

National Organic Standards Board,
c/o Robert Pooler, Agricultural Marketing Specialist,
USDA/AMS/TM/NOP, Room 2510-So., Ag Stop 0268,
P.O. Box 96456, Washington, D.C. 20090-6456.

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National List Petition
Submitted: November 29, 2000

Ammonium Hydroxide

This Petition is submitted by the following:

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**Petition for Amending the National List of the USDA's
National Organic Program
for inclusion of:**

Ammonium Hydroxide

Petitioners are required to provide the following information as applicable:

Category for inclusion on the National List:

➤ *Synthetic*

Common name:

➤ *Aqua Ammonia* Common synonyms Ammonia water, Aqueous ammonia, Household ammonia, Aqua ammonia, Ammonia solution

Chemical Structure:

➤ NH_4OH or NH_3H_2O

Manufacturers name, address and telephone number

There are many manufacturers and providers of this chemical. Annual US production exceeds 1 million pounds.

Tradename(s):

Production sites: AIR PRODUCTS AND CHEMS. INC., ESCAMBIA CHEM. CORP. SUBSID., NEW ORLEANS, LA; PENSACOLA (PACE), FL; ALLIED CHEM. CORP., AGRICULTURAL DIV., GEISMAR, LA; HOPEWELL, VA; IRONTON (SOUTH POINT), OH; OMAHA (LA PLATTE), NEB. AMERICAN CYANAMID CO., AGRICULTURAL DIV., FORTIER (NEW ORLEANS), LA; APACHE POWDER CO., BENSON, AZ; ARKANSAS LOUISIANA GAS CO., ARKLA CHEM. CORP. SUBSID., HELENA, AR; ATLANTIC RICHFIELD CO., ARCO CHEM. CO. DIV., FORT MADISON, IA; ATLAS CHEM. INDUST. INC., CHEMS. DIV., JOPLIN, MO; BORDEN INC., BORDEN CHEM. DIV., PETROCHEMICALS, GEISMAR, LA; CF INDUST. INC. FEL-TX DIV., FREMONT, NEB. FIRST NITROGEN CORP. SUBSID., DONALDSONVILLE, LA; CENTRAL NITROGEN, INC., TERRE HAUTE, IN; CHEROKEE NITROGEN CO., PRYOR, OK; CITIES SERVICE CO. INC., NORTH AMERICAN CHEMS. AND METALS GROUP, AGRICULTURAL CHEMS. DIV., TAMPA, FL; COLORADO INTERSTATE CORP., WYCON CHEM. CO. SUBSID., CHEYENNE, WY; COLUMBIA NITROGEN CORP., AUGUSTA, GA; COMMERCIAL SOLVENTS CORP., STERLINGTON, LA; CONTINENTAL OIL CO, AGRICO CHEM. CO. DIV.,

