

CONDENSED MATERIAL SAFETY INFORMATION FOR NASCO-GUARD® SPECIMENS

REVISED JANUARY 1993

Manufacturer's Name: Nasco, Fort Atkinson, Wisconsin 53538
Emergency Phone Number: 414-563-2446 Extension 265

The following safety data applies to Nasco-Guard® preservative fluid (or tissue fluids) containing approximately 74% water, 25% ethylene glycol (1, 2-ethanediol) and/or propylene glycol (1, 2-propanediol), 0.5% or less formaldehyde, and 0.5% or less phenol. The Chemical Abstracts Service (CAS) registration number for ethylene glycol is 107-21-1. The CAS number for propylene glycol is 57-55-6. The CAS number for formaldehyde is 50-00-0. The CAS number for phenol is 108-95-2.

GENERAL INFORMATION: Nasco-Guard® specimens are fixed in formaldehyde solutions ranging from 0.8% — 3.7%. The embalming fluid of large mammals (e.g., cats, dogs, fetal pigs) may also contain 1.9% phenol. All specimens are subsequently perfused with an ethylene or propylene glycol-water solution until tissue fluids and ambient fluid contain at least 25% glycol. Residual free formaldehyde is thus reduced to 0.5% or less. Phenol, if present, is reduced commensurately. The ethylene glycol in specimens and ambient fluids presents no hazard by skin absorption or inhalation, but it is toxic if ingested in large quantities. Specimens are intended for observation and dissection only and must not be eaten by humans or pets. Dogs and cats may eat Nasco-Guard® specimens due to the sweet taste of ethylene glycol. The relative safety of ethylene glycol is shown by its worldwide, 50-year acceptance as the prime ingredient of antifreeze solutions for automobiles. Propylene glycol has a very low level of toxicity.

APPEARANCE AND ODOR: Colorless, sweet tasting liquid with mild odor (slight disinfectant odor if phenol is present).

FIRE AND EXPLOSION HAZARD: None.

HEALTH HAZARD: NASCO-GUARD® PRESERVATIVE FLUID (OR TISSUE FLUIDS)

Eyes — Direct contact with eyes may cause irritation. Wash eyes with water. Safety glasses may be worn as a precautionary measure.

Skin — Mild irritation possible in hypersensitive individuals. Wash hands with soap and water after handling specimens. Rubber or plastic gloves may be worn as a precautionary measure.

Inhalation — Very small quantities of formaldehyde gas can cause distress (dizziness, nausea, headache, etc.) in hypersensitive individuals. Long-term exposure (8 hours/day, 5 days/week, 2 years) to atmospheric formaldehyde concentrations of 14 ppm have caused nasal carcinomas in rats. Such animal data and limited epidemiological evidence indicates that formaldehyde is a probable human carcinogen. Specimens should be used in a well-ventilated room. Employees and students should not work in the same room where specimens are stored.

Oral — Because Nasco-Guard® specimens are moist packed, little fluid is available for consumption. The main danger lies in eating specimens.

EMERGENCY AND FIRST AID PROCEDURES:

Swallowing — If conscious, give two glasses of water and induce vomiting. Call a physician (or veterinarian in case of cat or dog) immediately.

Skin — Remove contaminated clothing and flush skin with water.

Inhalation — Remove to fresh air. Call a physician if discomfort persists.

Eyes — Flush with water.

SUPPLEMENTAL INFORMATION ON CHEMICALS USED IN THE NASCO-GUARD® PROCESS:

Ethylene glycol is poisonous if ingested (100 cc of 100% ethylene glycol can be fatal in humans). The LD₅₀ for rats is 5840 mg/kg. Severe kidney damage results from ingesting large volumes of ethylene glycol. Specimens must not be consumed by humans or pets. There is no apparent danger, however, from putting fingers in the mouth or chewing fingernails of unwashed hands. Hands should be washed, however, after handling any chemical — including Nasco-Guard®. In case of ethylene glycol poisoning, consult a medical doctor or veterinarian immediately (see Notes to Physician). Ethylene glycol has been shown to produce dose-related teratogenic effects in rats and mice when given by forced feeding or in drinking water at high concentrations. There is, however, no currently available information to suggest that ethylene glycol has caused birth defects in humans. Therefore, ethylene glycol is considered an animal teratogen. Two chronic feeding studies, using rats and mice, have not produced any evidence that ethylene glycol causes dose-related increases in tumor incidence, or a different pattern of tumors compared with untreated controls. The absence of carcinogenic potential for ethylene glycol has been supported by numerous in vitro genotoxicity studies showing that it does not produce mutagenic or clastogenic effects.

