown in Table LXV.

5.38.2 Specifications. Military, DOD-P-82670, Propanediol, 1-,2-(Metric); MIL-P-83800, 1-,2-Propanediol (Metric); and ASTM D 2695, Standard Specification for Propylene Glycol.

TABLE LXV. Characteristics of 1-,2-Propanediol.

Characteristic	Nominal Value
Melting point, °C	-59
Boiling point	
bp_{760}, °C	188.2
bp_{400}, °C	168.1
bp_{200}, °C	149.7
bp_{100}, °C	132.0
bp_{60}, °C	119.9
bp_{40}, °C	111.2
bp_{20}, °C	96.4
bp_{10}, °C	83.2
bp_{5}, °C	70.8
bp_{1}, °C	45.5
Flash point (open cup), °C (°F)	99 (210)

5.38.2.1 Requirements. 1-,2-Propanediol has properties shown in Table LXVI.

TABLE LXVI. Properties of 1-,2-Propanediol.

Property	Requirements					
	DOD-P-82670		DOD-P-83800		ASTM D 2695	
	Min	Max	Min	Max	Min	Max
Color (Pt/Co scale)	---	10	---	10	---	15
Specific gravity						
d_{25}^{25}	---	---	---	---	1.0375	1.0390
d_{25}^{20}	1.0340	1.0390	1.0351	1.0366	1.0351	1.0366
Acidity (as acetic acid), % by wt	---	0.03	---	0.003	---	0.005
Refractive index, n_D^{25}	1.4300	1.4340	---	---	---	---
Distillation range						
185-190°C (@760 mm Hg), % by wt	98	---	---	---	---	---
Initial boiling point, bp_{760}	---	---	185	---	185	---
Dry point, dp_{760}	---	---	---	190	---	190
Carbonyl, ppm	---	40	---	---	---	---
Moisture, % by wt	---	0.50	---	0.20	---	0.20
Dipropylene glycol, % by wt	---	0.10	---	---	---	0.10
Ash, % by wt	---	---	---	0.005	---	---
Iron, ppm	---	---	---	0.5	---	0.5
Chlorides, ppm	---	---	---	1.0	---	---
Flash point, °C	---	---	105	---	---	---

5.38.3 Use. 1-,2-Propanediol is used for the manufacture of propellant ingredient and as an aircraft antifreeze mixture for F-11 aircraft's environment control system.

5.38.4 Safety.

5.38.4.1 Health hazard. 1-,2-Propanediol is a skin irritant as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. In case of contact with skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. LD_{50} orally in rats is 25 ml/kg.

5.38.4.2 Fire and explosive hazard. 1-,2-Propanediol is a combustible liquid that can produce explosive vapor mixtures in dry air.

5.38.4.3 Reactivity. 1-,2-Propanediol is reactive with inorganic acids, anhydrides and oxidizing compounds.

5.38.5 Storage. 1-,2-Propanediol is stored in the original container (1-gallon jar, 5-gallon pail and 55-gallon drum). Storage space is away from heat and open flame. The shelf life is unlimited in closed, sealed containers. (Refer to 4.3.2)

5.38.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills are to be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazards. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in 40 CFR.

clear characteristics of table I when tested as specified therein. and pH,

5.39 Name. n-PROPYL ALCOHOL C_3H_8O FW 60.09
1-Propanol
Propylic Alcohol

5.39.1 Technical description. n-Propyl alcohol is miscible with water, alcohol and ether. n-Propyl alcohol has characteristics shown in Table LXVII.

TABLE LXVII. Characteristics of n-Propyl Alcohol.

Characteristics	Nominal Value
Flash point, °C (°F)	22 (59)
Refractive index, n_D^{20}	1.3862
Melting point, °C	-127
Boiling point, bp_{760}, °C	97.2

5.39.2 Specifications. ASTM D 3622, Standard Specification for n-Propyl Alcohol (1-Propanol).

5.39.2.1 Requirements. n-Propyl alcohol has properties shown in Table LXVIII.

TABLE LXVIII. Properties of n-Propyl Alcohol.