SLYTHEVILLE, AR; COOPERATIVE FARM CHEMS. ASSOCIATION,
LAWRENCE, FL; DIAMOND SHAMROCK CORP., DIAMOND SHAMROCK OIL
AND GAS CO., DUMAS, TX; THE DOW CHEM. CO., FREEPORT, TX; E.I.
DU PONT DE NEMOURS AND CO. INC. EXPLOSIVES DEPT., BEAUMONT,
TX; INDUST. AND BIOCHEMS. DEPT., BELLE, SC; PLASTICS DEPT.,
VICTORIA, TX; EARLY CALIFORNIA INDUST. INC., SOUTHWESTERN
NITROCHEMICAL CORP., SUBSID. OF ARIZONA AGROCHEMICAL CORP.,
CHANDLER, AZ; EL PASO NATURAL GAS CO., EL PASO PRODUCTS CO.
SUBSID., ODESSA, TX; FMC CORP., INORGANIC EHCMS. DIV., SOUTH
CHARLESTON, SC; FARMERS CHEM. ASSOCIATION, INC., TUNIS, NC;
TYNER, TN; FARMLAND INDUST. INC., DODGE CITY, FL; FORT DODGE,
IA; HASTINGS, NEB. FELMONT OIL CORP., OLEAN, NY; GOODPASTURE,
INC., DIMMITT, TX; W.R. GRACE AND CO., AGRICULTURAL CHEMS.
GROUP, BIG SPRING, TX; MEMPHIS, TN; GREEN VALLEY CHEM. CORP.,
CRESTON, IA; GULF OIL CORP., GULF OIL CHEMS. CO. DIV.,
AGRICULTURAL CHEMS. DIV., DONALDSONVILLE FAUSTINA, LA; GULF
AND WESTERN INDUST. INC., THE NEW JERSEY ZINC CO. SUBSID,
PALMERTON, PA; HERCULES INC., SYNTHETICS DEPT., HERCULES, CA;
LOUISIANA, MO; HILL CHEMS. INC., BORGER, TX; KAISER ALUMINUM
AND CHEM. CORP., KAISER AGRICULTURAL CHEMS. DIV., SAVANNAH,
GA; LONE STAR GAS CO., NIPAK, INC. SUBSID., KERENS, TX;
PRYOR, OK; MISCOA, PASCAGOULA, MS; YAZOO CITY, MS; MOBIL OIL
CORP., MOBIL CHEM. CO. DIV. OF MOBIL OIL CORP.,
PETROCHEMICALS DIV., BEAUMONT, TX; MONSANTO CO., AGRICULTURAL
DIV., LULING, IA; MUSCATINE, IA; OCCIDENTAL PETROLEUM CORP.
CALIFORNIA AMMONIA CO. SUBSID., LATHROP, CALIF. HOOKER CHEM.
CORP. SUBSID., INDUST. CHEMS. DIV., TACOMA, WA; OCCIDENTAL
CHEM. CO. SUBSID., WESTERN DIV., LATHROP, CALIF PLAINVIEW,
TX; OLIN CORP., AGRICULTURAL CHEMS. DIV., LAKE CHARLES, LA;
PPG INDUST. INC., INDUST. CHEM. DIV. (FORMERLY THE COLUMBIA-
SOUTHERN CHEM. CORP.), NEW MARTINSVILLE (NATRIUM), SC;
PENNWALT CORP., CHEM. DIV., PORTLAND, OR; WYANDOTTE, MI;
PHILLIPS PACIFIC CHEM. CO., KENNEWICK, WA; PHILLIPS PETROLEUM
CO., BEATRICE, NEB.; ETTER, TX; PASADENA, TX; RESERVE OIL AND
GAS CO., HANFORD, CA; ROHM AND HAAS CO., DEER PARK, TX; ST.
PAUL AMMONIA PRODUCTS, INC., EAST DUBUQUE, IL; SHELL CHEM.
CO., AGRICULTURAL DIV., ST. HELENS, OR; VENTURA, CA; J.R.
SIMPLOT CO., MINERALS AND CHEM. DIV., POCATELLO, ID; SKELLY
OIL CO., HAWKEYE CHEM. CO. SUBSID., CLINTON, IA; STANDARD OIL
CO. OF CALIFORNIA, EL SEGUNDO, CA; RICHMOND CALIF, CHEVRON
CHEM. CO. SUBSID., ORTHO DIV., FORT MADISON, IA; STANDARD OIL
CO. (KENTUCKY) SUBSID., PASCAGOULA, MS; STANDARD OIL CO.
(INDIANA), AMERICAN OIL CO. SUBSID, TX; CITY, TX; THE
STANDARD OIL CO. (OHIO), VISTRON CORP. SUBSID., AGRICULTURAL
CHEMS. DEPT., LIMA, OH; SUN OIL CO, SUNOCO DIV., MARCUS HOOK,

PA; TENNECO INC., TENNECO CHEMS. INC. (A MAJOR COMPONENT OF TENNECO INC.), TENNECO HYDROCARBON CHEMS. DIV., HOUSTON, TX; TENNESSEE VALLEY AUTHORITY, MUSCLE SHOALS, AL; TERRA CHEMS. INTERNATIONAL, INC., PORT NEAL SIOUX CITY, IA; TEXACO INC., LOCKPORT, IL; TRIAD CHEM., DONALDSONVILLE, LA; UNION OIL CO. OF CALIFORNIA, COLLIER CARBON AND CHEM. CORP., SUBSID., BREA, CA; KENAI, ALAS. UNITED STATES STEEL CORP., USS AGRI-CHEMICALS DIV., CHEROKEE, AL; CLAIRTON, PA; VALLEY NITROGEN PRODUCERS, INC., EL CENTRO, CA; HELM NEAR FRESNO, CALIF. VULCAN MATERIALS CO., CHEMS. DIV., WICHITA, FL;

List of uses, rates and applications for crops and livestock uses, mode of action for handling uses:

Ammonium Hydroxide is used as a direct food ingredient for leavening, pH control and a surface finishing agent.