Propylene glycol is practically nontoxic, as evidenced by its wide use in foods, pharmaceuticals, and cosmetics. Ingestion may cause nausea. It may cause minor skin irritation.

Formaldehyde is well known for its toxic and irritant properties; the oral LD₅₀ for a 37% formaldehyde solution in rats is 0.80 g/kg. A large quantity of Nasco-Guard® would have to be ingested, however, to inflict a lethal dose because its residual formaldehyde concentration is 0.5% or less.

Phenol can be toxic; the average fatal dose in humans is 15 g, but death may result from as little as one gram. Ingestion of small amounts may cause a variety of serious disorders. Because phenol has a distinct medicinal smell, however, it is unlikely that specimens containing phenol would be eaten. Phenol's wide use as a disinfectant and deodorant attests to its relative safety when used in highly dilute solutions.

NOTES TO PHYSICIAN:

The principal toxic effect of ethylene glycol, when swallowed in significant amounts, will be kidney damage. Early administration of ethanol may block the formation of nephrotoxic metabolites of ethylene glycol in the liver. Ethanol should be given intravenously, as a 5% solution in sodium bicarbonate, at a rate of about 10 ml of ethanol per hour. Hemodialysis may be required.

DISPOSAL OF SPECIMENS:

Nasco-Guard® specimens are biodegradable. They are suitable for burial in an approved sanitary landfill or for incineration. Ambient fluids may be safely disposed via city sewers.

MSDS:

The following material safety data sheets provide additional information on chemicals used in the Nasco-Guard® process.

JAN 23 1995

THE MILSOLV COMPANIES
Product Code: 6150
ETHYLENE GLYCOL

UNION CARBIDE CHEMICALS AND PLASTICS COMPANY INC.

Industrial Chemicals Division

MATERIAL SAFETY DATA SHEET

EFFECTIVE DATE: 03/21/90

Union Carbide urges each customer or recipient of this MSDS to study it carefully to become aware of and understand the hazards associated with the product. The reader should consider consulting reference works or individuals who are experts in ventilation, toxicology, and fire prevention, as necessary or appropriate to use and understand the data contained in this MSDS.

To promote safe handling, each customer or recipient should: (1) notify its employees, agents, contractors and others whom it knows or believes will use this material of the information in this MSDS and any other information regarding hazards or safety; (2) furnish this same information to each of its customers for the product; and (3) request its customers to notify their employees, customers, and other users of the product of this information.

I. IDENTIFICATION

PRODUCT NAME: ETHYLENE GLYCOL, INDUSTRIAL GRADE

CHEMICAL NAME: Ethylene Glycol

CHEMICAL FAMILY: Glycols

FORMULA: HOC2H4OH

MOLECULAR WEIGHT: 62.07

SYNONYMS: EG; Glycol; 1,2-Ethanediol

CAS# and 107-21-1

CAS NAME: 1,2-Ethanediol

II. PHYSICAL DATA (Determined on typical material)

BOILING POINT, 760 mm Hg: &197C (&387F)

FREEZING POINT: - 13 C (9 F)

SPECIFIC GRAVITY (H2O = 1):
1.115 at 20/20 C

VAPOR PRESSURE AT 20°C:
0.08 mm Hg

VAPOR DENSITY (air = 1)
2.1

SOLUBILITY IN WATER by wt:
100

EVAPORATION RATE

(Butyl Acetate = 1): 0.01

APPEARANCE AND ODOR: Colorless liquid. A slight sweet odor may be detected.

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EMERGENCY PHONE NUMBER: 1-800-UCC-HELP (Number available at all times)

UNION CARBIDE CHEMICALS AND PLASTICS COMPANY INC.

Industrial Chemicals Division

39 Old Ridgebury Road, Danbury, CT. 06817-0001

PRODUCT NAME: ETHYLENE GLYCOL, INDUSTRIAL GRADE

III. INGREDIENTS

MATERIAL	%	TL V (Units)	HAZARD
Ethylene Glycol	100	50ppm C, OSHA & ACGIH	See Section V
CAS # 107-21-1			

IV. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT 241 F, Tag closed Cup, ASTM D 56
(test method(s)): 240 F, Cleveland open cup, ASTM D 92

FLAMMABLE LIMITS IN AIR, % by volume: LOWER: 3.2 Calculated
UPPER: 15.3 (Estimated)

EXTINGUISHING MEDIA: Apply alcohol-type or all-purpose-type foams by manufacturer's recommended techniques for large fires. Use CO2 or dry chemical media for small fires.

