To: Robert Pooler
USDA/AMS/TM/NOP
email: Bob.Pooler@USDA.gov

From: Co-petitioners
Date: 12/5/00

re; additional information for petitions of Cyclohexylamine, Diethylaminoethanol, and Morpholine

➢ **Justification Statement;**

Boiler water additives are essential to prevent the corrosion of steam generating and distribution systems. These additives prevent corrosion by neutralizing carbonic acid as it forms from the carbon dioxide captured within the steam. Most manufactures have one boiler system serving their entire plant and therefore producing steam for all the operating needs. These steam generating and distribution systems represent significant capital investments for food manufacturers. As an example; a 500-hp boiler costs roughly $200,000.00. Typically, a boiler this size will provide enough steam to operate a small processing facility with one or two production lines and fruit/vegetable processing area. The larger the operation the more boiler capacity is needed. Large operations will take multiple boiler systems, which will take on the average three boiler systems. This is an investment of approximately $600,000.00 for the boilers alone. Additional capitol investment of the entire production area is at risk if the steam is not treated to neutralize the carbonic acid. Effective and safe boiler/steam additives are vital to protect these systems. A poorly maintained system will require replacement every 5 to 8 years as opposed to lasting between 50 to 100 years. Additionally, Most State's and private insurance companies require inspections to verify that a boiler is being properly maintained. This includes a proper chemical documentation program. Worker safety is also an issue as a poorly maintained boiler system can result in steam leaks and equipment failure under load.

The only effective steam and condensate line corrosion inhibitors available are amine based with the exception or ammonium hydroxide which is the only approved steam line treatment in dairy. The code of Federal Regulations lists only three approved volatile amines; **Cyclohexylamine, Diethylaminoethanol, and Morpholine.** For the most complete and economical protection of a steam system, it is advisable to design a blend of these amines which will accommodate to the specific yet changing conditions in a boiler system. Suppliers of these materials are familiar with the conditions needed for proper distribution ratio's and will create an optimum blend for their client.

➢ **Non-synthetic Substances**

There are no approved non-synthetic substances.

➢ **Alternative Control Methods**

1. Many operations **discontinue the use of boiler water additives** only during the production of organic products minimizing the corrosive impact of not using boiler water additives. Below are some of the reasons why this is not feasible for all operations:
    - This would only be possible for manufacturers of both organic and non-organic products whose organic production represented a relatively small portion of their running time.

- This would be impractical for producers targeting a national distribution. To achieve production volumes for national distribution organic production lines would have to run virtually continuously.
- For perspective, a 500-hp system running without boiler water additives would increase fuel requirements by about $100,000.00. This would result in 2 additional tons of nitrogen oxide and 1 additional ton of sulfur dioxide released into the atmosphere each year. As corrosion builds up the efficiency of heat transfer decreases requiring more energy to run the boiler.

2. **Culinary steam filters** (as suggested by prior NOSB addendum Number 7 – Orlando, 1995) do not remove the volatile amines and therefore are not an alternative.

3. Placing a **steam to steam heat exchanger** between the existing boiler water system and the production line system .
    - Not a solution for all applications, the temperature differential has to be sufficient to maintain the required temperature and pressure to serve the production system
    - The cost of installation would present a significant expense. (Average cost for a line of national distribution is $500,000.00. Life span of equipment is 5-8 years.)

Beneficial effects to the environment from the use of the synthetic substance.

The environment benefits from the proper maintenance and boiler water treatment program. A poorly maintained boiler will increase fuel requirements as corrosion builds up and the efficiency of heat transfer decreases requiring more energy to run the boiler. These results in additional nitrogen oxide and sulfur dioxide release into the atmosphere and promotes an unsafe work environment due to deterioration and possible catastrophic steam into the work places.

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MORPHOLINE

Processing

Category: Synthetic

Common Name: Morpholine
Synonyms: Tetrahydro-2H-1,4-oxazine; Diethylene oximide; tetrahydro-1,4-oxazine; Diethyleneimide oxide; Tetrahydro-4H-1-4-oxazine; 1-Oxa-4-azacyclohexane; Diethylene imidoxide; tetrahydro-p-isoxazine; C_4H_9NO; BASF 238, Drewamine; UN2054.

Manufacturers: There are two producers who make almost all of the morpholine commercially available:

BASF
3000 Continental Drive – North
Mt. Olive, NJ 07828
Corp. Phone 973-426-2600
Mr. Allen Black, Morpholine Product Manager
Phone 973-426-4574

Huntsman (production facilities in Wales and near Houston, TX)
3040 Post Oak Boulevard
Houston, TX 77056
Phone 713-235-6000
Debra Direnfeld (Research & Development)
7114 N. Lamar Blvd.
Austin, TX 78752
Phone 512-483-0056
Morpholine brochure (28 pp. from Laura Cook - Customer Service
Phone 713-235-6292

According to both BASF and Huntsman representatives, the only other producers are smaller Asian locations. 1996 data from WHO listed 3 Japanese, 2 Chinese and 1 Indian producer. Do not know if these are still in operation or not.

List of uses, rates: Morpholine is used in boiler systems to neutralize carbonic acid formed from carbon dioxide in the vapor phase. The amount of morpholine used is dictated by the amount of carbonate and bicarbonate in the steam and condensate. CFR directs that usage cannot exceed 10 ppm and that usage cannot exceed the amount required to protect the system. The Huntsman brochure contains some information on uses, chemical reactions, physical properties and safety. See Attachment M-1.

IARC Monograph indicates morpholine is mainly used as an intermediate in the production of rubber chemicals and optical brighteners, as a corrosion inhibitor in steam condensate systems, as an ingredient in waxes and polishes and **as a component of protective coatings on fresh fruits and vegetables** (emphasis by petitioner).

Sources, mfg. Descrpt: Huntsman and BASF unwilling to divulge production process, but referred to Kirk-Othmer Encyclopedia of Chemical Technology as giving typical synthesis routes. Kirk-Othmer, Vol. 2, p. 4 (4^{th} edition) indicates "diethanolamine and diisopropanolamine can be cyclized to give morpholines", while pages 373-386 (same volume) lists method as "alcohol amination metal catalyzed: amination of an alcohol over a metal catalyst under reducing conditions" (See Attachment M-2). Production volumes were given as 4,500 ton/yr for BASF and 12,000 ton/yr for "Texaco" (bought by Huntsman?). Russian process offered as license to Romania indicates (see Attachment M-3) "from diethylene glycol and ammonia in the vapor phase in presence of hydrogen and catalysts", and Allen Black at BASF indicated that was accurate. As background, MSDS for diethylene glycol can be found in Attachment M-4.

Summary of previous reviews by state or private certification agencies: Have not been able to determine if any reviews have been conducted.

Regulatory status: Approved by FDA not to exceed 10 ppm in steam, and not approved for contact with milk and milk products. See 21CFR173.310 (Attachment M-5).

CAS Number & Label: CAS No. 110-91-8. Requires Flammable markings. Labels in Attachment M-6.

Physical properties, chemical mode of action, environmental impact, interaction with other materials, toxicity and persistence, effects on human health, effects on soil organisms, crops or livestock:

Reviewers are directed to the first reference "**Morpholine**" published by WHO in 1996. This is a complete review of morpholine in all aspects of safety, environmental status, etc. It is a MUST READ for morpholine reviewers.

Physical properties: Flammable and corrosive colorless liquid, weak ammonia-like odor, forms explosive mixtures with air. Melting point –4.9 °C, boiling point 128.9 °C. Density 0.995 g/ml. (See Attachment M-7 from Chemfinder), also supplier MSDS files in Attachment M-15, and **Morpholine** (WHO, No.179), 1996, p.19.

Chemical mode of action: Neutralizes carbonic acid in steam and steam condensates.

Environmental impact: From JTBaker MSDS – "When released into the soil, this material may biodegrade to a moderate extent...is expected to leach into groundwater...is expected to quickly evaporate... when released into water this material is not expected to biodegrade...may evaporate to a moderate extent...has an experimentally determined bioconcentration factor (BCF) of less than 100...has a log octanol-water partition coefficient of less than 3.0. This material is not expected to bioaccumulate. When released into air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals...readily removed from the atmosphere by wet deposition...expected to have a half-life of less than 1 day....Environmental toxicity: No information found."

From **Morpholine** (WHO), page 20, "Morpholine is chemically stable in the biosphere although it is Subject to chemical and biological nitrosation to NMOR...Morpholine is inherently biodegradable... However, under non-adapted conditions there is probably no significant degradation of morpholine." There are inadequate data on the bioaccumulation in aquatic and terrestrial organisms, but no bioaccumulation is expected based on the n-octanol/water partition coefficient. In Section 1.10.2, page 27 entitled "Evaluation of Effects on the Environment" WHO reported "In view of the very restricted knowledge regarding environmental exposure, the lack of effect data relating to long-term exposure in water and to short- and long-term exposure in the terrestrial environment, a sound risk assessment cannot be carried out at present. On the basis of reported properties of morpholine, the available ecotoxicological information and the few data on environmental concentration, certain conclusions can be drawn. The high water solubility of morpholine and its low volatility (under environmental conditions) make the hydrosphere the predominant environmental sink." The book says the material is inherently biodegradable and that no data suggest accumulation, so bioaccumulation is unlikely. It goes on to say that it is unlikely that current levels cause any significant damage and that local effects due to factory emissions remain to be evaluated. The book concludes (p. 28) that "morpholine does not present a toxic risk to humans at the usual levels of exposure, but its conversion to the carcinogenic NMOR should be noted. There is no evidence at present levels of exposure that morpholine poses a substantial risk to biota in the environment."

NIOSH indicates "This substance may be hazardous to the environment; special attention should be given to water organisms." See Attachment M-8

Interaction with other materials: From JTBaker MSDS: "Incompatibilities: cellulose nitrate, nitromethane, other nitro compounds, strong acids, and oxidizing agents. Corrosive to metals.

Jpn. J. Cancer Res. 88, 797-806, September 1997, indicates mixtures of morpholine and sodium nitrite are carcinogenic to rats. See Attachment M-9.

Also, sodium nitrite is a known boiler treatment. See Attachment M-10, page 7.

Toxicity and persistence: See comment under environmental impact

Effects on human health: Search of National Academy Press indicated one reference to morpholine in the form of a literature reference to publication by Academy Press, NRC. 1983a. "An Assessment of the Health Risks of Morpholine and Diethylaminoethanol." (See Attachment M-11)

IARC Monographs, Vol. 47 (1989)(p. 199) indicates under "exposures" that morpholine has been detected in samples of foodstuffs and beverages. It concludes there is inadequate evidence for carcinogenicity in experimental animals and no data on humans (rated 'not classifiable'). Does not appear to be a mutagen. **IARC Monographs, Vol. 71** (1999)(p. 1511) reaffirms inadequate evidence for carcinogenicity and not classifiable for humans (See Attachment M-12).

For additional information, see data from **Sax** (Attachment M-13) and various MSDS sheets in Attachment M-15.

Effects on soil organisms: NIOSH indicates "This substance may be hazardous to the environment; special attention should be given to water organisms."

Safety, MSDS, NIEHS reports: Significant human handling hazard, flammable and can be explosive, must avoid inhaling vapor, absorbed through skin, causes blurred vision, diarrhea and vomiting if ingested. See **Sax** (Attachment M-13) and the NIEHS report in Attachment M-14. A variety of MSDS sheets are included in Attachment M-15.

Research information, reviews, bibliographies:

Morpholine / first draft prepared by J. Kielhorn and G. Rosner, published by Geneva: World Health Organization, 1996, 163 pages (including 18 pages of references). **THIS IS A MUST READ!**

Lewis, R. J., Sr. and R. L. Tatken, Eds. **Registry of Toxic Effects of Chemical Substances**. DHEW (NIOSH) Publication No. 79-100. National Institute for Occapational Safety and Health. Cincinnati, OH. 1979

Weast, R.C. and M.A. Astle. Eds. **CRC Handbook of Chemistry and Physics**. 57th Ed. CRC Press, Inc. Boca Raton, FL 1977. p 379.

Windholz, M., Ed. **The Merck Index**. 9th Ed. Merck and Co., Rahway, NJ, 1976. p 815.

Sax, N. I., **Dangerous Properties of Industrial Materials**, 10th edition, 2000, MRP 750 (Vol. 3), p 2579.

International Technical Information Institute. **Toxic and Hazardous Industrial Chemicals Safety Manual for Handling and Disposal with Toxicity and Hazard Data**. International Technical Information Institute. 1978. p 946.

Hawley, G.G., Ed. **The Condensed Chemical Dictionary**. 9th edition, Van Nostrand Reinhold, New York. 1977, p 591.

Aldrich Chemical Company, **Aldrich Catalog / Handbook of Fine Chemicals**, Aldrich Chemical Co., Inc., Milwaukee, WI, 1978, p 619.

Proctor, N.H. and J.P. Huges, **Chemical Hazards of the Workplace**, J.B. Lippincott, Philadelphia, 1978, p 362.

U.S. Environmental Protection Agency, Office of Toxic Substances, **Toxic Substances Control Act Chemical Substances Inventory, Initial Inventory**, 6 Vols. U.S. Environmental Protection Agency Washington, D.C. 1979. LISTED

Oak Ridge National Laboratory, Environmental Mutagen Information Center (EMIC), Bibliographic Data Base. Oak Ridge National Laboratory, Oak Ridge, TN LISTED

Oak Ridge National Laboratory, Environmental Teratogen Information Center (ETIC), Bibliographic Data Base. Oak Ridge National Laboratory, Oak Ridge, TN LISTED

Occupational Safety and Health Administration, **Tentative OSHA Listing of Confirmed and Suspected Carcinogens by Category**, Occupational Safety and Health Administration, Washington, D.C. 1979. NOT LISTED
1980.

Clansky, Kenneth B., Ed. **Suspect Chemicals Source Book: A Guide to Industrial Chemicals Covered Under Major Federal Regulatory and Advisory Programs**, Roytech Publications, Inc., Burlingame, CA. 1990, Update, p. xxix.

United States National Toxicology Program, **Chemical Status Report**., NTP Chemtrack System, Research Triangle Park, NC, November 6, 1990. NOT LISTED

Kitano, M., et.al., "Carcinogenicity of Methylurea or Morpholine in Combination with Sodium Nitrite in a Rat Multi-organ Carcinogenesis Bioassay", **Jpn. J. Cancer Res. 88**, 797-806, September 1997.

RESULTS OF DIALOG AND TOXLINE COMPUTER SEARCHES FOR 1996 FORWARD: The **Morpholine** WHO document is so thorough that it was felt necessary to search only the period since it's publication. None of the "hits" reported for searching "morpholine" with words like "safety", "toxicity", "environment", "steam", or "food" appeared of sufficient interest to warrant delaying submission to obtain reprints. Copies of the computer search printouts are included in Attachment M-16. The following references might be of interest to the TAP.

"Biogenic amines in foods: Histamine and food processing", Bodmer, S., et. al., **Inflammation Research, 48**(6), 1999, p. 296-300.

"Genetic toxicology data in the evaluation of potential human environmental carcinogens", Water, M.D., et. al., **Mutagen Research, 437** (1), 1999, p. 21-49.

"Degredation of morpholine and thiomorpholine by an environmental Mycobacterium involves a cytochrome P450.", Besse, P, et. al., **Journal of Molecular Catalysis B Enzymatic, 5** (104), 1998, p. 403-309.

"Morpholine (Addendum), Anonymous, **Beratergremium fuer umweltrelevante Altstoffe (BUA), 193**, 1998, 14 pages.

"Scientific basis for Swedish occupational standards XVII. Consensus report for morpholine", **Arbete och H lsa**(25 (1996:24 in Swedish)), 1996, 46-55.

"Migration and Sorption Phenomena in Packaged Foods", Gnanasekharan, V, and J.D. Floros, **Critical Reviews in Food Science and Nutrition, 37** (6), 1997, p. 519-559.

"A hazard ranking of organic contaminants in refinery effluents", Siljeholm, J., **Toxicology and Industrial Health, 13** (4), 1007, p. 527-551.

"Photocatalytic degradation of aromatic and alicyclic pollutants in water: By-products, pathways and mechanisms", Pichat, P., **Water Science and Technology, 35** (4), 1997, p. 73-38.

"Oxygen scavenger and boiler water treatment chemical", Shimura and others, **Eur. Pat. Appl.**, 30 pp., Pat. No. WO 9858925, 1998.

"On 'toxicity equivalent factors' and 'relative potency' to account for differential toxicity and carcinogenicity:

concerns about uncommon effects of dose in animal experiments and environmental exposures to humans", Jones, Troyce D., **Environmetrics** (1998), 9(5), p. 525-539.

LIST OF ATTACHMENTS:

M-1: Morpholine Product Literature from Huntsman. 28 pages
M-2: Kirk-Othmer Encyclopedia, excerpts.
M-3: Morpholine and its production process
M-4: Diethylene glycol MSDS, Mallinckrodt Baker, Inc.
M-5: Excerpts from 21CFR173.310
M-6: Morpholine Label – from Chemfinder: Genium's Chemical Container Label Database – Morpholine label
M-7: Chemfinder: Morpholine "home page"
NTP:
NTP Search results page
Morpholine MSDS
Morpholine page
Hazardous Chemicals Database at the University of Akron – 3 files.
Australian Atmospheric Exposure Standards
Environmental Science Center database with Experimental Log P coefficients, etc.
NIST Chemistry WebBook
M-8: NIOSH:
International Chemical Safety Cards – Morpholine
IDLH Documentation

M-9: Abstract: "Carcinogenicity of Methylurea or Morpholine in Combination with Sodium Nitrite in a Rat Multi-organ Carcinogenesis Bioassay", Kitano, Mitsuaki, et.al., ***Jpn. J. Cancer Res. 88***, 797-806, September 1997.
M-10: AGI Water Treatment Brochure
M-11: The National Academies Database Search – one reference to 1983 study on Health Risks "An Assessment of the Health Risks of Morpholine and Diethylaminoethanol", National Academy Press.
M-12: IARC Monographs:
Vol. 47 (1989)(p. 199)
Vol. 71 (1999)(p. 1511)
M-13: SAX's **Dangerous Properties of Industrial Materials**, 10th edition, 2000, MRP750 (Vol. 3), p. 2579
M-14: NIEHS report
M-15: Product MSDS Sheets:
J.T. Baker
Air Products & Chemicals
Van Waters & Rogers Inc.
Louisiana State University
M-16: DIALOG and TOXLINE Searches, 1996 to present
M-17: Internet Search Bibliography for "Morpholine":
Printout of 195 of 760 hits, only a very few are actually specific to morpholine.

National Organic Standards Board,
c/o Robert Pooler, Agricultural Marketing Specialist,
USDA/AMS/TM/NOP, Room 2510-So., Ag Stop 0268,
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National List Petition
Submitted: November 29, 2000

MORPHOLINE

This Petition is submitted by the following:

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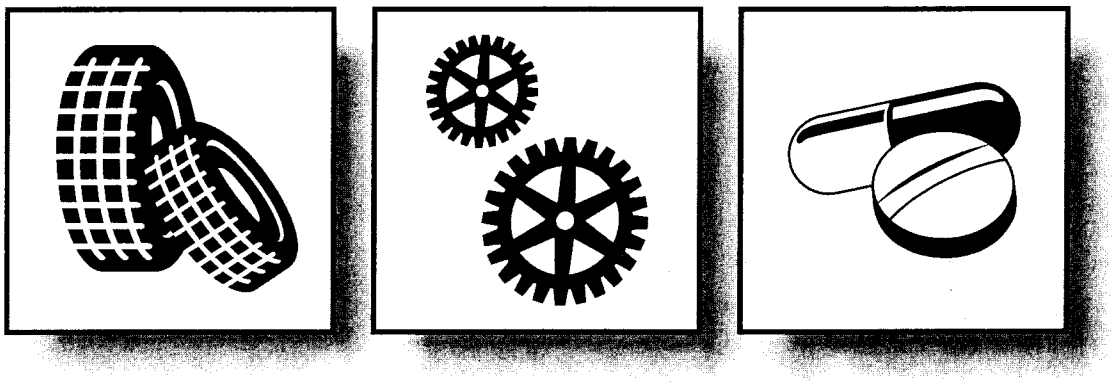
MORPHOLINE

offering a wide spectrum of applications



HUNTSMAN

3040 Post Oak Boulevard • Houston, TX 77056
713-235-6000 • fax: 713-235-6437

Quality Policy

Huntsman Corporation is committed to providing products and services that consistently conform to our customers' requirements.

To fulfill this commitment, the employees of Huntsman Corporation are dedicated to "being the best" through continuous improvement.

In implementing its quality policy, Huntsman Corporation is committed to the use of statistical methods.

Product Safety Policy

It is the product safety policy of Huntsman Corporation to provide our customers with information on the safe handling and use of our products. The Material Safety Data Sheet (MSDS) should always be read and understood thoroughly before handling the product, and adequate safety procedures should be followed. Information on the toxicity, environmental, and industrial hygiene aspects of our products may be found in the MSDS.

INTRODUCTION

Morpholine, CAS Number 110-91-8, is a colorless, mobile, hygroscopic liquid with a characteristic amine-like odor. It is completely miscible with water and a large number of organic solvents, and is itself a solvent for a large variety of organic materials, including resins, dyes, waxes, shellac, and casein.

Morpholine is an extremely versatile chemical with many important applications. It is used as an intermediate in the manufacture of rubber chemicals and optical brighteners. It is also used extensively as a corrosion inhibitor in steam boiler systems.

Fatty acid derivatives of morpholine are used as emulsifiers in the manufacture of waxes and polishes. Other derivatives have found applications as bactericides, pharmaceutical chemicals, and antioxidants for lubricating oils. Morpholine derivatives are particularly useful in the textile industry, where they are employed as textile lubricants and sizing emulsifiers.

Chemically, morpholine is an amino ether. The ether function of the molecule is typically inert and most of the reactions of morpholine involve the secondary amine group.

SALES SPECIFICATIONS/ANALYTICAL PROCEDURES

Sales Specifications

The following sales specifications are subject to change without notice. Appropriate analytical procedures for these specifications may be found to the right.

		Method of Determination
Appearance	Clear liquid, substantially free from suspended matter	ST-30.1
Color, Pt-Co scale	15 max.	ST-30.12
Morpholine, wt. %	99.0 min.	ST-35.77
Water, wt. %	0.3 max.	ST-31.53 Procedure 6

Analytical Procedures

Abbreviated forms of the standard methods of test for use with morpholine specifications are presented here. Copies of the methods in detail are available from our Technical Services Section in Austin, Texas, upon request.

APPEARANCE (Method No. ST-30.1) is determined by visual inspection of DIGLYCOLAMINE agent in a 100-ml tall-form Nessler tube.

COLOR (Method No. ST-30.12) is determined visually in a 40-ml tube with APHA color disc standards, or in a 100-ml tall-form Nessler tube with liquid platinum cobalt (APHA) standards.

MORPHOLINE ASSAY (Method No. ST-35.77) is used to determine morpholine and impurities by gas chromatography.

WATER (Method No. ST-31.53) is determined by the standard Karl Fischer method, the end point being detected electrometrically.

Rubber Chemicals

A major use of morpholine is as an intermediate in the production of delayed-action type rubber accelerators. Accelerators are added to rubber before fabrication to increase the rate of vulcanization. Since during fabrication there is a danger of prevulcanization, particularly if high temperatures are involved or if furnace black rather than channel black is present, delayed-action accelerators are highly desirable.

Morpholine-based delayed-action accelerators are usually made by reacting morpholine with 2-mercapto-benzothiazole. Several other morpholine-based accelerators have been reported in the literature.

Catalysts

Morpholine has been employed as a catalyst for the condensation of aldehydes and ketones which contain active methyl or methylene groups. The condensates may be hydrogenated to polyhydroxy compounds which can be sulfated to form surface-active agents.

Small quantities of morpholine are used in the emulsion polymerization of monomers, such as butadiene and isoprene, as well as their copolymerization with styrene, acrylonitrile, and the like.

Morpholine has been used as a temperature sensitive polymerization inhibitor. Small amounts permit complete impregnation of porous materials with molten vinylpyrrole-type monomers just above their melting points, but still allow complete polymerization at slightly higher temperatures.

Morpholine has also been used as a gelling agent in the preparation of alumina catalysts for the treatment of hydrocarbons. Catalysts of fine particle size suitable for fluidized solid techniques result from this procedure.

Corrosion Inhibitors

Morpholine is widely used as a neutralizing amine in combating carbonic acid corrosion in condensate return lines of steam boiler systems. The morpholine volatilizes with the steam from the boiler and condenses when the steam does, thereby affording protection to the lines, which otherwise would be subjected to corrosion by the carbonic acid present in the steam condensate.

Morpholine vapors protect silver and other metals against corrosion and tarnish by acid fumes, such as sulfur dioxide and hydrogen sulfide. The morpholine is supplied by evaporation from solution in a solid, such as camphor, or by sublimation from morpholinium N,N'-oxydiethylenecarbamate.

Morpholine is a component of a corrosion inhibitor system that prevents decomposition of a chlorinated hydrocarbon in a composition containing the chlorinated hydrocarbon and a large amount of water.

Corrosion of metal aerosol containers and valves can be prevented by the use of low levels of morpholine.

Morpholine is one of several amines employed as phosphates for inhibiting the corrosive action of grease-proof paper on steel and other metals. Di-4-morpholinyl polysulfides have been claimed as corrosion inhibitors to be added to mineral lubricating oils. Turbine oils, especially, are quickly contaminated with water, and to protect the machinery against rusting, 4,4'-alkylidenedimorpholines and poly (4-morpholinylmethyl) phenols have been used. Storage tanks, pipes, and other devices for handling petroleum distillates must be protected against corrosion, and for this purpose 4,4'-butylmercaptomorpholine, morpholinium mahogany sulfonates, and morpholine in conjunction with ammonium mahogany sulfonates have been suggested.

APPLICATIONS

Separating Agents
The physical and chemical properties of morpholine make it useful in various purification procedures. Marked differences in the solubility of the methyl amines in morpholine have led to a convenient extractive method for separating these volatile amines. The addition of morpholine to styrene-containing hydrocarbon mixtures makes possible the isolation of substantially pure styrene by azeotropic distillation. It is claimed that aldehydo or keto derivatives of morpholine, e.g., 4-formylmorpholine, are useful for separating low-viscosity components from mineral, animal, vegetable, and fish oils. It is reported that morpholine is the preferred amine to use in an oil-amine mixture for scrubbing organic sulfur compounds from fuel gas. Morpholine is also used in the purification of acetylene and certain olefins.

Optical Brighteners
Morpholine is an important intermediate in the manufacture of optical brighteners. Optical brighteners are employed by the soap and detergent industry in the compounding of detergents. The diaminostilbene triazine type brightener with morpholine as a substituent on one of the triazine rings is particularly effective on cellulosics. Having greater stability to chlorine bleaches than other types of brighteners, they are particularly suitable for home laundry detergents.

Pharmaceutical Chemicals
The physiological activity of the morpholine nucleus is attested by the number of pharmaceutical applications which have been found for it.

The hydroperiodide is suitable for incorporation in ointments for the treatment of skin disorders, such as athlete's foot.

A number of morpholine derivatives have been described as analgesics and local anesthetics. The 4-benzyl morpholines are particularly effective. 4-(4-Bromobenzyl) morpholine, for instance, is reported to be only 25% as toxic as procaine, but almost equal to it in activity.

Several morpholine-derived chemicals are useful as respiratory and vasomotor stimulants. The N,N'-ethylenebis (N-alkyl-4-morpholinecarboxamides) are especially valuable, since the ratio of active dose to toxic dose is low. The dibutyl derivative, for example, shows 12 times the activity of nikethamide.

Other pharmaceutical fields in which morpholine has found application include choleretics, antispasmodics, analeptics, and antimalarials. In addition, the use of morpholine as a peptizing agent for preparing aqueous dispersions of phenothiazines for anthelmintic purposes has been claimed. Likewise, the use of morpholine in preparing soluble salts of certain sulfanilamides has been patented, and various derivatives are claimed to have therapeutic value.

Bactericides, Fungicides, and Herbicides

A number of morpholine derivatives have been shown to possess bactericidal activity. For example, morpholinium salts of certain acylated sulfonamides possess strong bacteriostatic or bactericidal properties, and morpholine hydroperiodide has been used as a water disinfectant.

The reaction of morpholine with 3,4,5-trichloro-2,6-pyridinedicarbonitrile yields a product which is useful in the control of fungi.

Morpholine is used in preparing compounds that are excellent herbicides and that can be applied either to the soil before the weeds emerge or to the growing plants.

Antioxidants

In addition to its use as a corrosion inhibitor, 4-*t*-butylmercaptomorpholine has been employed as an antioxidant for lubricating oils. Di-4-morpholinyl monosulfide has been claimed as a lubricating oil stabilizer, and multifunctional oil additives that possess antioxidant properties can be prepared from wax-phenols, formaldehyde, and morpholine.

Small quantities of morpholine and *l*-ascorbic acid are claimed to show marked synergistic antioxidant properties for use in fatty products. The morpholine salt of gallic acid is an oil-soluble antioxidant for glyceridic oils and a stabilizer for vitamin A and carotene, and 4-alkyl morpholines have been found to act as stabilizers for 2-chlorothiophene.

Wax Emulsifiers and Surface-Active Agents

When morpholine is reacted with fatty acids, it forms soaps possessing excellent emulsifying properties. The oleic soap is a particularly important emulsifier used in the formulation of self-polishing waxes and polishes. One of the main advantages of morpholine-based emulsifiers is the similar boiling points of morpholine and water. When the loosely bound fatty acid-morpholine compound breaks down, the morpholine component evaporates at approximately the same rate as the water. Consequently, the resultant wax film is left dry and void of morpholine, and is then highly water resistant. This is a very desirable feature in household and automobile waxes and polishes.

The reaction products of morpholine and tung oil or linseed oil have been found to be good emulsifying and dispersing agents. Also, the quaternary alkyl ammonium sulfates of Mannich bases from morpholine and mono- or polyhydric phenols have been patented as emulsifying and wetting agents.

A number of other morpholine-containing compounds have been used as wetting agents, and it is said that morpholinium linoleate is an especially good surface tension depressor for use in rust-preventive compositions because it tends to harden the rust-preventive film.

The morpholine salt of a polymeric maleamic acid has been used in compositions for coating paper, cloth, etc. Small quantities of morpholine have been incorporated in fireproofing materials, and the stability of certain asphalt emulsions has been improved by the addition of morpholine. This amine has also been used as an equalizing and dispersing agent in dye baths and printing pastes, and its quaternary alkyl ammonium sulfates have been patented as general surface-active agents.

Miscellaneous Applications

Morpholine derivatives have found application in the textile industry. Thus, a biquaternary compound derived from 4,4'-ethylenedimorpholine is suitable as a softening agent for natural or regenerated cellulose. In viscose spinning, small amounts of quaternary morpholine derivatives, introduced into either the viscose solution or regenerating bath, prevent fouling of the spinnerets during extrusion. Compounds of this type are also useful as textile lubricants and sizing emulsifiers. A superior whitening agent for textiles includes morpholine in the formula, and α-4-morpholinylacrylic esters have been claimed as textile adjuvants.

A compound prepared from sulfur dioxide and morpholine is useful in photographic developers, and a small amount of morpholine in the recipe improves the keeping qualities of a fine grain developer.

Morpholinium salts of sulfonated azo dye components are used in dry mixtures for the production of dye images by electrolytic recording methods.

Morpholine is used in an ink eradicator formulation that is used to remove a graphic arts ink. The eradicator enables the user to modify his original graphic representation almost immediately.

A strongly basic ion-exchange resin can be prepared by treating a polymerized 4,4'-diallylmorpholinium bromide with alkali, and it is reported that a quaternary morpholinium ethosulfate is useful as a hair conditioner and deodorant in popular wave formulations. The ethosulfate is also found in shampoos and mouthwashes. A process for citric acid by fermentation includes a small quantity of morpholine in the mash, and it has been found that dimorpholinium oxalate is an excellent precipitant for trivalent gold. A rapid test for acrylates and acrylonitrile depends upon reaction with morpholine as a first step.

Morpholine may be used alone to thermally stabilize cellulose materials. Electric graded kraft papers treated with morpholine will retain a higher degree of their original tensile strength after subjection to heat aging.

Morpholine is used to prevent the deterioration of paper, especially in books. The paper is impregnated with gaseous morpholine, thereby raising the pH of the paper and removing the acidic conditions which cause its deterioration.

The following physical properties are for the pure compound.

Autoignition temperature, °F	590
Boiling point, 760 mm Hg, °C	128.3
Conductivity, mho/cm x 10^{10}	6
Density, 20°C, g/cc	0.999
Dielectric constant, esu	7.176
Dipole moment, Debyes	1.58
Flash point, TCC, °F	95
Freezing point, °C	-4.9
Heat capacity, 25°C, cal/mol/deg	41.6
Heat of vaporization, 45-129°C, cal/mol	9510
Molar polarization, P ∞ in benzene	75.3
Molecular weight	87.12
pK_b	5.64
Refractive index, n_D, 20°C	1.4545
Specific gravity, 20/20°C	1.0017
Surface tension, 20°C, dynes/cm	37.5
Vapor pressure, 20°C, mm Hg	7
Viscosity, 20°C, centipoises	2.23
Weight, 20°C, lb/gal	8.3

Solubility

The solvent power of morpholine is said to exceed that of benzene, pyridine, and dioxane. Listed below are the solubilities of some commom materials in morpholine.

Substance	g Solute in 100 g Morpholine at 25°C
Acetone	∞
Beeswax	<1
Benzene	∞
Benzyl cellulose	>5
Butyl ether	∞
Carbon tetrachloride	∞
Castor oil	∞
Cellulose acetate	>5
Cellulose nitrate	>5
Copal gum	>5
Dimethylamine (gaseous)	109
Ester gum	>55
Ethanol	∞
2-Ethylbutanol	∞
Ethylene glycol	∞
Ethyl ether	∞
Methyl glycol ether	∞
n-Heptane	∞
2-Hexanone	∞
Linseed oil	∞
Methanol	∞
Methylamine (gaseous)	33
Methylcyclohexanol	∞
Naphtha	>5
Paraffin oil	<1
Paraffin wax (hot)	>5
Pine oil	∞
Polyvinyl acetate	>5
Polyvinyl butyral	>5
Polyvinyl chloride	>5
Resin	>5
Shellac	>5
Sulfur	<5
Toluene	∞
Trimethylamine (gaseous)	34
Turpentine	∞
Water	∞
Xylene	∞

PHYSICAL PROPERTIES

Additional physical properties pertinent to the handling and use of morpholine are presented in the pages that follow.