- Ammonium Hydroxide is used as a boiler additive to neutralize carbonic acid in condensate thus preventing corrosion to boiler equipment. It's function is similar to amines but Ammonium Hydroxide is not an amine. It is the only product of this type approved for the dairy industry. It presents a potential safety problem for the people handling it because of exposure to its corrosive vapors which limits its' use in other segments of the food industry.
- See the attached MSDS for additional information.

Sources and detailed description of manufacturing procedures:

Summary of any previous reviews by state or private certification agencies

- Classified as "regulated" by OTCO Ammonium Hydroxide is generally regarded by certification agencies as necessary and the least harmful alternative in many food production applications.

Regulatory status with EPA, FDA or state authorities:

From CFR Title 21;

Subpart B--General Purpose Food Additives

Sec. 582.1139 **Ammonium** hydroxide.

(a) Product. **Ammonium** hydroxide.

(b) Conditions of use. This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

- Ammonium Hydroxide is Generally Recognized As Safe when used in accordance with good manufacturing or feeding practices.
- See attached MSDS (section 15) for a listing of Federal, State and international regulatory information.

Chemical Abstract Service (CAS) number or other product number, samples of labels:

- CAS number – (1336-21-6)

Physical properties of the substance and chemical mode of action: including environmental impacts, interactions with other materials, toxicity and persistence, effects on human health, effects of soil organisms, crops or livestock:

- Physical properties are detailed in the attached MSDS sheet.
- Chemical Mode of action is described in the attachment from Watercare Boiler Treatment Seminar Review Notes

Safety information, including a MSDS (Material Safety Data Sheet) and report from National Institute of Environmental Health Studies (NIEHS):

- MSDS Sheets are attached
- NIEHS information was not found. It will be submitted as an addendum if and when such information becomes available.

Research information, including research reviews and bibliographies:

World Health Organization (WHO) No. 54: Ammonia

1986, 210 pages

ISBN 92 4 154194 6

Sw.fr. 29.-/US \$26.10; in developing countries: Sw.fr. 20.30

Order no. 1160054

An expert assessment of the effects on human health and the environment posed by ammonia. Prepared by a 14-member task group, the book cites more than 600 published reports of epidemiological, laboratory, and clinical investigations, including controlled studies in man. The most extensive sections evaluate the effects of ammonia in the aquatic and terrestrial environments where, as a result of urbanization, industry, and farming, significant toxic effects of ammonia may arise. Readers will find especially detailed assessments of the effects on aquatic animals as well as effects on cattle, swine, and poultry resulting from continuous exposure under confined housing conditions. Information on the kinetics and metabolism of ammonia and on its effects on experimental animals and *in vitro* systems is also presented.

"... a thorough, well-referenced monograph on the toxicology of ammonia..."

- American Public Health Association Newsletter

Petition justification statement - that states why the synthetic substance is necessary, alternatives that could be used, beneficial effects to the environment, etc

- Volatile Amines are designed to travel past culinary filters with steam to adjust the pH of the resulting condensate, since they directly contact food surfaces they are a concern in organic production. Ammonium Hydroxide is not an amine but serves a similar purpose as it neutralizes carbonic acid in steam condensate. It is GRAS and is the only such chemical allowable for use in the Dairy industry. Without this tool available for use to boiler operators equipment designed to last beyond 75 years would corrode and become exhausted in as little as 5-10 years. Since organic production in a plant is typically

a small portion of the total it is impractical to mandate discontinuing the use of a product so fundamental to equipment maintenance. Assuming Good manufacturing practices Ammonium Hydroxide is not a compromise to food safety. Furthermore post filter residue levels can easily be tested documenting the GMP's and setting enforceable maximum tolerances.