SPECIAL FIRE FIGHTING PROCEDURES:

Do not spray pool fires directly; a solid stream of water or foam directed into hot burning liquid can cause frothing. Use self-contained breathing apparatus and protective clothing.

UNUSUAL FIRE AND EXPLOSION HAZARDS None

V. HEALTH HAZARD DATA

TLV AND SOURCE:	See Section III.
EFFECTS OF SINGLE OVEREXPOSURE:	
SWALLOWING:	May cause abdominal discomfort or pain, nausea, vomiting, dizziness, drowsiness, malaise, blurring of vision, irritability, lumbar pain, oliguria, uremia, and central nervous system effects, including irregular eye movements, convulsions and coma. Cardiac failure and pulmonary edema may develop. Severe kidney damage follows the swallowing of large volumes of ethylene glycol. May be fatal. A few reports have been published describing the development of weakness of the facial muscles, diminished hearing, and difficulty with swallowing, during the late stages of severe poisoning.
SKIN ABSORPTION:	No evidence of adverse effects from available information.
INHALATION:	May cause irritation of the nose and throat with headache, particularly from mists. High vapor concentrations caused, for example, by heating the material in an enclosed and poorly ventilated workplace, may produce nausea, vomiting, headache, dizziness, and irregular eye movements
SKIN CONTACT:	No evidence of adverse effects from available information.
EYE CONTACT:	Liquid, vapor, and mist, may cause discomfort in the eye with persistent conjunctivitis, seen as slight excess redness of conjunctiva. Serious corneal injury is not anticipated.

EFFECTS OF REPEATED OVEREXPOSURE:

Inhalation of mist may produce signs of central nervous system involvement, particularly dizziness and nystagmus.

PRODUCT NAME: ETHYLENE GLYCOL, INDUSTRIAL GRADE

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE:

May aggravate existing kidney disease.

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN

HEALTH HAZARD EVALUATION: Ethylene Glycol has been shown to produce dose-related teratogenic effects in rats and mice when given by gavage or in drinking water at high concentrations or doses. The no-effect dose for developmental toxicity for ethylene glycol given by gavage over the period of organogenesis has been shown to be 150 mg/kg/day for the mouse and 500 mg/kg/day for the rat. Also in a preliminary study to assess the effects of exposure of pregnant rats and mice to aerosols at concentrations 150, 1000 and 2500 mg/m³ for 6 hour a day throughout the period of organogenesis, teratogenic effects were produced at the highest concentration, but only in mice. The conditions of these latter experiments did not allow a conclusion as to whether the developmental toxicity was mediated by inhalation of aerosol, percutaneous absorption of ethylene glycol from contaminated skin, or swallowing of ethylene glycol as a result of grooming the wetted coat. In a further study, comparing effects from high aerosol concentration by whole-body or nose-only exposure, it was shown that nose-only exposure resulted in maternal toxicity (1000 and 2500 mg/m³) and developmental toxicity with minimal evidence of teratogenicity (2500 mg/m³). The no-effects concentration (based on maternal toxicity) was 500 mg/m³. In a further study in mice, no teratogenic effects could be produced when ethylene glycol was applied to the skin of pregnant mice over the period of organogenesis. The above observations suggest that ethylene glycol is to be regarded as an animal teratogen; there is currently no available information to suggest that ethylene glycol has caused birth defects in humans. Cutaneous application of ethylene glycol is ineffective in producing developmental toxicity; exposure to high aerosol concentration is only minimally effective in producing developmental toxicity; the major route for producing developmental toxicity is perorally. Two chronic feeding studies, using rats and mice, have not produced any evidence that ethylene glycol causes dose-related increases in tumor incidence, or a different pattern of tumors compared with untreated controls. The absence of a carcinogenic potential for ethylene glycol has been supported by numerous in vitro genotoxicity studies showing that it does not produce mutagenic or clastogenic effects.

OTHER EFFECTS OF OVEREXPOSURE:

Repeated skin contact may, in a very small proportion of cases, cause sensitization with the development of allergic contact dermatitis. The incidence is significantly less than 1% with the undiluted material.

EMERGENCY AND FIRST AID PROCEDURES:

SWALLOWING:	If conscious, give two glasses of water and induce vomiting. Call a physician immediately. If medical advice is delayed and the person has swallowed moderate volumes of ethylene glycol (a few ounces), then give three to four ounces of hard liquor such as whiskey.
SKIN:	Remove contaminated clothing and flush skin with water.
INHALATION:	Remove to fresh air. Call a physician if discomfort persists.
EYES:	Immediately flush with water, and continue washing the eyes for several minutes.