Property	Requirements	
	Min	Max
Specific gravity:		
d_{20}^{20}	0.804	0.807
d_{25}^{25}	0.801	0.804
Color (Pt/Co scale)	---	10
Distillation range, °C	97.2 [1/]	
Nonvolatile matter, mg/100 ml	---	5
Water	See [2/]	
Acidity (free acid as acetic acid), % by wt	---	0.003

[1/] The sample shall distill entirely within 2°C range which shall include 97.2°C.
[2/] This quantitative water limit ensures miscibility without turbidity when one volume is diluted with 19 volumes of 99 percent heptane at 20°C.

5.39.3 Use. n-Propyl alcohol is used as a solvent for resins and cellulose esters and the like.

5.39.4 Safety.

5.39.4.1 Health hazard. n-Propyl alcohol is a skin irritant, as well as an irritant to the eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. The permissible exposure limit is 200 ppm or 500 mg/m^3 and the IDLH level is 4000 ppm. LD_{50} orally in rats is 1.87 mg/kg. (Refer to 4.3.1)

5.39.4.2 Fire and explosion hazard. n-Propyl alcohol is a combustible liquid that can produce explosive vapor mixtures in air.

5.39.4.3 Reactivity. n-Propyl alcohol is reactive with inorganic acids, anhydrides, oxides and oxidizing compounds.

5.39.5 Storage. n-Propyl alcohol is stored in the original container (1-gallon jar, 5-gallon pail and 55-gallon drum). Storage space is away from heat and open flame and where the temperature is below 100°F (38°C). The shelf life is unlimited in closed sealed containers. (Refer to 4.3.2)

5.39.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills shall be absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills shall be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazard. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

In accordance with CFR 49, 172.101, n-Propyl alcohol is listed as a flammable liquid having a transportation number of UN1274. An EPA Hazardous Waste Classification is not listed in CFR 40.

5.40 Name. QUINONEDIOXIME $C_6H_4(:NOH)_2$ FW 138.12
p-Benzoquinone Dioxime
Para-quinonedioxime

5.40.1 Technical description. Quinonedioxime is colorless to yellow needle-like needles which is soluble in hot water and ether, but insoluble in alcohol.

5.40.2 Specifications. Military, MIL-Q-51093, Quinonedioxime, Commercial Grade.

5.40.3 Requirements. The nominal composition of quinonedioxime is essentially para-quinone dioxime and as shown in Table LXIX.

TABLE LXIX. Characteristics of Quinonedioxime.

Characteristic	Requirement	
	Min	Max
Acetone insoluble, % by wt	---	4.0
Ash, % by wt	---	1.0
Quinone monoxime, % by wt	4.8	6.2
Volatile matter, % by wt	---	0.9
Decomposition temperature, °C	223	---
Particle size (retained on U.S. Standard Sieve #200), % by wt	---	0.2

5.40.4 Use. Quinonedioxime is used as an ingredient in rocket solid propellants.

5.40.5 Safety. Quinonedioxime is an irritant to the skin, eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush area with water. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. In case of inhalation, obtain medical attention immediately. There are no TLV or PEL referenced for quinonedioxime. (Refer to 4.3.1)

5.40.6 Storage. Quinonedioxime shall be stored in approved containers (cans containing 25-, 50-, and 100-pounds of material). The storage area shall be well ventilated, and there shall be no open flames or areas of definite fire hazard nor nearby powerful oxidizing agents. (Refer to 4.3.2)

5.40.7 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is listed in 40 CFR as U197.

5.41 Name. RESORCINOL $C_6H_6O_2$ FW 110.11
1,3-Benzenediol
m-Dihydroxybenzene
Resorcin

5.41.1 Technical description. Resorcinol is solid in the form of white, needle-like crystals which become pink when exposed to light and air or by contact with iron.

5.41.2 Specifications. Military, MIL-R-22578, Resorcinol and Military, MIL-R-60864, Resorcinol.

5.41.2.1 Requirements. Resorcinol is furnished as crystal, powder, or flake as shown in Table LXX and is as shown in Table LXXI.

TABLE LXX. Forms of Resorcinol.