Commercial Confidential Information Statement - describing information that is considered to be confidential business or commercial information

➤ None of this information is considered confidential at this time.

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[ChemQuote.Com](#) [ChemACX.Com](#) [SciStore.Com](#) [LabEquip.Com](#) [ChemSell.Com](#)

Enter a chemical name, CAS Number, molecular formula, or molecular weight

Or choose: [Substructure Query with Plug-In](#) or [Structure Query with Java](#)

Olympus and Polaroid Present

Ammonium hydroxide [1336-21-6]

Synonyms: Aqua ammonia; Ammonia Water; ammonium, aqueous; Ammonia, monohydrate; Aqueous Ammonia; Ammonia-15N; AMMONIUM HYDROXIDE, REDISTILLED;

H_5NO
35.0456

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VIEW CHEM3D MODEL

ACX Number	X1002146-0	CAS RN	1336-21-6
Melting Point (°C)	-77 (unstab)	Density	0.895
Boiling Point (°C)	36	Vapor Density	
Refractive Index		Vapor Pressure	
Evaporation Rate		Water Solubility	Soluble
Flash Point (°C)		EPA Code	
DOT Number	NA 2672 Corrosive material; UN 2073 Nonflammable gas	RTECS	BQ9625000
Comments	Strong pungent ammonia odor detectable at 17 ppm. LACHRYMATOR.		

More information about the chemical is available in these categories:

[Biochemistry](#) [Chemical Online Order](#) [Health](#) [Misc](#)
[MSDS](#) [Pesticides/Herbicides](#) [Physical Properties](#) [Regulations](#)
[Usage](#)

Biochemistry

[Ligand Chemical Database for Enzyme Reactions](#)

[Information about this particular compound](#)

Chemical Online Order

[Available Chemicals Exchange](#)

[Information about this particular compound](#)

Health

[ATSDR Internet HazDat Site Contaminant Query](#)

[Information about this particular compound](#)

[Berkeley Carcinogenic Potency Database](#)

[Hazardous Chemicals Database at the University of Akron](#)

[Information about this particular compound](#)

[8\(e\) TRIAGE Chemical Studies Database](#)

[Lab Chem Safety Summaries](#)

[Information about this particular compound](#)

[UMCP Partial list of acute toxins](#)

[International Chemical Safety Cards](#)

[Information about this particular compound](#)

Misc

[Protocol Analytical Supplies, Inc. Single-component standards](#)

MSDS

[New Jersey Right to Know Hazardous Substance Fact Sheets](#)

[Information about this particular compound](#)

Pesticides/Herbicides

[USEPA / OPP's Chemical Ingredients Database](#)

[Information about this particular compound](#)

Physical Properties

[ABCRC GmbH&Co KG](#)

[Ammonia-15N](#)

[DuPont TYVEK® Protective Apparel Information Service](#)

[Information about this particular compound](#)

[Pollution Prevention Progress Measurement Method \(3P2M\) Hazard Ranking](#)

[Genium's Chemical Container Label Database](#)

[Information about this particular compound](#)

[Romil Ltd.](#)

[Information about this particular compound](#)

[Relative strengths of acids and bases](#)

Regulations

[NASA Department of Environmental Services List Of Lists of Regulated Chemicals](#)[Information about this particular compound](#)[California EPA List of Lists](#)[Title III List of Lists](#)**Usage**[Gloves compatibility info](#)[Electron Microscopy Sciences](#)[Information about this particular compound](#)

Enter a chemical name, CAS Number, molecular formula, or molecular weight

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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



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

National Response in Canada
CANUTEC: 613-998-6666

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.

AMMONIUM HYDROXIDE (10 - 35% NH3)

MSDS Number: A5916 --- *Effective Date: 03/04/99*

1. Product Identification

Synonyms: Ammonium hydroxide solutions; ammonia aqueous; ammonia solutions

CAS No.: 1336-21-6

Molecular Weight: 35.05

Chemical Formula: NH₄OH in H₂O

Product Codes:

J.T. Baker: 4807, 5019, 5350, 5358, 5604, 5817, 5820, 5838, 5891, 7847, 9718, 9719, 9721, 9730, 9731, 9733, 9741, 9742

Mallinckrodt: 0124, 0127, 1177, 3248, 3256, 5318, 6665, H007, H010, H893, H894, V044, V066, V592, V649, V893

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Ammonium Hydroxide	1336-21-6	21 - 72%	Yes
Water	7732-18-5	28 - 79%	No
Contains between 10 and 35% ammonia.			