Figure 1
pH Value of Aqueous Morpholine

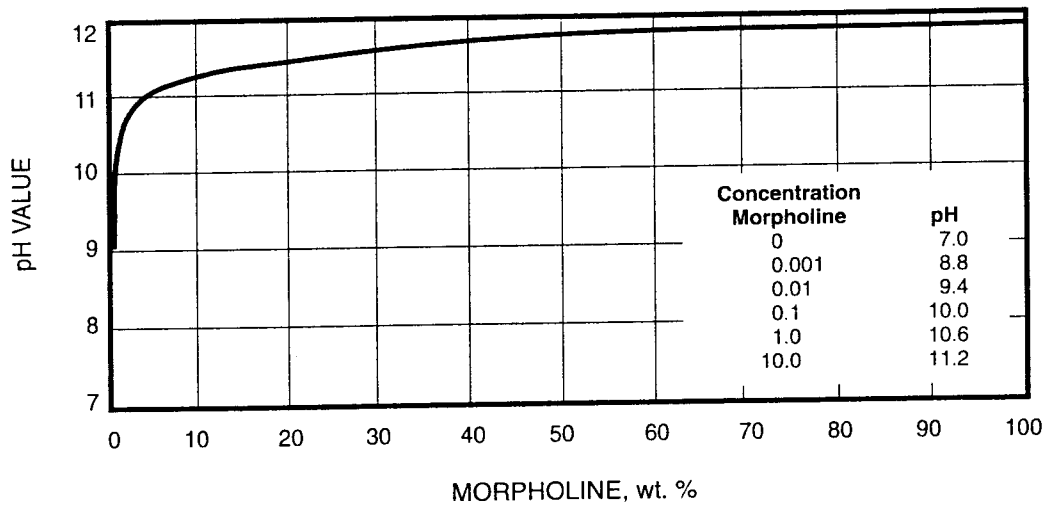


Figure 2
Flash Point of Aqueous Morpholine

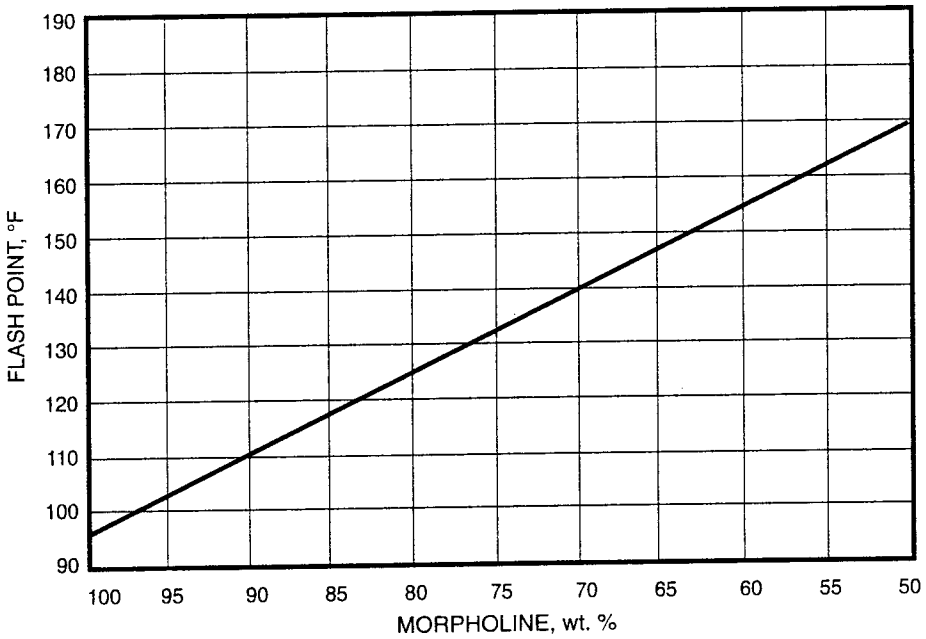


Figure 3
Freezing Point of Aqueous Morpholine

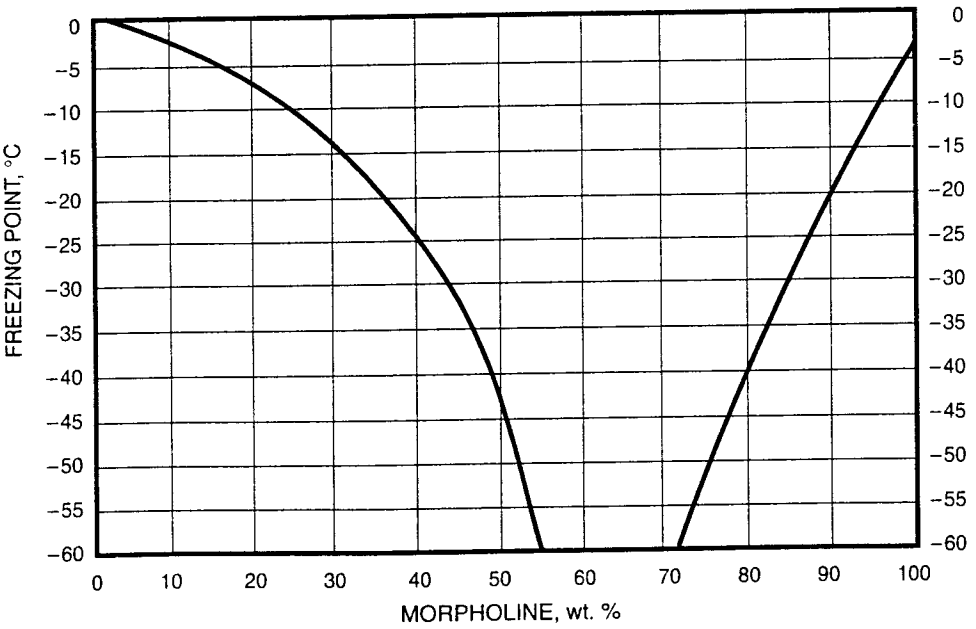


Figure 4
Refractive Index of Aqueous Morpholine at 20°C

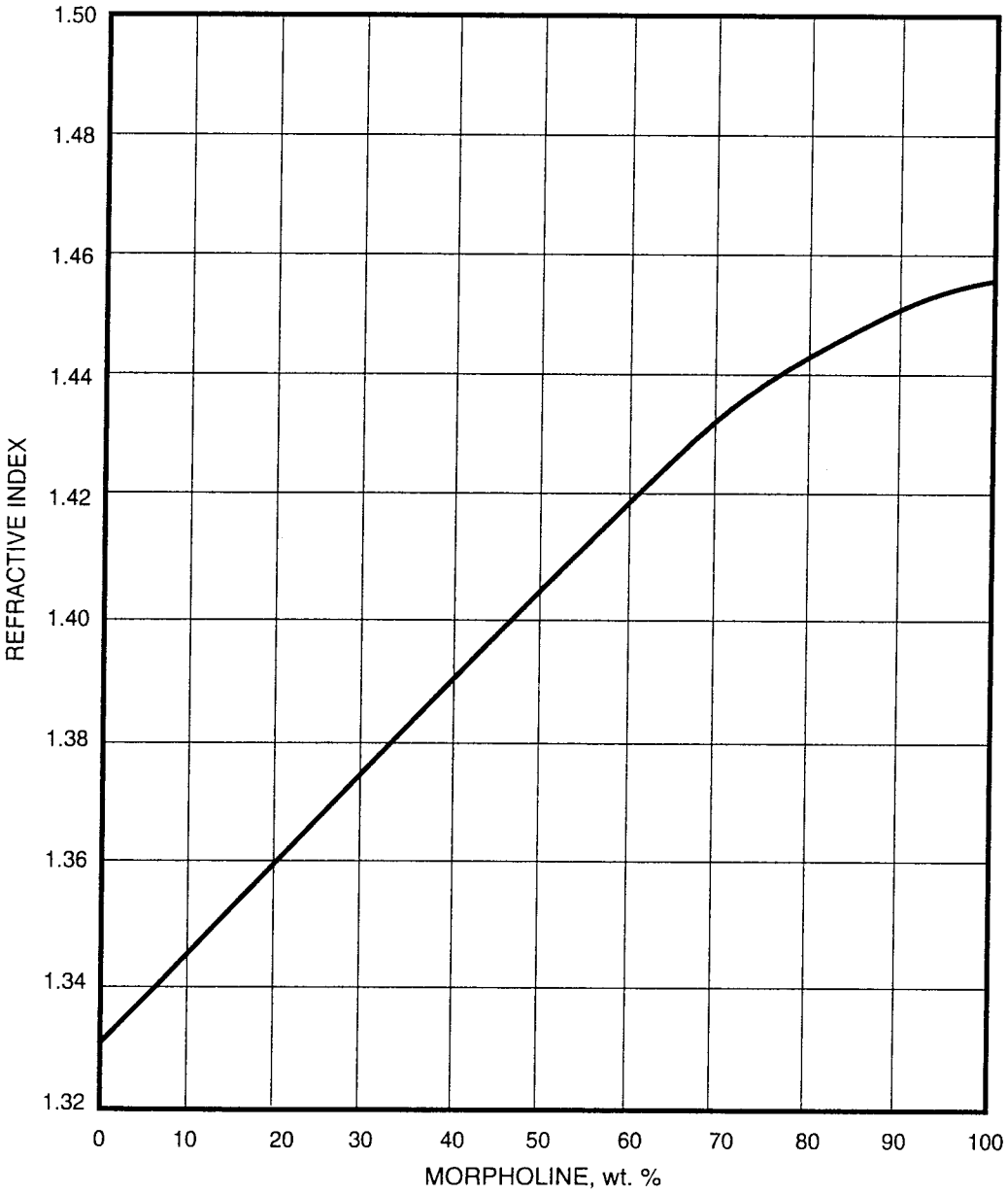


Figure 5
Specific Gravity of Aqueous Morpholine at 20°C

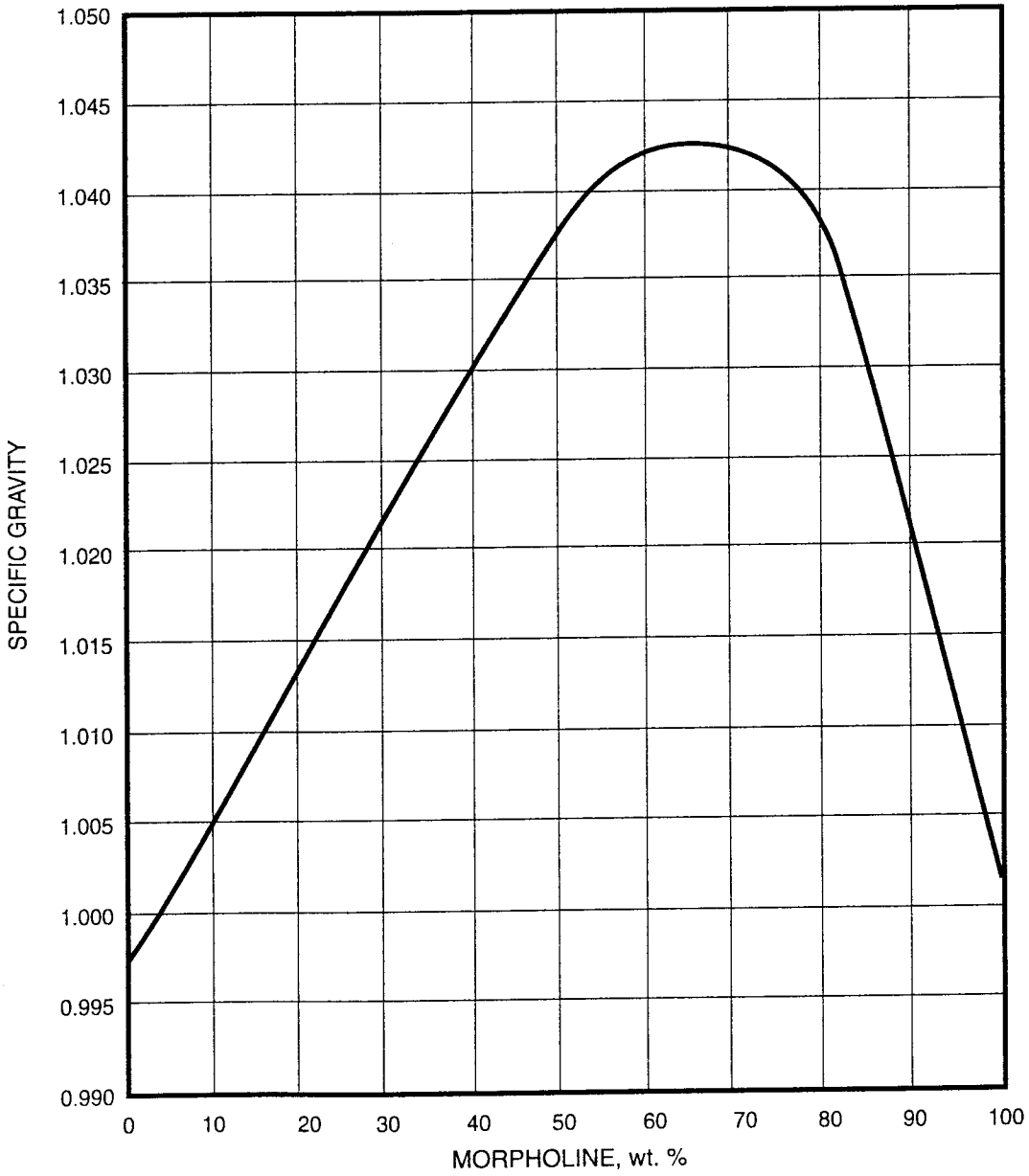


Figure 6
Specific Gravity of Morpholine Versus Temperature

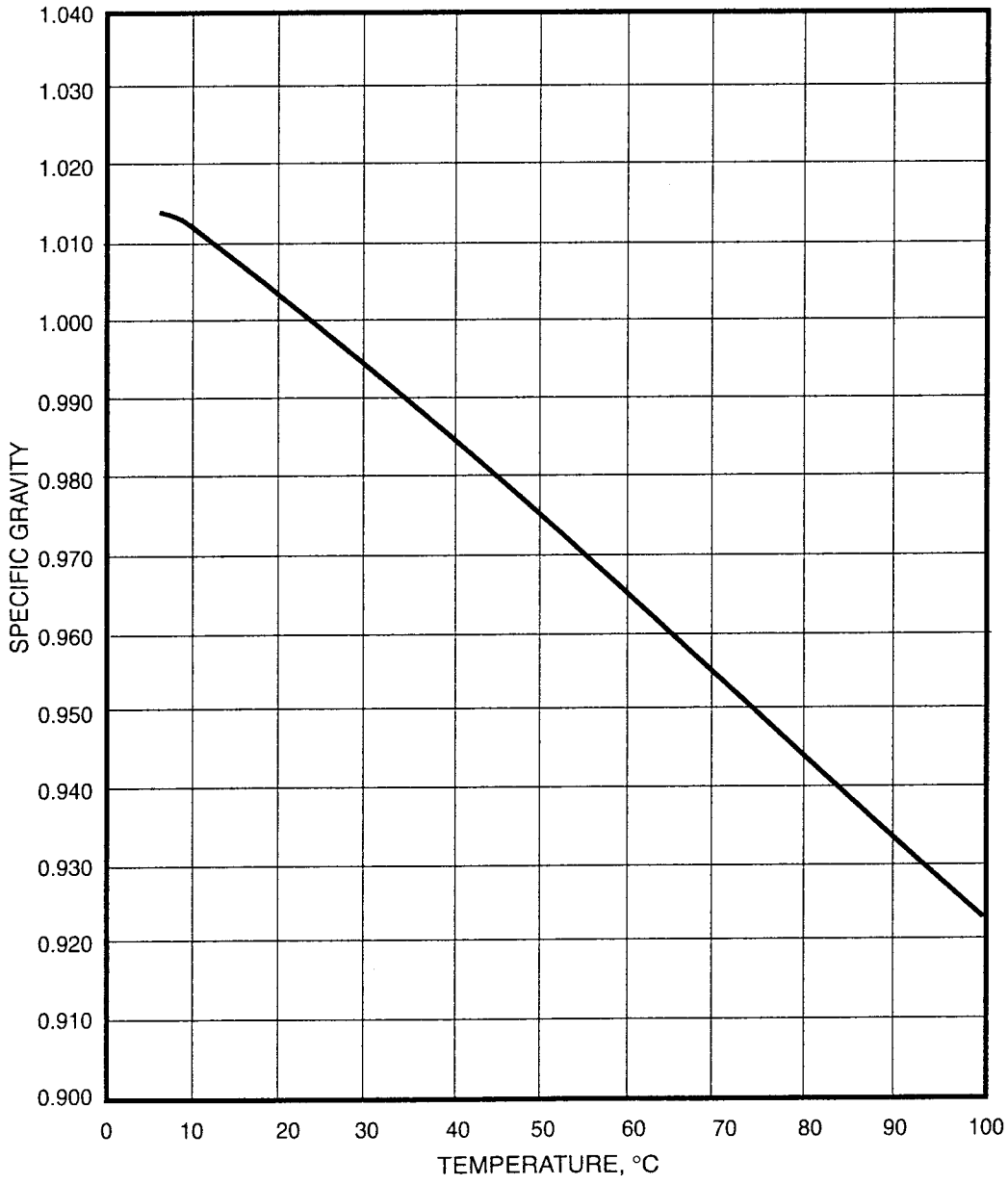


Figure 7
Surface Tension of Aqueous Morpholine at 20°C

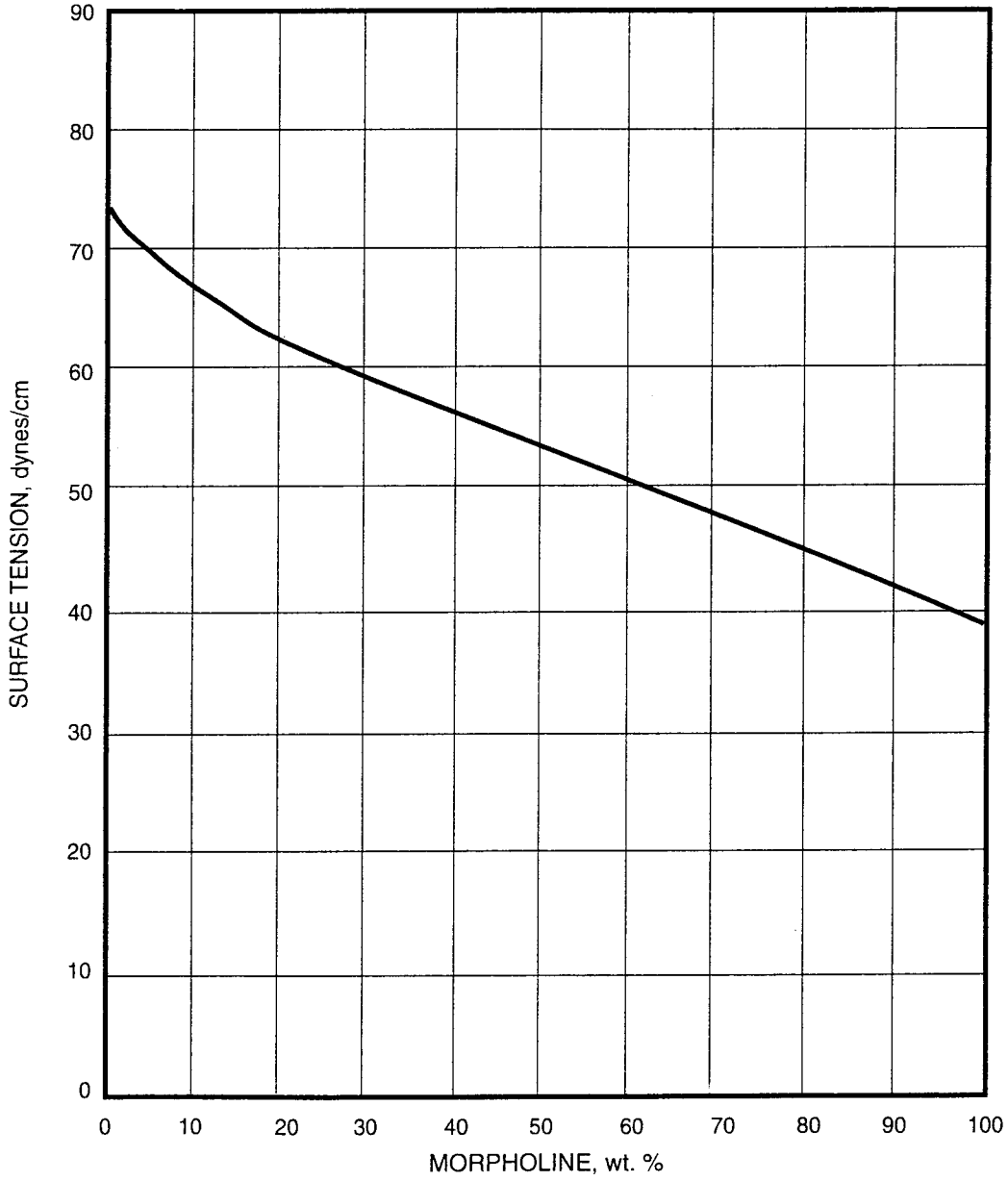


Figure 8
Vapor-Liquid Equilibria for Aqueous Morpholine at Atmospheric Pressure

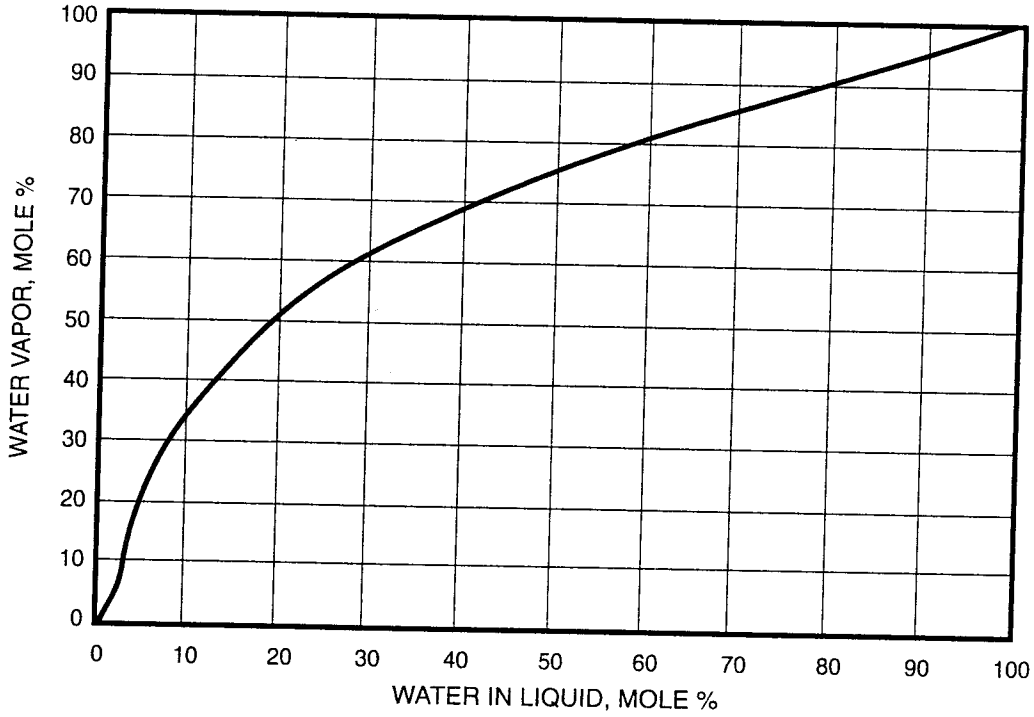


Figure 9
Vapor Pressure Versus Temperature of Morpholine

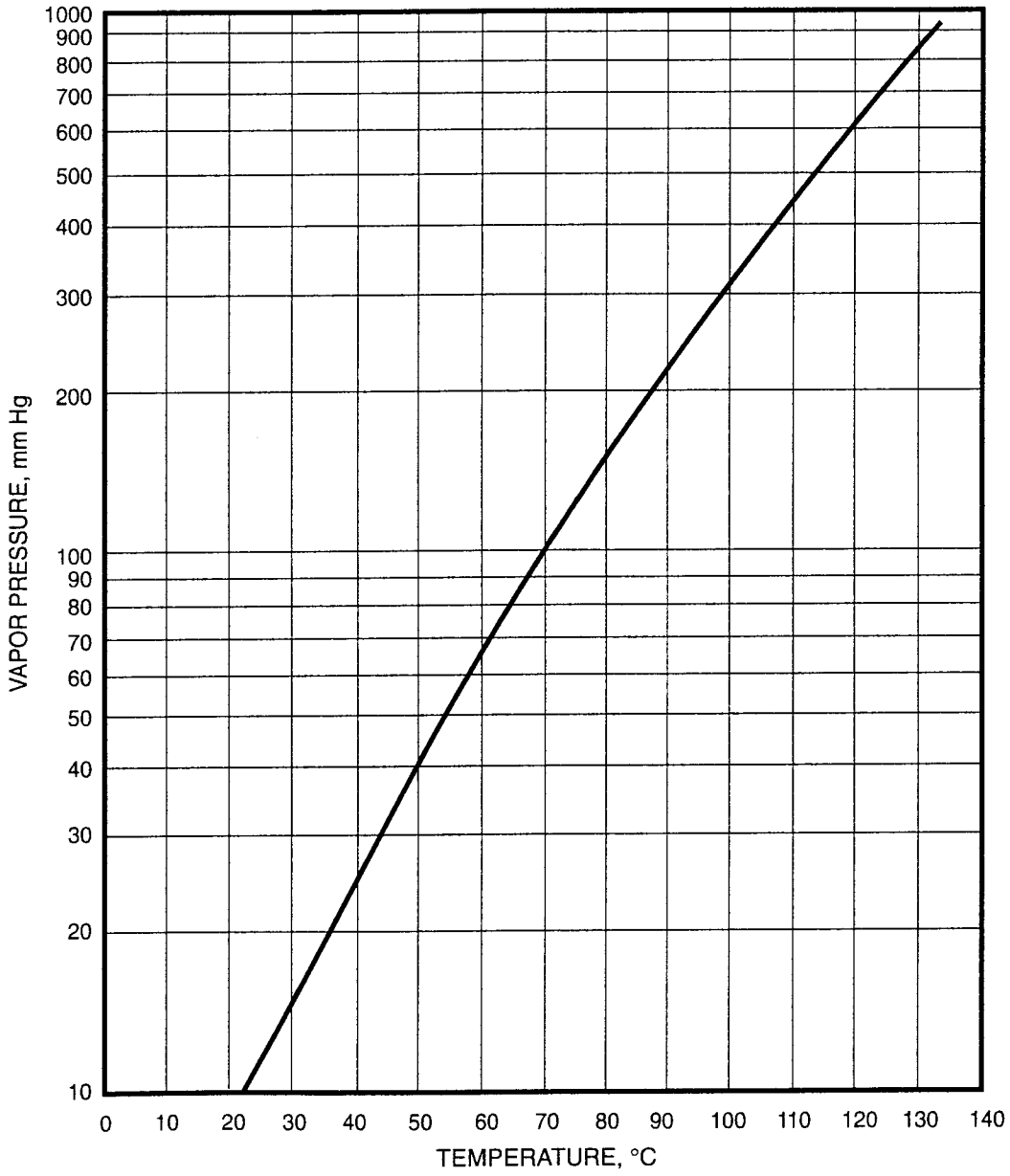
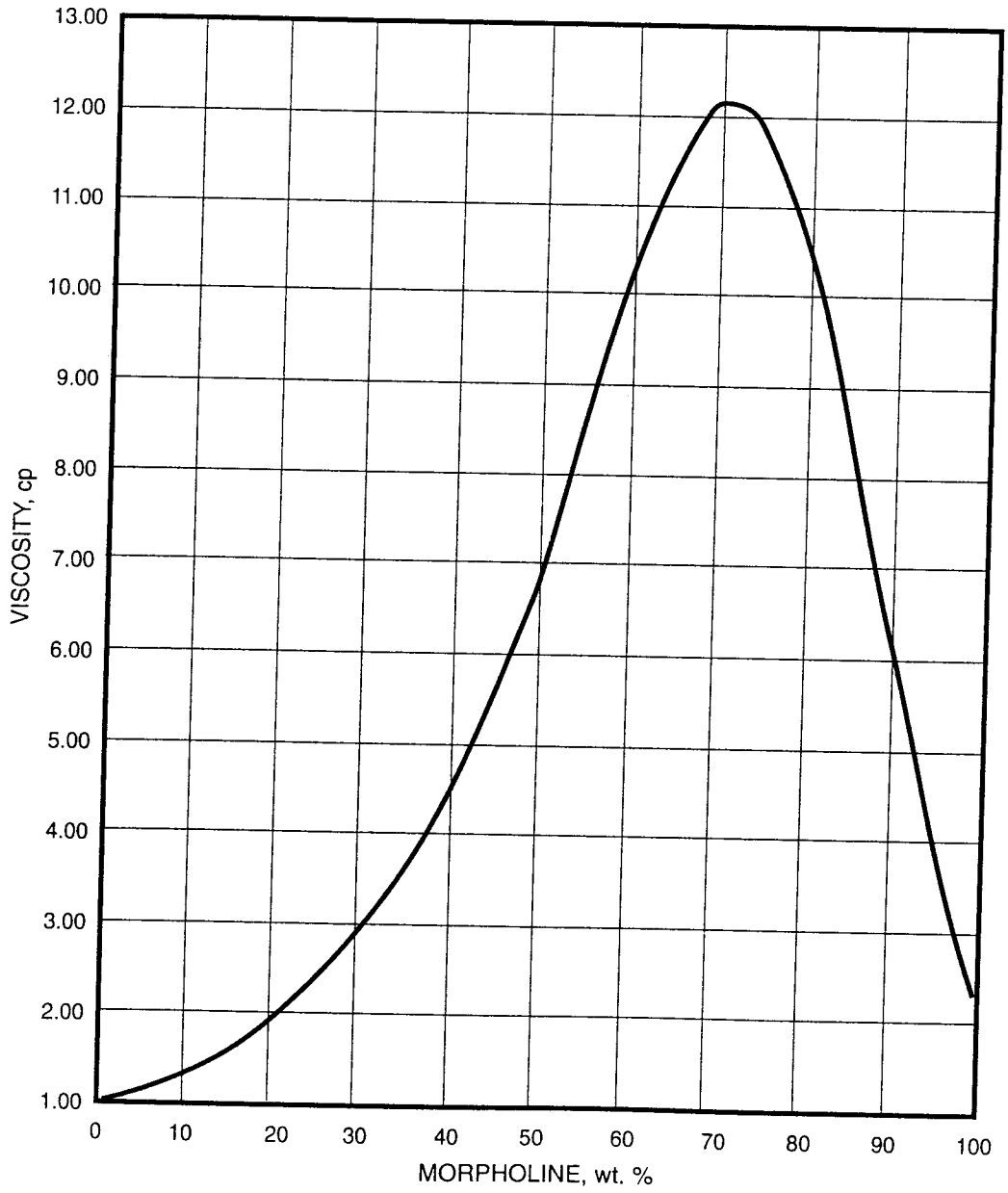


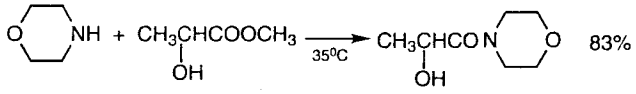
Figure 10
Viscosity of Aqueous Morpholine at 20°C



Because of the chemical inertness of ethers in general, most of the chemical reactions of morpholine involve the secondary amine function of the molecule. An outline of the chemistry of morpholine is given in the following sections. Reaction yields are given where they are available.

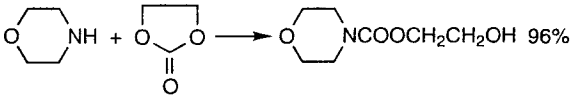
Reaction with Acids and Acid Derivatives

Like most secondary amines, morpholine reacts with carboxylic acids and their anhydrides, chlorides, and esters to give the corresponding morpholides.

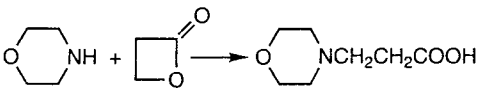


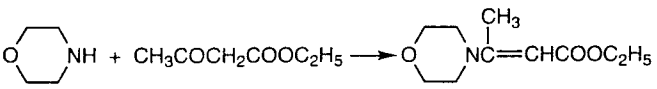
It is interesting that in the particular case cited, other secondary amines, such as diethylamine or diphenylamine, were essentially unreactive.

Ethylene carbonate reacts smoothly with morpholine at temperatures below 100°C to give β-hydroxyethyl N,N'-oxydiethylenecarbamate.



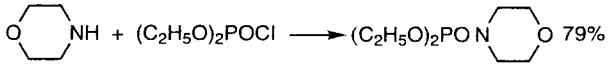
A morpholide is not formed, however, with β-propiolactone or ethyl acetoacetate.

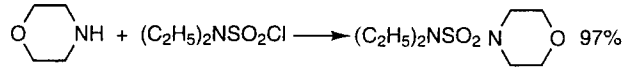




The last reaction is an important one, for it offers a clean-cut route to mono-substituted acetoacetic esters via alkylation of the β-4-morpholinylcrotonic ester. Alkyl halides or sulfates are satisfactory alkylation reagents. The mechanism of alkylation of ethyl β-4-morpholinylcrotonate permits the attack of only one alkyl group and treatment of the adduct with hot water leads to the mono-alkyl acetoacetic ester.

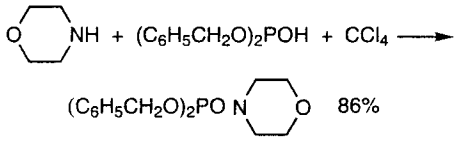
Although reaction of morpholine with dialkyl sulfates and trialkyl phosphates results in 4-alkyl morpholines, the related acid chlorides lead to morpholides.



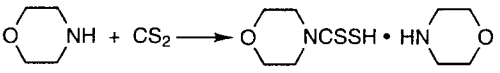


It is expected that ethyl chlorosulfonate would react with morpholine in a similar manner.

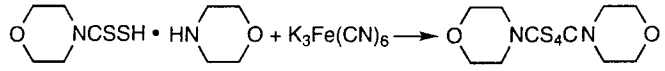
Dibenzyl phosphite undergoes oxidation when treated with morpholine and carbon tetrachloride and yields the corresponding phosphoramidate.



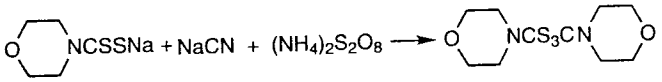
Morpholine reacts with carbon dioxide to form a carbamate that sublimes unchanged at about 95 to 100°C. Carbon disulfide gives the corresponding dithiocarbamate.



The action of potassium ferricyanide on the dithiocarbamate yields N,N,N',N'-bis (oxydiethylene) thiuram disulfide.



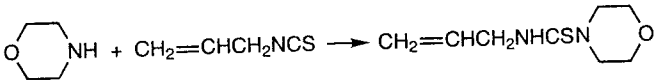
In the presence of certain water-soluble cyanides and oxidizing agents, N,N,N',N'-bis (oxydiethylene) thiuram sulfide is obtained from the dithiocarbamate salts.

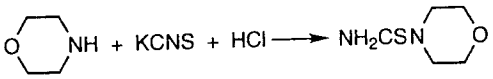


The monosulfide can also be obtained by treating the disulfide with potassium cyanide.

Reaction with Isocyanates and Isothiocyanates

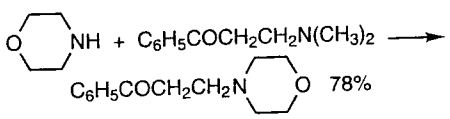
Reactions of morpholine with isocyanates give the corresponding substituted ureas, and isothiocyanates yield thioureas.



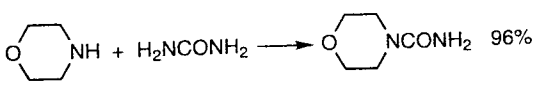


Reaction with Amines and Amides

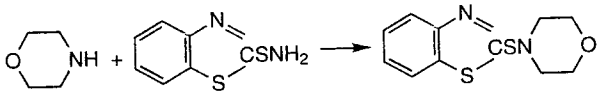
Mannich bases, such as β-dimethylaminopropiophenone, and Betti bases, e.g., *1*-α-dimethylaminobenzyl-2-naphthol, undergo amine exchange when heated with morpholine.



The amine function of certain amides, too, can be caused to exchange with morpholine. Heating the latter with urea in a nitrogen atmosphere gives 4-morpholinecarboxamide.

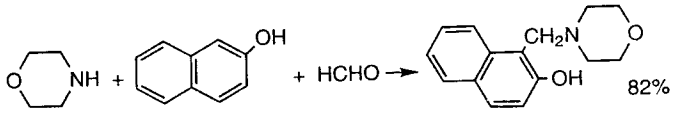


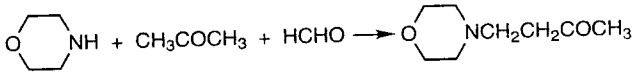
Morpholine also reacts with 2-benzothiazolesulfenamide to give the substituted sulfenamide.

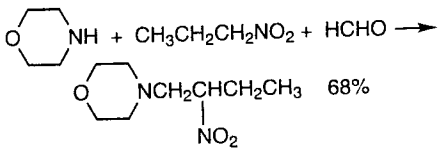


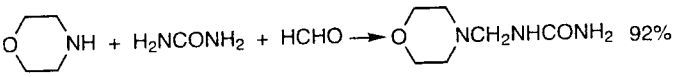
The Mannich and Related Reactions

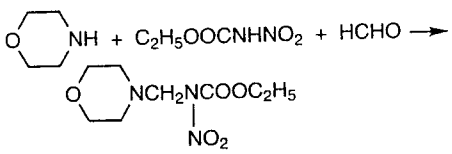
Morpholine has been found to enter into the Mannich reaction in the broadest sense. Thus, phenols, ketones, nitroalkanes, and amides react with morpholine and formaldehyde to give corresponding 4-morpholinylmethyl compounds.





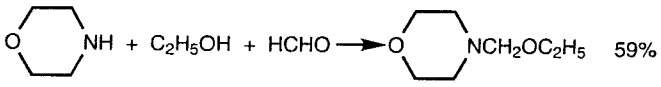






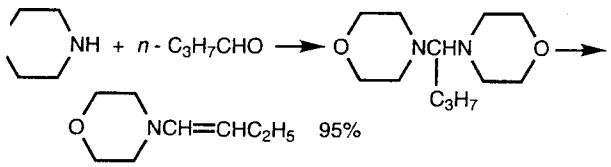
No reaction occurs with a simple aliphatic nitrile, but if the effect of the nitrile group is augmented by that of a phenyl group, reaction does occur. Thus, phenylacetonitrile reacts, but acetonitrile does not.

Alcohols enter this reaction to give 4-morpholinylmethyl ethers.



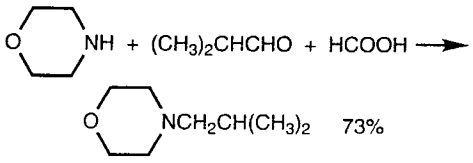
Reaction with Aldehydes

Two molecules of morpholine condense with an aldehyde to form a 4,4'-alkylidenedimorpholine. When the aldehyde bears an alpha hydrogen atom, the appropriate enamines form upon gentle heating.



The Leuckart-Wallach Reaction

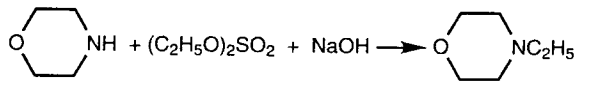
The addition of formic acid to a mixture of morpholine and aldehyde leads to reductive alkylation of the morpholine. This is the Leuckart-Wallach reaction.

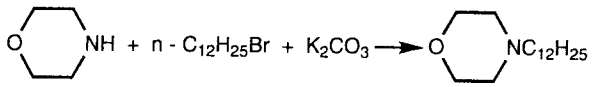


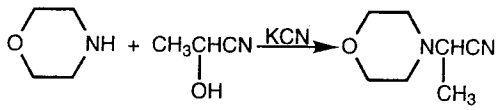
Some ketones, e.g., cyclohexanone, can be used instead of aldehydes.

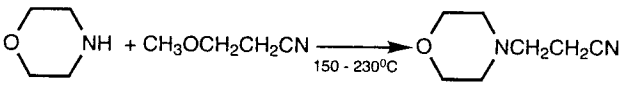
Alkylation

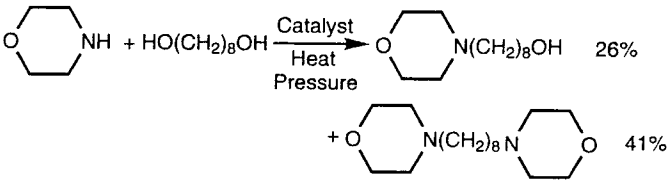
In addition to the Mannich and Leuckart-Wallach reactions, morpholine can be alkylated by several other methods. Dialkyl sulfates, trialkyl phosphates, alkyl halides, and cyanhydrins are effective reagents for preparing 4-substituted morpholines. Certain activated ethers also react with morpholine to give morpholine derivatives and, under vigorous conditions, polymethylene glycols have been found to give low yields of ω-4-morpho-linylalkanols and 4,4'-polymethylenemorpholines. Examples of these reactions are:





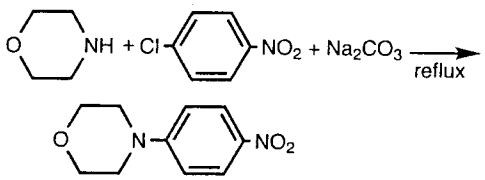






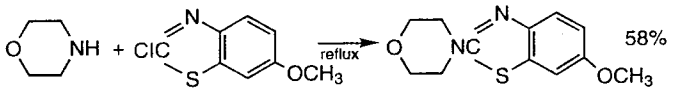
Arylation

Morpholine can be arylated by aryl halides that possess relatively labile halogens.



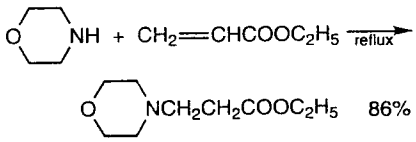
Morpholine reacts more slowly than does piperidine in this respect, but it is equally favored by the absence of by-products and the morpholine derivatives are, in general, higher melting.

Aryl halides characterized by reduced aromaticity, e.g., halogenated anthraquinones or 2-chloro-6-methoxybenzothiazole, also arylate morpholine.

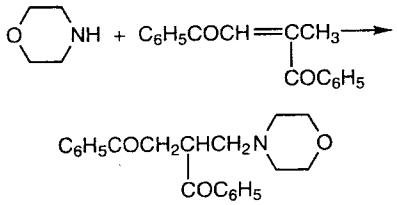


Addition to Unsaturation

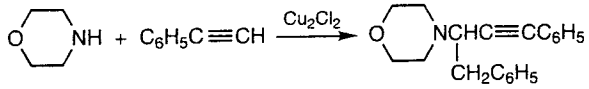
Like most secondary amines, morpholine adds to α, β-unsaturated ketones, esters, and nitriles in a manner presumed to be typical 1,4-addition.



In certain instances, however, apparently as a consequence of enolization, reaction occurs at an allylic position rather than at the normal olefinic linkage.

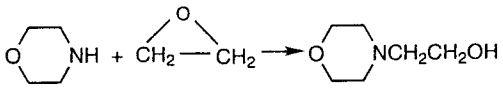


In the presence of cuprous chloride, morpholine reacts with phenylacetylene to give 3-(4-morpholinyl)-1,4-diphenyl-1-butyne.

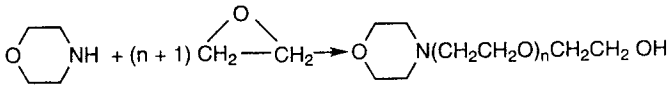


Reaction with Epoxides and Imines

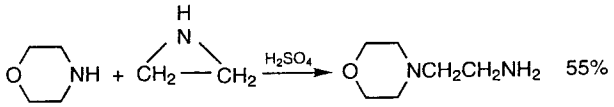
Morpholine reacts with alkylene oxides to give the corresponding β-4-morpholinylalkanols.



Polyoxyethylene derivatives also can be obtained.



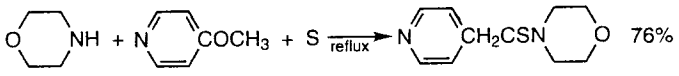
Ethylenimine and morpholine yield 4-(2-aminoethyl)-morpholine.



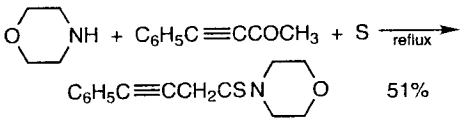
Willgerodt Reaction

As originally reported, yellow ammonium sulfide was employed in the Willgerodt reaction to convert aryl alkyl ketones to ω-aryl fatty acid amides. The volatility of ammonium polysulfide required that the reaction be carried out in a closed vessel at 150°C. The disadvantage was overcome when morpholine and sulfur were substituted for the volatile sulfide. Since then, the reaction has been the subject of considerable investigation, much of it employing morpholine, although other high-boiling amines can be used.

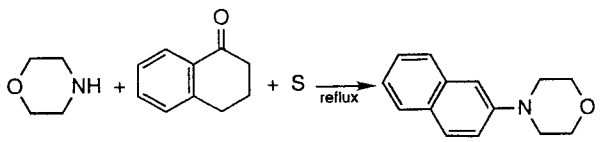
The nucleus may be heterocyclic as well as homocyclic. Thus, 4-acetylpyridine gives 4-pyridylthioacetomorpholide.



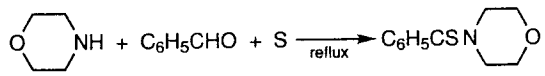
Acetylphenylacetylene and benzalacetone have been found to behave as typical aryl alkyl ketone, giving γ-phenylethylthioacetomorpholide and γ-phenylvinylthioacetomorpholide, respectively.



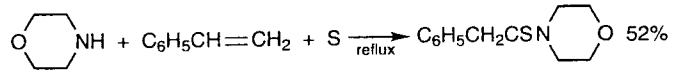
When α-tetralone is the ketone employed, no thiomorpholide is possible without ring rupture and the product is 4-(2-naphthyl)-morpholine.



In addition to aryl alkyl ketones, the reaction has been found to be applicable to aldehydes, alcohols, mercaptans, amines, olefins, and acetylenes. Thus, benzaldehyde, benzylamine, and benzylmercaptan give benzothiomorpholide when refluxed with equivalent quantities of morpholine and sulfur.

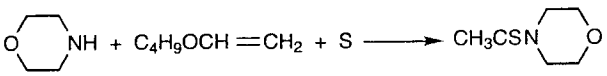


Styrene and vinylnaphthalene yield the corresponding aryl acetothiomorpholides under the conditions of the Willgerodt reaction.