Form	Specification Designation	
	MIL-R-22578	MIL-R-60864
Crystal	Type I	Grade A, Class 1
General	Type I, Class 1	---
Special	Type I, Class 2	---
Powder	Type II	Grade A, Class 2
Flake	Type III	Grade B

TABLE LXXI. Chemical and physical properties of Resorcinol.

Property	Requirements				
	MIL-R-22578				MIL-R-60864
	Type I		Type II	Type III	
	Class 1	Class 2			
Resorcinol content, % min.	99.5	99.5	99.5	99.5	99.5
Ash, % max	0.005	0.005	0.005	0.005	0.005
Moisture, % max	0.2	0.2	0.2	0.2	0.2
Phenol	no perceptible odor	no perceptible odor	no perceptible odor	no perceptible odor	no perceptible odor
Catechol, % max	0.1	0.1	0.1	0.1	none
pH, min	4.4	6.0	4.4	4.4	4.4
Water insoluble, % max	0.01	0.01	0.01	0.01	none
Color when molten	---	---	---	1.0[1/]	1.0[1/]
Solidification or freezing point, °C, min	---	109.7	---	---	---
Melting range, °C	---	109-111	---	---	---
Granulation (thru U.S. Sieve No. 8), % min	---	98	---	---	---

[1/] ASTM Scale
[2/] Grade B

5.41.3 Use. Resorcinol is intended to be used in explosives and the manufacture of lead styphnate (MIL-R-60864, Type I, Class 2). It is used commercially in tanning leather, manufacture of resins, resin adhesives, hexylresorcinol, p-aminosalicylic acid, dyes, in cosmetic dyeing and printing textiles.

5.41.4 Safety. Resorcinol is toxic and may cause eye and skin irritation. In case of contact with the skin, flush affected areas with water. In case of contact with the skin, flush affected areas with water. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. In case of inhalation, obtain medical attention immediately. In case of contact with the skin, flush affected areas with water. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. In case of inhalation of crystals or fumes, obtain medical attention immediately. There are no TLV or PEL referenced for resorcinol. (Refer to 4.3.1)

5.41.5 Storage. Resorcinol shall be stored in original containers (38- and 51-gallon drums and 100- and 200-pound drums) away from light. If properly stored, this material has an indefinite shelf life. (Refer to 4.3.2)

5.41.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is listed in CFR 40 as U201.

5.42 Name. TETRAETHYLENE GLYCOL DIMETHYL ETHER MW 222.28

$CH_3(OCH_2CH_2)_4OCH_3$

5.42.1 Technical description. Tetraethylene glycol dimethyl ether is a water-white liquid with a very mild odor. Generally speaking, it is considered quite inert. However, this compound is affected by certain chemicals because of activation by the ethylene-oxygen linkage. This material is miscible with acetone, benzene, ethanol, ether, octane, or water. The acidity shall be not more than 0.015 percent as acetic acid; the hydrogen content shall be not more than 0.5 percent; and it shall have 0.2 percent maximum water content. The physical properties are as shown in Table LXXII.

TABLE LXXII. Physical properties of Tetraethylene Glycol Dimethyl Ether.

Property	Nominal Value
Autoignition temperature, °C	610
Boiling point, bp_{760}, °C	275.8
Flash point (open cup), °C	140.5
Freezing point, °C	-29.7
Refractive index, n_D^{20}	1.4322
Specific gravity, d_{20}^{20}	1.0132
Vapor pressure (20°C), mm	0.01
Viscosity (20°C), cps	40.5

5.42.2 Specifications. None.

5.42.2.1 Requirements. (Refer to 5.4.2.1)

5.42.3 Use. Tetraethylene glycol dimethyl ether is intended for military use as a solvent. Typical commercial applications include use as a solvent, in dust control, and to remove carbon dioxide from gas mixtures which are utilized in ammonia synthesis.