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED OR INHALED. MIST AND VAPOR CAUSE BURNS TO EVERY AREA OF CONTACT.

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

Health Rating: 3 - Severe (Poison)

Flammability Rating: 1 - Slight

Reactivity Rating: 2 - Moderate

Contact Rating: 3 - Severe (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD;
PROPER GLOVES

Storage Color Code: White Stripe (Store Separately)

Potential Health Effects

Inhalation:

Vapors and mists cause irritation to the respiratory tract. Higher concentrations can cause burns, pulmonary edema and death. Brief exposure to 5000 ppm can be fatal.

Ingestion:

Toxic! May cause corrosion to the esophagus and stomach with perforation and peritonitis. Symptoms may include pain in the mouth, chest, and abdomen, with coughing, vomiting and collapse. Ingestion of as little as 3-4 mL may be fatal.

Skin Contact:

Causes irritation and burns to the skin.

Eye Contact:

Vapors cause irritation. Splashes cause severe pain, eye damage, and permanent blindness.

Chronic Exposure:

Repeated exposure may cause damage to the tissues of the mucous membranes, upper respiratory tract, eyes and skin.

Aggravation of Pre-existing Conditions:

Persons with pre-existing eye disorders or impaired respiratory function may be more susceptible to the effects of this material.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician 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. Call a physician, immediately. Wash clothing before reuse.

Eye Contact:

Immediately flush eyes with gentle but large stream of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Call a physician immediately. Immediate action is critical to minimize possibility of blindness.

5. Fire Fighting Measures

Fire:

Autoignition temperature: 651C (1204F)

Flammable limits in air % by volume:

lcl: 16; ucl: 25

Explosion:

Flammable vapors may accumulate in confined spaces.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire. Use water spray to blanket fire, cool fire exposed containers, and to flush non-ignited spills or vapors away from fire.

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. Keep unnecessary and unprotected people away from area of spill. Wear appropriate personal protective equipment as specified in Section 8. Contain and recover liquid when possible. Do not flush caustic residues to the sewer. Residues from spills can be diluted with water, neutralized with dilute acid such as acetic, hydrochloric or sulfuric. Absorb neutralized caustic residue on clay, vermiculite or other inert substance and package in a suitable container for disposal. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRACIT(R)-2 or BuCAIM(R) caustic neutralizers are recommended for spills of this product.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Separate from incompatibilities. Store below 25C. Protect from direct sunlight. 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):

50 ppm (NH3)

-ACGIH Threshold Limit Value (TLV):

25 ppm (NH3) (TWA) 35 ppm (STEL)

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 an ammonia/methylamine 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. Neoprene and nitrile rubber are recommended materials. Polyvinyl alcohol is not recommended.

Eye Protection:

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear, colorless solution.

Odor:

Ammonia odor.

Solubility:

Infinitely soluble.

Specific Gravity:

0.9 (28% NH₄OH)

pH:

11.6 (1.0N)

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

No information found.

Boiling Point:

ca. 36C (ca. 97F)

Melting Point:

-72C (-98F)

Vapor Density (Air=1):

0.60 NH₃

Vapor Pressure (mm Hg):

115 @ 20C (68F)

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 ammonia, nitrogen oxides.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Acids, acrolein, dimethyl sulfate, halogens, silver nitrate, propylene oxide, nitromethane, silver oxide, silver permanganate, oleum, beta-propiolactone. Most common metals.

Conditions to Avoid:

Heat, sunlight, incompatibles, sources of ignition.

11. Toxicological Information

For ammonium hydroxide:

oral rat LD50: 350 mg/kg; eye, rabbit, standard Draize, 250 ug; severe, investigated as a mutagen.