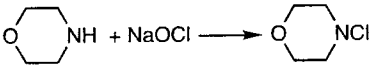
Acetylene gives 54% dithioöxalomorpholide and 45% acetothiomorpholide.

Aryl alkyl ethers give β-aryloxypropiothiomorpholides when refluxed with morpholine and sulfur, but vinyl ethers and esters are cleaved at the oxygen to give thioacetomorpholide.

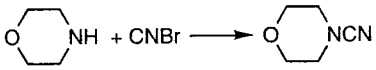


Reaction with Oxidizing Agents

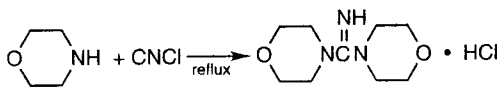
Morpholine reacts with aqueous sodium hypochlorite in the cold to give a quantitative yield of 4-chloromorpholine. Sodium hypobromite reacts similarly.



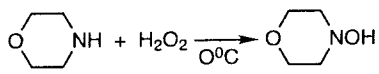
Essentially quantitative yields of 4-cyanomorpholine result when a cold ethereal solution of morpholine is treated with cyanogen bromide.



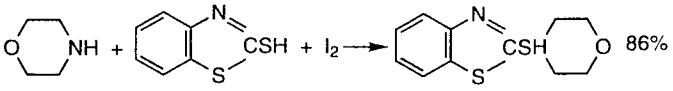
On the other hand, if a benzene solution of morpholine and cyanogen chloride is refluxed, the product is the hydrochloride of 1,1,3,3-bis(oxydiethylene)-quanidine. The hydrobromide of the same base results from reaction of 4-cyanomorpholine with morpholine hydrobromide.



Morpholine reacts with aqueous hydrogen peroxide to give low yields of 4-hydroxymorpholine.

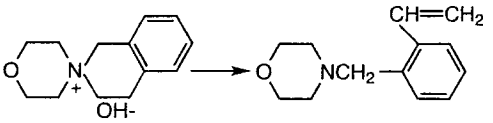


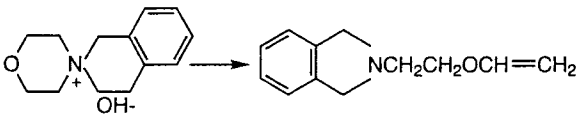
Oxidative condensation of morpholine with 2-mercaptobenzothiazole in the presence of iodine yields 2-(4 morpholinylmercapto)-benzothiazole.



The Hofman Degradation

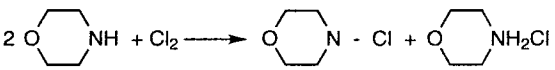
Thermal decomposition of quaternary morpholinium hydroxides may result in either retention or rupture of the morpholine ring.





Direct Chlorination

An excess of morpholine reacts with chlorine to form 4-chloromorpholine and an equivalent amount of morpholinium chloride.



Complex Formation

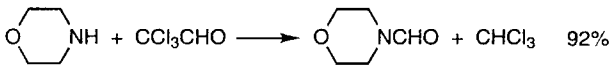
The addition of certain metallic halides to hot morpholine results in the formation of addition complexes which contain two moles of morpholine per mole of metallic halide. The complexes are sensitive to moisture, but in an anhydrous condition some of them are stable to temperatures in excess of 200°C. The decomposition temperatures of several of the halide complexes are:

Halide Complex	Decomposition Range,°C	Halide Complex	Decomposition Range,°C
$CdBr_2$	250-252	$ZnCl_2$	200-210
CdI_2	205-210	$ZnBr_2$	230-240
$HgBr_2$	131-135	$SnCl_4$	215-235

Cuprous chloride combined in a 1:1 molecular ratio with aqueous morpholine hydrochloride at temperatures below 50°C gives a 90% yield of a complex which melts with decomposition at 110.5 to 112°C. Cupric chloride, under the same conditions, gives a complex containing two moles of morpholine hydrochloride per mole of cupric chloride. This complex melts at 160°C.

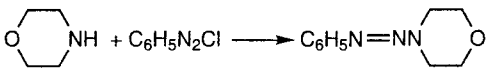
Miscellaneous Reactions

Morpholine attacks chloral in the same fashion as does sodium hydroxide; the products are chloroform and 4-formylmorpholine.



The latter is formed in equally good yield from morpholine and formic acid.

Aryl diazonium salts treated with morpholine give 4-aryl-azomorpholines. These compounds are readily purified and are reported to be remarkably stable in the solid state.



General

The handling and storage of morpholine presents no unusual problems. Huntsman Corporation's Technical Service Section is available to assist those who may desire additional information.

Commercial morpholine is liquid at room temperature, but will solidify at approximately 23°F.

The vapor pressure of morpholine is less than 7 mm of mercury at 20°C. Being an organic compound, it will undergo combustion, and it is classified as flammable by the Department of Transportation. Although not considered poisonous, morpholine is moderately toxic and should not be ingested or allowed to come in contact with the skin. In case of contact with the eyes, flush immediately with plenty of water for at least 15 minutes and obtain medical attention. (See toxicity statement on pages 26-27.)

Maintaining Specifications

Morpholine is hygroscopic and, if its water content is to be minimized, a dry gas pad under a few ounces of pressure should be used on storage tanks. Since morpholine is basic, it will react with acidic gases, hence carbon dioxide and natural gas containing acidic sulfur compounds cannot be used. Nitrogen is quite suitable. Nitrogen should also be used if low color is important, since absorbed atmospheric oxygen will cause morpholine to develop color.

Morpholine will react with copper to form complex salts. Because of this, the use of copper and alloys containing copper should be avoided in equipment which will contact morpholine or its aqueous solutions.

Other factors that should be considered in the installation of storage and handling facilities are the solvent properties and alkaline nature of morpholine. Storage tanks constructed according to a recognized code, using carbon steel as a material of construction, generally are satisfactory. In those cases where low color is needed, stainless steel or aluminum should be used. However, aluminum should not be used if the temperature of the morpholine will exceed 150°F. Neither should it be used in contact with aqueous morpholine solutions at any temperature.

In areas where the temperature is expected to fall below 23°F, steam coils of a suitable area to heat the tank contents using low-pressure steam should be built into the tank about 6 inches above the floor. The coils should be constructed in such a manner as to allow the condensate to drain. Stainless steel is the preferred material of construction for the coils, particularly when low color of the morpholine is important. When steam heat is to be used continuously to prevent freezing of the morpholine, a temperature regulator that throttles either the steam or condensate should be installed.

In situations where the ambient temperature is low, insulation of the tank will probably be desirable. The temperature of the morpholine in the tank should not exceed 100°F if the low color is to be maintained.

If a dry gas pad is used, pressure relief and vacuum relief valves of suitable capacities should be installed. The dry gas system may consist of a cylinder of nitrogen and a line to the top of the storage tank. Tanks should be diked and electrically bonded and grounded.

Transfer Lines

Transfer lines, preferably not less than 2 inches in diameter, constructed of carbon steel and joined by welds or flanges are suitable. Screwed joints are subject to failure unless back-welded. Morpholine will leach conventional pipe dopes. However, threads can be wrapped with Teflon tape. Garlock 7021 gasket material, or its equivalent, is satisfactory for use with flanged connections in morpholine service.

If the ambient temperature is low, the transfer line should be steam-traced and insulated. Steam-tracing can be accomplished by affixing copper tubing, approximately $^3/_8$-inch diameter, to the underside of the line, insulating, and using low-pressure steam in the tubing. For flexible connections, stainless steel metal hose is preferred to rubber, since rubber will generally deteriorate in morpholine service.

Systems which are insulated and steam-traced should be preheated in cool weather before being put into service. Normally,15 to 30 minutes of applying steam to the tracing will adequately warm, but not overheat, the system.

Transfer piping and pumps may be equipped with an inert gas padding system so that the morpholine can be pressured out of the lines when an extended idle period is due. This practice will help to reduce losses and increases in color that would result if the morpholine was allowed to remain in the lines.

Pumps

Rotary or centrifugal pumps of all-iron construction can be used with morpholine, although a centrifugal pump is preferred. Rotary pumps should be equipped with externally lubricated bearings. John Crane Type 9 Mechanical Seal is suitable. Where pump packing is needed, Garlock 234, Garlock 239, or equivalent is considered satisfactory. Provision should be made for preheating pumps that are exposed to the cold. This can be done by playing live steam on the uninsulated pump, or by having the pump wrapped with copper tubing and insulated, then applying low-pressure steam to the tubing.

Unloading in Cold Weather

Thawing a tank or tank car of morpholine is accomplished by applying steam at 50 pounds maximum pressure to the coils of the tank or tank car. The liquid temperature should be kept below 100°F to avoid discoloring the product.

As the morpholine melts, solids will remain in the bottom and on the sides of the tank while the warmer liquid rises. The thawing may be accelerated by using a liquid circulating pump. As soon as the flow of steam to the coils is discontinued, they should be blown free of condensate with dry air to prevent freezing of the condensate and rupturing of the coils.

Morpholine which has frozen in drums may be thawed in a hot room at about 100°F. The thawing should be expected to require two days.

New Facilities and Cleaning

Prior to putting storage vessels into service, it is sometimes desirable to purge with inert gas to remove oxygen from the tank atmosphere. Although cleaning tanks and transfer lines frequently is not recommended, it is sometimes necessary as the result of contamination or accumulation of foreign material in the system. For such cleaning, a water wash is generally satisfactory.

Tank cleaning is normally accomplished by thoroughly sluicing the interior of the tank with a water jet and following this with cloth or chamois drying. Unless excessive rust scale makes it necessary, the interior of the tank should not be wire-brushed or sand-blasted because the oxides of iron are relatively inert to morpholine. Once clean and dry, the tank should be sealed and purged with dry inert gas to avoid undue condensation and rust formation.

New systems frequently introduce line scale, rust, and the like, which will be a source of contamination and possible plugging. These solids can be effectively removed with either a "y" strainer, using a 150-200 mesh stainless steel screen, or with a commercial-type cloth filter. A good grade of woven cotton canvas,12-ounce or heavier, is suitable as a cloth filter medium. Wool and synthetic fibers have been found to be unsatisfactory.

Most of what has just been described concerns commercial, essentially anhydrous, morpholine. Its aqueous solutions have lower freezing points and lower viscosities, so storage and handling may be simplified considerably by dilution in storage if the morpholine is to be used as an aqueous solution.

Delivery of morpholine can be made in 10,000- and 20,000-gallon tank cars. These cars are constructed of welded carbon steel, and have bottom-unloading fittings and steam coils. In areas within reasonable proximity of bulk storage points, deliveries can be made in full or compartmented, insulated, stainless-steel tank wagons with steam coils. If requested, tank wagons can be equipped with unloading pumps and hoses. Drums of morpholine can be shipped promptly from local warehouses in carload, truckload, or smaller quantities. The net weight of a drum is 460 pounds, approximately 55 gallons per drum. Drums are UN1A1 or UN1H1, nonreturnable.

Under US Department of Transportation (DOT) and Canadian Transportation of Dangerous Goods (TDG) regulations, the proper shipping name for this product is "morpholine," identification number UN 2054. This product is considered a flammable material (TDG hazard class 3.3) and requires a "FLAMMABLE" label for shipping. Please note: The Department of Transportation (DOT) classification for morpholine, UN 2054, as a Packing Group III flammable liquid, does not address the potential dermal corrosivity hazards of morpholine. Huntsman has recently sponsored DOT dermal corrosivity studies using morpholine which indicate that morpholine should be reclassified as a Packing Group I dermal corrosive. On the basis of these studies, Huntsman has petitioned the DOT for a change in the Hazardous Materials Table entry for morpholine, from Packing Group III flammable liquid to Packing Group I corrosive liquid with a subsidiary hazard of flammability. Until the DOT rules on our petition for this change, we will continue to identify morpholine as a Packing Group III flammable liquid on our MSDS, product labels, and shipping papers, to minimize any confusion which could result from a discrepancy between our DOT Packing Group determination and the existing DOT classification for morpholine. **However, to ensure employee, customer and public safety, Huntsman will handle and transport morpholine as a Packing Group I corrosive, using appropriate shipping containers and handling procedures.**

For further information, please refer to the Material Safety Data Sheet (MSDS) for this product.

MORPHOLINE FDA CLEARANCES UNDER 21 CFR

Direct Additives

172.235	173.310

Indirect Additives

175.105	176.210
175.300	177.1200
176.170	177.1210
176.180	178.3120
176.200	178.3300

TOXICITY STUDIES

Acute Toxicity

The results of acute toxicity testing using morpholine indicate that this product is moderately toxic by single oral and single dermal exposures. The oral LD_{50} in rats and the dermal LD_{50} in rabbits are 1.05 g/kg and 1.21 g/kg, respectively.

Acute irritation studies have shown this product to be extremely irritating/corrosive to the skin of rabbits, with a Draize dermal irritation score of 8.0 (maximum score 8.0). Rabbit eye irritation studies using morpholine have shown that this product is extremely irritating to the eyes, with a Draize ocular irritation score of >80 (maximum score 110).

Chronic Toxicity

A chronic inhalation (vapor) study of morpholine was conducted using Sprague-Dawley rats at exposure concentrations of 0, 10, 50, and 150 ppm for 6 hours per day, 5 days per week, over a period of 104 weeks.

Survival, body weight gains, organ weights, hematology/clinical chemistry blood parameters, gross pathology, and histopathology were normal in the exposed groups and comparable to the control animals. There were no exposure-related adverse changes in the liver, kidney, brain, intestine, lung, or any other internal organ or tissue. The incidences of neoplasia were comparable among all groups (including controls), and were typical for the strain and age of rat used in this study. Not unexpectedly, irritation of the eyes, nose, and skin was observed during the course of this study. Chronic exposure to morpholine vapors produced inflammation of the cornea (keratitis) at the highest exposure concentration.

Nasal effects included nasal cavity irritation and necrosis at the highest exposure concentration. Posterior nasal structures (trachea, bronchial tree, and lungs) were histologically normal.

The results of this chronic exposure study demonstrate that morpholine is neither carcinogenic nor systemically toxic. These exposures did result in local (ocular, nasal, and dermal) irritation, consistent with the known irritation properties of morpholine.

Genetic Toxicity

A battery of *in vitro* genetic toxicity studies, employing an Ames assay, a Cell Transformation assay, an Unscheduled DNA Synthesis (UDS) assay, and a Sister Chromatid Exchange (SCE) assay, were equivocal in their responses to morpholine. Morpholine was negative in the Ames and UDS assays, and weakly positive in the Mouse Lymphoma Forward Mutation and SCE assays. Morpholine was active (positive) in the Cell Transformation assay. The interpretation of these assays may be confounded by the contribution of the pH of the test medium (after introduction of morpholine) to the observed genotoxic activity in these assays. The possible presence of nitrosating agents in the test system may also contribute to genotoxic activity in these assays, due to the potential formation of genetically active nitrosamines.

Aquatic Toxicity

The acute toxicity (LC_{50}) of morpholine to freshwater fish has been reported to range from 180 to 380 mg/l (*Salmo* species). The acute toxicity (LC_{50}) to freshwater crustaceans (*Daphnia* species) has been reported to range from 100 to 119 mg/l. The toxicity threshold (EC_{50}) to algae has been reported to be 1.7 to 28 mg/l.

HUMAN HEALTH EFFECTS AND FIRST AID

On the basis of these animal toxicity studies, the principal health hazard from accidental exposures to morpholine is a moderate to severe irritation/corrosion of the eyes, skin, and mucous membranes. Chemical-type goggles with face shield must be worn during handling or use of the undiluted product or concentrated solutions. Contact lenses should not be worn. Protective clothing and gloves resistant to chemicals and petroleum distillates must be worn.

Should accidental eye contact occur, flush eyes with ɜrge amounts of water for at least 15 minutes, after which ɑ physician should be consulted. During flushing of the eyes, eyelids should be held apart to permit rinsing of entire surface of eye and lids.

For skin contact, immediately flush skin with large amounts of water for at least 15 minutes. Clothing wet with the product must be removed immediately and laundered before reuse. Morpholine has been known to produce dermal sensitization (allergic skin reaction) in sensitive exposed individuals.

If morpholine is accidentally ingested and the individual is conscious and can swallow, he or she should be given two large glasses of water, after which a physician should be consulted. Since this product is expected to produce severe irritation/corrosion of mucous membranes, vomiting should not be induced, due to the possibility of lung damage from aspiration of the product into the lungs during vomiting.

Under usual circumstances, exposure to harmful quantities of vapor should not be a health problem; however, exposure to appreciable concentrations of morpholine vapors can result in irritation to the eyes, nose, and throat, and may produce temporary and reversible hazy or blurred vision. These symptoms disappear when exposure to morpholine is terminated. Adequate ventilation should be provided where a large quantity of product is exposed, or where mists or vapors are generated. Spills in confined areas should be cleaned up promptly, using appropriate personal protective equipment.

The Threshold Limit Value (TLV) for morpholine, as established by the American Conference of Governmental Industrial Hygienists (ACGIH) is 20 ppm (71 mg/m^3), calculated as an 8-hour time weighted average (TWA). The TLV for morpholine also includes a "skin" notation, warning of the potential significant contribution to the overall exposure by the cutaneous route. The Occupational Safety and Health Administration (OSHA) has established a Permissible Exposure Limit (PEL) for morpholine at 20 ppm, and a Short Term Exposure Limit (STEL) of 30 ppm. Exposures should be kept below these values to avoid symptoms of irritation to eyes, nose, and throat.

For further information, please refer to the Material Safety Data Sheet (MSDS) for this product.

FOR MORE LITERATURE OR INFORMATION
Please Call the Nearest Huntsman Corporation Office

HUNTSMAN CORPORATION
3040 Post Oak Boulevard
Houston, TX 77056
Tel: 713-235-6000
Fax: 713-235-6977

Research and Development
7114 North Lamar Boulevard
Austin, TX 78752
Tel: 512-459-6543
Fax: 512-483-0925

REGIONAL CUSTOMER SERVICE REPRESENTATIVES

Midwest
Tel: 1-800-231-3107

Southeast
Tel: 1-800-624-6419

Northeast
Tel: 1-800-231-3104

North Central
Tel: 1-800-624-6417

West Coast/Texas
Tel: 1-800-826-0868

Huntsman International Trading Corporation
350 Orchard Road #11-07
Shaw House
SINGAPORE 238868
Tel: (65) 730-0288
Fax: (65) 730-0280

Huntsman do Brasil
AV. Paulista, 807 Conj. 2314
01311-000 Sao Paulo – SP
BRAZIL
Tel/Fax: (55) 11-283-0623

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Multicentro Paseo El Parral
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Huntsman Corporation Belgium N.V.
Woluwe Office Garden
Woluwedal 26
B-1932 Zaventem
BELGIUM
Tel: 32-2-718-0120
Fax: 32-2-718-0211

Huntsman Corporation Canada Inc.
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Guelph, Ontario N1E 5R1
CANADA
Tel: 519-824-3280
Fax: 519-824-4979

Huntsman de Mexico, S.A. de C.V.
Angel Urraza # 303
Col. Insurgentes San Borja
C.P. 03100 MEXICO, D.F.
Tel: (52) 5-687-7551
(52) 5-687-5529
Fax: (52) 5-687-0991

Emergency Assistance
For transportation emergencies only, call CHEMTREC 1-800-424-9300.

For all other emergencies, call 409-722-8381, our 24-hour emergency number in Port Neches, Texas.

1080-1298

Main Offices: Huntsman Corporation / P.O. Box 27707 / Houston, Texas 77227-7707 / 713/235-6000

Technical Services Section: P.O. Box 15730 / Austin, Texas 78761 / 512/459-6543

ATTACHMENT M-2

Source: ***Kirk-Othmer Encyclopedia of Chemical Technology, 22***, Fourth Edition

Page 4 – diethanolamine and diisopropanolamine can be cyclized to give morpholines (reference: Czech. Pat. 146,401 (1972), V. Patek and co-workers.

Page 373-386 – in section written by Michael G. Turcotte and Thomas A. Johnson of Air Products and Chemicals, Method "2" is "alcohol amination metal catalyzed: amination of an alcohol over a metal catalyst under reducing conditions.

Page 384 – shows production capacity at BASF to be 4,500 ton/yr by Method 2, Texaco capacity at 12,000 ton/yr, again by Method 2. Huntsman apparently bought Texaco plant in intervening years.

Morpholine and its production process

Purpose

Morpholine is employed as raw material for manufacturing accelerators of rubber vulcanization, optical bleaching agents, pharmaceuticals, corrosion inhibitors, emulgators. But the widest application it can find during water preparation for high pressure boilers.

Description

Morpholine production (from diethylene glicol and ammonia in the vapour phase in the presence of hydrogen and catalysts) features simple technology and high yield of the finished product (to 75%). The advantage of the method consists in employing unigue catalyst and flow diagram ensuring long service life and high quality of commercial morpholine. The unigue production based on this method with the capacity of 3500 t/year has been established at Volzhsky JSC "Orgsintez".

Stage of development

The technology has author`s certificates and patents protection.

Suggestions for cooperation

Sale of a license is expedient action. The license was saled to Romania.

Today morpholine is used at Volzhsky JSC "Orgsintez" for sulphonamide M production; potential bulk consumer of morpholine can be thermo-electric power stations.

Morpholine is imported by US, Japan, Germany.

Developer: State Research Centre of Russian "NIOPIK"

Please reduce your browser font size for better viewing and printing.

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

DIETHYLENE GLYCOL

MSDS Number: O8764 --- *Effective Date: 02/25/99*

1. Product Identification

Synonyms: 2,2'-Oxydiethanol; 2,2'-Oxybisethanol; 2,2' Dihydroxydiethyl ether; CELLOSOLVE(R); glycol ether; Glycolethyl ether
CAS No.: 111-46-6
Molecular Weight: 106.14
Chemical Formula: C4H10O3
Product Codes:
J.T. Baker: S856
Mallinckrodt: 4911

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Diethylene Glycol	111-46-6	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED. MAY CAUSE IRRITATION TO SKIN AND EYES.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 1 - Slight
Flammability Rating: 1 - Slight

Reactivity Rating: 1 - Slight
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT
Storage Color Code: Orange (General Storage)

Potential Health Effects

Inhalation:
Low inhalation hazard unless heated because of low vapor pressure.

Ingestion:
Low acute toxicity. Probable lethal dose to humans is 0.5-5 g/kg. Causes nerve depression, liver and kidney lesions and anuria (urination retardation). Causes irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea.
Skin Contact:
May be an irritant to skin on prolonged exposure.
Eye Contact:
May be an irritant to eyes and surrounding tissue.
Chronic Exposure:
Liver and kidney lesions and damage.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. Not expected to require first aid measures.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Call a physician.
Skin Contact:
Remove any contaminated clothing. Wash skin with soap and water for at least 15 minutes. Get medical attention if irritation develops or persists.
Eye Contact:
In case of contact, immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Call a physician if irritation persists.

5. Fire Fighting Measures

Fire:
Flash point: 124C (255F) CC
Autoignition temperature: 229C (444F)
Flammable limits in air % by volume:
lel: 1.6; uel: 10.8
Fire is possible at elevated temperatures or by contact with an ignition source.
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above.
Fire Extinguishing Media:

Powder, alcohol foam, water spray or carbon dioxide.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer!

7. Handling and Storage

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, moisture and incompatibilities. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
AIHA Workplace Environmental Exposure Level (WEEL): Vapor and Aerosol = 50ppm; Aerosol, only = 10mg/m3.
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a half-face respirator with an organic vapor cartridge and particulate filter (NIOSH type P95 or R95 filter) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece respirator with an organic vapor cartridge and particulate filter (NIOSH P100 or R100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. Please note that N series filters are not recommended for this material. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear protective gloves and clean body-covering clothing.
Eye Protection:

Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Odorless.
Solubility:
Infinitely soluble.
Specific Gravity:
1.18 @ 20C/20C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
244 - 245C (471 - 473F)
Melting Point:
-6.5C (21F)
Vapor Density (Air=1):
3.66
Vapor Pressure (mm Hg):
1 @ 91.8C (198F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Toxic gases and vapors may be released if involved in a fire. Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizers, strong acids and strong bases.
Conditions to Avoid:
Incompatibles.

11. Toxicological Information

Oral rat LD50: 12565 mg/kg. Skin rabbit LD50: 11.89 g/kg Irritation: eye rabbit, standard Draize: 50 mg mild. Investigated as a tumorigen and reproductive effector.

--------\Cancer Lists\----------
---NTP Carcinogen---

Ingredient	Known	Anticipated	IARC Category
Diethylene Glycol (111-46-6)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\--------

Ingredient	TSCA	EC	Japan	Australia
Diethylene Glycol (111-46-6)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\--------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Diethylene Glycol (111-46-6)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\--------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Diethylene Glycol (111-46-6)	No	No	No	Glycol ether

--------\Federal, State & International Regulations - Part 2\--------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Diethylene Glycol (111-46-6)	No	No	No

Chemical Weapons Convention:' No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No

Reactivity: No (Pure / Liquid)

Australian Hazchem Code: No information found.
Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **1** Flammability: **1** Reactivity: **0**
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED. MAY CAUSE IRRITATION TO SKIN AND EYES.
Label Precautions:
Wash thoroughly after handling.
Avoid contact with eyes, skin and clothing.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Call a physician. In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. Call a physician if irritation develops or persists.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 8.
Disclaimer:
****

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Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

[Code of Federal Regulations]
[Title 21, Volume 3, Parts 170 to 199]
[Revised as of April 1, 2000]
From the U.S. Government Printing Office via GPO Access
[**CITE: 21CFR173.310**]

[Page 128-130]

TITLE 21--FOOD AND DRUGS

CHAPTER I--FOOD AND DRUG ADMINISTRATION, DEPARTMENT OF HEALTH AND HUMAN SERVICES (CONTINUED)

PART 173--SECONDARY DIRECT FOOD ADDITIVES PERMITTED IN FOOD FOR HUMAN CONSUMPTION-

Subpart D--Specific Usage Additives

Sec. 173.**310** Boiler water additives.

Boiler water additives may be safely used in the preparation of steam that will contact food, under the following conditions:

(a) The amount of additive is not in excess of that required for its functional purpose, and the amount of

[[Page 129]]

steam in contact with food does not exceed that required to produce the intended effect in or on the food.

(b) The compounds are prepared from substances identified in paragraphs (c) and (d) of this section, and are subject to the limitations, if any, prescribed:

(c) List of substances:

Substances	Limitations
Acrylamide-sodium acrylate resin...	Contains not more than 0.05 percent by weight of acrylamide monomer.
Acrylic acid/2-acrylamido-2-methyl propane sulfonic acid copolymer having a minimum weight average molecular weight of 9,900 and a minimum number average molecular weight of 5,700 as determined by a method entitled ``Determination of Weight Average and Number Average Molecular Weight of 60/40 AA/ AMPS'' (October 23, 1987), which is incorporated by reference in accordance with 5 U.S.C. 552(a). Copies may be obtained from the Center for Food Safety and Applied Nutrition (HFS-200), Food and Drug Administration, 200 C St. SW., Washington, DC 20204, or may be examined at the Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC.	Total not to exceed 20 parts per million (active) in boiler feedwater.
Ammonium alginate.....	
Cobalt sulfate (as catalyst).....	
1-hydroxyethylidene-1,1- diphosphonic acid (CAS Reg. No.	

2809-21-4) and its sodium and potassium salts.	
Lignosulfonic acid.....	
Monobutyl ethers of polyethylene-polypropylene glycol produced by random condensation of a 1:1 mixture by weight of ethylene oxide and propylene oxide with butanol.	Minimum mol. wt. 1,500.
Poly(acrylic acid-co-hypophosphite), sodium salt (CAS Reg. No. 71050-62-9), produced from a 4:1 to a 16:1 mixture by weight of acrylic acid and sodium hypophosphite.	Total not to exceed 1.5 parts per million in boiler feed water. Copolymer contains not more than 0.5 percent by weight of acrylic acid monomer (dry weight basis).
Polyethylene glycol.....	As defined in Sec. 172.820 of this chapter.
Polymaleic acid [CAS Reg. No. 26099-09-2], and/or its sodium salt. [CAS Reg. No. 30915-61-8 or CAS Reg. No. 70247-90-4].	Total not to exceed 1 part per million in boiler feed water (calculated as the acid).
Polyoxypropylene glycol.....	Minimum mol. wt. 1,000.
Potassium carbonate.....	
Potassium tripolyphosphate.....	
Sodium acetate.....	
Sodium alginate.....	
Sodium aluminate.....	
Sodium carbonate.....	
Sodium carboxymethylcellulose.....	Contains not less than 95 percent sodium carboxymethylcellulose on a dry-weight basis, with maximum substitution of 0.9 carboxymethylcellulose groups per anhydroglucose unit, and with a minimum viscosity of 15 centipoises for 2 percent by weight aqueous solution at 25 deg.C; by the method prescribed in the ``Food Chemicals Codex,'' 4th ed. (1996), pp. 744-745, which is incorporated by reference in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies are available from the National Academy Press, Box 285, 2101 Constitution Ave. NW., Washington, DC 20055 (Internet address ``http://www.nap.edu''), or may be examined at the Center for Food Safety and Applied Nutrition's Library, Food and Drug Administration, 200 C St. SW., rm. 3321, Washington, DC, or at the Office of the Federal Register, 800 North Capitol St. NW., suite 700, Washington, DC.
Sodium glucoheptonate.....	Less than 1 part per million cyanide in the sodium glucoheptonate.
Sodium hexametaphosphate.....	
Sodium humate.....	
Sodium hydroxide.....	
Sodium lignosulfonate.....	
Sodium metabisulfite.....	

Sodium metasilicate.....	
Sodium nitrate.....	
Sodium phosphate (mono-, di-, tri-)	
Sodium polyacrylate.....	
Sodium polymethacrylate.....	
Sodium silicate.....	
Sodium sulfate.....	
Sodium sulfite (neutral or alkaline).	

[[Page 130]]

Sodium tripolyphosphate.....	
Sorbitol anhydride esters: a mixture consisting of sorbitan monostearate as defined in Sec. 172.842 of this chapter; polysorbate 60 ((polyoxyethylene (20) sorbitan monostearate)) as defined in Sec. 172.836 of this chapter; and polysorbate 20 ((polyoxyethylene (20) sorbitan monolaurate)), meeting the specifications of the Food Chemicals Codex, 4th ed. (1996), pp. 306-307, which is incorporated by reference in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies are available from the National Academy Press, 2101 Constitution Ave. NW., Box 285, Washington, DC 20055 (Internet http://www.nap.edu), or may be examined at the Center for Food Safety and Applied Nutrition's Library, Food and Drug Administration, 200 C St. SW., rm. 3321, Washington, DC, or at the Office of the Federal Register, 800 North Capitol St. NW., suite 700, Washington, DC.	The mixture is used as an anticorrosive agent in steam boiler distribution systems, with each component not to exceed 15 parts per million in the steam.
Tannin (including quebracho extract).	
Tetrasodium EDTA.....	
Tetrasodium pyrophosphate.....	

Substances	Limitations
Cyclohexylamine.....	Not to exceed 10 parts per million in steam, and excluding use of such steam in contact with milk and milk products.
Diethylaminoethanol.....	Not to exceed 15 parts per million in steam, and excluding use of such steam in contact with milk and milk products.
Hydrazine.....	Zero in steam.
Morpholine.....	Not to exceed 10 parts per

	million in steam, and excluding use of such steam in contact with milk and milk products.
Octadecylamine.....	Not to exceed 3 parts per million in steam, and excluding use of such steam in contact with milk and milk products.
Trisodium nitrilotriacetate.....	Not to exceed 5 parts per million in boiler feedwater; not to be used where steam will be in contact with milk and milk products.

(e) To assure safe use of the additive, in addition to the other information required by the Act, the label or labeling shall bear:

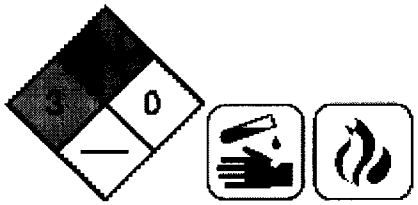
(1) The common or chemical name or names of the additive or additives.

(2) Adequate directions for use to assure compliance with all the provisions of this section.

[42 FR 14526, Mar. 15, 1977, as amended at 45 FR 73922, Nov. 7, 1980; 45 FR 85726, Dec. 30, 1980; 48 FR 7439, Feb. 22, 1983; 49 FR 5748, Feb. 15, 1984; 49 FR 10106, Mar. 19, 1984; 50 FR 49536, Dec. 3, 1985; 53 FR 15199, Apr. 28, 1988; 54 FR 31012, July 26, 1989; 55 FR 12172, Apr. 2, 1990; 61 FR 14245, Apr. 1, 1996; 64 FR 1759, Jan. 12, 1999; 64 FR 29227, June 1, 1999]

Morpholine

CAS No. 110-91-8



Danger!
Flammable!
Corrosive!

Genium MSDS No: 0356

[Search for another material] [Search Tips] [Return to Genium's Home Page]
[Genium's MSDS Collection] [Software to produce chemical laser labels]

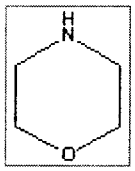
Chemfinder

Morpholine [110-91-8]

Synonyms: Tetrahydro-2H-1,4-oxazine; Diethylene oximide; tetrahydro-1,4-oxazine; diethylenimide oxide; Tetrahydro-4H-1-4-oxazine; 1-Oxa-4-azacyclohexane;

C_4H_9NO

87.1212



View with ChemDraw Plugin
Save in CDX format

ACX Number	X1001097-8	CAS RN	110-91-8
Melting Point (°C)	-4.9	Density	0.994
Boiling Point (°C)	128.9	Vapor Density	3
Refractive Index		Vapor Pressure	10
Evaporation Rate		Water Solubility	miscible.
Flash Point (°C)	38	EPA Code	
DOT Number	UN 2054; NA 2054 Flammable liquid; NA 1760 Corrosive material	RTECS	QD6475000
Comments	Colorless liquid with a weak, ammonia-like odor. HYGROSCOPIC.		

More information about the chemical is available in these categories:

Biochemistry Chemical Online Order Health Misc
Pesticides Herbicides Physical Properties Regulations Structures
Usage

Biochemistry

Chemicals Inspection and Testing Service, Japan: Biodegradation and Bioaccumulation Data of Existing Chemicals

Information about this particular compound unable to access 11/13, 11/14

Chemical Online Order

Available Chemicals Exchange

Information about this particular compound

Health

NTP Chemical Health and Safety Data

→ Information about this particular compound MSDS - attached

→ Hazardous Chemicals Database at the University of Akron

Information about this particular compound "File Not Found"

8(e) TRIAGE Chemical Studies Database

IARC Evaluations of Carcinogenicity to Humans

International Chemical Safety Cards

Information about this particular compound Not readable, code?

Idaho Toxic and Hazardous Substances

North American Emergency Response Guidebook 1996 (NAERG96)

Information about this particular compound Page moved or does not exist

Australian Atmospheric Exposure Standards

→ Information about this particular compound

Australian Hazardous Substances Database

Information about this particular compound Error Processing SSI file

Information about this particular compound " " "

Misc

Protocol Analytical Supplies, Inc. Single-component standards

Pesticides/Herbicides

USEPA / OPP's Chemical Ingredients Database

Information about this particular compound

Physical Properties

Environmental Science Center database with Experimental Log P coefficients etc.

→ Information about this particular compound

NIST Chemistry WebBook

→ Information about this particular compound

ABCR GmbH&Co KG

Morpholine, 99% Catalogue

Morpholine

Dielectric Constant Reference Guide

Proton NMR Spectral Molecular Formula Index

Information about this particular compound

DuPont TYVEK® Protective Apparel Information Service
Information about this particular compound
Critical Properties of Various Gases
Galactic Industries Corporation Spectral Database
FTIR SPECTRUM of MORPHOLINE
FTIR SPECTRUM of MORPHOLINE
Genium's Chemical Container Label Database
→ Information about this particular compound
NFPA Chemical Hazard Labels
Information about this particular compound
Acoustic properties of liquids
Information about this particular compound

Regulations

NASA Department of Environmental Services List Of Lists of Regulated Chemicals
Information about this particular compound "you don't have permission to access"
Information about this particular compound " "
Texas Clean Air Act
California EPA List of Lists
OSHA Chemical Sampling and Methods
Information about this particular compound – server error, file not found
OSHA Limits for Air Contaminants
Guide to NIOSH/OSHA Air Sampling Methods
Information about this particular compound
Information about this particular compound

Structures

Web Molecules (in VRML)
Information about this particular compound

Usage

Gloves compatibility info

Search Results

Search For: [ ] Search

Found 5 document(s) matching search terms:

100% Morpholine, aqueous mixture
Morpholine, aqueous mixture Physical Data Registry numbers and hazard ratings.
Matching Terms: [morpholine] More like this.

100% Morpholine, aqueous mixture
Morpholine, aqueous mixture Physical Data Registry numbers and hazard ratings.
Matching Terms: [morpholine] More like this.

71% Morpholine
Morpholine Synonyms tetrahydro-2H-1,4-oxazine tetrahydro-1,4-oxazine diethylenimide oxide Formula: C4H9NO Formula Weight: 87 Physical Data Vapor pressure at 20oC (mm Hg): 7 Vapor density: 3 Melting point oC : -4.9 Boiling point oC : 128.9 Flash point oC
Matching Terms: [morpholine] More like this.

54% N-Aminopropylmorpholine
N-Aminopropylmorpholine Synonyms 4-(3-aminopropyl)morpholine Formula: C7H16N2O Formula Weight: 144.22 Physical Data Melting point oC : -15 Boiling point oC : 224 Flash point oC : 98 Density: 0.987 Registry numbers and hazard ratings.
Matching Terms: [morpholine] More like this.

52% 4-Methylmorpholine
4-Methylmorpholine Synonyms 4-Methyl-1-oxa-4-azacyclohexane N-methyl morpholine Formula: C5H11NO Formula Weight: 101.15 Physical Data Melting point oC : -66 Boiling point oC : 115 Flash point oC : 13 Density: 0.92 Registry numbers and hazard ratings.
Matching Terms: [morpholine] More like this.

(1 - 5)

Edit Your Search: [morpholine] Search

This page processed by WebSTAR Search, a product of StarNine Technologies Inc.

Morpholine, aqueous mixture

Physical Data

Registry numbers and hazard ratings.

- DOT
  - UN 2054
  - Guide 132
  - Hazard Class: 3

Morpholine, aqueous mixture

Physical Data

Registry numbers and hazard ratings.

- DOT
  - UN 1760
  - Guide 154
  - Hazard Class: 8

Morpholine

Synonyms

- tetrahydro-2H-1,4-oxazine
- tetrahydro-1,4-oxazine
- diethylenimide oxide

Formula: C4H9NO

Formula Weight: 87

Physical Data

- Vapor pressure at 20°C (mm Hg): 7
- Vapor density: 3
- Melting point °C : -4.9
- Boiling point °C : 128.9
- Flash point °C : 38
- Lower explosive limit: 1.8 %
- Upper explosive limit: 11 %
- Solubility in water at 20°C: miscible
- Density: 0.998

Registry numbers and hazard ratings.

- Chemical Abstracts: 110-91-8
- RTECS: QD6475000
- OSHA permissible exposure limit: 20 ppm 70 mg/M^3
- NFPA Ratings
  - Health: 2
  - Flammability: 3
  - Reactivity: 0
- DOT
  - UN 2054
  - Guide 132
  - Hazard Class: 3

Description: colorless liquid with a weak ammonia-like odor

Incompatabilities: strong acids, strong oxidizers

EXPOSURE STANDARDS

Morpholine

SUBSTANCE NAME: Morpholine

CAS Number: 110-91-8

Exposure Standard:

TWA: 20 ppm 71 mg/m3

STEL: - ppm - mg/m3

Skin absorption notice: Absorption through the skin may be a significant source of exposure. See Chapter 11 of the Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment, published by Worksafe Australia.

Documentation notice. American Conference of Governmental Industrial Hygienists (ACGIH), Documentation of Threshold Limit Values and Biological Exposure Indices, 6th Edition, ACGIH, Cincinatti, Ohio, 1991

No standard should be applied without reference to the Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)], and to the related documentation.

Footnotes:

Documentation notice

Documentation for the majority of substances can be found in the American Conference of Governmental Indistrial Hygienists' (ACGIH) documentation of the threshold limit values and biological exposure indices - users should refer to the ACGIH documentation cited.

[Main Search Pages] [Exposure Standards Database]

Last update: 17 November 1999

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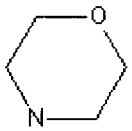
Morpholine

- **Formula:** C_4H_9NO
- **Molecular Weight:** 87.12
- **CAS Registry Number:** 110-91-8
- **Chemical Structure:**



This structure is also available as a 2d Mol file.