5.42.4 Safety. Tetraethylene glycol dimethyl ether is a flammable liquid with a flash point of 140.5°C and a boiling point of 276°C. It is an irritant to the skin, eyes and respiratory tract and can be toxic as an inhalant. In case of contact with the skin, flush affected areas with water. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. In case of inhalation, obtain medical attention immediately. There are no TLV or PEL referenced for tetraethylene glycol dimethyl ether. (Refer to 4.3.1)

5.42.5 Storage. Tetraethylene glycol dimethyl ether shall be stored in original containers (1-gallon and 5-gallon cans and 55-gallon drums). The material shall be kept away from heat and open flames. The storage area shall

have adequate ventilation and shall be kept under 120°F. It stored as recommended, the shelf life of this material is indefinite. (Refer to 4.3.2)

5.42.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.43 Name. TETRAETHYLENE PENTAMINE FW 189.27

$NH_2(CH_2CH_2NH)_2(CH_2)NH_2$

5.43.1 Technical description. Tetraethylene pentamine is a viscous hydroscopic liquid soluble in water and organic solvents. It is as shown in Table LXXIII.

TABLE LXXIII. Characteristics of Tetraethylene Pentamine.

Characteristics	Nominal Value
Specific gravity, d_{20}^{20}	0.998
Boiling point: bp_{760}, °C	333

5.43.2 Specification. Military, MIL-T-47064, Tetraethylenepentamine.

5.43.2.1 Requirements. The physical and chemical properties are as shown in Table LXXIV.

TABLE LXXIV. Physical and chemical properties of Tetraethylene Pentamine.

Property	Requirement	
	Min	Max
Distillation range		
For 5 ml (at 760 mm Hg), °C	310	---
For 50 ml (at 760 mm Hg), °C	320	---
Chlorides, % by wt	---	0.5
Moisture, % by wt	---	1.0

5.43.3 Use. Tetraethylene Pentamine is used as a catalyst in a potting compound for humidity and pressure seals. It is also used as an organic solvent, as well as gas purification and synthesis of rubber accelerators.

5.43.4 Safety. Tetraethylene pentamine is a flammable organic compound and may be considered toxic when ingested or inhaled. Allergic dermatitis may result from skin contact. In case of contact with the skin, flush with water for at least 20 minutes and obtain medical attention immediately.

5.43.5 Storage. Tetraethylene pentamine shall be stored in a cool, dry place in tightly closed containers away from acids and alkalis. (Refer to 4.3.2)

5.43.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.44 Name. TRIBUTYLAMINE (SOCMA) $C_{12}H_{27}N$ FW 185.34
Tri-n-butylamine
N,N-Dibutyl-1-butanamine

5.44.1 Technical description. Tributylamine is a hygroscopic liquid that is sparingly soluble in water and very soluble in alcohol and ether. It has characteristics as shown in Table LXXV.

TABLE LXXV. Characteristics of Tributylamine.

Characteristic	Nominal Value
Flash point (open cup), °C (°F)	85 (185)
Specific gravity, d_{20}^{20}	0.7782
Boiling point, bp_{760}, °C	217

5.44.2 Specifications. Military, MIL-T-12014, Tributylamine, Normal (Metric).

5.44.2.1 Requirements. Tributylamine has properties as shown in Table LXXVI.

TABLE LXXVI. Properties of Tributylamine.

Property	Requirement	
	Min	Max
Color	See 1/	
Total alkalinity (as tributylamine), %	97	
Specific gravity, d_{20}^{20}	0.77	0.80
Boiling point range (95% minimum distilling), °C	196	216
Moisture, % by wt	---	0.10

1/ No darker than a standard containing 75 ppm potassium dichromate compared in 50 ml Nessler tubes.

5.44.3 Use. Tributylamine is intended for military use as a stabilizer. Commercial uses are the same and it is also used as a solvent and an inhibitor in hydraulic fluids.

5.44.4 Safety. Tributylamine is a flammable organic compound and may be considered toxic when injested or inhaled. Allergic dermatitis may result from skin contact. Also causes CNS stimulation. In case of contact with the skin,

flush with water for at least 20 minutes and obtain medical attention immediately. Tributylamine shall be used with adequate ventilation and gloves and goggles are to be used when handling this material. (Refer to 4.3.1)

5.44.5 Storage. Tributylamine shall be stored in a cool, dry place in tightly closed containers away from acids and alkalis. (Refer to 4.3.2)

5.44.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in 40 CFR.