NOTES TO PHYSICIAN:

The principal toxic effects of ethylene glycol, when swallowed, are kidney damage and metabolic acidosis. Ethanol is antidotal, and its early administration may block the formation of nephrotoxic metabolites of ethylene glycol in the liver. Ethanol should be given intravenously, as a 5% solution in sodium bicarbonate, at a rate of about 10 ml ethanol per hour. A desired therapeutic level of ethanol in blood is 100 mg/dl. Hemodialysis may be required. 4-Methylpyrazole, a potent inhibitor of alcohol dehydrogenase, has been used therapeutically to decrease the metabolic consequences of ethylene glycol poisoning before coma, seizure, and renal failure have occurred (20 mg/kg/day). Pulmonary edema with hypoxemia has been described in a number of patients following poisoning with ethylene glycol. The mechanism of production has not been elucidated, but it appears to be noncardiogenic in origin in several cases. Respiratory support with mechanical ventilation and positive end-expiratory pressure may be required. There may be cranial nerve involvement in the late stages of toxicity from swallowed ethylene glycol. In particular, effects have been reported involving the seventh, eighth and ninth cranial nerves, presenting with bilateral facial paralysis, diminished hearing and dysphagia.

VI. REACTIVITY DATA

STABILITY:	Stable
CONDITIONS TO AVOID:	None
INCOMPATIBILITY (materials to avoid):	Explosive decomposition may occur if combined with strong acids or strong bases and subjected to elevated temperatures. Therefore, avoid strong acids and strong bases at elevated temperatures. Avoid contamination with strong oxidizing agents and materials reactive with hydroxyl compounds.

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS:

Burning can produce carbon monoxide and/or carbon dioxide.

HAZARDOUS POLYMERIZATION:

Will Not Occur

CONDITIONS TO AVOID: None

VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

Wear suitable protective equipment. Small spills should be flushed with large quantities of water. Larger spills should be collected for disposal.

WASTE DISPOSAL METHOD:

Incinerate in a furnace where permitted under appropriate Federal, State, or local regulations. At very low concentration in water, ethylene glycol is readily biodegradable in a biological wastewater treatment plant.

VIII. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (specify type):

NIOSH approved breathing air equipment or NIOSH approved face mask with organic vapor cartridge and dust or mist pre-filter (not for use in fire fighting or in atmospheres with reduced oxygen content).

VENTILATION:

General (mechanical) room ventilation may be adequate if handled at ambient temperatures or in covered equipment. If ambient temperatures are exceeded or operations exist which may produce misting, local exhaust ventilation is needed.

PROTECTIVE GLOVES:

Rubber or polyvinyl chloride coated.

EYE PROTECTION:

Monogoggles or faceshield.

OTHER PROTECTIVE EQUIPMENT:

Eye bath and safety shower.

IX. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:

DANGER!! Harmful or fatal if swallowed.
Prolonged or repeated breathing of mist or vapor harmful.
Causes eye irritation
May cause kidney and nervous system damage.
Causes birth defects in laboratory animals.

Do not swallow.

Do not breathe mist from spray.

Avoid prolonged or repeated breathing of vapor.

Avoid contact with eyes.

Keep container closed.

Use with adequate ventilation.

Wash thoroughly after handling.

FOR INDUSTRY USE ONLY

OTHER PRECAUTIONS:

WARNING: Hot organic chemical vapors or mists are susceptible to sudden spontaneous combustion when mixed with air. Ignition may occur at temperatures below those published in the literature as "autoignition" or "ignition" temperatures. Ignition temperatures decrease with increasing vapor volume and vapor/air contact time, and are influenced by pressure changes.

Ignition may occur at typical elevated — temperature process conditions, especially in processes operating under vacuum if subjected to sudden ingress of air, or outside process equipment operating under elevated pressure if sudden escape of vapors or mists to the atmosphere occurs.

Any proposed use of this product in elevated — temperature processes should be thoroughly evaluated to assure that safe operating conditions are established and maintained.

X. REGULATORY INFORMATION**STATUS ON SUBSTANCE LISTS:**

The concentrations shown are maximum or ceiling levels (weight %) to be used for calculations for regulations. Trade Secrets are indicated by "TS".

FEDERAL EPA

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center of release of quantities of Hazardous Substances equal to or greater than the reportable quantities (RQs) in 40 CFR 302.4.

Components present in this product at a level which could require reporting under the statute are:

CHEMICAL	CAS NUMBER	UPPER BOUND CONCENTRATION %
Dioxane	123-91-1	.0026
Ethylene Oxide	75-21-8	.0001

Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires emergency planning based on Threshold Planning Quantities (TPQs) and release reporting based on Reportable Quantities (RQs) in 40 CFR 355 (used for SARA 302, 304, 311 and 312).