- **Other Names:** p-Isoxazine, tetrahydro-; BASF 238; Diethylene Imidoxide; Diethylene oximide; Diethylenimide oxide; Tetrahydro-p-oxazine; Tetrahydro-1,4-oxazine; Tetrahydro-2H-1,4-oxazine; 1-Oxa-4-azacyclohexane; 2H-1,4-Oxazine, tetrahydro-; 4H-1,4-Oxazine, tetrahydro-; Diethyleneimide oxide; Tetrahydro-1,4-isoxazine; Drewamine; Morpholine mixture; NA 1760; NA 2054; UN 2054
- Notes / Error Report
- **Other Data Available:**
  - Condensed phase thermochemistry data
  - Phase change data
  - Reaction thermochemistry data
  - Gas phase ion energetics data
  - Gas Phase IR Spectrum
  - Mass Spectrum
- Switch to calorie-based units

Notes / Error Report

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Data From SRC PhysProp Database:

Abbreviations in the 'Type' field: EXP = Experimental Data, EST = Estimated Data, EXT = Extrapolated Data. Extrapolated data is based upon experimental measurement outside the temperature range of the reported value.
References below are abbreviated citations ... the full reference citations are NOT available here. References for Estimated data generally refer to the method used to make the estimate ... most estimates were made using SRC software.

```
CAS Number : 000110-91-8
Chem Name  : MORPHOLINE
Mol Fcrmula: C4H9NO
Mol Weight : 87.122
Melting Pt : -4.9 deg C
Boiling Pt : 128 deg C
Water Solubility:
   Value : 1E+006 mg/L
   Temp  :
   Type  : EXP
   Ref   : RIDDICK,JA ET AL. (1986)
Log P (octanol-water):
   Value : -0.86
   Type  : EXP
   Ref   : HANSCH,C ET AL. (1995)
Vapor Pressure:
   Value : 10.08 mm Hg
   Temp  : 25 deg C
   Type  : EXP
   Ref   : RIDDICK,JA ET AL. (1986)
pKa Dissociation Constant:
   Value : 8.49
   Temp  : 25 deg C
   Type  : EXP
   Ref   : PERRIN,DD (1972)
Henry's Law Constant:
   Value : 1.16E-006 atm-m3/mole
   Temp  : 25 deg C
   Type  : EST
   Ref   : VP/WSOL
Atmospheric OH Rate Constant:
   Value : 1.378E-010 cm3/molecule-sec
   Temp  : 25 deg C
   Type  : EST
   Ref   : MEYLAN,WM & HOWARD,PH (1993)
```

Back To PhysProp Demo Page

International Chemical Safety Cards

MORPHOLINE

ICSC: 0302

MORPHOLINE
Tetrahydro-1,4-oxazine
Diethylene oximide
C_4H_9ON
Molecular mass: 87.1

CAS # 110-91-8
RTECS # QD6475000
ICSC # 0302
UN # 2054
EC # 613-028-00-9

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking.	Powder, alcohol-resistant foam, water spray, carbon dioxide.
EXPLOSION	Above 38°C explosive vapour/air mixtures may be formed.	Above 38°C closed system, ventilation, and explosion-proof electrical equipment.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT GENERATION OF MISTS! STRICT HYGIENE!	
• **INHALATION**	Burning sensation. Cough. Laboured breathing. Shortness of breath. Sore throat.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Half-upright position. Artificial respiration if indicated. Refer for medical attention.
• **SKIN**	MAY BE ABSORBED! Redness. Skin burns. Pain.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
• **EYES**	Redness. Pain. Blurred vision.	Face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**	Abdominal pain. Cough. Diarrhoea. Vomiting.	Do not eat, drink, or smoke during work.	Rinse mouth. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL

Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place (extra personal protection: complete protective clothing including self-contained breathing apparatus).

STORAGE

Fireproof. Separated from strong oxidants, acids. Dry.

PACKAGING & LABELLING

C symbol
R: 10-20/21/22-34
S: 23-26
UN Haz Class: 3
UN Pack Group: III

SEE IMPORTANT INFORMATION ON BACK

Prepared in the context of cooperation between the International Programme on Chemical Safety & the

International Chemical Safety Cards

MORPHOLINE

ICSC: 0302

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS HYGROSCOPIC LIQUID , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:

CHEMICAL DANGERS:
The substance decomposes on heating producing toxic fumes (nitrogen oxides). The substance is a weak base. Reacts with strong oxidants causing fire hazard. Attacks copper and its compounds.

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV (as TWA): 20 ppm; 71 mg/m^3 (skin) (ACGIH 1992-1993).
MAK: 20 ppm; 70 mg/m^3; I, H (1992).
OSHA PEL: TWA 20 ppm (70 mg/m^3) skin
NIOSH REL: TWA 20 ppm (70 mg/m^3) ST 30 ppm (105 mg/m^3) skin
NIOSH IDLH: 1400 ppm LEL

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is corrosive to the eyes, the skin and the respiratory tract. Inhalation of the substance may cause lung oedema (see Notes).

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The substance may have effects on the liver and kidneys.

PHYSICAL PROPERTIES

Boiling point: 129°C
Melting point: -5°C
Relative density (water = 1): 1.0
Solubility in water: miscible
Vapour pressure, kPa at 20°C: 1.06
Relative vapour density (air = 1): 3.00
Relative density of the vapour/air-mixture at 20°C (air = 1): 1.01
Flash point: 38°C (o.c.)
Auto-ignition temperature: 310°C
Explosive limits, vol% in air: 1.8-11.2
Octanol/water partition coefficient as log Pow: -0.86

ENVIRONMENTAL DATA

This substance may be hazardous to the environment; special attention should be given to water organisms.

NOTES

Depending on the degree of exposure, periodic medical examination is indicated. The symptoms of lung oedema often do not become manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation are therefore essential. Immediate administration of an appropriate spray, by a doctor or a person authorized by him/her, should be considered. The odour warning when the exposure limit value is exceeded is insufficient.

NFPA Code: H 2; F 3; R 0;

ADDITIONAL INFORMATION

Morpholine

IDLH Documentation

CAS number: 110–91–8

NIOSH REL: 20 ppm (70 mg/m^3) TWA, 30 ppm (105 mg/m^3) STEL [skin]

Current OSHA PEL: 20 ppm (70 mg/m^3) TWA [skin]

1989 OSHA PEL: 20 ppm (70 mg/m^3) TWA, 30 ppm (105 mg/m^3) STEL [skin]

1993–1994 ACGIH TLV: 20 ppm (71 mg/m^3) TWA [skin]

Description of substance: Colorless liquid with a weak, ammonia- or fish–like odor.

LEL :. . 1.4% (10% LEL, 1,400 ppm)

Original (SCP) IDLH: 8,000 ppm

Basis for original (SCP) IDLH: The chosen IDLH is based on the statement by ILO [1972] that 1 of 6 rats died following an 8–hour exposure to 8,497 ppm. The chosen IDLH is also supported by Patty [1963] who reported that 1 hour was the maximum survival time for rats exposed to the saturated vapor (9,200 ppm); exposure of 6 rats to 8,000 ppm (calculated) for 8 hours resulted in no deaths [Smyth et al. 1954].

Short–term exposure guidelines: None developed

ACUTE TOXICITY DATA:

Lethal concentration data:

Species	Reference	LC_{50} (ppm)	LC_{Lo} (ppm)	Time	Adjusted 0.5-hr LC (CF)	Derived value
Rat	ILO 1972	LC_{17}: 8,497	-----	8 hr	21,243 ppm (2.5)	2,124 ppm
Mouse	Toksikol Nov Prom Khim Vesh 1966	365	-----	2 hr	584 ppm (1.6)	58 ppm

Lethal dose data:

Species	Reference	Route	LD_{50} (mg/kg)	LD_{Lo} (mg/kg)	Adjusted LD	Derived value
Mammal	Bazarova & Miguekina 1975	oral	1,220	-----	2,359 ppm	236 ppm
Mouse	Patel et al. 1985	oral	525	-----	1,015 ppm	102 ppm
Rat	Smyth et al. 1954	oral	1,050	-----	2,030 ppm	203 ppm

Other animal data: No deaths resulted from exposures of 6 rats to 8,000 ppm for 8 hours [Smyth et al. 1954].

Human data: Irritation of the nose has been reported after a 1–minute exposure to 12,000 ppm and coughing started after 1.5 minutes; it was suggested that this concentration would probable be intolerable for long periods [Shea 1939].

Revised IDLH: 1,400 ppm [LEL]

Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in humans [Shea 1939] and animals [ILO 1972; Smyth et al. 1954], a value of 2,000 ppm would have been appropriate for morpholine. However, the revised IDLH for morpholine is 1,400 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 1.4%).

REFERENCES:

1. Bazarova LA, Miguekina NV [1975]. Comparative evaluation of the toxicity, hazard and effect of piperidine and morpholine. Toksikol Nov Prom Khim Vesh *14*:90–95 (in Russian).

2. ILO [1972]. Morpholine. In: Encyclopaedia of occupational health and safety. 2nd ed. Vol. II (L–Z). Geneva, Switzerland: International Labour Office, pp. 915–916.

3. Patel VK, Venkatakrishna–Bhatt H, Patel NB, Jindal MN [1985]. Pharmacology of new glutarimide compounds. Biomed Biochim Acta *44*(5):795–803.

4. Patty FA, ed. [1963]. Industrial hygiene and toxicology. 2nd rev. ed. Vol. II. Toxicology. New York, NY: Interscience Publishers, Inc., pp. 2203–2204.

5. Shea TE Jr [1939]. The acute and sub–acute toxicity of morpholine. J Ind Hyg Toxicol *21*(7):236–245.

6. Smyth HF Jr, Carpenter CP, Weil CS, Pozzani UC [1954]. Range–finding toxicity data: list V. AMA Arch Ind Hyg Occup Med *10*:61–68.

7. Toksikol Nov Prom Khim Vesh [1966]; *8*:60–70 (in Russian).

Go back to the Documentation for Immediately Dangerous To Life or Health Concentrations (IDLHs)

This page was last updated : 8/16/96

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or to the CDC home page. 

Regular Paper

[Jpn. J. Cancer Res. 88, 797-806, September 1997]

Carcinogenicity of Methylurea or Morpholine in Combination with Sodium Nitrite in a Rat Multi-organ Carcinogenesis Bioassay

Mitsuaki Kitano,[1, 5] Nobuyasu Takada,[1] Tianxin Chen,[1] Hiroshi Ito,[2] Takakazu Nomura,[2] Hiroyuki Tsuda,[3] Christopher P. Wild[4] and Shoji Fukushima[1]

[1]First Department of Pathology, Osaka City University Medical School, 1-4-54 Asahi-machi, Abeno-ku, Osaka 545, [2]Osaka Branch Laboratory, Japan Food Research Laboratories, 3-1 Toyotsu-cho, Suita 564, [3]Chemotherapy Division, National Cancer Center Research Institute, 5-1-1 Tsukiji, Chuo-ku, Tokyo 104 and [4]Molecular Epidemiology Unit, Research School of Medicine, University of Leeds, 24 Hyde Terrace, GB-Leeds LS2 9LN, United Kingdom

(Received May 29, 1997/Accepted July 14, 1997)

For carcinogenic risk assessment of combinations of *N*-nitroso precursors in man, the effects of feeding methylurea (MU) or morpholine (Mor) plus sodium nitrite ($NaNO_2$) were investigated using a multi-organ carcinogenesis model. In experiment 1, to initiate multiple organs, groups of 10 or 20 male F344 rats were treated with 6 carcinogens targeting different organs. Starting a week after completion of this initiation phase, animals were given 0.1% MU or 0.5% Mor in their food and/or 0.15% $NaNO_2$ in their drinking water for 23 weeks. The induction of tumors and/or preneoplastic lesions in the forestomach and esophagus was significantly increased in the group receiving MU plus $NaNO_2$. The numbers and areas of liver glutathione *S*-transferase placental form (GST-P)-positive foci were significantly elevated with MU or Mor plus $NaNO_2$. Experiment 2 was conducted to assess formation of *N*-nitroso compounds in the stomach, and to detect DNA adduct generation in target organs by immunohistochemical staining. Groups of 5 or 14 animals were starved overnight, then given 0.4% MU or 2.0% Mor in the diet, or basal diet alone for 1 h. Then $NaNO_2$ or distilled water was given intragastrically. The mean gastric *N*-methyl-*N*-nitrosourea yield in the MU plus $NaNO_2$ group was 7700 μg at 2 h after combined administration. The mean *N*-nitrosomorpholine yield in the group given Mor plus $NaNO_2$ was 6720 μg. Immunohistochemically, N7-methyldeoxyguanosine-positive nuclei were evident in the forestomach epithelium at 8 h after the combination treatment with MU plus $NaNO_2$.

Key words: Methylurea - Morpholine - Sodium nitrite - Multi-organ carcinogenesis - *N*-Nitroso compound

[5] To whom correspondence should be addressed.

Japanese Journal of Cancer Research is available on the Web at: **http://www.bcasj.or.jp/jjcr/**

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Last modified on April/6/1999

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Hot Water Boiler-Closed System | Oxygen Scavengers |

Potable Water Treatment | Steam Boiler Treatment

BIOCIDES

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0152	**Algicide™ 10-53, EPA**	**An anionic carbamate type biocide. Works very well on slime forming bacteria. Works well in alkaline systems. Low foam.**
	Sample MSDS	Sample Tech Data
0215	**MBC 215 (Nashville Chem)**	**A isothiazoline non-oxidizing liquid biocide for both cooling systems and air washer systems. Can be used with chorine or other non-oxidizing biocides.**
0909	**Stabrom 909, EPA**	**A liquid, single-feed bromine biocide composed of**

	(Albemarle Corp.)	stabilized bromine chloride. It is also used to control biofilm deposits in pumps, pipes, heat exchangers, and filters in industiral systems.
0020	Towerbrom, EPA (Occidental Product)	A brominated/chlorinated isocyanurate. Used normally with the quaternary ammonium compounds. Do not use with Algicide™ 10-53.
0220	Tolcide PS-2000 (Albright & Wilson)	A non-foaming, non-flammable, non-corrosive, halogen free biocide for both cooling systems and air washer systems. Especially effective against Sulfate Reducing bacteria with good biofilm penetration. Has shown to provide effective control of Legionella and algae.

CLEANER/DESCALERS

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0104	Alkaline Purge	A concentrated highly alkaline cleaner for preoperational cleaning of industrial boilers. Removes oil and grease from the boiler.
0169	CST™-C	An inhibited citric acid solution for removal of iron scale in closed systems.
0105	Scale Purge	An inhibited hydrochloric solution for the removal of lime and iron deposits from a host of industrial equipment including steam boilers. Do not use on riveted or sectional boilers without prior AGI approval. Use at 5-20% rate. Contains an indicator which allows the user to know when the acid is used up.
0296	Process Antifoam	A silicone solution for use with Scale Purge. It reduces the foaming associated with chemical cleaning of boilers.
0121	Scale Purge Dry	A special blend of inhibitors and sulfamic acid. Designed for cleaning galvanized cooling towers.
0184	Resin Restor	A hydrosulfite based resin cleaning system for softeners.
0199	DELIMER	A phosphate based hot water heater cleaner/delimer.
0100	WTC-10	A phosphate, carbonate, surfactant combination for use in precleaning steam boilers, hot water boilers, and closed systems. Does not contain sodium or potassium hydroxide.

CONDENSATE TREATMENT

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0113	Industrial Voltreet®	A blended condensate line treatment. Excellent choice for deaerated systems. USDA G7 approved.
0108	Voltreet®	A blended condensate treatment. Excellent choice for low pressure systems with long condensate runs. USDA G7 approved.
0183	Voltreet®D	A condensate treatment for dairy applications. Contains ammonia. Meets FDA requirements 21 CFR part 173.310.

0182	Voltreet® FP-10	A DEAE Condensate Treatment. USDA G6 approved.
0180	Voltreet® FP-20	A DEAE Condensate treatment. USDA G6 approved.
0181	Voltreet®FP-40	A DEAE Condensate treatment. USDA G6 approved.
0179	Voltreet® Special	A blended condensate treatment. Excellent choice for process systems with long steam lines. Will lose some of the product thru deaerators.
0110	Voltreet Preferred	A blend of Cyclohexylamine and Morpholine. Excellent choice for low pressure systems with long steam lines, and/or systems using steam for humidification.
0095	Voltreet 95	10% AMP for treatment of systems used for humidification

COOLING TOWER TREATMENT

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0148	Rustoscale® Custom 40	A zinc/phosphonate tower treatment.
0147	Rustoscale® Custom 43	A zinc/phosphonate tower treatment.
0139	Rustoscale® Custom 44	A phosphate/polymer/phosphonate tower treatment. Requires supplemental pH control.
0170	Rustoscale® Custom 46	A zinc/phosphonate tower treatment.
0132	Rustoscale® Custom 60	A phosphonate/polymer all organic tower treatment. Alkaline formulation with high levels of copper corrosion inhibitor.
0026	CWT-26	A phosphonate polymer blend all organic treatment. Product is formulated as a nonhazardous material.
0028	CWT-28	A phosphonate polymer blend all organic treatment. Product is formulated as a nonhazardous material.
0030	CWT-30	A phosphonate polymer blend all organic treatment. Product is formulated as a nonhazardous material.
0065	CWT-65	A phosphonate/polymer/zinc tower treatment
0070	CWT-70	A phosphonate/polymer/zinc tower treatment
0089	CWT-89	An all organic tower treatment. Utilizes advanced polymer technology.
0094	CWT-94	An all organic tower treatment. Utilizes advanced polymer technology.
0099	CWT-99	An all organic tower treatment. Utilizes advanced polymer technology.
0103	CWT-103	An all organic tower treatment. Utilizes advanced polymer technology.
0125	CWT-125	A phosphonate/polymer/zinc/molybdate tower treatment.
0129	CWT-129	A phosphonate/polymer/zinc/molybdate tower treatment.
0145	CWT-145	A phosphate/polymer/phosphonate tower treatment. Requires supplemental pH control.
0174	CWT-174	A sulfuric acid/phosphonate/zinc/molybdate blend.
0187	50% Sulfuric Acid	50% Sulfuric acid. Safer alternative to 66° baume acid.

0162	**Rustoscale® Polysperse 30**	**A sludge and scale inhibitor. A blend of polymers. USDA G6 approved.**
0006	**Biosperse**	**A Bio dispersant. A combination of nonionic and anionic surfactants.**
0142	**Tower Kleen 142**	**A cooling tower bio-cleaner with superior organic suspension. Has a use rate of 40-50 ounces per 1000 gallons of system capacity.**

HOT WATER BOILER - CLOSED SYSTEM

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0158	**CST™-10**	**A nitrite based closed system treatment.**
0153	**CST™-20**	**A nitrite based closed system treatment.**
0144	**CS-144**	**A molybdate based closed system treatment.**
0167	**CS-167**	**A molybdate based closed system treatment.**
0163	**CS-163**	**A specialty formulated closed system treatment for systems containing aluminum.**
0114	**CST-114**	**A sodium sulfite based oxygen scavenger and corrosion inhibitor to protect copper and copper alloys**

OXYGEN SCAVENGERS

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0111	**Oxytrol™**	**A liquid sulfite based oxygen scavenger for use in low pressure steam boilers. Meets FDA requirements 21 CFR part 173.310.**
0112	**Oxytrol™ A**	**A concentrated catalyzed acidic sulfite based oxygen scavenger. Normally used in deaerator systems with a continuous feed to storage section of deaerator. Mixing with alkaline chemicals destroys the catalyst. Meets FDA requirements 21 CFR part 173.310.**
0101	**Oxytrol™ A-DC**	**A concentrated catalyzed, decharacterized acidic sulfite based oxygen scavenger. Normally used in deaerator systems with a continuous feed to storage section of deaerator. Mixing with alkaline chemicals destroys the catalyst. USDA G6 approved.**
0191	**Oxytrol™ DC-2**	**A powdered catalyzed sulfite based oxygen scavenger. Normally used in deaerator systems with a continuous feed to storage section of deaerator. For mixing use a 10% by weight solution. Mixing with alkaline chemicals destroys the catalyst. Meets FDA requirements 21 CFR part 173.310.**
0190	**Oxytrol™ FP-100**	**A powdered catalyzed, decharacterized sulfite based oxygen scavenger. Normally used in deaerator systems with a continuous feed to storage section of deaerator. Mixing with alkaline chemicals destroys the catalyst. USDA G6 approved.**
0193	**Oxytrol™ LD**	**A catalyzed acidic sulfite based oxygen scavenger.**

		Normally used in deaerator systems with a continuous feed to storage section of deaerator. Mixing with alkaline chemicals destroys the catalyst. USDA G6 approved.
0143	**Oxytrol™ S**	**A catalyzed slightly acidic sulfite based oxygen scavenger. Normally used in deaerator systems with a continuous feed to storage section of deaerator. Mixing with alkaline chemicals destroys the catalyst. Meets FDA requirements 21 CFR part 173.310.**
0192	**OS-192**	**A neutral concentrated sulfite based oxygen scavenger.**
0131	**MP-131**	**A liquid erythrobate based metal passivator and oxygen scavenger. Can be used in combination with sulfites or used alone as the sole oxygen scavenger. USDA G6 approved.**
0188	**MP-283**	**A liquid erythrobate based metal passivator and oxygen scavenger. Can be used in conjunction with sulfites to provide metal passivation. USDA G6 approved.**
0005	**VOS-5**	**A liquid volatile catalyzed DEHA based oxygen scavenger and metal passivator. Can be used in conjunction with sulfite. Do not mix with sulfite for feeding.**
0002	**VOS-2**	**A liquid volatile catalyzed DEHA based oxygen scavenger and metal passivator.**

POTABLE WATER TREATMENT

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0135	**AW-24**	**A polyphosphate potable water treatment. USDA G2 approved.**
0136	**AW-27**	**A polyphosphate potable water treatment. USDA G2 approved.**
0138	**AW-29**	**A NSF approved polyphosphate potable water treatment. USDA G6 and G2 approved.**
0156	**AW-66**	**A powdered polyphosphate potable water treatment.**
0306	**AW #306**	**A NSF approved phosphate, zinc potable water treatment.**
0010	**Phosphoric Acid 75%**	**A NSF approved phosphoric acid used for the control of lead in potable water systems.**

STEAM BOILER TREATMENT

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0165	**Alkalinity Adjunct**	**Used as an alkalinity supplement in boilers. USDA G6 approved.**
0164	**Alkalinity Aid**	**Used as an alkalinity supplement in boilers. USDA G6 approved.**
0194	**Antifoam BW**	**A boiler water antifoam. Do not use for other applications. USDA G6 approved.**
0117	**Rustoscale® 6**	**Carbonate cycle internal boiler treatment for low**

		pressure boilers. Use where the total alkalinity - calcium hardness is less than 30 ppm. Contains dispersants, alkalinity and antifoam. USDA G6 approved.
0127	**Rustoscale®14**	**Carbonate cycle internal boiler treatment. Use where the total alkalinity - calcium hardness is greater than 30 ppm. Contains dispersants, alkalinity and antifoam. Double strength Rustoscale #19. USDA G6 approved.**
0128	**Rustoscale® 19**	**Carbonate cycle internal boiler treatment. Use where the total alkalinity - calcium hardness is greater than 30 ppm. Contains dispersants, alkalinity and antifoam. USDA G6 approved.**
0175	**Rustoscale® 140**	**Carbonate cycle 2 in 1 internal boiler treatment for low pressure boilers. Use where the total alkalinity - calcium hardness is greater than 30 ppm. Contains dispersants, sulfite, antifoam, and alkalinity.**
0134	**Rustoscale® 152**	**Carbonate cycle 3 in 1 internal boiler treatment. Use where the total alkalinity - calcium hardness is greater than 30 ppm. Contains dispersants, sulfite, amine, and alkalinity. USDA G6 approved.**
0133	**Rustoscale® 162**	**Carbonate cycle 3 in 1 internal boiler treatment. Use where the total alkalinity - calcium hardness is greater than 30 ppm. Contains dispersants, sulfite, amine, and alkalinity.**
0126	**Rustoscale® 176**	**Carbonate cycle 3 in 1 internal boiler treatment. Use where the total alkalinity - calcium hardness is less than 30 ppm. Contains dispersants, sulfite, amine, and alkalinity. USDA G6 approved.**
0102	**Rustoscale® 186**	**Carbonate cycle 3 in 1 internal boiler treatment. Use where the total alkalinity - calcium hardness is less than 30 ppm. Contains dispersants, sulfite, amine, and alkalinity.**
0012	**BWT-012**	**A carbonate cycle 2 in 1 internal boiler treatment. Use where the total alkalinity - calcium hardness is less than 30 ppm. Contains dispersant, sulfite, and alkalinity.**
0011	**BWT-011**	**A phosphate cycle 3 in 1**
0009	**BWT-009**	**A liquid phosphate to be used with dispersants, oxygen scavengers, and other appropriate chemicals.**
0106	**BWT-106**	**A blend of neutralizing amines and dispersants formulated for keeping dissolved solids low in sectional boilers.**
0196	**BWT-196**	**A liquid phosphate cycle internal boiler treatment. Contains phosphate, alkalinity and advanced polymer technology.**
0198	**AF-198**	**A boiler water antifoam. Do not use for other applications.**
0189	**BD-4409**	**An iron and calcium dispersant.**
0195	**BD-4427**	**An iron and *calcium phosphate* dispersant. USDA approved for non food contact.**
0177	**BD-0177**	**An iron, calcium carbonate, and calcium phosphate**

		dispersant. Use at less than 350 psig pressure. USDA G6 approved.
0161	**Rustoscale® Polysperse BW**	**A general boiler dispersant and sludge conditioner. USDA G6 approved.**
6010	**BWT-010**	**Carbonate cycle 3 in 1 internal boiler treatment. Use in high pressure, soft water applications. Contains dispersants, sulfite and amine.**
7605	**Start-up™**	**A combination of sodium nitrite and alkalinity. Use to get the initial nitrite levels to recommended concentrations on a Unitreat program.**
0166	**Unitreat™ 2**	**A sodium nitrite based internal boiler treatment. Contains alkalinity, sodium nitrite, dispersant, and amine. Use where total alkalinity - calcium hardness is greater than 30 ppm.**
0168	**Unitreat™ 6**	**A sodium nitrite based internal boiler treatment. Contains alkalinity, sodium nitrite, dispersant, and amine. Use where total alkalinity - calcium hardness is less than 30 ppm.**
0141	**Unitreat™ 16**	**A sodium nitrite based internal boiler treatment. Contains alkalinity, sodium nitrite, and dispersant. Use where total alkalinity - calcium hardness is less than 30 ppm. Does not contain amine.**

Information Request Form

Select the items that apply, and then let us know how to contact you.

- [x] Send product literature
- [ ] Send a products safety data sheet
- [ ] Send company literature
- [ ] Have a salesperson contact me

Name
Title
Company
Address
E-mail
Phone
Fax
Product Name
Date Purchased

(Safety Sheet Only)

Submit Request | Reset Form

Send mail to agiwater@execpc.com with questions or comments about this web site.

Last modified: June 25, 2000

Indoor Allergens: Assessing and Controlling Adverse Health Effects (1993)
Institute of Medicine (more titles from IOM)

Hits were found on page 267
A total of 35 pages of uncorrected, machine-read text were searched.
1 page was identified which contains a total of 1 lines that match "morpholine."

On PAGE 267 emy Press. NRC. 1983a. An Assessment of the Health Risks of Morpholine and Diethylaminoethanol. Washington, D.C.: National Academy Press.

IARC Monographs

MORPHOLINE
(Group 3)

For definition of Groups, see Preamble Evaluation.

VOL.: 47 (1989) (p. 199)

CAS No.: 110-91-8
Chem. Abstr. Name: Morpholine

5. Summary of Data Reported and Evaluation

5.1 Exposures

Morpholine is a synthetic organic liquid used mainly as an intermediate in the production of rubber chemicals and optical brighteners, as a corrosion inhibitor in steam condensate systems, as an ingredient in waxes and polishes and as a component of protective coatings on fresh fruits and vegetables. Occupational exposure may occur during the production of morpholine and in its various uses, but data on exposure levels are sparse. It has been detected in samples of foodstuffs and beverages.

5.2 Experimental carcinogenicity data

Morpholine was tested for carcinogenicity by oral administration in two strains of mice, one strain of rats and one strain of hamsters. The studies in one of the strains of mice and in hamsters were considered inadequate for evaluation. In the other strain of mice, no significant increase in the incidence of tumours was seen in treated animals. In the study in rats, a few tumours of the liver and lung occurred in treated animals. Morpholine was also tested by inhalation exposure in rats; it did not increase the incidence of tumours over that in controls.

5.3 Human carcinogenicity data

No data were available to the Working Group.

5.4 Other relevant data

Morpholine is an irritant in humans and experimental animals. It caused kidney damage in experimental animals.

Morpholine did not induce micronuclei, chromosomal aberrations or mutation in hamsters. It did not induce morphological transformation, chromosomal aberrations or DNA damage in cultured animal cells. It did not induce mutations in bacteria.

5.5 Evaluation

There is *inadequate evidence* for the carcinogenicity of morpholine in experimental animals.

No data were available from studies in humans on the carcinogenicity of morpholine.

Morpholine is *not classifiable as to its carcinogenicity to humans (Group 3).*

For definition of the italicized terms, see Preamble Evaluation.

Subsequent evaluation: Vol. 71 (1999)

Synonyms

- BASF 238
- Diethylene imidoxide
- Diethylene oximide
- Diethylenimide oxide
- Drewamine
- 1-Oxa-4-azacyclohexane
- Tetrahydro-*para*-isoxazine
- Tetrahydro-1,4-isoxazine
- Tetrahydro-1,4-oxazine
- Tetrahydro-(2*H*)-1,4-oxazine
- Tetrahydro-(4*H*)-1,4-oxazine
- Tetrahydro-*para*-oxazine

Last updated: 13 April 1999

IARC Monographs

MORPHOLINE (Group 3)

For definition of Groups, see Preamble Evaluation.

VOL.: 71 (1999) (p. 1511)

CAS No.: 110-91-8
Chem. Abstr. Name: Morpholine

5. Evaluation

No epidemiological data relevant to the carcinogenicity of morpholine were available.

There is *inadequate evidence* in experimental animals for the carcinogenicity of morpholine.

Overall evaluation

Morpholine is *not classifiable as to its carcinogenicity to humans (Group 3).*

For definition of the italicized terms, see Preamble Evaluation.

Previous evaluation: Vol. 47 (1989)

Last updated: 13 April 1999

ATTACHMENT M-13

SAX's **Dangerous Properties of Industrial Materials**, 10th edition, 2000, MRP750 (Vol. 3), p. 2579

Toxicity data with reference:

"skn-rbt 995 mg / 24H SEV	BIOFX 10-4/70
skn-rbt 500 mg open MOD	UCDS 4/21/67
eye-rbt 2 mg SEV	AJOPAA 29,1363,46
otr-mus:lym 1μL/L	ENMUDM 4,390,82
orl-mus TDLo: 2560 mg/kg/y-c:NEO	GISAAA 44(8),15,79
ihl-rat LC50: 8000 ppm/8H	NPIRI 1,85,74
orl-mus LD50: 525 mg/kg	BBIADT 44,795-85
ihl0mus LC50: 1320 mg/m^3/2H	TPKVAL 8,60,66
ipr-mus LD50: 413 mg/kg	CANCAR 2, 1055,49
skn-rbt LD50: 500 mg/kg	AMIHBC 10,61,54

CONCENSUS REPORTS: reported in EPA TSCA Inventory. EPA Genetic Toxicology Program

OSHA PEL: TWA 20 ppm(skin); STEL 30 ppm (skin)

ACGIH TLV: TWA 20 ppm (skin); Not classifiable as a human carcinogen.

DFG MAK: 10 ppm (36 mg/m^3)

DOT Classification: 3; Label: Flammable Liquid

SAFETY PROFILE: "Moderately toxic by ingestion, inhalation, skin contact, and intraperitoneal routes. Mutation data reported. A corrosive irritant to skin, eyes, and mucous membranes. Can cause kidney damage. Questionable carcinogen with experimental neoplastigenic data. Flammable liquid. A very dangerous fire hazard when exposed to flame, heat, or oxidizers; can react with oxidizing materials....."

Search Results

for **"morpholine"** are listed below.
Hits 1-13 of 13

- RoC: N-Nitrosomorpholine
- H&S:N-NITROSOMORPHOLINE 59-89-2
- H&S:N-ETHYLMORPHOLINE 100-74-3
- H&S: MORPHOLINE 110-91-8
- H&S: 2,6-DIMETHYL MORPHOLINE 141-91-3
- Testing Status: N-ETHYLMORPHOLINE
- Testing Status: N-NITROSOMORPHOLINE
- Testing Status: 2,6-DIMETHYL MORPHOLINE
- Testing Status: MORPHOLINE
- Appendix G: CAS Registry Number Index (8th RoC)
- 8th RoC: Substances Reasonably Anticipated to be Human Carcinogens
- Eighth Report on Carcinogens: REFERENCES
- H&S: DDT 50-29-3

NTP CHEMICAL REPOSITORY
MORPHOLINE

-IDENTIFIERS
==========

*CATALOG ID NUMBER: 000061

*CAS NUMBER: 110-91-8

*BASE CHEMICAL NAME: MORPHOLINE

*PRIMARY NAME: MORPHOLINE

*CHEMICAL FORMULA: C4H9NO

*STRUCTURAL FORMULA:

*WLN: T6M DOTJ

*SYNONYMS:
TETRAHYDRO-1,4-OXAZINE
DIETHYLENIMIDE OXIDE
DIEYTHYLENE OXIMIDE
DIETHYLENE IMIDOXIDE

-PHYSICAL CHEMICAL DATA
==========

*PHYSICAL DESCRIPTIONS: Colorless liquid.

*MOLECULAR WEIGHT: 87.12

*SPECIFIC GRAVITY: 0.998 @ 25/25 C

*DENSITY: 1.00 g/mL @ 20 C

*MP (DEG C): -4.9

*BP (DEG C): 128.9

*SOLUBILITIES:
WATER : Soluble

DMSO : Not available

95% ETHANOL : Soluble

METHANOL : Not available

ACETONE : Very soluble.

TOLUENE : Not available

OTHER SOLVENTS:
Ethylene glycol: Very soluble.
Castor oil: Very soluble.
ETHER : Very soluble.
BENZENE: Very soluble.

*VOLATILITY: Vapor pressure: 6.6 mm Hg at 20.0 C Vapor density: 3.00

*FLAMMABILITY(FLASH POINT):
Flash point: 100 F degrees (open cup). Flammable. Moderate fire risk. Fire involving this chemical should be extinguished with alcohol foam, CO2, and/or dry chemical extinguishers. The autoignition temperature is 310 C (590 F).

*UEL: Not available LEL: Not available

*REACTIVITY: Reacts with oxidizers. Corrosion inhibitor.

*STABILITY: This compound is sensitive to moisture.

*OTHER PHYSICAL DATA:
Hygroscopic
Amine odor
Moderate base
Refractive index: 1.4548 @ 20 C
Boiling point: 24.8 C @ 10 mm Hg
pKa: 8.4
pKb: 5.6
Steam-volatile

-TOXICITY
========

*NIOSH REGISTRY NUMBER: QD6475000

*TOXICITY: (abbreviations)

typ. dose	mode	specie	amount	unit	other
LD50	orl	rat	1050	mg/kg	
LC50	ihl	rat	8000	ppm/8H	
LD50	orl	mus	1200	mg/kg	
LC50	ihl	mus	1320	mg/m3	
LD50	ipr	mus	413	mg/kg	
LD50	skn	rbt	500	mg/kg	
LD50	orl	mam	1220	mg/kg	
LD50	ihl	mam	12000	mg/m3	

*AQTX/TLM96: 1000-100 ppm

*SAX TOXICITY EVALUATION:
THR: High via dermal and Moderate via oral routes. Irritant to skin, eyes, and mucous membrane.

*CARCINOGENICITY:
Tumorigenic Data:
TDLo: orl-mus 2560 mg/kg/Y-C
Review: IARC Cancer Review: Animal Inadequate Evidence
IARC: Not classifiable as a human carcinogen (Group 3) [610]

*MUTATION DATA: Not available

*TERATOGENICITY: Not available

*STANDARDS, REGULATIONS & RECOMMENDATIONS:
OSHA: Federal Register (1/19/89) and 29 CFR 1910.1000 Subpart Z
Transitional Limit: PEL-TWA 20 ppm (skin) [610]
Final Limit: PEL-TWA 20 ppm (skin); STEL 30 ppm [610]
ACGIH: TLV-TWA 20 ppm (skin); STEL 30 ppm, with a notice of intent to delete STEL [610]

NIOSH Criteria Document: None
NFPA Hazard Rating: Health (H): 2
Flammability (F): 3
Reactivity (R): 0
H2: Materials hazardous to health, but areas may be entered freely with full-faced mask self-contained breathing apparatus which provides eye protection (see NFPA for details).
F3: Materials which can be ignited under almost all normal temperature conditions (see NFPA for details).
R0: Materials which are normally stable even under fire exposure conditions and which are not reactive with water (see NFPA for details).

*OTHER TOXICITY DATA:
Skin and Eye Irritation Data:
skn-rbt 995 mg/24H SEV
skn-rbt 500 mg open MOD
eye-rbt 2 mg SEV
Review: Toxicology Review
Status: "NIOSH Manual of Analytical Methods" Vol. 3 S150
Reported in EPA TSCA Inventory, 1980
EPA TSCA 8(a) Preliminary Assessment Information Proposed Rule

-OTHER DATA (Regulatory)

*PROPER SHIPPING NAME (IATA): Morpholine

*UN/ID NUMBER: UN2054

*HAZARD CLASS: 3 SUBSIDIARY RISK: None PACKING GROUP: III

*LABELS REQUIRED: Flammable liquid

*PACKAGING: PASSENGER: PKG. INSTR.: 309, Y309 MAXIMUM QUANTITY: 60 L, 10 L
CARGO : PKG. INSTR.: 310 MAXIMUM QUANTITY: 220 L

*SPECIAL PROVISIONS: None

*USES: Rubber accelerator; solvent; additive to boiler water; component of waxes and polishes; optical brightener for detergents; corrosion inhibitor; preservation of book paper; organic intermediate; antioxidant.

*COMMENTS: Not available

-HANDLING PROCEDURES

*ACUTE/CHRONIC HAZARDS:
This compound is an irritant and is corrosive.

*MINIMUM PROTECTIVE CLOTHING:
If Tyvek-type disposable protective clothing is not worn during handling of this chemical, wear disposable Tyvek-type sleeves taped to your gloves.

*RECOMMENDED GLOVE MATERIALS:
Recommended Glove Type For Use With Neat (Undiluted) Chemical:
Recommendations based on permeation test results are made for handling the neat (undiluted) chemical. If this chemical makes direct contact with your glove, or if a tear, puncture or hole develops, replace them at once.

Suggested Glove Type(s) (RAD): Butyl rubber, PVA (to 360 minutes)

*RECOMMENDED RESPIRATOR:
Where the neat test chemical is weighed and diluted, wear a NIOSH-approved half face respirator equipped with an organic vapor/acid gas cartridge (specific for organic vapors, HCl, acid gas and SO2) with a dust/mist filter.
Splash proof safety goggles should be worn while handling this chemical. Alternatively, a full face respirator, equipped as above, may be used to provide simultaneous eye and respiratory protection.

*OTHER: Not available

*STORAGE PRECAUTIONS:
You should store this chemical under refrigerated temperatures, and protect it from moisture. STORE AWAY FROM SOURCES OF IGNITION.

*SPILLS AND LEAKAGE:
If you should spill this chemical, use absorbent paper to pick up all liquid spill material. Seal the absorbent paper, as well as any of your clothing which may be contaminated, in a vapor-tight plastic bag for eventual disposal. Wash any surfaces you may have contaminated with a soap and water solution. Do not reenter the contaminated area until the Safety Officer (or other responsible person) has verified that the area has been properly cleaned.

*DISPOSAL AND WASTE TREATMENT:
You should dispose of all waste and contaminated materials associated with this chemical as specified by existing local, state and federal regulations concerning hazardous waste disposal. It is suggested that your contaminated materials should be destroyed by incineration in a special, high temperature (>2000 degrees F), chemical incinerator facility.

-EMERGENCY PROCEDURES

*SKIN CONTACT:
IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water.
IMMEDIATELY call a hospital or poison control center even if no symptoms (such as redness or irritation) develop.
IMMEDIATELY transport the victim to a hospital for treatment after washing the affected areas.

*INHALATION:
IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. If symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop, call a physician and be prepared to transport the victim to a hospital.
Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Respirator Recommendation.