5.45 Name. TRIETHANOLAMINE $(HOCH_2CH_2)_3N$ MW 149.19
2,2',2"-Nitrilotriethanol (IUPAC) (SOCMA)
Trihydroxytriethylamine
Tris(hydroxyethyl) amine

5.45.1 Technical description. Triethanolamine, technical is a colorless, very hygroscopic, clear, viscous liquid. It is miscible with water or alcohol, is soluble in chloroform, and is slightly soluble in benzene or ether. It turns brown on exposure to air and light. Triethanolamine has characteristics as shown in Table LXXVII.

TABLE LXXVII. Characteristics of Triethanolamine.

Characteristic	Nominal Value
Specific gravity:	
d_4^{20}	1.1242
d_4^{60}	1.0985
Weight per gallon, lbs	9.37
Flash point, °C (°F)	185 (365)
Melting point, °C (°F)	21.57 (71)
Boiling point, °C (°F)	178 (335)
Viscosity:	
(at 25°C), cps	591
(at 50°C), cps	65.7
K (at 25°C)	3.15×10^{-10}
pH (0.1N aqueous solution)	10.5
Refractive index:	
n_D^{20}	1.4852
n_D^{25}	1.484

5.45.2 Specifications. Military, MIL-E-50011, Ethanolamines (Monoethanolamine, Diethanolamine, Triethanolamine).

5.45.2.1 Requirements. Triethanolamine is substantially free from suspended matter and has properties shown in Table LXXVIII.

trace in allowed iron as Fe shall be determined by the atomic absorption me

TABLE LXXVIII. Physical and chemical properties of Triethanolamine.

Property	Requirements	
	Min	Max
Triethanolamine content, % by wt	98	---
Monoethanolamine content, % by wt	---	1.0
Diethanolamine content, % by wt	---	1.5
Specific gravity, d_{20}^{30}	1.124	1.129
Water content, % by wt	---	1.0
Color (Pt/Co scale)	---	100

5.45.3 Use. Triethanolamine is intended for military use as an organic base corrosion inhibitor in pipes, radiators, and boilers. It is used as an intermediate in the manufacture of surface active agents, textile specialties, waxes, polishes, herbicides, petroleum demulsifiers, toilet goods, cement additives, and cutting oils. Triethanolamine is used in making emulsions with mineral and vegetable oils, paraffin and waxes. It is used as a solvent for casein, shellac dyes and in the manufacture of synthetic resins and it increases the penetration of organic liquids into wood and paper. It is also used in the production of lubricants for the textile industry.

5.45.4 Safety.

5.45.4.1 Health hazard. Triethanolamine is an irritant to the eyes, skin, and respiratory tract and can be toxic as an inhalant. In case of contact with the eyes or skin, flush affected areas with water for at least 20 minutes and obtain medical attention immediately. (Refer to 4.3.1)

5.45.4.2 Fire and explosion hazard. Triethanolamine is a combustible liquid and can produce explosive vapors. Fires are to be extinguished using dry chemical, alcohol, foam or carbon dioxide. In fire conditions, personnel wear self-contained breathing apparatus.

5.45.4.3 Reactivity. Triethanolamine is reactive with oxidizing materials, inorganic acids, anhydrides and oxides.

5.45.5 Storage. Triethanolamine is stored in the original container (1-gallon bottles, 5-gallon composite steel pails and 55-gallon steel drums). Storage space is away from heat and open flame. The maximum shelf life in unopened containers is unlimited. If the container is opened, the shelf life is six months from the date of opening. (Refer to 4.3.2)

5.45.6 Disposal. In case of spills, eliminate all sources of ignition. Small spills are absorbed with a nonreactive absorbent and placed in sealed containers for disposal. Large spills are to be diked to prevent spreading and transferred to salvage containers. Water spray can be used to reduce vapor ignition hazard. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

An EPA Hazardous Waste Classification is not listed in CFR 40.

5.46 Name. TRIETHYLAMINE (SOCMA) $C_6H_{15}N$ FW 101.19

5.46.1 Technical description. Triethylamine is a colorless liquid with a strong ammoniacal odor. It is slightly soluble with water above 18.7°C and miscible with water below 18.7°C and alcohol and ether. Triethylamine has characteristics shown in Table LXXIX.