Components present in this product at a level which could require reporting under the statute are:

☆☆NONE☆☆

Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires submission of annual reports of release of toxic chemicals that appear in 40 CFR 372 (for SARA 313). This information must be included in all MSDSs that are copied and distributed for this material.

Components present in this product at a level which could require reporting under the statute are:

CHEMICAL	CAS NUMBER	UPPER BOUND CONCENTRATION %
Ethylene Glycol	107-21-1	100.0

STATE RIGHT-TO-KNOW**CALIFORNIA Proposition 65**

This product contains trace levels of ACETALDHYDE AND DIOXANE which the State of California has found to cause cancer, birth defects or other reproductive harm.

MASSACHUSETTS Right-To-Know, Substance List (MSL) Hazardous Substances and Extraordinarily Hazardous Substances on the MSL must be identified when present in products.

Components present in this product at a level which could require reporting under the statute are:

EXTRAORDINARILY HAZARDOUS SUBSTANCES (= > 0.0001%)

CHEMICAL	CAS NUMBER	UPPER BOUND CONCENTRATION %
Dioxane	123-91-1	.0026
Methanol	67-56-1	.0024

HAZARDOUS SUBSTANCES (= > 1%)

CHEMICAL	CAS NUMBER	UPPER BOUND CONCENTRATION %
Ethylene Glycol	107-21-1	100.0

PENNSYLVANIA Right-To-Know, Hazardous Substance List Hazardous Substances and Special Hazardous Substances on the List must be identified when present in products.

Components present in this product at a level which could require reporting under the statute are:

HAZARDOUS SUBSTANCES (= > 1%)

CHEMICAL	CAS NUMBER	UPPER BOUND CONCENTRATION %
Ethylene Glycol	107-21-1	100.0

Toxic Substances Control Act (TSCA) Status:

The ingredients of this product are on the TSCA inventory.

CALIFORNIA SCAQMD RULE 443.1 VOC'S:

Not presently available

NOTE---

The opinions expressed herein are those of qualified experts within Union Carbide Chemicals and Plastics Company. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and of these opinions and the conditions of the use of the product are not within the control of Union Carbide Chemicals and Plastics Company, it is the user's obligation to determine the conditions of safe use of the product.

REVISED SECTIONS:

Revisions in this MSDS occurred in the following sections:

Section II: PHYSICAL DATA (Subtitle: Appearance and Odor)

Section V: HEALTH HAZARD DATA (Subtitles):

Medical Conditions Aggravated By Overexposure

Significant Laboratory Data

Emergency and First Aid Procedures — "Swallowing"

Section X: Dioxane level

PC: 35202

F NUMBER: NO1

UNION CARBIDE CORPORATION
Specialty Chemicals Division
MATERIAL SAFETY DATA SHEET
EFFECTIVE DATE: 05/15/89

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I. IDENTIFICATION

PRODUCT NAME: PROPYLENE GLYCOL, ALL GRADES

CHEMICAL NAME: 1,2-Propanediol

CHEMICAL FAMILY: Glycols

FORMULA: CH₃CH(OH)CH₂OH

MOLECULAR WEIGHT: 76.1

SYNONYMS: 1,2-Dihydroxypropane

CAS# and 57-55-6

CAS NAME: 1,2-Propanediol

II. PHYSICAL DATA (Determined on typical material)

BOILING POINT, 760 mm Hg: > 187.3C (> 369.1F)

FREEZING POINT: Sets to glass below -60 C (-76 F)

SPECIFIC GRAVITY (H₂O = 1):

1.038

VAPOR PRESSURE AT 20°C:

0.04 mm Hg (0.005kPa)

VAPOR DENSITY (air = 1)

2.6

SOLUBILITY IN WATER by wt:

100

EVAPORATION RATE

(Butyl Acetate = 1): 0.005

APPEARANCE AND ODOR: Water-white liquid; mild odor.

PERCENT VOLATILES (BY VOLUME): 100

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EMERGENCY PHONE NUMBER: 1-800-UCC-HELP (Number available at all times)

UNION CARBIDE CORPORATION

Specialty Chemicals Division

39 Old Ridgebury Road, Danbury, CT. 06817-0001

PRODUCT NAME: PROPYLENE GLYCOL, ALL GRADES

III. INGREDIENTS

MATERIAL	%	TL V (Units)	HAZARD
Propylene Glycol	100	None established	See Section V

IV. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT 214 F, (101 C). Tag closed cup, ASTM D 56

(test method(s)): 225 F, (106 C). Cleveland open cup, ASTM D 92