*EYE CONTACT:
First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center.
Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician.
IMMEDIATELY transport the victim after flushing eyes to a hospital even if

no symptoms (such as redness or irritation) develop.

*INGESTION:
DO NOT INDUCE VOMITING. Corrosive chemicals will destroy the membranes of the mouth, throat, and esophagus and, in addition, have a high risk of being aspirated into the victim's lungs during vomiting which increases the medical problems.
If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and IMMEDIATELY call a hospital or poison control center. IMMEDIATELY transport the victim to a hospital.
If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. Transport the victim IMMEDIATELY to a hospital.

*SYMPTOMS:
Symptoms of exposure to this compound may include irritation of the eyes, skin, nose, mucous membranes and respiratory tract, nausea, headache, difficult breathing, visual disturbances and coughing.

*FIREFIGHTING:

-SOURCES
=======

*SOURCES:
Lewis, R.J., Sr. and R.L. Tatken, Eds. Registry of Toxic Effects of Chemical Substances. DHEW (NIOSH) Publication No. 79-100. National Institute for Occupational Safety and Health. Cincinnati, OH. 1979. QD6475000.

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Windholz, M., Ed. The Merck Index. 9th Ed. Merck and Co. Rahway, NJ. 1976. PP. 815.

Sax, N.I. Dangerous Properties of Industrial Materials. 5th Ed. Van Nostrand Reinhold. New York. 1979. PP. 946.

International Technical Information Institute. Toxic and Hazardous Industrial Chemicals Safety Manual for Handling and Disposal with Toxicity and Hazard Data. International Technical Information Institute. 1978. PP. 350.

Hawley, G.G., Ed. The Condensed Chemical Dictionary. 9th Ed. Van Nostrand Reinhold. New York. 1977. PP. 591.

Aldrich Chemical Company. Aldrich Catalog/Handbook of Fine Chemicals. Aldrich Chemical Co., Inc. Milwaukee, WI. 1978. PP. 619.

Proctor, N.H. and J.P. Hughes. Chemical Hazards of the Workplace. J.B. Lippincott. Philadelphia. 1978. PP. 362.

U.S. Environmental Protection Agency, Office of Toxic Substances. Toxic Substances Control Act Chemical Substances Inventory, Initial Inventory. 6 Vols. U.S. Environmental Protection Agency. Washington, D.C. 1979. LISTED.
SO90 PP. 792.

Oak Ridge National Laboratory. Environmental Mutagen Information Center (EMIC), Bibliographic Data Base. Oak Ridge National Laboratory. Oak Ridge, TN. LISTED

Oak Ridge National Laboratory. Environmental Teratogen Information Center (ETIC), Bibliographic Data Base. Oak Ridge National Laboratory. Oak Ridge, TN. LISTED

Occupational Safety and Health Administration. Tentative OSHA Listing of Confirmed and Suspected Carcinogens by Category. Occupational Safety and Health Administration. Washington, DC. 1979. NOT LISTED

[610] Clansky, Kenneth B., Ed. Suspect Chemicals Sourcebook: A Guide to Industrial Chemicals Covered Under Major Federal Regulatory and Advisory Programs. Roytech Publications, Inc. Burlingame, CA. 1990. Update, p. xxix.

[620] United States National Toxicology Program. Chemical Status Report. NTP Chemtrack System. Research Triangle Park, NC. November 6, 1990. Not listed.

MORPHOLINE

CASNO: 110-91-8

FORMULA: C4 H9 N O

SYNONYMS/COMMON NAMES

- DIETHYLENE IMIDIOXIDE

KNOWN USES:

- SALTS OF SULFONATED AZO DYES; PHOTOGRAPHIC DEVELOPER; PHARMACEUTICALS; WAX COMPONENT; INSECTICIDES; FUNGICIDES; CHEMICAL INTERMEDIATE FOR DISULFIDE & SULFENAMIDE RUBBER ACCELERATORS; INTERMEDIATE FOR BACTERICIDES

CHEMICAL HEALTH AND SAFETY INFORMATION:

GENETIC TOXICOLOGY

- SALMONELLA
  - NEGATIVE
  - **CITATION** Haworth, S., Lawlor, T., Mortelmans, K., Speck, W., and Zeiger, E. Salmonella mutagenicity test results for 250 chemicals. Environ. Mutagen. 5(Suppl 1) (1983): 3-142.

Last Updated 10/17/00

Morpholine, 99+%

02/13/96

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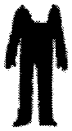
Protective Equipment


Splash Goggles


Face Shield


Gloves


Protective Clothing


Vapor Respirator

Eyes

- Wear chemical resistant safety goggles and a 8-inch faceshield.

Skin

- Chemical resistant gloves and other protective clothing to prevent skin contact.

Respiratory

- Wear appropriate NIOSH/MSHA approved respirator.

Special Precautions

- **Ventilation:** Use only in a chemical fume hood.
- **Storage:**

1. Keep tightly closed.
2. Keep away from heat, sparks, and open flame.
3. Store in a cool dry place.

- Possible mutagen
- Readily absorbed through skin.
- Use non-sparking tools.
- Avoid contact with fumes.
- Wash thoroughly after handling.

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Toxicity

Irritation Data

- SKN-RBT 995 mg/24hr. Severe
- SKN-RBT 500 mg open Moderate
- Eye-RBT 2 mg Severe

Toxicity Data

- ORL-RAT LD50 1450 mg/kg
- IHL-RAT LC50 8000 ppm/8hr.
- ORL-MUS LD50 525 mg/kg
- IHL-MUS LC50 1320 mg/m^3/2hr
- IPR-MUS LD50 413 mg/kg
- SKN-RBT LD50 500 µl/kg
- ORL-MAM LD50 1220 mg/kg
- IHL-MAM LC50 12000 mg/m3

Target Organ Data

- Sense Organs and Special Senses (other olfaction effects)
- Behavioral (sleep, somnolence)
- Gastrointestinal (ulceration or bleeding form stomach and/or small

intestine)
- Paternal Effects (testes, epididymis, sperm duct)

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Health

Effects:

- **Inhalation:** Harmful if inhaled. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. Inflammation may be fatal as a result of spasm, inflammation and edema of the larynx and bronchi, chemical pneumonitis and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea and vomiting.
- **Skin:** Harmful if absorbed through skin. This material is extremely destructive to the tissues of the skin.
- **Eye:** Harmful if absorbed through eye. This material is extremely destructive to the tissues of the eye.
- **Ingestion:** Harmful if swallowed. Exposure can cause stomach pains, vomiting, diarrhea. May cause liver and/or kidney damage.

First Aid:

- **Inhalation:** Move to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Contact physician at once.
- **Skin:** In case of contact immediately flush skin with copious amounts of water for at least 15 minutes while removing contaminated clothing and shoes. Remove and wash contaminated clothing promptly.
- **Eyes:** In case of contact immediately flush eye with copious amounts of water for at least 15 minutes. To insure adequate flushing separate eyelids with fingers.
- **Ingestion:** Wash out mouth with water provided person is conscious. Call a physician.

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PEL/TWA

PEL

- OSHA PEL (8-hour TWA) 20 ppm (70 mg/m^3) (skin)
- STEL 105 mg/m^3 (30 ppm)

TWA

- ACGIH TLV-TWA 20 ppm (skin)

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Fire Hazard Data

- **Flash point:** 96°F (35°C) *[38°C (102°F)]
- **Autoignition Temperature:** 590°F (309°C) *[290°C (555°F)]
- **Explosion Limits:** **upper**- 10.8% *(11%) **lower**-1.8%
- **Storage Color Code:** Red (flammable)
- **Extinguishing Media:** Carbon dioxide, dry chemical powder, appropriate foam.
- **Special Fire-Fighting Procedures:** Wear self-contained breathing apparatus with full facepiece operated in positive pressure and protective clothing to prevent contact with skin and eyes. Use water spray to cool fire-exposed containers. Move containers from fire if it can be done without risk.
- **Unusual Hazards:** Flammable liquid. Vapor may travel considerable distance to source of ignition and flash back. Under fire conditions, material may decompose to form flammable and/or explosive mixtures in air. Emits toxic fumes under fire conditions. Contact with strong oxidizers may cause fire or explosion.

* J.T. Baker

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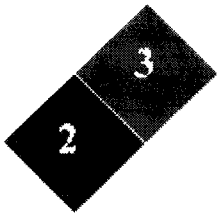
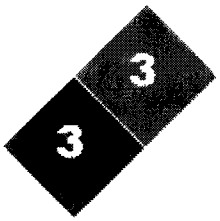
NFPA



- **Health:** 2
- **Flammability:** 3
- **Reactivity:** 0

- **CERCLA:**



- **Health:** 3
- **Flammability:** 3
- **Reactivity:** 1

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Synonyms

- BASF 238
- Diethyleneimide Oxide
- Diethylene Imidoxide
- Diethylene Oximide
- Diethylenimide Oxide
- Drewamine

- P-Isoxazine, Tetrahydro-
- Morpholine
- 1-Oxa-4-Azacyclohexane
- 2H-1,4-Oxazine, Tetrahydro-
- 4H-1,4-Oxazine, Tetrahydro-
- Tetrahydro-1,4-Isoxazine
- Tetrahydro-1,4-Oxazine
- Tetrahydro-2H-1,4-Oxazine
- UN2054
- CAS # 110-91-8

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Incompatibles

- Acids
- Acid Anhydrides
- Acid Chlorides
- Oxidizing Agents
- Heat, flame, and other sources of ignition

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Structure

- Molecular Formula: C_4H_9NO

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Disposal

Spill Procedures:

- Evacuate Area.
- Wear self-contained breathing apparatus, rubber boots and heavy rubber gloves.
- Shut off all sources of ignition.
- Cover with dry-lime, sand, or soda ash.
- Place in covered containers.
- Use non-sparking tools.

- Transport outdoors.

Disposal:

- Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable.
- Observe all federal, state, and local environmental regulations.
- EPA Hazardous Waste #: D001 (ignitable waste)

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Hazardous Decomposition

- Nitrogen Oxides
- Carbon Dioxide
- Carbon Monoxide

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Physical Data

- Boiling point: 129°C *(264°F) **[128°C (263°F)]
- Melting point: -7 to -9°C *[-5°C(23°F)]
- **Decomposes at: 489°F (250°C)
- Specific Gravity: 0.999 *[1.0] **[1.0005]
- Vapor Density: 3.0
- *Solubility in H_2O: 100%
- **% Volatile/Volume: 100 (21°C)
- Vapor Pressure: 7mm (20°C) *[10mm (20°C)]
- **Evaporation Rate: (butyl acetate=1): 1
- *Physical State: liquid
- Viscosity: 2.23 (at 20°C)
- **pH: 11.0
- Appearance: colorless liquid
- *Odor: Amine-like Odor **(weak, characteristic, fishy, amine-like odor)

* J.T. Baker

** Fisher Scientific

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Manufacturer

Aldrich Chemical Co.

P.O. Box 355

Milwaukee, Wisconsin 53201, USA

Phone #: (414) 273-3850

Fax #: (414) 273-4979

Catalog #: 13423-6

Emergency Phone: (414) 273-3850

J.T. Baker Chemical Co.

Not manufacturer per Diana

222 Red School Lane

Phillipsburg, N.J. 08865

Phone: (800) JT Baker

Product Codes: R357

Emergency Phone: (908) 859-2151

.(800) 424-9300 [Chemtrec]

- **(800) 424-8802 [National Response Center]**
- ***Fisher Scientific (Chemical Division)***
- 1 Reagent Lane

Fair Lawn, NJ 07410

Phone #: (201) 796-7100

Catalog #: M2631

Emergency Phone: (201) 796-7100

- **(800) 424-9300 [Chemtrec]**

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Please reduce your browser font size for better viewing and printing.

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

MORPHOLINE

MSDS Number: M8155 --- *Effective Date: 02/18/99*

1. Product Identification

Synonyms: Diethyleneimide oxide; tetrahydro-p-isoxazine
CAS No.: 110-91-8
Molecular Weight: 87.12
Chemical Formula: -NH(CH2)2O(CH2)2- (heterocyclic)
Product Codes:
J.T. Baker: R357
Mallinckrodt: 1884

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Morpholine	110-91-8	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! CORROSIVE. CAUSES BURNS TO ANY AREA OF CONTACT. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS THE LIVER AND KIDNEYS. FLAMMABLE LIQUID AND VAPOR.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate
Flammability Rating: 3 - Severe (Flammable)

Reactivity Rating: 1 - Slight
Contact Rating: 3 - Severe (Life)
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER.
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Extremely destructive to tissues of the mucous membranes and upper respiratory tract. Symptoms may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea and vomiting.
Ingestion:
Corrosive. Swallowing can cause severe burns of the mouth, throat, and stomach, leading to death. Can cause sore throat, vomiting, diarrhea.
Skin Contact:
Corrosive. Caustic vapors may cause irritation, redness, and pain. Contact may cause skin burns and absorption; symptoms may include hypoactivity, tremors, lacrimation, and salivation. Death may occur from prolonged exposure.
Eye Contact:
Corrosive. Caustic vapors may cause irritation, redness, pain, foggy vision, and corneal edema. Contact may cause eye damage.
Chronic Exposure:
Prolonged or repeated exposure through any route may cause liver, kidney, and lung damage.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems, or impaired liver, kidney or respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Flash point: 38C (100F) OC
Autoignition temperature: 310C (590F)

Flammable limits in air % by volume:
lel: 1.8; uel: 11.0
Flammable. (lel value is calculated; uel is estimated).
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Vapors can flow along surfaces to distant ignition source and flash back. Moderate explosion hazard when heated. Sealed containers may rupture when heated. Sensitive to static discharge.
Fire Extinguishing Media:
Dry chemical, alcohol foam or carbon dioxide. Water spray may be used to keep fire exposed containers cool. Water may be used to flush spills away from exposures and to dilute spills to non-flammable mixtures.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures.

J. T. Baker SOLUSORB(R) solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
20 ppm (TWA).

-ACGIH Threshold Limit Value (TLV):
20 ppm (TWA) skin
Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a full facepiece respirator with organic vapor cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.

Odor:
Characteristic amine odor. Odor is detectable above 0.1 ppm.

Solubility:
Miscible in water.

Specific Gravity:
1.0 @ 20/4C

pH:
ca. 11 For 25% soln.

% Volatiles by volume @ 21C (70F):
100

Boiling Point:
128C (262F)

Melting Point:
-5C (23F)

Vapor Density (Air=1):
3.0

Vapor Pressure (mm Hg):
10 @ 23C (73F)

Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:
Burning may produce carbon monoxide, carbon dioxide, nitrogen oxides.

Hazardous Polymerization:

Will not occur.
Incompatibilities:
Cellulose nitrate, nitromethane, other nitro compounds, strong acids, and oxidizing agents. Corrosive to metals.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 1450 mg/kg; inhalation LC50: 8000 ppm/8H; skin rabbit LD50: 1220 mg/Kg. Investigated as a tumorigen, mutagen.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Morpholine (110-91-8)	No	No	3

12. Ecological Information

Environmental Fate:
When released into the soil, this material may biodegrade to a moderate extent. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material is not expected to biodegrade. When released into water, this material may evaporate to a moderate extent. This material has an experimentally-determined bioconcentration factor (BCF) of less than 100. This material has a log octanol-water partition coefficient of less than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition. When released into the air, this material is expected to have a half-life of less than 1 day.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: MORPHOLINE
Hazard Class: 3
UN/NA: UN2054
Packing Group: III
Information reported for product/size: 4L

International (Water, I.M.O.)

Proper Shipping Name: MORPHOLINE SOLUTION
Hazard Class: 3.3
UN/NA: UN2054
Packing Group: III
Information reported for product/size: 4L

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Morpholine (110-91-8)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Morpholine (110-91-8)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Morpholine (110-91-8)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Morpholine (110-91-8)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: No (Pure / Liquid)

Australian Hazchem Code: 2P
Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **2** Flammability: **3** Reactivity: **0**
Label Hazard Warning:
DANGER! CORROSIVE. CAUSES BURNS TO ANY AREA OF CONTACT. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS THE LIVER AND KIDNEYS. FLAMMABLE LIQUID AND VAPOR.
Label Precautions:
Do not breathe vapor.
Do not get in eyes, on skin, or on clothing.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep away from heat, sparks and flame.
Label First Aid:
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 8.
Disclaimer:
****

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.
****

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

AIR PRODUCTS & CHEMICALS -- MORPHOLINE - MORPHOLINE, TECHNICAL
MATERIAL SAFETY DATA SHEET
NSN: 6810005599889
Manufacturer's CAGE: 88381
Part No. Indicator: A
Part Number/Trade Name: MORPHOLINE

General Information

Item Name: MORPHOLINE, TECHNICAL
Company's Name: AIR PRODUCTS AND CHEMICALS INC.
Company's Street: 7201 HAMILTON BLVD
Company's City: ALLENTOWN
Company's State: PA
Company's Country: US
Company's Zip Code: 18195-1501
Company's Emerg Ph #: 215-481-4911 / 215-481-5900
Company's Info Ph #: 215-481-4911 / 215-481-5900
Distributor/Vendor # 1: TWO DIANES INC (804-798-0685)
Distributor/Vendor # 1 Cage: 01DK7
Record No. For Safety Entry: 008
Tot Safety Entries This Stk#: 009
Status: SE
Date MSDS Prepared: 01MAR94
Safety Data Review Date: 21MAY96
Supply Item Manager: CX
MSDS Serial Number: BXBZQ
Specification Number: O-M-575
Spec Type, Grade, Class: 3 CLASS
Hazard Characteristic Code: C2
Unit Of Issue: DR
Unit Of Issue Container Qty: 460 LBS
Type Of Container: DRUM
Net Unit Weight: 460 LBS

Ingredients/Identity Information

Proprietary: NO
Ingredient: MORPHOLINE
Ingredient Sequence Number: 01
Percent: 40
NIOSH (RTECS) Number: QD6475000
CAS Number: 110-91-8
OSHA PEL: S, 20 PPM
ACGIH TLV: S, 20 PPM; 9495
Other Recommended Limit: NONE RECOMMENDED

Physical/Chemical Characteristics

Appearance And Odor: COLORLESS LIQUID. AMMONIA ODOR.
Boiling Point: 264F,129C
Melting Point: UNKNOWN
Vapor Pressure (MM Hg/70 F): 25
Vapor Density (Air=1): 1
Specific Gravity: 0.994
Decomposition Temperature: UNKNOWN
Evaporation Rate And Ref: 1
Solubility In Water: COMPLETELY SOLUBLE
pH: 10-12
Corrosion Rate (IPY): UNKNOWN

Fire and Explosion Hazard Data

Flash Point: 190F,88C
Lower Explosive Limit: UNKNOWN
Upper Explosive Limit: UNKNOWN
Extinguishing Media: WATER FOG, CARBON DIOXIDE, FOAM.
Special Fire Fighting Proc: WEAR SELF CONTAINED BREATHING APPARATUS.
Unusual Fire And Expl Hazrds: MAY GENERATE AMMONIA GAS, CARBON MONOXIDE, AND TOXIC NITROGEN OXIDE GASES. MAY EXPLODE AND CAUSE CONTAINER RUPTURE WHEN HEATED.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): OPEN FLAMES.
Materials To Avoid: OXIDIZING AGENTS, ACIDS.
Hazardous Decomp Products: AMMONIA, CARBON MONOXIDE, CARBON DIOXIDE, NITROGEN OXIDES.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT APPLICABLE

Health Hazard Data

LD50-LC50 Mixture: ORAL LD50 (RAT): 1050 MG/KG
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
IRRITATION OR CHEMICAL BURNS UPON PROLONGED CONTACT. INHALATION: IRRITATION OF RESPIRATORY TRACT. INGESTION: MODERATELY TOXIC. CHRONIC: CHEMICAL BURNS UPON PROLONGED CONTACT.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NOT APPLICABLE
Signs/Symptoms Of Overexp: EYES: SEVERE IRRITATION. SKIN: IRRITATION, MODERATELY TOXIC.
Med Cond Aggravated By Exp: ASTHMA, SKIN DISORDERS AND ALLERGIES. CHRONIC RESPIRATORY DISEASE.
Emergency/First Aid Proc: EYES: FLUSH WITH LARGE AMOUNTS OF WATER. GET MEDICAL ATTENTION. SKIN: REMOVE CONTAMINATED CLOTHING. WASH AREA WITH SOAP DO NOT INDUCE VOMITING. GET MEDICAL ATTENTION.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: VENTILATE AREA WELL. CONTAIN SPILL OR ABSORB IN SUITABLE ABSORBENT, THEN DISPOSE OF IN SUITABLE MANNER.
Neutralizing Agent: SODIUM BISULFITE
Waste Disposal Method: DISPOSE OF WASTE IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS. IF PERMITTED, DISPOSE OF BY BIOLOGICAL METHODS OR INCINERATION.
Precautions-Handling/Storing: STORE IN WELL VENTILATED AREA AWAY FROM IGNITION SOURCES, OXIDIZING AGENTS, ACIDS.
Other Precautions: NONE

Control Measures

Respiratory Protection: SUPPLIED AIR RESPIRATOR WITH FULL FACE SHIELD. SELF-CONTAINED BREATHING APPARATUS. NIOSH APPROVED TYPE C UNDER THE FOLLOWING CONDITIONS: EMERGENCY SITUATIONS, VAPOR CONC. > 20 PPM FOR LONGER THAN 15 MIN., DURING REPAIR & CLEANING OF EQUIP.
Ventilation: MAINTAIN AIR CONCENTRATIONS IN WORK SPACES IN ACCORD WITH APPROPRIATE STANDARDS.
Protective Gloves: BUTYL RUBBER GLOVES.
Eye Protection: SPLASH-PROOF EYE GOGGLES.
Other Protective Equipment: IN EMERGENCY SITUATIONS, USE EYE GOGGLES WITH A FULL FACE SHIELD.

Work Hygienic Practices: WASH AFTER HANDLING AND BEFORE EATING, DRINKING, OR SMOKING. LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.
Suppl. Safety & Health Data: AVOID BREATHING OF VAPORS. AVOID CONTACT WITH SKIN OR EYES. EMPTY CONTAINERS MAY CONTAIN EXPLOSIVE VAPORS.

Transportation Data

Trans Data Review Date: 96031
DOT PSN Code: DWG
DOT Proper Shipping Name: CORROSIVE LIQUIDS, N.O.S.
DOT Class: 8
DOT ID Number: UN1760
DOT Pack Group: III
DOT Label: CORROSIVE
IMO PSN Code: ESH
IMO Proper Shipping Name: CORROSIVE LIQUID, N.O.S. o
IMO Regulations Page Number: 8147
IMO UN Number: 1760
IMO UN Class: 8
IMO Subsidiary Risk Label: -
IATA PSN Code: HKW
IATA UN ID Number: 1760
IATA Proper Shipping Name: CORROSIVE LIQUID, N.O.S. *
IATA UN Class: 8
IATA Label: CORROSIVE
AFI PSN Code: HKW
AFI Prop. Shipping Name: CORROSIVE LIQUID, N.O.S.
AFI Class: 8
AFI ID Number: UN1760
AFI Pack Group: III
AFI Special Prov: A7
AFI Basic Pac Ref: A12.3
N.O.S. Shipping Name: MORPHOLINE

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 31JAN96
Label Status: F
Common Name: MORPHOLINE
Chronic Hazard: NO
Signal Word: WARNING!
Acute Health Hazard-Moderate: X
Contact Hazard-Moderate: X
Fire Hazard-Moderate: X
Reactivity Hazard-None: X
IRRITATION OR CHEMICAL BURNS UPON PROLONGED CONTACT. INHALATION: IRRITATION OF RESPIRATORY TRACT. INGESTION: MODERATELY TOXIC. CHRONIC: CHEMICAL BURNS UPON PROLONGED CONTACT. STORE IN WELL VENTILATED AREA AWAY FROM IGNITION SOURCES, OXIDIZING AGENTS, ACIDS. FIRST AID: EYES: FLUSH WITH LARGE AMOUNTS OF WATER. GET MEDICAL ATTENTION. SKIN: REMOVE CONTAMINATED CLOTHING. WASH AREA WITH SOAP AND WATER. INHALATION: MOVE TO FRESH AIR IF IRRITATION OCCURS. INGESTION: DO NOT INDUCE VOMITING. GET MEDICAL ATTENTION. TARGET ORGANS: EYES, SKIN, RESPIRATORY SYSTEM.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: AIR PRODUCTS AND CHEMICALS INC.
Label Street: 7201 HAMILTON BLVD
Label City: ALLENTOWN
Label State: PA

Label Zip Code: 18195-1501
Label Country: US
Label Emergency Number: 215-481-4911 / 215-481-5900

Van Waters & Rogers Inc.
** Material Safety Data Sheet **

Date:	11/13/2000	Time:	16:50:00
To:	JOE HALL	Fax:	1209-858-4076
From:	PATRICIA LEISZ	Phone:	
Re:	MSDS - MORPHOLINE		

REMARKS:

VW&R

Fax Cover Sheet

Including this cover sheet, you should receive 10 pages.

For emergency assistance involving chemicals,
call CHEMTREC - (800) 424-9300

Van Waters & Rogers, a Royal Pakhoed Company
6100 Carillon Point, Kirkland, WA 98033 425-889-3400

003 10/12/00 MORPHOLINE

****
SECTION I PRODUCT IDENTIFICATION
****

PRODUCT NAME: MORPHOLINE

MSDS #: P17595VS

DATE ISSUED: 3/30/00

SUPERSEDES: 9/8/97

ISSUED BY: 003681

****

2. COMPOSITION/INFORMATION ON INGREDIENTS

THE CRITERIA FOR LISTING COMPONENTS IN THE COMPOSITION SECTION IS AS FOLLOWS: CARCINOGENS ARE LISTED WHEN PRESENT AT 0.1 % OR GREATER; COMPONENTS WHICH ARE OTHERWISE HAZARDOUS ACCORDING TO OSHA ARE LISTED WHEN PRESENT AT 1.0 % OR GREATER; NON-HAZARDOUS COMPONENTS ARE LISTED AT 3.0 % OR GREATER. THIS IS NOT INTENDED TO BE A COMPLETE COMPOSITIONAL DISCLOSURE. REFER TO SECTION 14 FOR APPLICABLE STATES' RIGHT TO KNOW AND OTHER REGULATORY INFORMATION.

Product and/or Component(s) Carcinogenic According to:

OSHA	IARC	NTP	OTHER	NONE
				X

Composition:

Chemical Name	CAS Number	Exposure Limits	Range in %
Morpholine	110-91-8	20 ppm TWA- OSHA (SKIN) 30 ppm STEL-OSHA 20 ppm TWA-ACGIH (SKIN)	100.00

THIS PRODUCT IS CONSIDERED HAZARDOUS ACCORDING TO OSHA (1910.1200).

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW
Appearance:
Colorless liquid

Odor:
Ammonia-like odor

WARNING STATEMENT

DANGER ! FLAMMABLE LIQUID AND VAPOR
CORROSIVE - CAUSES EYE AND SKIN BURNS
HARMFUL OR FATAL IF SWALLOWED
HARMFUL IF ABSORBED THROUGH SKIN
CAUSES RESPIRATORY TRACT IRRITATION AND CAN CAUSE DAMAGE
ASPIRATION HAZARD IF SWALLOWED -
CAN ENTER LUNGS AND CAUSE DAMAGE
HARMFUL IF ABSORBED THROUGH SKIN
DO NOT ADD NITRITES - MAY FORM SUSPECTED CANCER CAUSING NITROSAMINES

HMIS			NFPA		
Health:	3	Reactivity: 0	Health:	3	Reactivity: 0
Flammability:	3	Special : -	Flammability:	3	Special : -

POTENTIAL HEALTH EFFECTS

	EYE	SKIN	INHALATION	INGESTION
Primary Route of Exposure:	X	X	X	

EFFECTS OF OVEREXPOSURE
Acute:
Eyes:
Causes irritation, experienced as pain, with excess blinking and tear production, and seen as extreme redness and swelling of the eye and chemical burns of the eye. Severe eye damage may cause blindness.

Skin:
In addition to the potential skin irritation effects noted above, skin contact may result in other adverse health effects. Causes severe irritation with pain, severe excess redness and swelling with chemical burns, blister formation, and possible tissue destruction.

Inhalation:
Vapors or mist, especially as generated from heating the material or as from exposure in poorly ventilated areas or confined spaces, are irritating and cause nasal discharge, coughing, and discomfort in nose and throat. Prolonged or repeated overexposure may result in lung damage. Prolonged or repeated overexposure may result in the absorption of potentially harmful amounts of material.

Ingestion:
Causes burning of mouth, throat, and stomach with abdominal and chest pain, nausea, vomiting, diarrhea, thirst, weakness, and collapse. Aspiration may occur during swallowing or vomiting, resulting in lung damage.

Sensitization Properties:
Although there has been secondary (anecdotal reports of the potential for morpholine to be a dermal sensitizer in humans, the weight of the available scientific information indicates that morpholine is not expected to be a dermal sensitizer based on animal and human skin patch testing data.

Chronic:
Repeated skin contact may cause a persistent irritation or dermatitis. Repeated inhalation may cause lung damage.

Medical Conditions Aggravated by Exposure:
Skin contact may aggravate an existing dermatitis (skin condition) Overexposure to vapor, dust or mist may aggravate existing respiratory conditions, such as asthma, bronchitis, and inflammatory or fibrotic respiratory disease.

Other Remarks:
This product contains one or more amines which may produce temporary and reversible hazy or blurred vision. Symptoms disappear when exposure is terminated.

4. FIRST AID MEASURES

Eyes:
Immediately flush eyes with large amounts of running water for at least 15 minutes. Hold eyelids apart while flushing to rinse entire surface of eye and lids with water. Do not attempt to neutralize with chemical agents. Obtain medical attention immediately. Continue flushing for an additional 15 minutes if medical attention is not immediately available.

Skin:
Immediately remove contaminated clothing and shoes. Under a safety shower, flush skin thoroughly with large amounts of running water for at least 15 minutes. Do not attempt to neutralize with chemical agents. Get medical attention immediately. Discard or decontaminate clothing and shoes before reuse.

Ingestion:
If person is conscious and can swallow, immediately give two glasses of water (16 oz.) but do not induce vomiting. This material is corrosive. If vomiting occurs, give fluids again. Have a physician determine if condition of patient will permit induction of vomiting or evacuation of stomach. Do not give anything by mouth to an unconscious or convulsing person.

Inhalation:
If inhaled, remove to fresh air. If not breathing or in respiratory distress, clear person's airway and start artificial respiration. With a physician's advice, give supplemental oxygen using a bag-valve mask or manually triggered oxygen supply.

Other Instructions:
Swallowing of this corrosive material may result in severe ulceration, inflammation, and possible perforation of the upper alimentary tract, with hemorrhage and fluid loss. Aspiration of this product during induced emesis can result in severe lung injury. If evacuation of stomach is necessary, use method least likely to cause aspiration, such as gastric lavage after endotracheal intubation. Contact a Poison Control Center for additional treatment information.

5. FIRE-FIGHTING MEASURES

Ignition Temperature - AIT (degrees F):
310 (590 F)

Flash Point (degrees C):
35 (95 F) (TCC)

Flammable Limits (%):
Lower: 1.8
Upper: 10.8

Recommended Fire Extinguishing Agents And Special Procedures:
Water may be ineffective on flames but should be used to cool fire-exposed containers and provide protection for persons attempting to stop the leak. Use water spray, dry chemical, alcohol resistant foam or carbon dioxide to extinguish fire.

Unusual or Explosive Hazards:
Danger! Flammable materials may release vapors that travel long distances, ignite and flash back. Containers may explode in a fire. Do not expose to heat, sparks, flame, or other sources of ignition. When handling, use non-sparking tools, ground and bond all containers.

Special Protective Equipment for Firefighters:
Wear special chemical protective clothing and positive pressure self-contained breathing apparatus. Approach fire from upwind to avoid hazardous vapors and toxic decomposition products. Decontaminate or discard any clothing that may contain chemical residues.

6. ACCIDENTAL RELEASE MEASURES

Procedures in Case of Accidental Release, Breakage or Leakage:
Eliminate all ignition sources including internal combustion engines and power tools. Ventilate area. Barricade the immediate hazard area. Stay upwind and warn of possible downwind explosion hazard. Avoid breathing vapor. Avoid contact with skin, eyes, or clothing. Pressure demand air supplied respirators should always be worn when the airborne concentration of the contaminant or oxygen is unknown. Otherwise, wear respiratory protection and other personal protective equipment as appropriate for the potential exposure hazard. Contain spill if possible. Remove with inert absorbent. Prevent entry into sewers and waterways.

7. HANDLING AND STORAGE

Precautions to be Taken in Handling:
Use spark-proof tools. Material may be at elevated temperatures and/or pressures. Exercise care when opening bleeders and sampling ports.
Eye wash and safety shower should be available nearby when this product is handled or used.

Storage:
Ground and bond shipping container, transfer line, and receiving container.
Keep away from heat, sparks, flame, and other sources of ignition.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Protective Equipment (Type)

Eye/Face Protection:
Avoid eye contact. Chemical type goggles with face shield must be worn.
Do not wear contact lenses.

Skin Protection:
Protective clothing such as coveralls or lab coats must be worn. Launder or dry-clean when soiled. Gloves resistant to chemicals and petroleum distillates required. When handling large quantities, impervious suits, gloves, and rubber boots must be worn.

Respiratory Protection:
Airborne concentrations should be kept to lowest levels possible. If vapor, mist or dust is generated and the occupational exposure limit of the product, or any component of the product, is exceeded, use appropriate NIOSH or MSHA approved air purifying or air supplied respirator after determining the airborne concentration of the contaminant. Air supplied respirators should always be worn when airborne concentration of the contaminant or oxygen content is unknown.

Ventilation:
Adequate to meet occupational exposure limits (see below).

Exposure Limit for Total Product:
Morpholine: OSHA PEL-TWA 20 ppm; STEL 30 ppm (SKIN)
ACGIH TLV-TWA 20 ppm (SKIN)

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:
Colorless liquid

Odor:
Ammonia-like odor

Boiling Point (degrees C):
128.3 (263 F)

Melting/Freezing point (degrees C):
-5 (23 F)

Specific Gravity (water=1):
1.0017

pH :
11.2

Vapor Pressure:
7 mmHg at 20 C (68 F)

Viscosity:

2.2 cSt at 20.0 C (68 F)

VOC Content:
100% BY ASTM D 2369

Vapor Density (air=1):
3

Solubility in Water (%):
> 10

Other: None

10. STABILITY AND REACTIVITY

This Material Reacts Violently With:

Air	Water	Heat	Strong Oxidizers	Others	None of These
		X	X	X	

Comments:
This material reacts violently with acids.
Do not add or formulate with nitrites. See Section 16, OTHER INFORMATION.

Products Evolved When Subjected to Heat or Combustion:
Toxic levels of ammonia, combustion products of nitrogen, carbon monoxide, carbon dioxide, irritating aldehydes and ketones may be formed on burning in a limited air supply.

Hazardous Polymerizations: DO NOT OCCUR

11. TOXICOLOGICAL INFORMATION

TOXICOLOGICAL INFORMATION(ANIMAL TOXICITY DATA)

Oral:
LD50 1.05 g/kg (rat) moderately toxic

Inhalation:
Believed to be practically non-toxic

Dermal:
LD50 1.21 g/kg (rabbit) moderately toxic

Irritation Index, Estimation of Irritation (Species)

Skin:
(Draize) 8.00 /8.0 (rabbit) corrosive

Eyes:
(Draize) Believed to be > 80.00 - 110.00 /110 (rabbit) extremely irritating

Sensitization:
Although there has been secondary (anecdotal) reports of the potential for Morpholine to be a dermal sensitizer in humans, the weight of the available scientific information indicates that morpholine is not expected to be a dermal sensitizer based on animal and human skin patch testing data.

Other:
Prolonged and repeated exposure to morpholine vapors causes ocular, nasal, and skin irritation in laboratory animals. Prolonged and repeated inhalation of morpholine vapors did not cause cancer or organ damage in rats exposed for up to 2 years.

12. DISPOSAL CONSIDERATIONS

Waste Disposal Methods

This product (as presently constituted) has the RCRA characteristics of ignitability, and, if discarded in its present form, would have the hazardous waste number of D001. Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste. This is because product uses, transformations, mixtures, processes, etc. may change the classification to non-hazardous, or hazardous for reasons other than, or in addition to ignitability.

Remarks
None

13. TRANSPORT INFORMATION

Transportation
DOT:
Proper Shipping Name:
Morpholine

Hazard Class:
3(8)

Identification Number:
UN 2054

Packing Group:
III (See Section 16 of MSDS for additional information on the Packing Group designation for morpholine)

Label Required:
Flammable liquid, Corrosive

IMDG:
Proper Shipping Name:
Morpholine

Hazard Class:
3.3(8)

Identification Number:
UN 2054

Packing Group:
III (See Section 16 of MSDS for additional information on the Packing Group designation for morpholine)

Label Required:
Flammable liquid, Corrosive

ICAO:
Proper Shipping Name:
Morpholine

Hazard Class:
3(8)

Identification Number:
UN 2054

Packing Group:
III (See Section 16 of MSDS for additional information on the Packing Group designation for morpholine)

Label Required:
Flammable liquid, Corrosive

TDG:
Proper Shipping Name:
Morpholine

Hazard Class:
3.3/8

Identification Number:
UN 2054

Label Required:
Flammable liquids, corrosive

14. REGULATORY INFORMATION

Federal Regulations:
SARA Title III:
Section 302/304 Extremely Hazardous Substances

Chemical Name	CAS Number	Range in %
None		

Section 311 Hazardous Categorization:

Acute	Chronic	Fire	Pressure	Reactive	N/A
X	X	X			

Section 313 Toxic Chemical

Chemical Name	CAS Number	Concentration
None		

CERCLA 102(a)/DOT Hazardous Substances:

Chemical Name	CAS Number	Range in %
None		

States Right-to-Regulations

Chemical Name	State Right-to-know
Morpholine	CT, FL, IL, MA, NJ, PA, RI

State list: CT (Connecticut), FL (Florida), IL (Illinois), MI (Michigan), LA, (Louisiana), MA (Massachusetts), NJ (New Jersey), PA (Pennsylvania), RI (Rhode Island)

California Prop 65:
The following detectable components of this product are substances or belong to classes of substances, known to the State of California to cause cancer and/or reproductive toxicity.

Chemical Name	CAS Number
None	

INTERNATIONAL REGULATIONS

TSCA Inventory Status:
This product, or its components, are listed on or are exempt from the Toxic Substance Control Act (TSCA) Chemical Substance Inventory.

WHMIS Classification:
Class D, Div 1, Subdiv B, Toxic
Class B, Div 2 Flammable liquid
Class E Corrosive

Canadian Inventory Status:
This product, or its components, are listed on or are exempt from the Canadian Domestic Substance List (DSL)

EINECS Inventory Status:

This product, or its components, are listed on or are exempt from the European Inventory of Existing Chemical Substances (EINECS) or the European List of Notified Chemical Substances (ELINCS)

Australian Inventory Status:
This product, or its components, are listed on or are exempt from the Australian Inventory of Chemical Substances (AICS)

Japan Inventory Status:
This product or its components, are listed on or are exempt from the Japan Ministry of International Trade and Industry (MITI) inventory.

SECTION 15 ENVIRONMENTAL INFORMATION

Aquatic Toxicity:
LC50-96hr Aquatic toxicity rating is > 100.00 - 1000.00 ppm practically non-toxic

Mobility:
Not determined.

Persistence and Biodegradability:
Expected to slowly biodegrade in the environment.

Potential to Bioaccumulate:
Not expected to bioaccumulate (log Kow = -0.84 (pH 10) to -2.55 (pH 7)

Remarks:
None

16. OTHER INFORMATION
Please note: The Department of Transportation (DOT) classification for morpholine, UN 2054, as a Packing Group III flammable liquid, does not address the potential dermal corrosivity hazards of morpholine. Huntsman has recently sponsored DOT dermal corrosivity studies using morpholine which indicate that morpholine should be reclassified as a Packing Group I dermal corrosive. On the basis of these studies, vendor has petitioned the DOT for a change in the Hazardous Materials Table entry for morpholine, from Packing Group III flammable liquid to Packing Group I corrosive liquid with a subsidiary hazard of flammability. Until the DOT rules on our petition for this change, we will continue to identify morpholine as a Packing Group III flammable liquid on our MSDS, product labels, and shipping papers, to minimize any confusion which could result from a discrepancy between our DOT Packing Group determination and the existing DOT classification for morpholine.

"SKIN" notation in Section 2 indicates possible adverse health effects as a result of absorption through the skin, mucous membranes and eyes, by contact with vapor, mist, spray or liquid. Appropriate measures should be taken to minimize contact.