TABLE LXXIX. Physical and chemical characteristics of Triethylamine.

Characteristic	Value		
	Nominal	Min	Max
Purity (as triethylamine), % by wt	---	98.5	---
Specific gravity, d_{20}^{20}	---	0.726	0.730
Distillation range:			
bp_{760}, °C	---	88	---
dp_{760}, °C	---	---	90
Freezing point, °C	115.3	---	---
Flash point (closed cup), °C (°F)	-7 (20)	---	---

5.46.2 Specifications. None.

5.46.2.1 Requirements. (Refer to 5.46.1)

5.46.3 Use. Triethylamine is intended for military use as a corrosion inhibitor in water systems and in chlorinated solvents. Commercial uses are catalytic solvent in chemical synthesis; accelerator activators for rubber; wetting, penetrating and water proofing agents of quaternary ammonium types; curing and hardening of polymers and propellant.

5.46.4 Safety. Triethylamine is a flammable organic compound with a flash point of 20°F (-6°C) and may be considered toxic when injested or inhaled. Allergic dermatitis may result from skin contact. In case of contact with the skin, flush with water for at least 20 minutes and obtain medical attention immediately. Triethylamine shall be used with adequate ventilation. The permissible exposure level is 25 ppm or 100 mg/m^3 and the IDHL level is 1000 ppm. LD_{50} orally in rats is 0.46 g/kg. (Refer to 4.3.1)

5.46.5 Storage. Triethylamine shall be stored in a cool, dry place at a temperature not above 70°F (21°C) in tightly closed containers away from acids and alkalis. (Refer to 4.3.2)

5.46.6 Disposal. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4)

In accordance with CFR 49, 172.101, triethylamine is listed in the Hazard Class of flammable liquids with a transportation number of UN1296. An EPA Hazardous Waste Classification is not listed in CFR 40.

6. NOTES

(This section contains information of general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. This standard is intended to cite nomenclature, formulas, physical and chemical properties, specification requirements, military and typical commercial uses, safety information, storage information, and disposal information for alcohols and amines preferred for application by the Department of Defense.

6.2 Subject term (key word) listing.

α,α,-α-Trimethyltrimethyleneglycol
Aminobenzene
Aminocyclohexane (IUPAC)
Aminodianethylbenzene
2-Aminoethanol (IUPAC) (SOCMA)
Aminoform
1-Aminooctadecane
Aminophen
Ammoform
Ammonioformaldehyde
Amyl Alcohol (Synthetic)
n-AMYL ALCOHOL
Amylene hydrate
Anesthetic Ether
ANILINE (SOCMA)
Aniline Oil
Anilinobenzene
Aquamollin
ß-Amino Ethyl Alcohol
ß-Hydroxyethylamine
B-Aminoethanol
Benzeneamine
1,3-Benzenediol
bis (Hydroxyethyl) amine
Bis [B-aminoethyl] amine
Blueoil
Butanol
1-Butanol (IUPAC)
2-Butanol
n-Butanol
2-Butanol-2-methyl (IUPAC)
2-Butoxyethanol (IUPAC) (SOCMA)
Butyl Alcohol (SOCMA
n-BUTYL ALCOHOL
n-Butyl Carbinol
Butyl Cellosolve
Butylene Hydrate
Butylphen
Butyric Alcohol
Calsol
Carbinol