Do not add nitrites. This product contains amines which can combine with nitrites or other nitrosating agents to form nitrosamines. Many nitrosamines have been found to cause cancer in laboratory animals.

---------- FOR ADDITIONAL INFORMATION ----------
CONTACT: MSDS COORDINATOR VAN WATERS & ROGERS INC.
DURING BUSINESS HOURS, PACIFIC TIME (425)889-3400
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* * * E N D O F M S D S * * *

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Departamento de Qu imica Inorg anica, Facultad de Farmacia, Universidad de Salamanca, Spain.
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03333895 Subfile: BIOSIS-98-19186
Risk in cleaning: Chemical and physical exposure.
WOLFKOFF P; SCHNEIDER T; KILDESO J; DEGERTH R; JAROSZEWSKI M; SCHUNK H
Natl. Inst. Occupational Health, Lerso Parkalle 105, DK-2100 Copenhagen, Denmark.
Source: SCIENCE OF THE TOTAL ENVIRONMENT; 215 (1-2). 1998. 135-156. Coden: STEND
Language: *ENGLISH*

6/3/26
DIALOG(R)File 156:Toxline(R)

03324602 Subfile: BIOSIS-98-09891
Increased cytotoxic sensitivity of cultured FHM fish cells by simultaneous treatment with sodium dodecyl sulfate and buthionine sulfoximine.
DIERICKX PJ
Scientific Inst. Public Health, Afdeling Toxikologie, Wytsmanstraat 14, B-1050 Brussel, Belgium.
Source: CHEMOSPHERE; 36 (6). 1998. 1263-1274. Coden: CMSHA
Language: *ENGLISH*

6/3/27
DIALOG(R)File 156:Toxline(R)

03323701 Subfile: BIOSIS-98-08989
Plasmid-assisted morpholine degradation by Pseudomonas fluorescens CAS 102.
CHANDRASEKARAN S; LALITHAKUMARI D
Environmental Biotechnol. Programme, Centre Advanced Studies Botany, Univ. Madras, Madras-600 025, India.
Source: WORLD JOURNAL OF MICROBIOLOGY & BIOTECHNOLOGY; 14 (1). 1998. 7-10. Coden: WJMBE
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS.

6/3/28
DIALOG(R)File 156:Toxline(R)

03318534 Subfile: BIOSIS-98-03820
Toxicity of aliphatic amines: Structure-activity relationship.
GREIM H; BURY D; KLIMISCH H-J; OEBEN-NEGELE M; ZIEGLER-SKYLAKAKIS K
GSF--Inst. Toxikologie, Neuherberg Postfach 1129, 85758 Oberschleissheim, Germany.
Source: CHEMOSPHERE; 36 (2). 1998. 271-295. Coden: CMSHA
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS.

6/3/29
DIALOG(R)File 156:Toxline(R)

03316237 Subfile: BIOSIS-98-01523
Carcinogenicity of methylurea or morpholine in combination with sodium nitrite in a rat multi-organ carcinogenesis bioassay.
KITANO M; TAKADA N; CHEN T; ITO H; NOMURA T; TSUDA H; WILD CP; FUKUSHIMA S
First Dep. Pathol., Osaka City Univ. Med. Sch., 1-4-54 Asahi-machi, Abeno-ku, Osaka 545, Japan.
Source: JAPANESE JOURNAL OF CANCER RESEARCH; 88 (9). 1997. 797-806. Coden: JJCRE
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS.

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DIALOG(R)File 156:Toxline(R)
(c) format only 2000 The Dialog Corporation. All rts. reserv.

03311898 Subfile: BIOSIS-97-32129
CALMODULIN ANTAGONISTS AS POTENTIAL ANTIFUNGAL AGENTS
COUTTS I GC; BULPIT P CA; CUMMINS PJ; BUCKLEY GA; MILLS SD
Source: MEETING ON DESIGN OF BIOACTIVE COMPOUNDS: POSSIBILITIES FOR INDUSTRIAL APPLICATIONS', POSTDAM, GERMANY, SEPTEMBER 4-7, 1995. PESTICIDE SCIENCE; 51 (1). 1997. 99-101. Coden: PSSCB
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS. RRM

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DIALOG(R)File 156:Toxline(R)
(c) format only 2000 The Dialog Corporation. All rts. reserv.

03304921 Subfile: BIOSIS-97-25149
ACTIVATED SLUDGE AND OTHER AEROBIC SUSPENDED CULTURE PROCESSES
COWAN RM; ALAGAPPAN G; ELLIS TG; HIGGINS MJ; UBEROI V
Source: WATER ENVIRONMENT RESEARCH; 69 (4). 1997. 462-487. Coden: WAERE
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS. RRM

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DIALOG(R)File 156:Toxline(R)
(c) format only 2000 The Dialog Corporation. All rts. reserv.

03304517 Subfile: BIOSIS-97-24745
A hazard ranking of organic contaminants in refinery effluents.
SILJEHOLM J
Center Int. Studies, Massachusetts Inst. Technol., Cambridge, MA 02139, USA.
Source: TOXICOLOGY AND INDUSTRIAL HEALTH; 13 (4). 1997. 527-551. Coden: TIHEE
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS.

6/3/33
DIALOG(R)File 156:Toxline(R)
(c) format only 2000 The Dialog Corporation. All rts. reserv.

03296813 Subfile: BIOSIS-97-17035
Analysis of primary and secondary aliphatic amines in waste water and surface water by gas chromatography-mass spectrometry after derivatization with 2,4-dinitrofluorobenzene or benzenesulfonyl chloride.
SACHER F; LENZ S; BRAUCH H-J
DVGW-Technologiezentrum Wasser, Karlsruher Str. 84, 76139 Karlsruhe, Germany.
Source: JOURNAL OF CHROMATOGRAPHY A; 764 (1). 1997. 85-93. Coden: JCRAE
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS.

6/3/34
DIALOG(R)File 156:Toxline(R)

03291281 Subfile: BIOSIS-97-11499
Photocatalytic degradation of aromatic and alicyclic pollutants in water: By-products, pathways and mechanisms.
PICHAT P
URA au CNRS no. 1385, "Photocatalyse, Catalyse et Environnement", Ecole Centrale de Lyon, BP 163, 69131 Ecully Cedex, France.
Source: WATER SCIENCE AND TECHNOLOGY; 35 (4). 1997. 73-78. Coden: WSTED
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS.

6/3/35
DIALOG(R)File 156:Toxline(R)

03283328 Subfile: BIOSIS-96-06615
Fuzzy clustering of existing chemicals according to their ecotoxicological properties.
FRIEDERICHS M; FRAENZLE O; SALSKI A
Inst. Geography, Univ. Kiel, Ludewig-Meyn-Str. 14, 24089 Kiel, Germany.
Source: ECOLOGICAL MODELLING; 85 (1). 1996. 27-40. Coden: ECMOD
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS.

6/3/36
DIALOG(R)File 156:Toxline(R)

03278360 Subfile: BIOSIS-97-01472
Resistance to sterol demethylation inhibitors in Ustilago maydis. III. Cross-resistance patterns and sterol analysis.
WELLMANN H; SCHAUZ K; TIEMANN R
Dep. Biol., NW2, Univ. Bremen, PO Box 330440, D-28334 Bremen, Germany.
Source: PESTICIDE SCIENCE; 48 (3). 1996. 239-246. Coden: PSSCB
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS.

6/3/37
DIALOG(R)File 156:Toxline(R)

03278064 Subfile: BIOSIS-97-01176
Morpholine biodegradation in a bioreactor.
LAMANT C; JAFFRIN MY
Dep. Biological Eng., URA CNRS 858, Univ. Compiegne, BP 529, 60205 Compiegne Cedex, France.
Source: JOURNAL OF CHEMICAL TECHNOLOGY AND BIOTECHNOLOGY; 67 (3). 1996. 291-301. Coden: JCTBE
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS.

6/3/38
DIALOG(R)File 156:Toxline(R)
(c) format only 2000 The Dialog Corporation. All rts. reserv.

03270694 Subfile: BIOSIS-96-32560
GENOTOXIC ACTIVITY TESTING IN A LABORATORY CONSTRUCTION FOR HETEROTROPIC BIOLOGICAL DENITRIFICATION OF DRINKING WATER
KEVEKORDES S; URBAN M; JANZOWSKI C; EISENBRAND G; DUNKELBERG H
Source: 25TH ANNUAL MEETING OF THE EUROPEAN ENVIRONMENTAL MUTAGEN SOCIETY, NOORDWIJKERHOUT, NETHERLANDS, JUNE 18-23, 1995. MUTATION RESEARCH; 360 (3). 1996. 279-280. Coden: MUREA
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS. RRM

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DIALOG(R)File 156:Toxline(R)
(c) format only 2000 The Dialog Corporation. All rts. reserv.

03267745 Subfile: BIOSIS-96-29610
MORPHOLINE DEGRADATION BY STRAIN MYCOBACTERIUM AURUM MOI IMPROVEMENT OF CELLS GROWTH AND MORPHOLINE DEGRADATION RATE BY CELLS IMMOBILIZATION
POUPIN P; MAZURE N; TRUFFAUT N
Source: WIJFFELS, R. H., ET AL. (ED.). PROGRESS IN BIOTECHNOLOGY, VOL. 11. IMMOBILIZED CELLS: BASICS AND APPLICATIONS; INTERNATIONAL SYMPOSIUM, NOORDWIJKERHOUT, NETHERLANDS, NOVEMBER 26-29, 1995. XVII+845P. ELSEVIER SCIENCE, INC.: TARRYTOWN, NEW YORK, USA; ELSEVIER SCIENCE PUBLISHERS LTD.: OXFORD, ENGLAND, UK. ISBN 0-444-81984-3.; 0 (0). 1996. 770-776. Coden: 53467
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS. RRM

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DIALOG(R)File 156:Toxline(R)
(c) format only 2000 The Dialog Corporation. All rts. reserv.

03265007 Subfile: BIOSIS-96-26868
Genetics of responses to morpholine-type fungicides and of avirulences in Erysiphe graminis f. sp. hordei.
BROWN J KM; LE BOULAIRE S; EVANS N
Cereals Res. Dep., John Innes Centre, Colney Lane, Norwich NR4 7UH, UK.
Source: EUROPEAN JOURNAL OF PLANT PATHOLOGY; 102 (5). 1996. 479-490. Coden: XXAAT
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS.

6/3/41
DIALOG(R)File 156:Toxline(R)
(c) format only 2000 The Dialog Corporation. All rts. reserv.

03263495 Subfile: BIOSIS-96-25355
ENVIRONMENTAL HEALTH CRITERIA 179. MORPHOLINE
W HO
Source: WHO. ENVIRONMENTAL HEALTH CRITERIA, 179. MORPHOLINE. 163P. WHO: GENEVA, SWITZERLAND. ISBN 92-4-157179-9.; 179 (0). 1996. 163P. Coden: EHCRD
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS. RRM

6/3/42
DIALOG(R)File 156:Toxline(R)
(c) format only 2000 The Dialog Corporation. All rts. reserv.

03261462 Subfile: BIOSIS-96-23322
Derivatization reactions for the determination of amines by gas chromatography and their applications in environmental analysis.
KATAOKA H
Fac. Pharmaceutical Sciences, Okayama University, Tsushima, Okayama 700, Japan.
Source: JOURNAL OF CHROMATOGRAPHY A; 733 (1-2). 1996. 19-34. Coden: JCRAE
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS.

6/3/43
DIALOG(R)File 156:Toxline(R)
(c) format only 2000 The Dialog Corporation. All rts. reserv.

03261026 Subfile: BIOSIS-96-22886
Determination of aliphatic and alicyclic amines in water by gas and liquid chromatography after derivatization by chloroformates.
PIETSCH J; HAMPEL S; SCHMIDT W; BRAUCH H-J; WORCH E
DVGW-Technol. Wasser Karlsrhue, Aussenstelle Dresden, Scharfenberger Strasse 152, D-01139 Dreseden, Germany.
Source: FRESENIUS' JOURNAL OF ANALYTICAL CHEMISTRY; 355 (2). 1996. 164-173. Coden: FJACE
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS.

6/3/44
DIALOG(R)File 156:Toxline(R)
(c) format only 2000 The Dialog Corporation. All rts. reserv.

03260335 Subfile: BIOSIS-96-22195
TOXICOLOGICAL ASPECTS OF FOOD ANTIOXIDANTS
MADHAVI DL; SALUNKHE DK
Source: MADHAVI, D. L., S. S. DESHPANDE AND D. K. SALUNKHE (ED.). FOOD SCIENCE AND TECHNOLOGY (NEW YORK), 71. FOOD ANTIOXIDANTS: TECHNOLOGICAL, TOXICOLOGICAL, AND HEALTH PERSPECTIVES. VIII+490P. MARCEL DEKKER, INC.: NEW YORK, NEW YORK, USA; BASEL, SWITZERLAND. ISBN 0-8247-9351-X.; 71 (0). 1996. 267-359. Coden: FSTEE
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS. RRM

6/3/45
DIALOG(R)File 156:Toxline(R)
(c) format only 2000 The Dialog Corporation. All rts. reserv.

03251341 Subfile: BIOSIS-96-13197
Quantitative structure-activity relationships (QSARs) for skin corrosivity of organic acids, bases and phenols: Principal components and neural network analysis of extended datasets.
BARRATT MD
Unilever Environ. Safety Lab., Colworth House, Sharnbrook, Bedford MK44 1LQ, UK.
Source: TOXICOLOGY IN VITRO; 10 (1). 1996. 85-94. Coden: TIVIE
Language: *ENGLISH*
BIOSIS COPYRIGHT: BIOL ABS.

CHEMICAL ABSTRACTS references for morpholine and steam, 1996 to present

L7 ANSWER 1 OF 4 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 133:275699 CA
TITLE: Aqueous solution of N-methylmorpholine N-oxide as a stationary liquid phase in ***steam*** chromatography
AUTHOR(S): Berezkin, V. G.; Sorokina, E. Yu.; Sokolov, A. I.; Arzamastsev, A. P.; Golova, L. K.
CORPORATE SOURCE: A. V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences, Moscow, 117912, Russia
SOURCE: Russ. Chem. Bull. (2000), 49(6), 1071-1078
CODEN: RCBUEY; ISSN: 1066-5285
PUBLISHER: Consultants Bureau
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

AB The retention of >70 volatile org. compds. of different classes was studied by ***steam*** chromatog. using aq. solns. of N-methylmorpholine N-oxide as the stationary liq. phase (SLP). The effects of temp. and compn. of the mobile phase on the retention factors (k) for polar and nonpolar sorbates were elucidated. An unusual order of elution of aliph. alcs. was noted, namely, tert-Bu alc. < sec-Bu alc. < isopentyl alc. < iso-Bu alc. < iso-Pr alc. < n-pentyl alc. < Bu alc. < Pr alc. < ethanol < methanol. The retention of cyclohexanol was longer than those of benzyl alc. and n-hexyl alc. Nitrogen-contg. compds. were selectively sepd. on the water-org. SLP studied. For example, the retention of aniline was much longer than those of its derivs., N,N-dimethylaniline and N,N-diethylaniline, having higher b.ps.

L7 ANSWER 2 OF 4 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 126:163320 CA
TITLE: Laboratory study of corrosion of ***steam*** generator tubes: preliminary results
AUTHOR(S): Sala, B.; Organista, M.; Henry, K.; Erre, R.; Gelpi, A.; Cattant, F.; Dupin, M.
CORPORATE SOURCE: Departement Chimie-Corrosion, Centre Technique Framatome, Le Creusot, 71205, Fr.
SOURCE: Int. Symp. Environ. Degrad. Mater. Nucl. Power Syst.--Water React., 7th (1995), Volume 1, 259-275. Editor(s): Airey, Geoffrey. NACE International: Houston, Tex.
CODEN: 63RVA7
DOCUMENT TYPE: Conference
LANGUAGE: ***English***

AB Secondary side intergranular attack (IGA) and intergranular stress corrosion cracking (IGSCC) of ***steam*** generator tubes often occurs in crevices where impurities are concd., due to local elevated temps. and restricted water flow. From the anal. of tubes pulled from PWR plants, it is believed that aluminosilicate deposits and/or org. species may play a role in the development of IGA in near neutral environments. New observations suggest that similar environments and similar processes are operative inside the corroded grain boundaries. A former study using autoclave tests was mainly devoted to the formation of aluminosilicate deposits similar to those obsd. in nuclear power plants. The present work pursues the study of local environments responsible for IGA/SC. It confirms former results on the catalytic decompn. of org. species into acetates and presents more details on the mechanism of formation of aluminosilicate deposits on Alloy 600, particularly on the role of iron and, to a lesser extent, nickel cations. It is shown that, under the aluminosilicate deposits and in the presence of some org. species, a non-protective chromium rich layer may grow instead of the usual protective spinel oxide. The mechanism responsible for the formation of this layer is believed to involve interaction between iron and, to a lesser extent, nickel with silica and/or possible interaction between chromium and acetates. Preliminary capsule tests indicate that these conditions may induce the initiation of IGA.

L7 ANSWER 3 OF 4 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 126:80888 CA
TITLE: Modeling and field studies of fouling in once-through ***steam*** generators
AUTHOR(S): Thompson, Rocky; Gaudreau, Tina
CORPORATE SOURCE: Florida Power Corporation, Crystal River, FL, 34428-6708, USA
SOURCE: Int. Symp. Environ. Degrad. Mater. Nucl. Power Syst.--Water React., 7th (1995), Volume 1, 363-373. Editor(s): Airey, Geoffrey. NACE International: Houston, Tex.
CODEN: 63RVA7
DOCUMENT TYPE: Conference; General Review
LANGUAGE: ***English***

AB Efforts of the past 10 yr to minimize fouling of the Crystal River-3 once-through ***steam*** generators (OTSG) are reviewed. The major focus has been on improving at-temp. pH control in the secondary cycle. Various concns. of different pH control agents were tested in the field for hundreds of days to det. their effect on ***steam*** generator fouling. High concns. of morpholine (50 - 100 ppm) in the feedwater were found to apparently produce de-fouling of the ***steam*** generators without an assocd. decrease in feedwater iron concn. as compared to that at lower levels of morpholine. Computer modeling of the pH(t) within the OTSG for the various chemistries tested indicates that the pH can change significantly with elevation within the ***steam*** generator by varying the pH control agent or its concn. It is postulated that these variations in pH may change the surface charge of the tubes, tube support plates, and/or corrosion product particles in soln., to favor either deposition or repulsion of the particles, and thereby produce conditions that either favor fouling or de-fouling of the OTSG. Crystal River-3 experience indicates that corrosion product deposition and release processes inside the ***steam*** generator can be chem. manipulated to favor release, and thereby maximize plant performance, and delay or avoid costly hydraulic or chem. cleaning. 6 Refs.

L7 ANSWER 4 OF 4 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 124:69239 CA
TITLE: Sodium throw from deep bed polishers with alternate amine chemistry
AUTHOR(S): Miller, Alan D.; Asay, Roger H.; Millett, Peter J.
CORPORATE SOURCE: Pedro Point Technology, USA
SOURCE: Chim. React. Eau Actes Conf. Int. (1994), Volume 2, 699-702. Societe Francaise d'Energie Nucleaire: Paris, Fr.
CODEN: 61SMA5
DOCUMENT TYPE: Conference
LANGUAGE: ***English***

AB In the PWR secondary side and in some high pressure fossil fired power generating plants, corrosion is controlled by maintaining an elevated pH and controlling oxygen. Ammonia and hydrazine historically have allowed an all volatile chem. wherein the pH can be elevated to the passive range and oxygen scavenged effectively. Alternatives to this chem. may offer the plant operators better corrosion control at a lower cost by allowing for even higher pH levels. Favorable partitioning of the amine into the liq. phase may also better protect components within the plant. Several amines have been identified which offer better corrosion protection throughout the ***steam*** cycle. Lab. tests show that these alternate amines can be successfully used by the plants without deleterious effects on plant chem. or materials. The tests were conducted in a resin test loop using two types of condensate polisher resins: high cross-linked macroporous resins and premium gel-type resins.

CC 71-4 (Nuclear Technology)
Section cross-reference(s): 61

IT 107-15-3, 1,2-Ethanediamine, uses ***110-91-8*** , Morpholine, uses 124-68-5, 2-Amino-2-methyl-1-propanol 141-43-5, uses 5332-73-0, 3-Methoxypropylamine 7664-41-7, Ammonia, uses
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(***condensate*** demineralizer sodium sloughage during alternative amine corrosion inhibitor tests in a PWR resin test loop)

CHEMICAL ABSTRACTS references for morpholine and boilers or food processing or condensate, 1996 to present

L8 ANSWER 1 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 133:296492 CA
TITLE: Synthesis of chiral 2-oxo- and 2-thio-1,3,2-oxazaphospholidines via the asymmetric cyclization of L-serinoates with (thio)phosphoryl dichlorides
AUTHOR(S): He, Zheng-Jie; Chen, Wen-Bin; Zhou, Zheng-Hong; Tang, Chu-Chi
CORPORATE SOURCE: The State Key Laboratory of Elemento-Organic Chemistry, Institute of Elemento-Organic Chemistry, Nankai University, Tianjin, 300071, Peop. Rep. China
SOURCE: Synth. Commun. (2000), 30(18), 3473-3479
CODEN: SYNCAV; ISSN: 0039-7911
PUBLISHER: Marcel Dekker, Inc.
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 2 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 133:58620 CA
TITLE: Preparation of hydroxy diphenyl urea sulfonamides as IL-8 receptor antagonists
INVENTOR(S): Jin, Qi; McCleland, Brent W.; Palovich, Michael R.; Widdowson, Katherine L.
PATENT ASSIGNEE(S): Smithkline Beecham Corp., USA
SOURCE: PCT Int. Appl., 116 pp.
CODEN: PIXXD2
DOCUMENT TYPE: Patent
LANGUAGE: ***English***
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2000035442	A1	20000622	WO 1999-US29940	19991215

L8 ANSWER 3 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 132:308444 CA
TITLE: Probing the Dynamic Features of Bis(aminocyclopentadienyl) and Bis(aminoindenyl) Zirconium Complexes
AUTHOR(S): Knueppel, Stephanie; Faure, Jean-Luc; Erker, Gerhard; Kehr, Gerald; Nissinen, Maija; Froehlich, Roland
CORPORATE SOURCE: Organisch-Chemisches Institut, Universitaet Muenster, Muenster, D-48149, Germany
SOURCE: Organometallics (2000), 19(7), 2m1262-1268
CODEN: ORGND7; ISSN: 0276-7333
PUBLISHER: American Chemical Society
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 4 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 132:308205 CA
TITLE: The synthesis of 5-alkoxy and 5-amino substituted thiophenes
AUTHOR(S): Pinto, Ivan L.; Jarvest, Richard L.; Serafinowska, Halina T.
CORPORATE SOURCE: New Frontiers Science Park, SmithKline Beecham Pharmaceuticals, Essex, CM19 5AW, UK
SOURCE: Tetrahedron Lett. (2000), 41(10), 1597-1600
CODEN: TELEAY; ISSN: 0040-4039
PUBLISHER: Elsevier Science Ltd.
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 5 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 132:207918 CA
TITLE: Formation of functionalized [3]ferrocenophane derivatives by an enamine condensation reaction. [Erratum to document cited in CA131:337139]
AUTHOR(S): Knuppel, Stephanie; Frohlich, Roland; Erker, Gerhard
CORPORATE SOURCE: Organisch-Chemisches Institut, Universitat Munster, Munster, D-48149, Germany
SOURCE: J. Organomet. Chem. (2000), 595(2), 307
CODEN: JORCAI; ISSN: 0022-328X
PUBLISHER: Elsevier Science S.A.
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 6 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 132:3093 CA
TITLE: Preparation of Chiral, C-Protected .alpha.-Amino Aldehydes of High Optical Purity and Their Use as Condensation Components in a Linear Synthesis Strategy
AUTHOR(S): Myers, Andrew G.; Kung, Daniel W.; Zhong, Boyu; Movassaghi, Mohammad; Kwon, Soojin
CORPORATE SOURCE: Department of Chemistry and Chemical Biology, Harvard University, Cambridge, MA, 02138, USA
SOURCE: J. Am. Chem. Soc. (1999), 121(36), 8401-8402
CODEN: JACSAT; ISSN: 0002-7863
PUBLISHER: American Chemical Society
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 7 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 131:337139 CA
TITLE: Formation of functionalized [3]ferrocenophane derivatives by an enamine condensation reaction
AUTHOR(S): Knuppel, S.; Frohlich, R.; Erker, G.
CORPORATE SOURCE: Organisch-Chemisches Institut der Universitat Munster, Munster, D-48149, Germany
SOURCE: J. Organomet. Chem. (1999), 586(2), 218-222
CODEN: JORCAI; ISSN: 0022-328X
PUBLISHER: Elsevier Science S.A.
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 8 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 131:243317 CA
TITLE: Amidine function in constructing novel types of phosphorus-containing heterocycles
AUTHOR(S): Oshovsky, Gennady V.; Pinchuk, Alexander M.; Tolmachev, Andrei A.
CORPORATE SOURCE: Institute of Organic Chemistry, National Academy of Sciences of Ukraine, Kiev, 253660, Ukraine
SOURCE: Mendeleev Commun. (1999), (4), 161-162
CODEN: MENCEX; ISSN: 0959-9436
PUBLISHER: Russian Academy of Sciences
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 9 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 131:243022 CA
TITLE: Amino(hetero)arylmethylation of phenols with N-[.alpha.-amino(hetero)arylmethyl]benzotriazoles
AUTHOR(S): Katritzky, Alan R.; Abdel-Fattah, Ashraf A. A.; Tymoshenko, Dmytro O.; Belyakov, Sergei A.; Ghiviriga, Ion; Steel, Peter J.
CORPORATE SOURCE: Center for Heterocyclic Compounds Department of Chemistry, University of Florida, Gainesville, FL, 32611-7200, USA
SOURCE: J. Org. Chem. (1999), 64(16), 6071-6075
CODEN: JOCEAH; ISSN: 0022-3263
PUBLISHER: American Chemical Society
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 10 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 131:184912 CA
TITLE: Acetals and vinyl ethers of unsaturated aldehydes and ketones in new syntheses of heterocyclic compounds: IX. Ethoxyvinyl-1,3-dioxinyl cations: synthesis and reactions with nucleophiles
AUTHOR(S): Arsen'ev, V. G.; Olekhnovich, E. P.; Borodkin, G. S.; Glebova, Z. I.; Minkin, V. I.; Olekhnovich, L. P.
CORPORATE SOURCE: Research Institute of Physical and Organic Chemistry, Rostov State University, Rostov-on-Don, 344090, Russia
SOURCE: Russ. J. Org. Chem. (1998), 34(12), 1779-1785
CODEN: RJOCEQ; ISSN: 1070-4280
PUBLISHER: MAIK Nauka/Interperiodica Publishing
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 11 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 131:73717 CA
TITLE: C-acylation of electron-rich heterocyclic compounds with Kirsanov isocyanate
AUTHOR(S): Tolmachev, Andrei A.; Chaikovskaya, Aleksandra A.; Smaliy, Radomir V.; Kudrya, Tamara N.; Yurchenko, Aleksandr A.; Pinchuk, Aleksandr M.
CORPORATE SOURCE: Institute of Organic Chemistry, National Academy of Sciences of Ukraine, Kiev, 253660, Ukraine
SOURCE: Heteroat. Chem. (1999), 10(4), 343-348
CODEN: HETCE8; ISSN: 1042-7163
PUBLISHER: John Wiley & Sons, Inc.
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 12 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 131:73692 CA
TITLE: Synthesis of aminomethyl substituted silacyclohexanes from divinylsilanes: an unusually selective hydroformylation/aldol condensation sequence
AUTHOR(S): Barfacker, Lars; El Tom, David; Eilbracht, Peter
CORPORATE SOURCE: Fachbereich Chemie, Universitat Dortmund, Dortmund, D-44221, Germany
SOURCE: Tetrahedron Lett. (1999), 40(21), 4031-4034
CODEN: TELEAY; ISSN: 0040-4039
PUBLISHER: Elsevier Science Ltd.
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 13 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 131:44781 CA
TITLE: A convenient synthesis of pyrrolo[2,1-c][1,4] benzoxazines
AUTHOR(S): Sanchez, Isabel; Pujol, Maria Dolors
CORPORATE SOURCE: Laboratori de Quimica Farmaceutica, Facultat de Farmacia, Universitat de Barcelona, Barcelona, 08028, Spain
SOURCE: Tetrahedron (1999), 55(17), 5593-5598
CODEN: TETRAB; ISSN: 0040-4020
PUBLISHER: Elsevier Science Ltd.
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 14 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 130:311680 CA
TITLE: Neutral acylation (protection) of the indole nitrogen: a simple synthesis of indole-1-carboxylates, indole-1-thiocarboxylates and indole-1-carboxamides
AUTHOR(S): Macor, John E.; Cuff, Alison; Cornelius, Lyndon
CORPORATE SOURCE: Pharmaceutical Research Institute, Bristol-Myers Squibb, Princeton, NJ, 08543, USA
SOURCE: Tetrahedron Lett. (1999), 40(14), 2733-2736
CODEN: TELEAY; ISSN: 0040-4039
PUBLISHER: Elsevier Science Ltd.
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 15 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 130:296656 CA
TITLE: Synthesis and some reactions of 4-aroyl-6-arylpyridazine-3-(2H)-ones
AUTHOR(S): Mustafa, O. E. A.; Derbala, H. A. Y.; Emara, S. A.; Sallam, H. A.; Ismail, M. Fekry
CORPORATE SOURCE: Chemistry Department, Faculty of Science, Ain Shams University, Cairo, Egypt
SOURCE: Egypt. J. Chem. (1998), 41(1-6), 175-186
CODEN: EGJCA3; ISSN: 0367-0422
PUBLISHER: National Information and Documentation Centre
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 16 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 130:282529 CA
TITLE: Specific fluorinated ethers as reaction medium
INVENTOR(S): Dams, Rudolf J.; Qiu, Zai-ming; Smolders, Robert Remi Louis; Coppens, Dirk M.; Nagase, Makoto
PATENT ASSIGNEE(S): Minnesota Mining and Manufacturing Company, USA
SOURCE: PCT Int. Appl., 44 pp.
CODEN: PIXXD2
DOCUMENT TYPE: Patent
LANGUAGE: ***English***
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 9916809	A1	19990408	WO 1997-US17458	19970929

L8 ANSWER 17 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 130:252302 CA
TITLE: Synthesis of heterocyclic compounds from 2-phenyl-1,2,3-triazole-4-formylhydrazine
AUTHOR(S): Liu, Fang-Ming; Yu, Jian-Xin; Lu, Wen-Jie,; Liu, Gang; Liu, Yu-Ting; Chen, Yao-Zu
CORPORATE SOURCE: Departmnt of Chemistry, Xinjiang University, Xinjiang, 830046, Peop. Rep. China
SOURCE: Chin. J. Chem. (1999), 17(1), 62-68
CODEN: CJOCEV; ISSN: 1001-604X
PUBLISHER: Science Press
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 18 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 130:237492 CA
TITLE: Utility of [(p-sulfonamidophenyl)azo]malononitrile in the synthesis of polyfunctionally substituted pyrimidine, pyrazole, isoxazole and pyridazine derivatives
AUTHOR(S): Hassanien, Abu Zeid Abd El-Baset; Hafiz, Ibrahim Saad Abdel; Elnagdi, Mohamed Hilmy
CORPORATE SOURCE: Department of Chemistry. Faculty of Education, Suez Canal University, Arish, Egypt
SOURCE: J. Chem. Res., Synop. (1999), (1), 8-9, 129-140
CODEN: JRPSDC; ISSN: 0308-2342
PUBLISHER: Royal Society of Chemistry
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 19 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 130:196655 CA
TITLE: Process for the preparation of omeprazole and intermediate compounds
INVENTOR(S): Baldwin, Jack Edward; Adlington, Robert Michael; Crouch, Nicholas Paul
PATENT ASSIGNEE(S): UK
SOURCE: Eur. Pat. Appl., 8 pp.
CODEN: EPXXDW
DOCUMENT TYPE: Patent
LANGUAGE: ***English***
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
EP 899268	A2	19990303	EP 1998-306413	19980811
EP 899268	A3	19990707		

L8 ANSWER 20 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 130:125081 CA
TITLE: Preparation of novel nitric oxide-releasing amidine- and enamine-derived diazeniumdiolates as drugs
INVENTOR(S): Hrabie, Joseph A.; Keefer, Larry K.
PATENT ASSIGNEE(S): United States Dept. of Health and Human Services, USA
SOURCE: PCT Int. Appl., 59 pp.
CODEN: PIXXD2
DOCUMENT TYPE: Patent
LANGUAGE: ***English***
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 9901427	A2	19990114	WO 1998-US13723	19980701
WO 9901427	A3	19990325		

L8 ANSWER 21 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 130:95560 CA
TITLE: Preparation of barbituric acid derivatives with antimetastatic and antitumor activity
INVENTOR(S): Oliva, Ambrogio; De Cillis, Gianpiero; Grams, Frank; Livi, Valeria; Zimmermann, Gerd; Menta, Ernesto; Krell, Hans-Willi
PATENT ASSIGNEE(S): Boehringer Mannheim G.m.b.H., Germany
SOURCE: PCT Int. Appl., 34 pp.
CODEN: PIXXD2
DOCUMENT TYPE: Patent
LANGUAGE: ***English***
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 9858925	A1	19981230	WO 1998-EP3677	19980618

L8 ANSWER 22 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 129:71897 CA
TITLE: Oxygen scavenger and boiler water treatment chemical
INVENTOR(S): Shimura, Yukimasa; Taya, Shiro
PATENT ASSIGNEE(S): Kurita Water Industries Ltd., Japan
SOURCE: Eur. Pat. Appl., 30 pp.
CODEN: EPXXDW
DOCUMENT TYPE: Patent
LANGUAGE: ***English***
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
EP 845438	A1	19980603	EP 1997-309363	19971120

L8 ANSWER 23 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 128:114841 CA
TITLE: Synthesis of enaminones using trimethylsilyl trifluoromethanesulfonate as an activator
AUTHOR(S): Cartaya-Marin, Claudia P.; Henderson, Darron G.; Soeder, Robert W.; Zapata, Antonio J.
CORPORATE SOURCE: Department of Chemistry, Appalachian State University, Boone, NC, 28608, USA
SOURCE: Synth. Commun. (1997), 27(24), 4275-4283
CODEN: SYNCAV; ISSN: 0039-7911
PUBLISHER: Marcel Dekker, Inc.
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 24 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 128:75262 CA
Correction of: 127:190706
TITLE: Studies of the reaction between indole-2,3-diones (isatins) and secondary aliphatic amines
AUTHOR(S): Bergman, Jan; Staalhandske, Claes; Vallberg, Hans
CORPORATE SOURCE: Dep. Org. Chem., R. Inst. Technol., Stockholm, S-100 44, Swed.
SOURCE: Acta Chem. Scand. (1997), 51(6/7), 753-759
CODEN: ACHSE7; ISSN: 0904-213X
PUBLISHER: Munksgaard
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 25 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 128:49400 CA
TITLE: Manufacture and use of stilbene compounds as fluorescent whitening agents and UV absorbers
INVENTOR(S): Reinehr, Dieter; Metzger, Georges; Sauter, Hansperter
PATENT ASSIGNEE(S): Ciba Specialty Chemicals Holding Inc., Switz.
SOURCE: Eur. Pat. Appl., 17 pp.
CODEN: EPXXDW
DOCUMENT TYPE: Patent
LANGUAGE: ***English***
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
EP 808837	A1	19971126	EP 1997-810297	19970514

L8 ANSWER 26 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 127:190706 CA
TITLE: Studies of the reaction between indole-2,3-diones (isatins) and secondary aliphatic amines
AUTHOR(S): Bergman, Jan; Staalhandske, Claes; Vallberg, Hans
CORPORATE SOURCE: Department of Organic Chemistry, Royal Institute of Technology, Stockholm, S-100 44, Swed.
SOURCE: Acta Chem. Scand. (1997), 51(6/7), 753-759
CODEN: ACHSE7; ISSN: 0904-213X
PUBLISHER: Munksgaard
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 27 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 125:194807 CA
TITLE: Further evidence about the role of bis(thiazolin-2-ylidene)s as the actual catalytic species in the generalized benzoin condensation
AUTHOR(S): Lopez-Calahorra, Francisco; Castro, Ester; Ochoa, Ana; Marti, Josep
CORPORATE SOURCE: Dep. Quim. Org., Univ. Barcelona, Barcelona, E-08028, Spain
SOURCE: Tetrahedron Lett. (1996), 37(28), 5019-5022
CODEN: TELEAY; ISSN: 0040-4039
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 28 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 124:232596 CA
TITLE: Synthesis of 2-substituted-5,5-dimethyl-1,3,2-dioxaphosphorinane 2-oxides
AUTHOR(S): Raghu, K. V.; Reddy, C. Devendranath; Raju, C. Naga
CORPORATE SOURCE: Dept. Chem., Sri Venkateswara Univ., Tirupati, 517 502, India
SOURCE: Asian J. Chem. (1996), 8(1), 45-8
CODEN: AJCHEW; ISSN: 0970-7077
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 29 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 124:126671 CA
TITLE: Investigating the interactions between alternative amines and ion-exchange resins
AUTHOR(S): Liang, Chung-Hsien; Liu, Mou-Tang
CORPORATE SOURCE: Atomic Energy Council, Institute Nuclear Energy Research, Lung-Tan, 32500, Taiwan
SOURCE: Ultrapure Water (1995), 12(8), 53-7
CODEN: ULWAE5; ISSN: 0747-8291
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L8 ANSWER 30 OF 30 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 124:56490 CA
TITLE: Synthesis of sugar ureas via phosphinimines
AUTHOR(S): Pinter, Istvan; Kovacs, Jozsef; Toth, Gabor
CORPORATE SOURCE: Central Research Institute for Chemistry, Hungarian Academy of Sciences, Budapest, H-1525, Hung.
SOURCE: Carbohydr. Res. (1995), 273(1), 99-108
CODEN: CRBRAT; ISSN: 0008-6215
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

CHEMICAL ABSTRACTS references for morpholine and environment or biodegradability or contamination or accumulation, 1996 to present

L13 ANSWER 1 OF 7 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 133:93801 CA
TITLE: Detection of base contaminants in gas samples
INVENTOR(S): Kishkovich, Oleg P.; Goodwin, William M.; Phelps, Mark; Kinkead, Devon
PATENT ASSIGNEE(S): Extraction Systems, Inc., USA
SOURCE: PCT Int. Appl., 81 pp.
CODEN: PIXXD2
DOCUMENT TYPE: Patent
LANGUAGE: ***English***
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2000042427	A1	20000720	WO 2000-US966	20000114

L13 ANSWER 2 OF 7 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 132:280648 CA
TITLE: Chemically strippable protective coating and method wherein coating is stripped with alkaline aqueous solution
INVENTOR(S): Hawes, Charles
PATENT ASSIGNEE(S): Armor All Products Corporation, USA
SOURCE: PCT Int. Appl., 15 pp.
CODEN: PIXXD2
DOCUMENT TYPE: Patent
LANGUAGE: ***English***
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2000021691	A1	20000420	WO 1999-US21467	19991015

L13 ANSWER 6 OF 7 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 128:151559 CA
TITLE: Degradation of morpholine by an environmental Mycobacterium strain involves a cytochrome P-450
AUTHOR(S): Poupin, P.; Truffaut, N.; Combourieu, B.; Besse, P.; Sancelme, M.; Veschambre, H.; Delort, A. M.
CORPORATE SOURCE: Laboratoire de Genetique Microbienne, Universite de Technologie de Compiegne, Compiegne, 60206, Fr.
SOURCE: Appl. Environ. Microbiol. (1998), 64(1), 159-165
CODEN: AEMIDF; ISSN: 0099-2240
PUBLISHER: American Society for Microbiology
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L13 ANSWER 7 OF 7 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 124:121199 CA
TITLE: Spontaneous Raman spectroscopy for power plants
AUTHOR(S): Allmon, W. E.; Hurst, W. S.; Bowers, W. J. Jr.; Bean, V. E.; Millett, P. J.
CORPORATE SOURCE: Research and Development Division, Babcock and Wilcox, Alliance, OH, USA
SOURCE: Phys. Chem. Aqueous Syst., Proc. Int. Conf. Prop. Water Steam, 12th (1995), Meeting Date 1994, 405-14.
Editor(s): White, Howard J., Jr. Begell House: New York, N. Y.
CODEN: 62CVAR
DOCUMENT TYPE: Conference
LANGUAGE: ***English***

L13 ANSWER 3 OF 7 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 130:42358 CA
TITLE: On "toxicity equivalent factors" and "relative potency" to account for differential toxicity and carcinogenicity: concerns about uncommon effects of dose in animal experiments and environmental exposures to humans
AUTHOR(S): Jones, Troyce D.
CORPORATE SOURCE: Biochemical and Biophysics Section, Life Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN, 37831-6101, USA
SOURCE: Environmetrics (1998), 9(5), 525-539
CODEN: ENVCEE; ISSN: 1180-4009
PUBLISHER: John Wiley & Sons Ltd.
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

L13 ANSWER 4 OF 7 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 130:15152 CA
TITLE: Environmentally-safe solvent compositions utilizing 1-bromopropane that are stabilized, non-flammable, and have desired solvency characteristics
INVENTOR(S): Henry, Richard G.
PATENT ASSIGNEE(S): Advanced Chemical Design, USA
SOURCE: PCT Int. Appl., 38 pp.
CODEN: PIXXD2
DOCUMENT TYPE: Patent
LANGUAGE: ***English***
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 9850517	A1	19981112	WO 1998-US9058	19980501

L13 ANSWER 5 OF 7 CA COPYRIGHT 2000 ACS
ACCESSION NUMBER: 129:241041 CA
TITLE: Optimization of an MCF7-E3 cell proliferation assay and effects of environmental pollutants and industrial chemicals
AUTHOR(S): Desaulniers, D.; Leingartner, K.; Zacharewski, T.; Foster, W. G.
CORPORATE SOURCE: Reproductive Toxicology Section, Environmental and Occupational Toxicology Division, Bureau of Chemical Hazards, Environmental Health Directorate, Health Protection Branch, Department of Health, Ottawa, ON, K1A 0L2, Can.
SOURCE: Toxicol. in Vitro (1998), 12(4), 409-422
CODEN: TIVIEQ; ISSN: 0887-2333
PUBLISHER: Elsevier Science Ltd.
DOCUMENT TYPE: Journal
LANGUAGE: ***English***

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1. **Amines & Plasticizers**
Manufactures ethanolamines, alkyl, morpholine, and plasticizers in India. View the lisst of currently manufactured and developing products.
http://www.amines.com/

Web Pages

2. **MORPHOLINE**
MORPHOLINE MSDS Number: M8155 --- Effective Date: 02/18/99 1. Product Identification Synonyms: Diethyleneimide oxide; tetrahydro-p-isoxazine CAS No.: 110-91-8 Molecular Weight: 87.12
http://www.jtbaker.com/msds/m8155.htm

3. **Sourcerer listing of 4-(2,5-dibutoxy-4-nitrophenyl)morpholine chemical suppliers, supplies and manufacturers of 4-(2,5-d**
4-(2,5-dibutoxy-4-nitrophenyl)morpholine suppliers and 4-(2,5-dibutoxy-4-nitrophenyl) morpholine manufacturers and suppliers of 4-(2,5-dibutoxy-4-nitrophenyl)morpholine chemical and 25,000 other chemicals, pharmaceuticals and reagants in the UK
http://www.sourcerer.co.uk/chempages/2026500P.HTM

4. **Morpholine and its production process**
Morpholine and its production process Purpose Morpholine is employed as raw material for manufacturing accelerators of rubber vulcanization, optical bleaching agents, pharmaceuticals, corrosion inhibitors, emulgators. But the widest application it c
http://www.extech.msk.su/src_eng/tech/tech_htm/te135711.htm

5. **Morpholine and its production process**
Morpholine and its production process Purpose Morpholine is employed as raw material for manufacturing accelerators of rubber vulcanization, optical bleaching agents, pharmaceuticals, corrosion inhibitors, emulgators. But the widest application it
http://www.ropnet.ru/niopik/TECH/tech_htm/te135711.htm

6. **Morpholine and morpholine-Water**
Morpholine C 4 H 4 NO and morpholine-water C 4 H 4 NO-H 2 O (diploma thesis, Uni Kiel) (For the design of the POVRay-Images I thank M. Sch&oumlnhoff, Uni Kiel.) The rotaional spectrum of the 13 C- and 15 N-isotopomers of morpholine and of the m
http://www.rwth-aachen.de/pci/Ww/stant/morph.htm

7. **Sourcerer listing of 4-(2,5-diethoxy-4-nitrophenyl)morpholine chemical suppliers, supplies and manufacturers of 4-(2,5-d**
4-(2,5-diethoxy-4-nitrophenyl)morpholine suppliers and 4-(2,5-diethoxy-4-nitrophenyl) morpholine manufacturers and suppliers of 4-(2,5-diethoxy-4-nitrophenyl)morpholine chemical and 25,000 other chemicals, pharmaceuticals and reagants in the UK
http://www.sourcerer.co.uk/chempages/2026600P.HTM

8. **N-Acryloyl morpholine**
N-Acryloyl morpholine (N-Propenoyl morpholine ACMO (CSN): Morpholine,4-(1-oxo-2-propenyl)-) CAS No. 5117-12-4 Dealers Manufacturers Manufacturers List | NEWS SEARCH | PRODUCT SEARCH | COMPANY SEARCH | Japan Chemical Search Home Page N-Acryloyl morp
http://www.chemical-metal.co.jp/jcs/product/A/A050.html

9. **MORPHOLINE**
ARE YOU LOOKING FOR morpholine? Request quotations directly from suppliers, our system will notify them, no charge, no obligation. COSMOS Online* - Link between suppliers and possible buyers.
http://www.cosmos.com.mx/pqs/____-lgsr.htm

10. **BUYER: Morpholine, Diisopropanolamine, Petroxyln**
[Contents | Search Buyers | Post Lead | Main Page] BUYER: Morpholine, Diisopropanolamine, Petroxyln Message Posted By: 10/19/1998 Contact Name: Koray A. Kotan Date: 19 Oct 1998 Time: 15:43:31 Remote Name: 12.78.123.15 Message We are intere
http://www.bc-trade.net/buyers/_buy/000001ed.htm

11. **N-(3-Aminopropyl) morpholine**
N-(3-Aminopropyl) morpholine (4-Morpholinepropanamine N-Aminopropylmorpholine (CSN): 4-Morpholinepropanamine) CAS No. 123-00-2 Dealers Manufacturers Koei Chemical | NEWS SEARCH | PRODUCT SEARCH | COMPANY SEARCH | Japan Chemical Search Home Page N-(
http://www.chemical-metal.co.jp/jcs/product/A/A128.html

12. **CHEMICAL REFERENCE FOR 4-((4-MORPHOLINYLTHIO)THIOXOMETHYL) MORPHOLINE**
Envirofacts Warehouse Chemical References 4-((4-MORPHOLINYLTHIO) THIOXOMETHYL)MORPHOLINE CAS #13752-51-7 The following information resources are not maintained by Envirofacts. Envirofacts is neither responsible for their informational content nor f
http://www.epa.gov/enviro/html/emci/chemref/13752517.html

13. **Morpholine**
Morpholine, 99 + % 02/13/96 Safety Chemistry Management Protective Synonyms Responsible Toxicity Incompatible Manufacturer and Order Number Health Effects Structure PEL/TWA Disposal NFPA Hazardous Decomposition Physical Data Top of Page | Chemica
http://www.camd.lsu.edu/msds/m/morpholine.htm

14. **Emission of morpholine from metalworking fluids**
Från bibliotekets hylla / Document title: Emission of morpholine from metalworking fluids Författare/Author: Sollenberg, Jan ; Ståhlbom, Bengt Källa/Source: Ingår i: Abstracts / IOHA 3rd International Scientific Conference, September 13-18, 1997,
http://www.niwl.se/WAIS/30208/30208499.htm

15. **AIR PRODUCTS & CHEMICALS -- MORPHOLINE - MORPHOLINE, TECHNICAL**
AIR PRODUCTS & CHEMICALS -- MORPHOLINE - MORPHOLINE, TECHNICAL MATERIAL SAFETY DATA SHEET NSN: 6810005599889 Manufacturer's CAGE: 88381 Part No. Indicator: A Part Number/Trade Name: MORPHOLINE
==========
http://hazard.com/msds/h/q337/q273.html

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Web Pages

16. **Dimethomorph, (E,Z) 4-[3-(4-chlorophenyl)-3-(3,4- dimethoxyphenyl)-1-oxo-2-propenyl]morpholine; Pesticide Tolerances**
[EPA Home | Federal Register Home | Comments | Search Federal Register | Search EPA] Federal Register Document Related Material Other Related Documents [Federal Register: May 12, 1999 (Volume 64, Number 91)] [Rules and Regulations]
http://www.epa.gov/fedrgstr/EPA-PEST/1999/May/Day-12/p11565.htm

17. **Amines & Plasticizers Ltd. Products Manufactured**
Products Manufactured ETHANOLAMINES & ALKYL ALKANOLAMINES Monoethanolamine (MEA) N- Propyl Ethanolamine (NPEA) Diethanolamine (DEA) N-Propyl Diethanolamine (NPDEA) Triethanolamine - 85% min. (TEA- 85%) Ethyl Monoethanolamine (EMEA) Triethanolamine
http://www.amines.com/amines2.htm

18. **MES (From: 3CHB.PDB; Formula: C6 H14 N1 O4 S1; resolution. 1.25 A.; Name(s): n-(ehtylsulfite)morpholine; n-(ethylsulfid**
HIC-Up files for compound MES n-(ehtylsulfite)morpholine; n-(ethylsulfide)morpholine; n (ehtylsulfite)morpholine; 2-(n-morpholino)-ethanesulfonic acid; mes buffer; n-(ethylsulfite) morpholine; n-ethylsulfonic acid morphol
http://alpha2.bmc.uu.se/hicup/MES

19. **SOX13113**
Morpholine, 4-[(phenylmethyl)thio]- rate constant with singlet oxygen Clennan, E.L.; Zhang, H. J. Am. Chem. Soc. 116(2): 809-10 (1994) Reaction: 4-[(Phenylmethyl)thio] morpholine + 1 O 2 * –> 4-[(Phenylmethyl)sulfinyl]morpholine Reference Reactio
http://www.rcdc.nd.edu/compilations/SingOx/table13/SOX13113.HTM

20. **Sample Spectra from the Raman Systems R-2000**
Sample Spectra Raman Systems R-2000 Sample spectra collected with the Raman Systems R-2001 are available here. Benzene Ethanol Benzene, Toluene, Xylene Morpholine Cyanide 500 ppb Cyanide in Water (example of Surface Enhanced Raman Spect
http://www.oceanoptics.com/ProductSheets/R2000_Spectra.asp

21. **Springer LINK: Archives of Microbiology - Abstract Volume 171 Issue 6 (1999) pp 417-423**
Archives of Microbiology ISSN: 0302-8933 (printed version) ISSN: 1432-072X (electronic version) Table of Contents Abstract Volume 171 Issue 6 (1999) pp 417-423 Morpholine-induced formation of l-alanine dehydrogenase activity in Mycobacterium strain
http://link.springer-ny.com/link/service/journals/00203/tocs/t71006/91710417.htm

22. **International Chemical Safety Cards (WHO/IPCS/ILO)**
International Chemical Safety Cards MORPHOLINE ICSC: 0302 MORPHOLINE Tetrahydro-1,4-oxazine Diethylene oximide C 4 H 9 ON Molecular mass: 87.1 CAS # 110-91-8 RTECS # QD6475000 ICSC # 03
http://www.cdc.gov/niosh/ipcsneng/neng0302.html

23. **International Chemical Safety Cards (WHO/IPCS/ILO)**
International Chemical Safety Cards MORPHOLINE ICSC: 0302 MORPHOLINE Tetrahydro-1,4-oxazine Diethylene oximide C 4 H 9 ON Molecular mass: 87.1 CAS # 110-91-8 RTECS # QD6475000 ICSC # 03
http://www.cdc.gov/niosh/ipcs/ipcs0302.html

24. **Documentation for Immediately Dangerous to Life or Health Concentrations (IDLHs)**
Morpholine IDLH Documentation CAS number: 110-91-8 NIOSH REL: 20 ppm (70 mg/m 3) TWA, 30 ppm (105 mg/m 3) STEL [skin] Current OSHA PEL: 20 ppm (70 mg/m 3) TWA [skin] 1989 OSHA PEL: 20 ppm (70 mg/m 3) TWA, 30 ppm (105 mg/m 3) STEL [skin]
http://www.cdc.gov/niosh/idlh/110918.html

25. **ChE 1004: Problem 2.7, page 1**
SECTION 2.1: Techniques of Problem Solving QUESTION: Problem 2.7, p. 136 of Himmelblau, 6 th ed. PROBLEM STATEMENT: There was an accident in Chicago and a truck carrying morpholine sprang a leak. The air temperature that day was in the 90s. The fire
http://www.unb.ca/che/che1004/prob2-7p1.htm

26. **Sample Spectra from the Raman Systems R-2000**
Sample Spectra Raman Systems R-2000 Sample spectra collected with the Raman Systems R-2001 are available here. Benzene Ethanol Benzene, Toluene, Xylene Morpholine Cyanide 500 ppb Cyanide in Water (example of Surface Enhanced Raman Spect
http://www.oceanoptics.com/productsheets/R2000_Spectra.asp

27. **- CHEMTEX TECHNICAL TOPICS ARCHIVE - TT-014-0891 -**
Amines Common Name Boiling Point Deg F Steam Distribution Ratio Amine / Carbonate Formation Azeotropic Formation Cyclohexylamine 273 1.6 - 9.0 Yes Yes Diethylaminoethanol 325 3.1 - 4.1 No Yes Morpholine 262 0.3 - 0.7 Yes, Slight No DMA - 2P 253 1.1
http://www.chemtexcorp.com/techtopics/TT-015-0891.html

28. **trifenmorph data sheet**
trifenmorph data sheet
http://www.hsrss.demon.co.uk/trifenmorph.html

29. **Article 1536**
China-ningbo BBS [Contents | Search | Post | Reply | Next | Previous | Up] Article 1536 From: citychem@volny.cz Category: Miscellaneous Date: 15 Nov 1999 Time: 02:23:41 Remote Name: 212.20.116.14 Comments We would like to inform you ,about our dem
http://www.ningbo.simplenet.com/bbs/_disc1/00000600.htm

30. **Solvents from FBC**
A listing of solvents available from FBC Chemical Corporation
http://www.fbcchem.com/products/solvents.shtml

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Web Pages

31. **Patrick NAVARD**
Page professionnelle Patrick NAVARD
http://www-cemef.cma.fr/cemef/pagesperso/pn/pn.html

32. **GROUPE PHYSICO-CHIMIE DES POLYMERES**
groupe physico-chimie des polymères, physical chemistry of polymers
http://www-cemef.cma.fr/cemef/groupes/descrpcp.html

33. **MES Chime**
Acronym: MES PDB entry: 3CHB Formula: C6 H14 N1 O4 S1 Resolution (Å): 1.25 Name (s): n-(ehtylsulfite)morpholine; n-(ethylsulfide)morpholine; n(ehtylsulfite)morpholine; 2-(n-morpholino)-ethanesulfonic acid; mes buffer; n-(ethylsulfite)morpholine; n-et
http://alpha2.bmc.uu.se/hicup/MES/mes_chime.html

34. **ELDATA Property Types**
BELB0971 abstract BELB0971 . . . . . ELDATA: Int. Electron. J. Phys.-Chem. Data 1997 , 3 , 191-194 Excess enthalpies of binary liquid mixtures of N-methylpiperidine + piperidine , + oxane , + morpholine or + 1,4-dioxane at 303.15 K Belaribi, B.F.;
http://bine.fiz-karlsruhe.de/eldata/propclass/belb0971.htm

35. **Jpn. J. Cancer Res. 88, 797-806, September 1997**
Regular Paper [Jpn. J. Cancer Res. 88, 797-806, September 1997] Carcinogenicity of Methylurea or Morpholine in Combination with Sodium Nitrite in a Rat Multi-organ Carcinogenesis Bioassay Mitsuaki Kitano, 1, 5 Nobuyasu Takada, 1 Tianxin Chen, 1 Hiro
http://www.bcasj.or.jp/jjcr/abstracts/v88/i88090797.html

36. **MOPS, GENAR 3-(N-MORPHOLINO) PROPANE SULFONIC ACID**
MOPS, GENAR 3-(N-MORPHOLINO) PROPANE SULFONIC ACID MSDS Number: M8014 --- Effective Date: 05/08/00 1. Product Identification Synonyms: 4-Morpholinepropanesulfonic acid; 3-(N-Morpholino)propanesulfonic acid; MOPS;
http://www.jtbaker.com/msds/m8014.htm

37. **ABSTR.Chrysselis**
CHRYSSELIS, M.C. , REKKA, E., KOUROUNAKIS, P.N. Department of Pharmaceutical Chemistry, School of Pharmacy, Aristotelian University of Thessaloniki, Thessaloniki, 54006, Greece HYPOCHOLESTEROLEMIC AND ANTIOXIDANT EFFECTS OF SOME NEW MORPHOLINE DERIV
http://www.biozentrum.uni-frankfurt.de/DPhG/doktorandentagung/abstracts/Chrysselis.html

38. **Alfa Aesar Online Catalog**
Morpholine, ACS, 99.0% min (Assay), Item # 31984 CAS Number 110-91-8 Formula C4H9NO Formula Weight 87.12 Form Liquid Melting Point -7° Boiling Point 129° Merck Number 12, 6362 UN Number UN2054 Refractive Index 1.4541 Substance is listed in Toxic Su
http://www.alfa.com/products/prod31984.html

39. **Alfa Aesar Online Catalog**
Morpholine, 99%, Item # A10355 CAS Number 110-91-8 Formula Weight 87.12 Boiling Point 128-130 UN Number UN2054 Substance is listed in Toxic Substance Control Act (TSCA) inventory. Price: see below Order Size Price 100g $8.80 500g $13.20 2500g $44.
http://www.alfa.com/products/prodA10355.html

40. **List of Allergens (N)**
List of Allergens (N) A B C D E F G H I J K L M N O P Q R S T U V W X Y Z Neomycin sulfate Cross : Streptomycin, gentamycin, framycetin, dihydrostreptomycin Nickel sulfatehexahydrate Formula : NiO 4 S¥6H 2 O Nitrofurazone Formula : C 6 H 6 N 4 O 4 N
http://dmd.nihs.go.jp/dmd2/safety/allergen/n.html

41. **Economy Polymers & Chemicals - Guar, Guar Derivitives, Guar Gum, Biocides, Corsslinkers, & Monomers**
VII. Monomers PRODUCT NAME DESCRIPTION NNDMA N,N-dimethyl acrylamide DMAEA N,N-dimethylamino ethylacrylate DMAEA-Q (79% aq.soln.) N,N-dimethylamino ethylacrylate,methyl chloride quarternary DMAPAA N,N-dimethylamino propylacrylamide DMAPAA-Q (75% aq
http://www.neosoft.com/~economy/mono.htm

42. **Morphysorb®**
"Morphysorb®" Morphysorb® For more information on this technology, also see: Morphysorb: acid gas removal from natural and synthesis gas A New Acid Gas Removal System for Subquality Natural Gas In this paper, M. Groß, J. Menzel and O. Tondorf, Krup
http://www.gri.org/pub/content/dec/19981207/131355/morphart.html

43. **Contre-Indications des Substances : GASTRITE**
Contre-Indications des Substances : GASTRITE ACETAMINOSALOL ACETYLSALICYLATE BASIQUE D'ALUMINIUM ACETYLSALICYLATE CARBONATE DE SODIUM ACETYLSALICYLATE DE LYSINE ACETYLSALICYLIQUE ACIDE ALOXIPRINE AZAPROPAZONE BENOXAPROFENE BENZYDAMINE CHLORHYDRATE B
http://www.biem2.org/www/SubCIMCGASTRITE.html

44. **Effets Secondaires des Substances : TROUBLE NEUROPSYCHIQUE**
Effets Secondaires des Substances : TROUBLE NEUROPSYCHIQUE ALDESLEUKINE AMOXYDRAMINE CAMSILATE BROMETENAMINE BUTIZIDE CLOBUTINOL CHLORHYDRATE CLOFEDANOL CLOROQUALONE CYCLOSERINE CYCLOTHIAZIDE DEBRISOQUINE SULFATE DESERPIDINE DIMETHOXANATE CHLORHYDRA
http://cti.ensmp.fr/biam/www/SubEIIMCTROUBLE_NEUROPSYCHIQUE.html

45. **Woordenboek Organische Chemie**
morfoline (110-91-8) brutoformule : C 4 H 9 NO engelse vertaling : morpholine Groepen : oplosmiddelen CAS Nummer : 110-91-8 NSC Nummer : 9376 UN Nummer : 2054 Kookpunt : 128.9 o C Smeltpunt : -3.1 o C Dipool : 1.005 D NB: Hieronder staan links
http://www.sci.kun.nl/sigma/Chemisch/Woordenboek/items/morfoline.shtml

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46. **Woordenboek Organische Chemie**
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http://www.sci.kun.nl/sigma/Chemisch/Woordenboek/gui/items/morfoline.shtml

47. **4,4'-Dithiodimorpholine**
4,4'-Dithiodimorpholine (Morpholinedisulfide (CSN): Morpholine, 4,4'-dithiobis-) CAS No. 1 34-4 Dealers Manufacturers Manufacturers List | NEWS SEARCH | PRODUCT SEARCH | COMPANY SEARCH | Japan Chemical Search Home Page 4,4'-Dithiodimorpholine
http://www.chemical-metal.co.jp/jcs/product/D/D334.html

48. **product-A**
PRODUCT SEARCH |A| Aminoguanidine hydrochloride Aminoguanidine salts 3-Aminonaphthalene-1,5-disulfonic acid monosodium salt m-Aminophenol o-Aminophenol p-Aminophenol 2-Aminophenol-4-sulfonamide 2-Aminophenol-4-sulfonic acid N-(3-Aminoprop morphol
http://www.chemical-metal.co.jp/jcs/product/A/tocA006.html

49. **product-A**
PRODUCT SEARCH |M| Methyltrichlorosilane Metol Mixed lauryl tridecyl acrylate Molybden Pentachloride Mono-n-butylamine Monoalkyl modified dipentaerithritol acrylate Monochloroacetic acid Monoethanolamine Monomethyl hydrazine Morpholine 2-(4'-Morph
http://www.chemical-metal.co.jp/jcs/product/M/tocM008.html

50. **product-A**
PRODUCT SEARCH |A| Acetylsalicylic acid 2B-Acid 4B-Acid gamma-Acid 2B-Acid, sodium Acrolein Acrylamide 2-Acrylamido-2-methyl propane sulfonic acid Acrylic acid Acrylic acid aluminum salt Acrylic acid calcium salt Acrylic acid magnesium salt Acr
http://www.chemical-metal.co.jp/jcs/product/A/tocA002.html

51. **N-Oxydiethylene-2-benzothiazolyl sulfenamide**
N-Oxydiethylene-2-benzothiazolyl sulfenamide (2-(Morpholinothio) benzothiazole 2-(4-Morpholinyl mercapte) benzothiazole N-Oxydiethylene-2-benzothiazole sulfenamide NOBS OBS 4-(2-Benzothiazolylthio)-morpholine) CAS No. 102-77-2 Dealers Manufacturers
http://www.chemical-metal.co.jp/jcs/product/O/O022.html

52. **Perkin Transactions 2 Electronic Supplementary Information**
Products Electronic Supplementary Information for Perkin Transactions 2, 1998, Issue 7, P 1701 Click on a link to retrieve supplementary data submitted for this article: Low energy an transition state structure for morpholine derivative 1 Low e
http://www.rsc.org/suppdata/perkin2/1998/1701

53. **dodemorph data sheet**
dodemorph data sheet
http://www.hclrss.demon.co.uk/dodemorph.html

54. **http://www.dsl.tutics.tut.ac.jp/db/pnmr/spec/1617.dat**
1 2718 N-(3-Aminopropyl)morpholine; 2 1617 S 144.22 C 7 H 16 N 2 O 1; 3 123-00-2 _____fp_____._-___./_ ___.-___./_____; 4 Q N2 N C2 C2 C2 C2 C2 C2 5 1 6 8 3 9 7 1 0 2 4 5 10 3; 6 2 1.39 ___ 2 7 2 1.63 ___ 5 8 2 2.41 ___ 10 9 4 2.4
http://www.dsl.tutics.tut.ac.jp/db/pnmr/spec/1617.dat

55. **Our Products**
JSC Aviabor - the sole producer of Boron Hydrides and associated compounds on a commercial scale in Russia and the CIS countries.
http://www.aviabor.com/Products/products.html

56. **Welcome to Uniroyal Chemical!**
Naugex ® SD-1 ACCELERATOR The addition of NAUGEX SD-1 to Uniroyal Chemical's complete line of accelerators assures the tire and rubber industry a continuing and adequat domestic suply of 4,4' dithio dimorpholine. NAUGEX SD-1 (4,4'dithio dimorpholi
http://www.uniroyalchemical.com/naugsd.htm

57. **Amorolfine Hydrochloride**
Amorolfine Hydrochloride C 21 H 35 NO.HCl :353.98 (±) - cis - 2, 6 - dimethyl - 4 - [3 - [4 1 - dimethyl - propyl) phenyl] - 2 - methylpropyl] morpholine monohydrochloride Space: , Ball&Stick: , Stick: , Dots On: Rotation On: , Rotatio
http://www.ps.toyaku.ac.jp/~dobashi/database/structure/a_group/amorolfine_hydrochloride.

58. **1825-26**
Served May 13, 1997 Notice Not to Review Served 6/19/97 FEDERAL MARITIME COMMISSION _____ INFORMAL DOCKET NO. 1825(I) INFORMAL DOCKET NO. 1826(I) _____ HUNTSMAN INTERNATIONAL TRADING CORPORATION v. HAPAG-
http://www.fmc.gov/dockets/1825-26.htm

59. **International Journal of Toxicology, Vol. 18, Supp. 3 - Contents**
International Journal of Toxicology Volume 18, Supplement 3 1999 CONTENTS 39 th Repo the CIR Expert Panel - Final Report on the Safety Assessment of: Ascorbyl Palmitate, Asco Dipalmitate, Ascorbyl Stearate, Erythorbic Acid, and Sodium Eryt
http://www.actox.org/journal/v18s3.htm

60. **amines**
TransChemical AMINES Decyclohexylamine Diethylamine Diethanolamine Dimethyl Formamide (DMF) Diethanolamine Monoethanolamine Monoethylamine Morpholine Triethylamine Triethanolamine There's no place like home... amines
http://www.transchemical.com/amines.htm

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61. **Effets Secondaires des Substances : REACTION ALLERGIQUE CUTANEE**
Effets Secondaires des Substances : REACTION ALLERGIQUE CUTANEE BENETHAMIN BENZYLE BENZYDAMINE CHLORHYDRATE BENZYLPENICILLINE POTASSIQUE BENZ
http://www.biam2.org/www/SubEffMCREACTION_ALLERGIQUE_CUTANEE.html

62. **Contre-Indications des Substances : NOUVEAU-NE**
Contre-Indications des Substances : NOUVEAU-NE ACETAMINOSALOL ACETYLSALICY ACETYLSALICYLATE DE LYSINE ACETYLSALICYLIQUE ACIDE ALOXIPRINE BORIQUE
http://www.biam2.org/www/SubCIMCNOUVEAU_NE.html

63. **Boiler Water Treatment Chemical BT-1117**
BT-1117 is a liquid multipurpose treatment for use in low pressure systems (0-250 psig). Au convenience. Formulated for hard water application
http://www.ahti.com/bt-1117.htm

64. **Springer LINK: Current Genetics - Abstract Volume 34 Issue 2 (1998) pp 93-99**
Current Genetics ISSN: 0172-8083 (printed version) ISSN: 1432-0983 (electronic version) T ergosterol mutant of Saccharomyces cerevisiae J. H. Crowley, Shirley Tove, L. W.
http://link.springer-ny.com/link/service/journals/00294/bibs/8034002/80340093.htm

65. **Boiler Water Treatment Chemical BT-1128**
BT-1128 is a liquid multipurpose treatment for use in low pressure systems (0-250 psig). Au convenience. Formulated for soft water application
http://www.ahti.com/bt-1128.htm

66. **Organic Chemistry**
Silver (I) Ion-Mediated Desulfurization-Condensation of Thiocarbonyl Compounds with Sev Jpn., 67 (11), pp. 3048, 1994] The desulfurization-condensation reactio
http://www.nimc.go.jp/publication/annual94/06/06_35.html

67. **http://alpha2.bmc.uu.se/hicup/SFO/sfo_superstructures.txt**
Y3 4-ACETYLAMINO-5-HYDROXNAPHTHALENE-2,7-DISULFONIC ACID) 2AN 1-ANILIN AERUGINOSIN 98-B) AEN ACETYLAMINOETHYL NAPHTHYLAMINE SULFONATE) ALS
http://alpha2.bmc.uu.se/hicup/SFO/sfo_superstructures.txt

68. **Waterhouse Chemical Direct - Home**
No Frames Waterhouse Chemical Direct 5910 Bent Pine Dr. #110 Orlando, FL 32822-0000 http://www.explorebr.com/115014 - web All Waterhouse consultants have over ten years fie
http://www.explore-br.com/115014/explore.htm

69. **Index of FBC's Supplier Listing #1**
A listing of FBC Chemical's Suppliers
http://www.fbcchem.com/products/sup1.shtml

70. **Hydrocortisone and Pramoxine - RxList Monographs**
Hydrocortisone and Pramoxine DESCRIPTION ProctoFoam HC (hydrocortisone acetate 1 hydrocortisone acetate 1% and pramoxine hydrochloride 1% in a h
http://www.rxlist.com/cgi/generic2/hydropra.htm

71. **Import**
MOS Demo Database First Previous Next Last REGNO 16551 TITLE A new access to 2-(c H Synth Commun 25(51) p. 3357-3362 1995 YIELD 81% TEMPERATURE 20 KEYPHRAS

http://www.synopsys.co.uk/products/database/mos/htmldemo/mos_1page62.html

72. **Import**
MOS Demo Database First Previous Next Last REGNO 16549 TITLE A new access to 2-(c H Synth Commun 25(51) p. 3357-3362 1995 YIELD 65% TEMPERATURE 80 KEYPHRAS
http://www.synopsys.co.uk/products/database/mos/htmldemo/mos_1page60.html

73. **Listings for PDB Heterogens and Their Codes**
PDB Code: MES X-PLOR files Heterogen file generated from the file hetero.pdb COMPND REMARK MES Extracted from PDB file 1aba.pdb REMARK MES Formula C6 H14 N1 O4 S
http://www.bmrb.wisc.edu/elec_dep/pdb_het_library/gjk_het_files/mes.htm

74. **http://iubio.bio.indiana.edu/R469959-470835-/Network-News/bionet/molbio/proteins/9**
From
usenet.ucs.indiana.edu!vixen.cso.uiuc.edu!sdd.hp.com!swrinde!tank.news.pipex.net!pipex! Fri Aug 25 14:28:16 1995 From: Calab@rvh.mcgill.ca (Ca Lab) Newsgroups
http://iubio.bio.indiana.edu/R469959-470835-/Network-News/bionet/molbio/proteins/9508.n

75. **(95/10/01) Chemicals Wanted the week of 10/01/95**
Chemicals Offered - Updated 10/01/95 This is a listing of the material we have available for our Sales Manager . Please be sure to include the appropriate ref
http://www.allchem.com/oldsell/s951001.html

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76. **http://www.lowe.legend.yorks.com/ecc.htm**
Updated AWE 17/5/2000 Lowe has an exclusive agreement with ESKOM of South Africa, for the technical development and manufacture of an electro-chemical cell. Marketed as the CAT - XL Cation Extraction Cell This device is capable
http://www.lowe.legend.yorks.com/ecc.htm

77. **Table 24 Hydrogenated heterocyclic parent hydrides.**
Table 24 Hydrogenated heterocyclic parent hydrides . Type 1-Unlimited substitution Chromane (Chalcogen analogues are named using the prefixes "thio-", "seleno-" and "telluro-".) Imidazolidine Indoline Isochromane (Chalcogen analogues are named using
http://www.acdlabs.com/iupac/nomenclature/93/r93_694.htm

78. **COSMOS Online* - DR. JOSE POLAK, S.A. DE C.V.**
DR. JOSE POLAK, S.A. DE C.V. [México], COSMOS Online* - Link between suppliers and possible buyers.
http://www.cosmos.com.mx/chem/drpolak

79. **Steam Condensate Water Treatment Chemicals from Applied Hydro Technologies**
Applied Hydro Technologies, Inc. offers a variety of steam water treatment chemicals: ST-1020 ST-1020 is a blend of volatile amines designed to protect steam and condensate return lines. Authorized by the USDA for use in f
http://www.ahti.com/steamprod.htm

80. **Re: MPK to BMK**
Re: MPK to BMK [Follow Ups] [Post Followup] [The Hive Posts] Posted by tamagotchi on January 12, 1998 at 03:13:18: In Reply to: Re: MPK to BMK posted by Osmium on January 12, 1998 at 02:32:14: : : : : Any idea if, and how to turn 4-bromo-methy
http://hive.lycaeum.org/messages/1293.html

81. **Re: MPK to BMK**
Re: MPK to BMK [Follow Ups] [Post Followup] [The Hive Posts] Posted by Osmium on January 12, 1998 at 02:32:14: In Reply to: MPK to BMK posted by tamagotchi on January 11, 1998 at 16:02:16: : : Any idea if, and how to turn 4-bromo-methylphenylk
http://hive.lycaeum.org/messages/1291.html

82. **PDB 1dge**
PDB code: 1dge Lyase Structure: Dialkylglycine decarboxylase (pyruvate) (dgd) mutant with gln 15 replaced by his (q15h) complexed with rubidium+ in metal-bind
http://pdb.weizmann.ac.il/bsm/pdbsum/1dge/main.html

83. **Listings for PDB Heterogens and Their Codes**
PDB Code: MES X-PLOR files Heterogen file generated from the PDB Het Group Dictionary RESIDUE MES 26 CONECT O1 2 C2 C6 CONECT C2 4 O1 C3 1H2 2H2 CONECT C3 4 C2 N4 1H3 2H3 CONECT N4 3 C3 C5 C7 C
http://www.bmrb.wisc.edu/elec_dep/pdb_het_library/pdb_het_files/mes.htm

84. **Index of /meetings/mug98/Bharadwaj/daylight/data/6-rings**
Index of /meetings/mug98/Bharadwaj/daylight/data/6-rings Name Last modified Size Description Parent Directory 06-Mar-1998 10:58 - 2-pyrone.tdt 06-Mar-1998 10:58 1k 2h-pyran.tdt 06-Mar-1998 10:58 1k 4-pyrone.tdt 06-Mar-1998 10:58
http://www.daylight.com/meetings/mug98/Bharadwaj/daylight/data/6-rings

85. **LaMotte Company - Potable & Wastewater Testing Products (A to Z Section)**
LaMotte Company sells and manufactures equipment for the testing of water, soil, & air. We service the pool & spa, environmental science education, aquaculture & aquarium, industrial wastewater, drinking water, soil testing, and home science markets
http://www.lamotte.com/WEB-SITE/IND/INDPAG05.HTM

86. **CONTACT ALLERGY TO THE ACTIVE INGREDIENTS OF BIOBAN P 1487**
[OSH-Link Home | IVI Online | Comments] BIOBAN P 1487 CONTACT-DERMATITIS CONTACT ALLERGY TO THE ACTIVE INGREDIENTS OF BIOBAN P 1487 A study was conducted to evaluate the frequency of contact sensitization to the preservative Bioban-P-1487 (CAS 373
http://infoventures.com/osh/abs/code0007.html

87. **New Document**
Sample Problem Problem: Find information about the compound: When the problem is stated only in terms of a structure and no name is provided, it is necessary to determine the CA Index Name in order to locate appropriate entries in the Chemical Subst
http://www.uwp.edu/info-services/library/sample.htm

88. **http://www.biam2.org/www/Sub2302.html**
PRAMOCAINE CHLORHYDRATE Introduction dans BIAM : 18/2/1992 Dernière mise à jour : 29/3/2000 Etat : validée Identification de la substance Propriétés Pharmacologiques Mécanismes d'action Effets Recherchés Indications thérapeutiques Effets secondai
http://www.biam2.org/www/Sub2302.html

89. **Bonded Chemicals Organic Chemicals**
Bonded Chemicals, Inc. is one of the six ChemGroup distributorships located in the multi-state area of Kentucky, Indiana, Ohio and Tennessee. We carry a full line of inorganic and organic chemicals for water treatment, metal finishing, compounding,
http://www.chemgroup.com/bciochemical.htm

90. **Chemicals Inc - Organic Chemicals**
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91. **COSMOS Online* - CATORR, S.A. DE C.V.**
CATORR, S.A. DE C.V. [México], COSMOS Online* - Link between suppliers and possible buyers.
http://www.cosmos.com.mx/pqs/4g8v.htm

92. **COSMOS Online* - PETROCARBONO, S.A. DE C.V.**
PETROCARBONO, S.A. DE C.V. [México], COSMOS Online* - Link between suppliers and possible buyers.
http://www.cosmos.com.mx/PQS/4gwq.htm

93. **COSMOS Online* - CATORR, S.A. DE C.V.**
CATORR, S.A. DE C.V. [México], COSMOS Online* - Link between suppliers and possible buyers.
http://www.cosmos.com.mx/PQS/4g8v.htm

94. **Lonza Homepage: Products and Services: Product Groups by Application: Pharmaceuticals**
Products and Services Product Groups by Application Adhesives | Anti-microbials | Automotive | Building & Furniture | Coatings & Inks | Crop Protection | Custom Manufacturing | Detergents | Disinfectants | Dyes & Pigments | Electric A
http://www.lonza.com/framer1_1.pharm.html

95. **IGT - NFM Process Agreement**
News Releases NEWS RELEASE Institute of Gas Technology 1700 South Mount Prospect Road Des Plaines, IL 60018 Telephone: (708) 768-0500 Fax: (708) 768-0501 IGT ENTERS INTO COOPERATIVE TECHNOLOGY DEVELOPMENTAND COMMERCIALIZATION AGREEMENT FOR ITS NFM P
http://www.igt.org/nrm/r950322.html

96. **Azeotrope Database**
Azeotropes beginning with W Component Boiling.Pt o C Azeotrope B.Pt o C Wt.% in azeotrope Water 100.00 Acetic_acid 118.10 76.60 3.00 Acetonitrile 82.00 76.50 83.70 Acrol
http://www.cheneng.ed.ac.uk/~neilm/new/azeotope/WW.html

97. **EXPANDED RUBBER & PLASTIC -- STAFOAM MF 102, COMPONENT C - PLASTIC FOAM KIT**
EXPANDED RUBBER & PLASTIC -- STAFOAM MF 102, COMPONENT C - PLASTIC FOAM KIT MATERIAL SAFETY DATA SHEET NSN: 9330001068657 Manufacturer's CAGE: 25598 Part No. Indicator: B Part Number/Trade Name: STAFOAM MF 102, COMPONENT C ==========
http://hazard.com/msds/h/q135/q441.html

98. **NAUGEX SD-1 Vulcanizing Agent 4,4'-Dithiodemorpholine**
NAUGEX SD-1 Vulcanizing Agent 4,4'-Dithiodemorpholine Form: Off-white powder or 100% active mini-pellet. Specific Gravity: 1.35 Melting Range: 123-128 (253-262F) Solubility: Insoluble in water. Soluble in acetone, benzene, or carbon tetrachloride. S
http://www.d-bond.com/119.htm

99. **Imprinting Salmon in Saltwater in Southcentral Alaska**
Imprinting Salmon in Saltwater in Southcentral Alaska Nick Dudiak[1], Lawrence Boyle[1], and William J. Hauser[2] [1]Alaska Department of Fish and Game Fisheries Rehabilitation,

Enhancement and Development, and Sport Fish Divisions 3298 Douglas Street, Home
http://www.lib.noaa.gov/test/report22/dudlak.html

100. **List of retained names**
List of retained names Parent Compound Radical Name (1) Isochroman Isochromanyl (3 - shown) (2) Chroman Chromanyl (7 - shown) (3) Pyrrolidine Pyrrolidinyl (2 - shown) (4) Pyrroline (2 - shown) Pyrrolinyl (2-Pyrroline-3-yl - shown) (5) Imidazolidine
http://www.acdlabs.com/iupac/nomenclature/79/r79_959.htm

101. **List of Funded Projects AR-G8**
List of Funded Projects ARP-8 Funded Research Projects in The Eighth General Grants Program. P.No. Title 29 Water Requirements of Wheat Under Different Climatic Conditions of Saudi Arabia. 36 Evaluation and Improvement of the Efficiency
http://www.kacst.edu.sa/kacst_departments/research_support/gen_dir_grants/ar_g8.htm

102. **Welcome to Chemicals Division Products**
product*"> html""> All of BASF Products Products & Services : Product Search Chemicals Coatings & Colorants Consumer & L
http://www.basf.com/search/products/chemprod.html