Carbitol Acetate
Carbitol®
Carbolic Acid
Cellosolve
Cheladrate
Chelaplex III
Colamine
Complexone
Cyclohexanamine
CYCLOHEXYLAMINE (SOCMA)
Cystamin
Cystogen
DEA
di-sec-Amyl Alcohol
2,2'-Diaminodiethylamine
N,N-Dibutyl-1-butanamine
DIETHANOLAMINE
Diethyl Ether
Diethyl Oxide
DIETHYLENE GLYCOL
Diethylene Imide Oxide
Diethylene Imidoxide
Diethylene Oximide
DIETHYLENETRIAMINE (SOCMA)
Diethylethylene Glycol Monoethyl Ether
Diethylolamine
M-Dihydroxybenzene
2,2-Dihydroxydiethylamine
2-,2'-Dihydroxydiethyl Ether
1,1-Dihydroxypropane
2;3-Dihydroxypropyl Oleate
Dimethyl Carbinol
Dimethyl Ethyl Carbinol
N,N-Dimethylaminobenzene
Dimethylaniline
N,N-DIMETHYLANILINE (SOCMA)
4-(1,1-Dimethylethyl) phenol
N,N-Dimethylphenylamine
Dinitromethylaniline
DIPHENYLAMINE (SOCMA)
DIPROPYLENE GLYCOL
Distol 8
Edentate Disodium
Edetate Sodium
Edetate Trisodium
Edetic Acid Tetrasodium Salt
Edetic Acid Trisodium Salt
EDTA Disodium
EDTA Tetrasodium
EDTA Trisodium
EGMEEA
Endrate Disodium
Endrate Tetrasodium
1,2-Ethanediol (IUPAC)

N,N'-1,2-Ethanediylbis [N-(Carboxymethyl) Glycine] Disodium Salt
N,N'-1,2-Ethanediylbis [N-(Carboxymethyl) Glycine] Tetrasodium Salt
N,N'-1,2-Ethanediylbis [N-(Carboxymethyl) Glycine] Trisodium Salt
Ethanolamine
Ether
Ethoxyethane (IUPAC)
2-Ethoxyethanol (IUPAC) (SOCMA)
2-Ethoxyethanol Acetate
2-(2-Ethoxyethoxy) Ethanol
2-Ethoxyethyl Acetate
ETHYL ETHER (SOCMA)
Ethyl Oxide
Ethyldigol
Ethylene Alcohol
Ethylene Diaminetetraacetic Acid Trisodium Salt
(Ethylene Dinitrilo)-Tetraacetic Acid Disodium Salt
ETHYLENE GLYCOL (SOCMA)
ETHYLENE GLYCOL MONOBUTYL ETHER
ETHYLENE GLYCOL MONOETHYL ETHER
ETHYLENE GLYCOL MONOETHYL ETHER ACETATE
ETHYLENE GLYCOL MONOMETHYL ETHER
Ethylenebis (Iminodiacetic Acid) Tetrasodium Salt
ETHYLENEDIAMINETETRAACETIC ACID, DISODIUM SALT OF
ETHYLENEDIAMINETETRAACETIC ACID, TETRASODIUM SALT OF
ETHYLENEDIAMINETETRAACETIC ACID, TRISODIUM SALT OF
(Ethylenedinitrilo) Tetraacetic Acid Tetrasodium Salt
Exposure limits, hazardous chemicals
Fermentation Butyl Alcohol
Formin
Glycerin
Glycerine
GLYCEROL (SOCMA)
Glycerol Monooleate
GLYCERYL MONOOLEATE
Glycol
Glycol Alcohol
Hazardous wastes, disposal and storage of
Hexahydroaniline
HEXAMETHYLENETETRAMINE (SOCMA)
Hexamine
HEXYLENE GLYCOL
HMT
HMTA
Hydroxy Benzene
2-Hydroxybutane
2-Hydroxyethylamine
1-Hydroxymethylpropane
IFP
2,2-Iminodiethanol (IUPAC) (SOCMA)
Incorporation Factor
Information, hazardous chemicals
IPA
Irgalon
ISOBUTYL ALCOHOL