103. **Exam 1 Answers**
Chem 336 - Spring 1999 - Organic Chemistry III Portland State University - Dr. Carl C. Wamser Exam 1 Answers 1. (12 points) Write a complete name for each of the following compounds, including designation of stereochemistry if it is specifically sho
http://www.chem.pdx.edu/~wamserc/C336S99/E1ans.htm

104. **Acid-Gas Removal System for Upgrading Subquality Natural Gas: Readiness Through Research.**
Acid-Gas Removal System for Upgrading Subquality Natural Gas: Readiness Through Research. Non-GRI Report Number: REPRINT-96-0001 Document Type: Conference Paper Conference Title: Jornadas de Gas, 12th, 1996 Authors: Palla, Nagaraju; Lee, Anthony L.;
http://www.gri.org/pub/abstracts/9946.html

105. **http://www.biam2.org/www/Cla50340.html**
Classe : SALICYLATES Autres dénominations : synonyme - SALICYLATE Substances de la classe ACETAMINOSALOL ACETYLSALICYLATE BASIQUE D'ALUMINIUM ACETYLSALICYLATE CARBONATE DE SODIUM ACETYLSALICYLATE DE LYSINE ALOXIPRINE AMYLE SALICYLATE BENZAMIDOSALIC
http://www.biam2.org/www/Cla50340.html

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106. **MSDS INVENTORY**
CHEMICAL INVENTORY : N - O N O CHEMICAL INVENTORY -N- Nalco 19 Neutracit-2 Caustic Neutralizer Nitrogen, Refrigerated Liquid Nalco 780 (contains the hazardous ingredient Sodiu
http://internet.michoner.on.ca/msds/chemntoo.htm

107. **http://www.biam2.org/www/Cla27314.html**
Classe : IODE DERIVE Substances de la classe ACETRIZOATE DE MEGLUMINE ADIPIODONE DE MEGLUMINE ALCOOL IODE AMIDOTRIZOATE DE MEGLUMINE AMIDOTRIZOATE DE SODIUM AMIODARONE CHLORHYDRATE ANETHOCURARIUM DIIODURE ARSENIC TRIIODURE BENZIODARONE BISMUTH OXYIO
http://www.biam2.org/www/Cla27314.html

108. **Précautions d'Emploi des Substances : ASTHME**
Précautions d'Emploi des Substances : ASTHME ACECLIDINE CHLORHYDRATE ACETAMINOSALOL ACETYLSALICYLATE BASIQUE D'ALUMINIUM ACETYLSALICYLATE CARBONATE DE SODIUM ACETYLSALICYLATE DE LYSINE ACETYLSALICYLIQUE ACIDE ALOXIPRINE AMOXICILLINE AMOXICILLINE SOD
http://www.biam2.org/www/SubPEMCASTHME.html

109. **Contre-Indications des Substances : ULCERE GASTRODUODENAL**
Contre-Indications des Substances : ULCERE GASTRODUODENAL ACETYLCYSTEINE ACETYLSALICYLATE BASIQUE D'ALUMINIUM ALMINOPROFENE AZAPROPAZONE BATROXOBINE BENORILATE BENOXAPROFENE BENZYDAMINE CHLORHYDRATE BETAHISTINE DICHLORHYDRATE BETAMETHASONE BETAMETHA
http://www.biam2.org/www/SubCIMCULCERE_GASTRODUODENAL.html

110. **4-Methylmorpholine**
4-Methylmorpholine MSDS Number: M5700 --- Effective Date: 04/28/99 1. Product Identification Synonyms: Morpholine, 4-Methyl-; 1-Methylmorpholine; N-Methylmorpholine CAS No.: 109-02-4
http://www.jtbaker.com/msds/m5700.htm

111. **COSMOS Online* - ERMA PRODUCTOS QUIMICOS, S.A. DE C.V.**
ERMA PRODUCTOS QUIMICOS, S.A. DE C.V. [México], Importadores y Distribuidores de productos para la industria Química en general. , Employees: 8, COSMOS Online* - Link between suppliers and possible buyers.
http://www.cosmos.com.mx/chem/erma

112. **COSMOS Online* - VENCATALYST, C.A.**
VENCATALYST, C.A. [Venezuela], Founded: 1976, COSMOS Online* - Link between suppliers and possible buyers.
http://www.cosmos.com.mx/pqs/bq31.htm

113. **COSMOS Online* - VENCATALYST, C.A.**
VENCATALYST, C.A. [Venezuela], Founded: 1976, COSMOS Online* - Link between suppliers and possible buyers.
http://www.cosmos.com.mx/PQS/bq31.htm

114. **Springer LINK: Fresenius' Journal of Analytical Chemistry - Abstract Volume 355 Issue 2 (1996) pp 164-173**
Fresenius' Journal of Analytical Chemistry ISSN: 0937-0633 (printed version) ISSN: 1432-

1130 (electronic version) Table of Contents Abstract Volume 355 Issue 2 (1996) pp 164-173 Determination of aliphatic and alicyclic amines in water by gas and liq
http://link.springer.de/link/service/journals/00216/bibs/6355002/63550164.htm

115. **ToxAlert 10 sensitivities**
Sensivity of the ToxAlert 10 ® test procedure on different chemicals The following list contains 84 chemicals. For each you may get sensivity data on the ToxAlert 10 ® instrument for incubation times from 5 to 30 minutes incubation time and using
http://www.merck-itd.env.assays.co.uk/chems/tox10chm.htm

116. **secondary alphabetical sort**
Easy Access For Azeotrope Components Beginning With M To access data on a component found in an azeotrope, please click on the prefix group that it belongs to. Contents Methanol... Methoxy... Methyl... Morpholine... Methanol... Components Boiling p
http://www.chemeng.ed.ac.uk/people/kinns/aca113.html

117. **Polystone - Resistance to chemicals**
Polystone ® - Resistance to chemicals and other media - M A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | XYZ Substance Concentration(s) PE 20°C PE 60 °C PP 20 °C PP 60 °C PP 10 0 °C
http://www.roechling-haren.de/english/polychem/m.htm

118. **http://www.pastec.co.jp/ftiraccessory/chemical/Fdm_surf.txt**
Index to the FDM FTIR Spectra of Surfactants Copyright (c) 1996, Fiveash Data Management, Inc. All Rights Reserved. Glyceryl monolaurate Glyceryl dilaurate Glyceryl monostearate Glyceryl distearate Glyceryl monooleate Glyceryl dioleate
http://www.pastec.co.jp/ftiraccessory/chemical/Fdm_surf.txt

119. **Dispersions (Continued)**
Mixland Plus Binder Blowing Agents Activity Filtration Mixland AZTF Azodicarbonamide 75 Not applicable Mixland OBSH 75 P,P'Oxi-bis(benzylsulphonyl)-hydrazide 75 Not applicable Mixland TSH* P-Toluene sulfonyl hydrazide 75 Not applicable Dithioca
http://www.sovereignchemical.com/Products/Dispersions/dispersions2.htm

120. **Gel Preparation**
Preparation of Gels for Electrophoresis Introduction: Different gel technologies: agarose, polyacrylamide and starch may be used for the electrophoresis of isozymes. The gels are chemically buffered to a specific pH and are the matrix through which
http://dendrome.ucdavis.edu/~phodgski/iso.gel.prep.html

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Web Pages

121. **http://www.biam2.org/www/Sub2494.html**
FOLESCUTOL Introduction dans BIAM : 18/2/1992 Dernière mise à jour : 28/7/1999 Etat : validée Identification de la substance Propriétés Pharmacologiques Mécanismes d'action Effets Recherchés Indications thérapeutiques Pharmaco-Dépendance Posologi
http://www.biam2.org/www/Sub2494.html

122. **Morpholinos Home**
The Morpholinos website describes the fundamentals of Morpholino antisense oligos. Synthesis, properties and use of Morpholino oligos are described in detail.
http://www.morpholino.com/

123. **NIGP885**
NIGP - 885 CLASS ITEM DESCRIPTION 885 00 WATER AND WASTEWATER TREATING CHEMICALS 885 08 Activated Carbon and Filter Elements 885 15 Algae and Microbe Control Chemicals (Copper Sulfate, etc.) 885 16 Algae and Microbe Control Chemicals (For Air Condit
http://www.doa.state.nc.us/PandC/nigp885.htm

124. **COSMOS Online* - MAQUILAS QUIMICAS Y DEPORTIVAS, S.A. DE C.V.**
MAQUILAS QUIMICAS Y DEPORTIVAS, S.A. DE C.V. [México], COSMOS Online* - Link between suppliers and possible buyers.
http://www.cosmos.com.mx/chem/maqydsa

125. **Springer LINK: Current Genetics - Abstract Volume 33 Issue 2 (1998) pp 145-150**
Current Genetics ISSN: 0172-8083 (printed version) ISSN: 1432-0983 (electronic version) Table of Contents Abstract Volume 33 Issue 2 (1998) pp 145-150 Genetic analysis of resistance to fenpropimorph in Aspergillus niger A. J. G. Engels (1), E. F. Ho
http://link.springer-ny.com/link/service/journals/00294/bibs/8033002/80330145.htm

126. **Documentation for Immediately Dangerous to Life or Health Concentrations (IDLHs)**
N-Ethylmorpholine IDLH Documentation CAS number: 100-74-3 NIOSH REL: 5 ppm (23 mg/m 3) TWA [skin] Current OSHA PEL: 20 ppm (94 mg/m 3) TWA [skin] 1989 OSHA PEL: 5 ppm (23 mg/m 3) TWA [skin] 1993-1994 ACGIH TLV: 5 ppm (24 mg/m 3) TWA [skin
http://siri.uvm.edu/nioshdb/idlh/100743.htm

127. **Alken® Treatment 666 - MATERIAL SAFETY DATA SHEET**
ALKEN® TREATMENT J-666 Effective Date: 11/11/99 Material Safety Data Sheet Manufacturer's Name: Alken-Murray Corporation Manufacturer's Address: P.O. Box 400, New Hyde Park, New York 11040 T: 540-636-1055 Fax: 718-224-0754 E-mail: msds@alken-m
http://www.alken-murray.com/666msd.htm

128. **Alken Treatment J-687- Product Information Bulletin**
ALKEN TREATMENT J-687 Material Safety Data Sheet CONDENSATE CORROSION INHIBITOR DESCRIPTION: ALKEN® TREATMENT J-686 is a blend of three volatile amines of low, medium and high distribution ratios, specially formulated to inhibit condensate c
http://www.alken-murray.com/687pib.htm

129. **COSMOS Online* - INSUMOS MULTIBASICOS**
INSUMOS MULTIBASICOS [México], Importadores y Distribuidores de productos

para la industria Química en general. , Employees: 8, COSMOS Online* - Link between suppliers and possible buyers.
http://www.cosmos.com.mx/PQS/43gr.htm

130. **CCCC 1997, Volume 62, Issue 3, Abstracts pp. 471-478**
Collection of Czechoslovak Chemical Communications Abstracts: Volume 62, Issue 3, pp. 471-478 Issue Contents Author Index 1997 Volume 62, 1997 Collection Home SYNTHESIS OF 24-(PIPERIDIN-1-YL, MORPHOLIN-4-YL AND 4-METHYLPIPERAZIN-1-YL)-5 b -CHOLAN-3
http://cccc.uochb.cas.cz/Vol/62/No03/19970471.html

131. **CCCC 1996, Volume 61, Issue 5, Abstracts pp. 673-680**
Collection of Czechoslovak Chemical Communications Abstracts: Volume 61, Issue 5, pp. 673-680 Issue Contents Author Index 1996 Volume 61, 1996 Collection Home EXTRACTION OF DITHIOCARBAMATE CHELATES OF Ni(II), Cu(II), Zn(II) Drahomir OKTAVEC, Jozef L
http://cccc.uochb.cas.cz/Vol/61/No05/19960673.html

132. **PHARMACEUTICAL INTERMEDIATES**
Ò½Ò©ÖÐ¼äÌå ²úÆ· °ü×° ¹æ¸ñ 2,4-Dichloro-5-Fluoro Acetophenone 50kg/drum 99% 2,4-Dichloroacetophenone 40kg/drum 98%Min 2-(1,4-Cyclohexadiene) Glycine 25kg/drum 99%Min(HPLC) 2-Amino-4-Nitro-6-Chlorophenol 25kg/drum 98% 2-Amino Pyridine 25kg/drum 97% 2-
http://www.spicl.com/c_intermediates.htm

133. **4-Nitrosomorpholin**
Zurück: Namensauswahl CAS-Nummernauswahl CHEMIS - CIVS Hauptname: 4-Nitrosomorpholin CAS-Nr.: 59-89-2 SYNONYME GESUNDHEITSGEFAHREN / ERSTE HILFE BRAND- UND TECHNISCHE GEFAHREN EINSATZHINWEISE BEI FREISETZUNG / BRAND UMWELT / LAGERUNG / VERPACKU
http://www.bgvv.de/fbs/chem/civs/5989.htm

134. **Safety4: Guide Body C**
Chemical C A S Reg. No . 21 o C (70 o F) Breakthru Time (min) 35 o C (95 o F) Breakthru Time (min) Carbon Disulfide 75-15-0 >1440 >240 Carbon Tetrachloride 56-23-5 >480 >240 Chlorine 7782-50-5 >240 NT Chloroaceto
http://www.safety4.com/guide/gd_c.htm

135. **News Releases**
AVi BIOPHARMA PRESENTS ANTISENSE GENE THERAPY DATA AT INTERNATIONAL BIOTECHNOLOGY CONFERENCE IN WASHINGTON, D.C. PORTLAND, OREGON OCTOBER 28, 1998 ANTIVIRALS INC. (Nasdaq: AVII, AVIIW) today presented a summary of data on the company's approac
http://www.antivirals.com/pr12.html

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136. **Sukhjeet**
Reactions of S-nitrosoglutathione with Glutathione Sukhjeet P. Singh, John S. Wishnok, Manesh Keshive, William M. Deen, and Steven R. Tannenbaum S-nitrosothiols have generated considerable interest due to their ability to act as nitric oxide (NO) d
http://web.mit.edu/org/t/toxms/www/spsacs.htm

137. **Manufacture of new generation fungicides**
Manufacture of new generation fungicides Country: India PROJECT NO.: INT\GUJ\CHEM\23 ISIC: 3512 DESCRIPTION: Sakshi Agrochemicals Private Limited intends to enter into a technology tie up with a foreign partner for establishing a facility f
http://www.unido.org/services/ip/ipopportunities/InvestGujarat/InvestGujarat23.htmls

138. **http://www.med.nagoya-u.ac.jp/Environderm/allergen/mmbt.htm**
No. ƒAƒŒƒ‹ƒQƒ“ Morpholinylmercaptobenzothiazole (MMBT) 'g ¬ •ª—Þ ƒSƒ "¯‹`Œê CA: 4-(2-benzothiazolylthio)morpholine ; IUPAC: 2-(morpholinothio)benzothiazole ; 2-(4-morpholinylmercapto)benzothiazole ; N-oxydiethylene-2-benzothiazolylsulfenamide ;
http://www.med.nagoya-u.ac.jp/Environderm/allergen/mmbt.htm

139. **ACD/Name vs Nomenclator**
Products Name Laboratory IUPAC Name Generation ACD/Name vs. Competition Comparison with AutoNom Comparison with Nomenclator Overview What's New Technical Info ACD/Labs vs. Competition Independent Reviews
http://www.acdlabs.com/products/name_lab/iupac/competit2.html

140. **FT-Raman Study on Charge-Transfer Polyiodide Complexes and Comparison with Resonance Raman Results**
FT-Raman Study on Charge-Transfer Polyiodide Complexes and Comparison with Resonance Raman Results by Paola Deplano, Francesco A. Devillanova, John R. Ferraro, Maria Laura Mercuri, Vito Lippolis, and Emanuele F. Trogu Appl. Spec. v48 (10) In the Res
http://www.s-a-s.org/journ/ASv48n10/ASv48n10_sp9.html

141. **Metabolising MAOIs**
Pharmacology of the new reversible inhibitor of monoamine oxidase A, RS-8359
http://www.biopsychiatry.com/maoi.htm

142. **http://www.biam2.org/www/Clp15843.html**
Classe : ANTISEPTIQUE Substances de la classe (Propriétés Pharma.) ACETIQUE ACIDE ACRIFLAVINIUM CHLORURE ALCOOL BENZYLIQUE ALCOOL IODE AMBAZONE ARGENT COLLOIDAL ARGENT FLUORESCEINATE ARGENT NITRATE ARGENT NUCLEINATE ARGENT PROTEINATE ARGENT VITELLIN
http://www.biam2.org/www/Clp15843.html

143. **http://www.biam2.org/www/Sub451.html**
PHENDIMETRAZINE EMBONATE Introduction dans BIAM : 18/2/1992 Dernière mise à jour : 21/3/2000 Etat : validée Identification de la substance Propriétés Pharmacologiques Mécanismes d'action Effets Recherchés Indications thérapeutiques Effets seconda
http://www.biam2.org/www/Sub451.html

144. **MSDS INVENTORY**
CHEMICAL INVENTORY : C - D C D CHEMICAL INVENTORY -C- Caffeine Chloral Hydrate Compare (hazardous ingredients not applicable *) Calcium Carbonate

Chloroform Congo Red Calcium Chloride
http://internet.michenet.on.ca/msds/CHEMCTOD.htm

145. **Public database of NMR spectra**
Public database of NMR spectra If you are seeing this instead of a set of menus, your browser is not java-enabled. You can view a site map instead. These are processed data in NUTS format, with embedded structures (in windows metafile forma
http://www.acornmr.com/database.htm

146. **Effets Secondaires des Substances : DYSURIE**
Effets Secondaires des Substances : DYSURIE ACEPROMAZINE ACEPROMETAZINE ADIPHENINE CHLORHYDRATE AMANTADINE CHLORHYDRATE AMBUTONIUM BROMURE AMFEPRAMONE CHLORHYDRATE AMITRIPTYLINE AMITRIPTYLINE CHLORHYDRATE ATROPINE ATROPINE AMINOXYDE CHLORHYDRATE ATR
http://www.biam2.org/www/SubEllMCDYSURIE.html

147. **CERTIFIED LABS DIV OF NCH -- TANK TONIC, 0630**
CERTIFIED LABS DIV OF NCH -- TANK TONIC, 0630 MATERIAL SAFETY DATA SHEET NSN: 685000N043119 Manufacturer's CAGE: 20913 Part No. Indicator: A Part Number/Trade Name: TANK TONIC, 0630
==========
http://siri.uvm.edu/msds/h/q179/q486.html

148. **Cleaning Solutions**
Article provides parents with helpful information on how they can make their own, natural, chemical-free household cleaners.
http://www.alternativeparenting.com/health/clean_solutions.htm

149. **COSMOS Online* - SERVICAL MEXICANA, S.A. DE C.V.**
SERVICAL MEXICANA, S.A. DE C.V. [México], Distribución de materias primas de prestigio mundial como Bayer y BASF*. Líderes en productos con tecnología avanzada en inhibidores de incrustación y corrosión pa
http://www.cosmos.com.mx/pqs/4gs8.htm

150. **E-Doc: Medicine Info for D-Phendimetrazine (anoretic)**
More information on medicine actives. D-Phendimetrazine (anoretic)
http://www.edoc.co.za/medilink/actives/283.html

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151. **Alken® Treatment 670 - MATERIAL SAFETY DATA SHEET**
ALKEN® TREATMENT J-670 Effective Date: 11/11/99 Material Safety Data Sheet Manufacturer's Name: Alken-Murray Corporation Manufacturer's Address: P.O. Box 400, N Hyde Park, New York 11040 T: 540-636-1055 Fax: 718-224-0754 E-mail: msds@alken-m
http://www.alken-murray.com/670msd.htm

152. **DIETHYLENE GLYCOL**
Home page for ChemExpo, a virtual trade show for the chemical industry sponsored Schnel Publishing and Chemical Marketing Reporter.
http://www.chemexpo.com/news/profile981026.cfm

153. **COSMOS Online* - MAQUILAS QUIMICAS Y DEPORTIVAS, S.A. DE C.V.**
MAQUILAS QUIMICAS Y DEPORTIVAS, S.A. DE C.V. [México], COSMOS Online between suppliers and possible buyers.
http://www.cosmos.com.mx/pqs/4gpz.htm

154. **COSMOS Online* - SINTETIC MEXICANA, S.A. DE C.V.**
SINTETIC MEXICANA, S.A. DE C.V. [México], Distribución de Productos Químicos , Founded: 1977, COSMOS Online* - Link between suppliers and possibl buyers.
http://www.cosmos.com.mx/pqs/4c0s.htm

155. **Institut für Pflanzenkrankheiten, Abt.: Pflanzenkrankheiten**
Abteilung Pflanzenkrankheiten Institut für Pflanzenkrankheiten, Abteilung: Pflanzenkrankhei Rheinische Friedrich-Wilhelms-Universität Bonn Wissenschaftliche Mitarbeiter Startseite Di und Krankheitsprognose Befalls-Verlust-Relationen Biologi
http://www.uni-bonn.de/pk/research.htm

156. **http://www.kita.or.kr/untpdc/news/eto/demand/9215**
Path: urgento.gse.rmit.EDU.AU!urgento.gse.rmit.EDU.AU!not-for-mail From: zhongye <zhongye@PPP.TZPTT.ZJ.CN> Newsgroups: eto.emaillink,eto.demand Subject: (WANTE [ETO] Demand [China] Chemicals & Pharmaceuticals Date: 15 Aug 1997 12:27:45 +1000
http://www.kita.or.kr/untpdc/news/eto/demand/9215

157. **crop notes - June 99**
DANI Farm Management Notes for June Crops Management CEREALS Cereal disease co The key to effective cereal disease control is careful crop monitoring. Control of foliar disea most effective when fungicide application is made at an ea
http://www.greenmount.ac.uk/crops/bulletin/jun99.htm

158. **3ÔÂ·ÝµÄÇó¹ºÐÅÏ¢**
ÒÔÏÂÊÇ3ÔÂ·ÝµÄÇó¹ºÐÅÏ¢Ä¿Â¼ [µÚÒ»Ò³] [µÚ¶þÒ³] DEMAND: [ID] Alternator Leroy So DEMAND: [ID] FERTILIZER - SUAGR DEMAND: [ID] Samotte / Chamotto sand DEMAND: [Saponin, Tea seed meal/cake DEMAND: [ID] USED CAMSHAFT GRINDER MACHINE DE [ID]
http://china-info.163.net/month3.htm

159. **BETZ LABORATORIES -- ENTEC 747A**
BETZ LABORATORIES -- ENTEC 747A MATERIAL SAFETY DATA SHEET NSN: 685000N074200 Manufacturer's CAGE: 24774 Part No. Indicator: A Part Number/Trade Na ENTEC 747A
==========

http://hazard.com/msds/h/q373/q319.html

160. **Boulder Scientific**
Click on '2D' to view a 2D structure. A free program Chime must be used as a Netscape Plu This plug-in is not supported by IE 3.0. SCANDIUM COMPOUNDS 2D BSC 645 Scandium [7440-20-2], 2D BSC 620 Scandium Oxide, [12061-08-1], ORGANO
http://www.chem.com/Boulder/page3.html

161. **Update -- Test Results from NFM Pilot Plant Testing**
Update--Test Results from NFM Pilot Plant Testing As reported earlier, preliminary testing fr ~1 MMscfd pilot plant absorption unit operating at Shell's Fandango facility indicates the us NFM as a treating solvent is extremely promisin
http://www.gri.org/pub/oldcontent/tech/3/e+p/gproc/tu/j.html

162. **Exam 1**
Chem 336 - Spring 1999 - Organic Chemistry III Portland State University - Dr. Carl C. Wa Exam 1 1. (12 points) Write a complete name for each of the following compounds, includin designation of stereochemistry if it is specifically shown: a) b
http://www.chem.pdx.edu/~wamserc/C336S99/E1.htm

163. **PTO Manual of Classification for US patents**
PTO Manual of Classification for US patents What follows are the subclasses from one clas Manual of Classification for US patents. As you scroll through the list and encounter a class/subclass of interest, you can jump back to the top and r
http://metalab.unc.edu/patents/class/CLASS544.html

164. **Pflanzenschutzmittel**
Pflanzenschutz- und Schädlingsbekämpfungsmittel Pflanzenschutzmittel (engl. Pesticides) Schädlingsbekämpfungsmittel gehören wie Mineraldünger heute zu den Produktionsmitteln Landwirtschaft. Das Qualitätsbewusstsein der Konsume
http://www.interlabor.ch/d/leistung/pflanzen.htm

165. **http://alpha2.bmc.uu.se/hicup/MES/mes_hetze_log.txt**
Program parameters : Bond tolerance (A) : (0.450) Bond deviation tolerance (A) : (0.050) range for bond lengths (A) : (0.075) Large range for bond angles (d) : (8.000) Large range dihedrals (d) :
http://alpha2.bmc.uu.se/hicup/MES/mes_hetze_log.txt

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166. **The List Of Target Substances For Redution/Elimination in the Canadian Printing and Graphics Industry Pollution Preventi**
APPENDIX II: The list of target substances for reduction/elimination in the Canadian Printing and Graphics Industry Pollution Prevention Project SUBSTANCE CAS No. SUBSTANCE CAS No. acetic acid methanol B (methyl alcohol) 67-56-1 acetone 67-
http://www.ccw.ca/glimr/data/first-printing-rep/appendix-2.html

167. **GeneTools, LLC**
The GENE TOOLS website describes the fundamentals of antisense and how to design, order, and use Morpholino antisense oligos.
http://www.gene-tools.com/

168. **http://www.biam2.org/www/Sub3175.html**
MORINAMIDE CHLORHYDRATE Introduction dans BIAM : 18/2/1992 Dernière mise à jour : 13/1/2000 Etat : validée Identification de la substance Propriétés Pharmacologiques Mécanismes d'action Effets Recherchés Indications thérapeutiques Effets secondai
http://www.biam2.org/www/Sub3175.html

169. **http://www.biam2.org/www/Clp24162.html**
Classe : ANTIINFLAMMATOIRE NON STEROIDIEN Autres dénominations : synonyme - ANTIINFLAMMATOIRE NON STEROIDIQUE synonyme - ANTIINFLAMMATOIRES NON STEROIDIENS Substances de la classe (Propriétés Pharma.) ACETAMINOSALOL ACETYLORTHOCRESOTINIQUE ACIDE AC
http://www.biam2.org/www/Clp24162.html

170. **STN Basics - Training Module Part 4**
Additional Search Tools Proximity Operators Proximity operators are used to control the relative proximity of search terms in answers. They are used to make a search more precise. The assumption is that the closer the terms are together, the more di
http://www.cas.org/training/basics/page5.html

171. **Alken Chemical Water Treatment , for boilers and cooling towers**
Chemical water treatment for boilers and cooling towers since 1934. Prevent corrosion and biofouling. Acid cleaners. Alkalinity boosters. Polymers from Solutions Chemical Consultants and biocides from Ques Industries. Also see our biological water
http://www.alken-murray.com/chemical.htm

172. **Appendix D**
APPENDIX D COMMON LABORATORY FLAMMABLE AND COMBUSTIBLE CHEMICALS Flammable and combustible chemicals are the most commonly used hazardous chemicals. The hazard of a flammable or combustible chemical is based on its flash point, and, in the case of
http://www.orobs.msu.edu/chemical/chp/appendixd.html

173. **MYHEADER**
Sorry, but you need a frame viewer for this page. Click Here to go to my non-frames version of the Biophysical Properties of Drugs - Flash Cards. Or you could just go download the latest Netscape. This Internet Study Guide was created due to the jo
http://www.geocities.com:0080/CapeCanaveral/3511/biophys.htm

174. **Reboxetine (Edronax , Vestra) and the blood**
Reboxetine: hemodynamic effects

http://www.reboxetine.com/rebhaem.htm

175. **pKa of Common acids and pKb of Common Bases**
pKs of acids and bases
http://www.chromatography.co.uk/techniqs/Other/buffers.htm

176. **Oxygen Scavenger Comparisons Treatment J-677**
Oxygen Removal Rates of Alken® Treatment J-677 vs. Other Chemicals D issolved Oxygen, ppm Removal of Oxygen versus Time in Minutes 0 15 30 60 90 120 1. Alken® Treatment J-677 8.60 4.70 2.63 1.05 0.54 0.33 2. N-N-Diethylhydroxylamine (DEHA
http://www.alken-murray.com/J-compar.htm

177. **FUNGICIDAL ACTIVITY OF NATURAL AND SEMISYNTHETIC CEVERATRUM ALKALOIDS**
BOTANICAL FUNGICIDES: NATURAL AND SEMISYNTHETIC CEVERATRUM ALKALOIDS GYULA OROS * and ISTVÁN UJVÁRY, Plant Protection Institute, Hungarian Academy of Sciences, POB 102, H-1525 Budapest, Hungary Sabadilla powder prepared from Schoenocaulon officinal
http://www.chemsoc.org/chempest/html/3A-0013.html

178. **COSMOS Online* - DR. JOSE POLAK, S.A. DE C.V.**
DR. JOSE POLAK, S.A. DE C.V. [México], Compra y Venta de Productos Químicas y Consultoría Técnica para la Industria Química , Founded: 1919, Employees: 78, COSMOS Online* - Link between suppliers and possibl
http://www.cosmos.com.mx/pqs/44s1.htm

179. **COSMOS Online* - DR. JOSE POLAK, S.A. DE C.V.**
DR. JOSE POLAK, S.A. DE C.V. [México], Compra y Venta de Productos Químicas y Consultoría Técnica para la Industria Química , Founded: 1919, Employees: 78, COSMOS Online* - Link between suppliers and possibl
http://www.cosmos.com.mx/PQS/44s1.htm

180. **Revue canadienne de microbiologie, Volume 45, numéro 3, mars 1999**
Canadian Journal of Microbiology Revue canadienne de microbiologie Table of Contents Table des matières Volume 45, Number 3, March 1999 ISSN 1480-3275 Volume 45, numéro 3, mars 1999 Growth properties of a folA null mutant of Escherichia coli K12 Mur
http://www.nrc.ca/cisti/journals/cjm/micro3-99f.html

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181. **SPACE CHEMICAL -- AI-1080-93-2 (CLEANING COMPOUND) - CLEANING COMPOUND,AIRCRAFT SURFACE**
SPACE CHEMICAL -- AI-1080-93-2 (CLEANING COMPOUND) - CLEANING COMPOUND,AIRCRAFT SURFACE MATERIAL SAFETY DATA SHEET NSN: 6850012378003 Manufacturer's CAGE: 0C3Y2 Part No. Indicator: A Part Number/Trade Name: AI-1080-93-2 (CLEANING COMPOUND) =====
http://hazard.com/msds/hvq256/q199.html

182. **Balazs News: Amines in your cleanroom air?**
Back to What´s New at Balazs Are Amines in Your Cleanroom Air Affecting Your Process? To analyze amines in air, Balazs developed a method that is sensitive to the 1 ppbM level, accurate, reproducible, easy to use, automated and able to differentia
http://www.balazs.com/news22amines.html

183. **Gas Processing Tech Update: November 1997**
Gas Processing Tech Update: November 1997 NFM Pilot Plant Testing Update--Mixed Solvent Tests See the previous Updates September 1997 , May 1997 , December 1996 , September 1996 for background information. See also the IGT presentation to SMP on N
http://www.gri.org/pub/oldcontent/tech/e+p/gproc/tu/gptu1197.html

184. **Spring 1999 Colloquia**
Department of Chemistry Spring 1999 Seminar Schedule FEBRUARY Monday, Feb. 22, 12 Noon Dr. Jonathan Wilker, Cal Tech "Rapid Delivery of Electrons and Holes to Buried Protein Active Sites" Tuesday, Feb. 23, 4:00 PM Prof. Lou-sing Kan, Academia Sini
http://chmwww.rutgers.edu/~webstaff/colloquia.html

185. **Whitaker Oil**
Chemical and solvent distributor of hydrocarbons, alcohols, ketones, paint and lacquer thinners, epoxy resins, glycols, glycol ethers, acetates, surfactants, amines, mineral oils, process oils.
http://www.whitakeroil.com/product.htm

186. **Alkali, Alkaline Earth Cation, Amines ºÐ¼®**
ÀÚ·á¹øÈ£ : WA-81106 Alkali, Alkaline Earth Cation, Amines ºÐ¼® - Waters CIA System - Capillary Ion Analysis System (CIA)À° ºÐÀÚ·®ÀÌ ÀÙÀ° ¹«±â À½ÀÌ¿Â , ¾çÀÌ¿Â , À¯±â»ê , Áß±Ý¼Ó , ¾Æ¹Î·ù µéÀ» ºÐ¼®ÇÏ±â Â§ÇØ Àü±â ¿µµ¿ ±â¼ú(Capillary Electrophoresis)À» À
http://www.youngin.com/app/WA-81106.htm

187. **Crop monitor - 16 Apr 99**
Crop Monitor Week ending 16 April 1999 Welcome to the first edition of Crop Monitor for the 1999 season. The aim of this publication is to provide growers with information to improve the competitiveness of their arable enterprises. Crop Monitor is
http://www.greenmount.ac.uk/crops/bulletin/16apr99.htm

188. **Chemical Additives for Metal Pretreatment and Metal Working Fluids**
Pax Enterprise Pvt. Ltd. is part of the PAX GROUP (an ISO 9001 Group); a group of companies manufacturing specialty chemicals.
http://www.paxgroup.com/mwf-bio.html

189. **products**
About Us Contact Us PRODUCT LIST Search by first letter A B C D E F G H I K L M N O P R S T U V W X Many items available in bulk, tote, drum, or pail quantities. A Acetone

Acids: Ace
http://www.industrialchemicals.com/products.htm

190. **ADS - Technical Support - Technical Note 2.108**
TECHNICAL NOTE 2.108 Chemical Resistance Properties of Polyethylene (HDPE) and Polyvinyl Chloride (PVC), Thermo-Plastics and Elasto-Meric Gasket Material for Thermo-Plastic Pipe and Joints Chemical Resistance
http://www.ads-pipe.com/techsup/tec2108E.html

191. **Formulaire d'évaluation**
Formulaire d'évaluation Travaux Pratiques de Chimie Organique Première et Seconde Licences en Sciences Chimiques Vous êtes invité à compléter ce formulaire d'évaluation pour chacune des manipulations que vous avez effectuée au laboratoire. Les rense
http://www.chim.ulg.ac.be/licence/commentaire.html

192. **paraffin wax - encyclopedia article from Britannica.com**
paraffin wax - colourless or white, somewhat translucent, hard wax consisting of a mixture of solid straight-chain hydrocarbons ranging in melting point from about 48o to 66o C (120o to 150o F). Paraffin wax is obtained from petroleum by dewaxing l
http://www.britannica.com/seo/p/paraffin-wax/

193. **http://cri.ensmp.fr/biam/www/Clp61794.html**
Classe : ANTIBACTERIEN Substances de la classe (Propriétés Pharma.) AMBAZONE AMFOMYCINE CALCIQUE AMIKACINE AMIKACINE SULFATE AMINO-4 BENZOATE SODIQUE AMOXICILLINE AMOXICILLINE SODIQUE AMPICILLINE AMPICILLINE SODIQUE AMYLONIAZIDE APALCILLINE SODIQUE
http://cri.ensmp.fr/biam/www/Clp61794.html

194. **Chemical Compatibility Chart - Gloves**
University of California, San Diego Department of Chemistry & Biochemistry Undergraduate Teaching Laboratories Chemical Compatibility Chart - Polymers and Solvents Resistance to Chemicals of Common Glove Material (E = Excellent. G = Good, F = Fair,
http://chem-courses.ucsd.edu/CoursePages/Uglabs/Education/chem.compat.gloves.html

195. **© POL.it 1999 BOLLETTINO DI AGGIORNAMENTO IN NEUROPSICOFARMACOLOGIA**
The first and most read Italian Psychiatric on line Magazine
http://www.pol-it.org/ital/riviste/bollettino/aprile99_1b.htm

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March 26, 2001
Food and Drug Administration
Freedom of Information Staff (HFI-35)
5600 Fishers Lane
Rockville, MD 20857

Dear FDA FOIA Staff:

The Organic Materials Review Institute (OMRI) requests, pursuant to the Freedom of Information Act (FOIA), 5 USC 552, information on the following substance that is approved for use by FDA as boiler water additives:

Substance	CAS #	21 CFR	Federal Register Notice	Date
Morpholine	**110-91-8**	**173.310(d)**	**27 FR 6232**	**June 30, 1962**

The appropriate *Federal Register* notice is attached for your convenience.

Please provide any data or information used by FDA to issue regulations regarding the safe use of the boiler compound listed above when used in the preparation of steam that contacts food. In particular, please provide the basis for the determination of the limitation found in 21 CFR 173.310(d). OMRI specifically requests any data submitted by the petitioners regarding the amount of this chemical found in steam and food. OMRI also requests data submitted by those who may have objected to the original notice, and any data submitted subsequent to the establishment of the regulation regarding the use of this compound as a boiler water additives.

Also, please provide any information on verification of compliance with the limitations set forth in that section. This would include test methods employed by FDA, the sampling procedure, the results from the analysis of the samples taken, and any actions taken against violators from 1962 to the most recent date for which information is available. Please provide any record of investigation and reports of measures taken by companies found out of compliance or in violation of these limitations, including any product recalls related to this compound.

OMRI respectfully requests that any and all fees for this request be waived because it meets both tests of FDA's FOIA Implementation Policy for Waivers contained in 21 CFR 20.43:

(1) Is in the public interest because it is likely to contribute significantly to public understanding of the operations or activities of the Government
OMRI is tendering this request as part of research under contract for the US Department of Agriculture's National Organic Program as the Technical Advisory Panel to the National Organic Standards Board (NOSB). The results

Organic Materials Review Institute™ • Box 11558 • Eugene, OR 97440-3758 U.S.A.
Phone 541-343-7600 • Fax 541-343-8971 • E-mail info@omri.org • www.omri.org

File: Boiler chem

Pooler, Bob

From: KBurton@jmsmucker.com%inter2
Sent: Friday, September 14, 2001 10:32 AM
To: Mathews, Richard
Cc: Pooler, Bob; steven.harper@smallplanetfoods.com%inter2; bb@omri.org%inter2; kdowney@omri.org%inter2
Subject: TAP Boiler Chemical FOIA Request

called Judy Kidwell go out 7th - Brian Baker

Richard,
Per our conversation this morning please have someone from NOP call FDA regarding the status of the FOIA's on diethyaminoethanol, cyclohexlamine, morpholine, and octadecylamine. Michael Howard, who was our original contact, suggested calling Judith Kidwell (202-418-3354) or Parvin Yasaei (202-418-3023) for the status of these FOIA request. If we can choose an order of preference the processing committee would like to have diethyaminoethanol as the highest priority and the others to follow. Please update Steve, Brian and I with the outcome of the conversation. Again, congrats on your promotion.....

go out

Thanks,

Kim

----- Forwarded by Kim Burton/Chico/JMS on 09/14/2001 06:50 AM -----

Brian Baker <bb@omri.org> 09/12/2001 01:46 PM

To: "Kim Burton" <kim.burton@jmsmucker.com>
cc: ebr@guppy.pond.net, kdowney@guppy.pond.net, "Steven Harper" <stevenh@smallplanetfoods.com>
Subject: TAP Boiler Chemical FOIA Request

Hi Kim--

I talked to Steve Harper today about the October TAP reviews, and also about the boiler water additive TAP reviews and the criteria used to determine when a petition is needed. Steve and I briefly discussed the ammonium hydroxide information. Immediately following the conversation with Steve, I called Judith Kidwell, the FOIA officer for diethyaminoethanol, morpholine, and octadecylamine. She said that she will try to find out the status of those FOIAs, but confirmed that they were still in the system and had not been sent. I asked her when FDA would send the files, and she would not give an estimate. She indicated that yesterday's events have changed staff availability and schedules for all Federal agencies in Washington, DC. I gave her our deadline for mailing TAPs to the NOSB and the dates of the NOSB meeting, indicating that if it was appropriate and would help, I was willing to meet the staff in person while in Washington before the meeting, and provide whatever assistance was needed to expedite the release of the information. She will call tomorrow if she has any new information. I will let you know as soon as I learn anything about the fulfillment of that request. Please let me know if I can be of further assistance.

Be well,
bb

File: Baker chem.

Pooler, Bob

To: Mathews, Richard; Strother, Toni
Cc: KBurton@jmsmucker.com; ebr@OMRI.org
Subject: FDA FOIA Information, response

Rick,

Judy Kidwell of FDA informed me that the FOIA material for octadecylamine went out on September 7th to B. Baker (OMRI) and the information on diethylaminoentanol, cyclohexlamine and morpholine was sent yesterday (09/18/01) to B. Baker. OMRI needs to forward the information to NOP for distribution to the NOSB ASAP.

Bob Pooler