First article inspection. 4.3.1.1 First article report. Upon completion of the

Isopropanol
ISOPROPYL ALCOHOL
Isopropylcarbinol
Kalex
Komplexon
Kyanol
Limclair
MEA
METHANOL (IUPAC) (SOCMA)
Methenamine
2-Methoxyethanol (IUPAC) (SOCMA)
2-Methyl-1-propanol
2-Methyl-2,4-pentanediol
Methyl Alcohol
Methyl Cellosolve
Methyl Glycol
Methyl Propyl Carbinol
1-Methylbutyl Alcohol
Methylethylcarbinol
MONOETHANOLAMINE
MONOETHANOLAMINE, CHELATING AGENT SOLUTION
1-Monoolein
MORPHOLINE (SOCMA)
Nervanaid B
2,2',2"-Nitrilotriethanol (IUPAC) (SOCMA)
4-Nitroso-N-phenyl benzamine
Nullapon
OCTADECYLAMINE (IUPAC) (SOCMA)
Ophthalgan
Oxitol
Oxybenzene
1,1-Oxybisethane
2-,2'-Oxybisethanol
2-,2'-Oxydiethanol
p-Benzoquinone Dioxime
p-NITROSODIPHENYLAMINE
p-tert-BUTYLPHENOL
Para-quinonedioxime
2-Pentanol (IUPAC) (SOCMA)
1-Pentanol
Pentyl Alcohol
Petrohol
Phenic Acid
PHENOL
Phenyl Hydroxide
Phenylamine
n-Phenylaniline
N-Phenyl-Benzamine
n-PHENYLMORPHOLINE
Phenylic Acid
Pinakon
1-,2-PROPANEDIOL
1,2,3-Propanetriol (IUPAC)
1-Propanol

2-Propanol
n-PROPYL ALCOHOL
Propyl Carbinol
Propylene Glycol
Propylic Alcohol
Questex
QUINONEDIOXIME
Resorcin
RESORCINOL
Safety, hazardous chemicals
SBA
sec-AMYL ALCOHO
sec-BUTYL ALCOHOL (SOCMA)
Secondary Propyl Alcohol
Sequestrene
Sequestrene Cheladrate
Sequestrene NA_2
Sequestrene NA_3
Sodium Edetate
Sodium Versenate
Stearylamine
Sulfuric Ether
Syntes 12a
tert-AMYL ALCOHOL
tert-Pentanol
tert-Pentyl Alcohol (SOCMA)
1,3,5,7-Tetraazaadamantane
1,3,5,7-Tetraazotricyclo[3.3.1.13,7]-decane
Tetracemate Disodium
Tetracemate Tetrasodium
Tetracemin
TETRAETHYLENE PENTAMINE
TETRAETHYLENEGLYCOL DIMETHYL ETHER
Tetrahydro-2H-1, 4-oxazine
Tetrahydro-p-oxazine
Tetrasodium Edetate
Tetrasodium Ethylenebis (Iminodiacetate)
Tetrasodium Ethylenediaminetetraacetate
Tetrine
Titriplex III
Tri-n-butylamine
TRIBUTYLAMINE (SOCMA)
TRIETHANOLAMINE
TRIETHYLAMINE (SOCMA)
Trihydroxypropane
Trihydroxytriethylamine
Trilon B
Tris(hydroxyethyl) amine
Trisodium Edetate
Trisodium Ethylenediaminetetraacetate
Tyclarosol
Uritone
Urotropin
Versene

Versene-9
Versene Disodium Salt
Wood Alcohol
Wood Spirit
Xylidine

6.3 Changes from previous issue. The changes from the previous issue include the addition of new safety, storage and disposal guidance for all materials, Section 6, an Index and the following added compounds: n-Amyl Alcohol, p-tert-Butylphenol, Disodium, Trisodium and Tetrasodium Salts of Ethylenediaminetetraacetic Acid, Ethylene Glycol Monoethyl Ether Acetate, Hexylene Glycol, Isobutyl Alcohol, Isopropyl Alcohol, p-Nitrosodiphenylamine, Phenol, n-Phenylmorpholine, 1-,2-Propanediol, Quinonedioxime, Resorcinol and Tetraethylene Pentamine.

6.4 Abbreviations. The use of abbreviations shall be in accordance with MIL-STD-12 where applicable. Metric system abbreviations and symbols shall be in accordance with ASTM E 380.

I N D E X

I N D E X
(Continued)

I N D E X
(Continued)

I N D E X
(Continued)

I N D E X
(Continued)

I N D E X
(Continued)

CONCLUDING MATERIAL

Lead Standardization Activity:

Defense General Supply Center - GS

Preparing Activity:

Army - EA
Project No. 6810-1248

Custodians:

Army - EA
Navy - OS
Air Force - 68

Review Activities:

Army - AR, MD, GL, ME, SM
Navy - AS
Air Force - 11

User Activities:

Army - None
Navy - MC, SA
Air Force - None