For ammonia:

inhalation rat LC50: 2000 ppm/4-hr; investigated as a tumorigen, mutagen.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Ammonium Hydroxide (1336-21-6)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:

This material is not expected to significantly bioaccumulate.

Environmental Toxicity:

This material is expected to be very toxic to aquatic life. The LC50/96-hour values for fish are less than 1 mg/l. The EC50/48-hour values for daphnia are less than 1 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. 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:** AMMONIA SOLUTIONS (WITH 10-35% AMMONIA)**Hazard Class:** 8

UN/NA: UN2672
 Packing Group: III
Information reported for product/size: 385LB

International (Water, I.M.O.)

Proper Shipping Name: AMMONIA SOLUTIONS (WITH 10-35% AMMONIA)
Hazard Class: 8
 UN/NA: UN2672
 Packing Group: III
Information reported for product/size: 385LB

15. Regulatory Information

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

Ingredient	TSCA	EC	Japan	Australia
Ammonium Hydroxide (1336-21-6)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

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

Ingredient	Korea	--Canada--		Phil.
		DSL	NDSL	
Ammonium Hydroxide (1336-21-6)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

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

Ingredient	-SARA 302-		-----SARA 313-----	
	RQ	TPQ	List	Chemical Catg.
Ammonium Hydroxide (1336-21-6)	No	No	No	No
Water (7732-18-5)	No	No	No	No

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

Ingredient	CERCLA	-RCRA-	-TSCA-
		261.33	8 (d)
Ammonium Hydroxide (1336-21-6)	1000	No	No
Water (7732-18-5)	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 (Mixture / Liquid)

Australian Hazchem Code: 2P
Poison Schedule: S6
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: 3 Flammability: 1 Reactivity: 0

Label Hazard Warning:

POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED OR INHALED. MIST AND VAPOR CAUSE BURNS TO EVERY AREA OF CONTACT.

Label Precautions:

- Do not get in eyes, on skin, or on clothing.
- Do not breathe vapor or mist.
- Keep container closed.
- Use only with adequate ventilation.
- Wash thoroughly after handling.

Label First Aid:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. 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. IMMEDIATE ACTION IS ESSENTIAL FOR EYE EXPOSURES. In all cases call a physician immediately.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 8.

Disclaimer:

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AMMONIUM HYDROXIDE

CASRN: 1336-21-6

*For other data, click on the Table of Contents***Human Health Effects:****Human Toxicity Excerpts:**

... IN CASE IN WHICH 1 DROP OF **AMMONIUM HYDROXIDE** SOLN OF APPROX 9% CONCEN WAS ACCIDENTALLY APPLIED TO PATIENTS EYE, & IRRIGATION WITH WATER ... STARTED WITHIN 10 SEC BECAUSE OF IMMEDIATE SEVERE PAIN & BLEPHAROSPASM, PH OF CONJUNCTIVA & CORNEA ... WITHIN 3 MIN ... RETURNED TO NORMAL, YET MOST OF CORNEAL EPITHELIUM WAS ALREADY LOST.

[Grant, W.M. Toxicology of the Eye. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986. 87]**PEER REVIEWED**

IN SEVERE INJURIES, WHERE CONCEN **AMMONIUM HYDROXIDE** SOLN ... HAS SPLASHED INTO EYE, OR FOLLOWING CONTACT WITH DIL SOLN, BUT WITH DELAY IN 1ST AID IRRIGATION, THROMBOSIS OF CONJUNCTIVAL & EPISCLERAL VESSELS, EVIDENT ON BIOMICROSCOPIC EXAM, MAY GIVE EARLY EYE UNNATURAL PALLOR & COOKED APPEARANCE.

[Grant, W.M. Toxicology of the Eye. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986. 87]**PEER REVIEWED**

... A CASE OF SEVERE CORNEAL & CONJUNCTIVAL ULCER WHICH DEVELOPED 10 DAYS AFTER AMMONIA WATER SPLASHED IN EYE /IS REPORTED/.

[Hamilton, A., and H. L. Hardy. Industrial Toxicology. 3rd ed. Acton, Mass.: Publishing Sciences Group, Inc., 1974. 207]**PEER REVIEWED**

AMMONIUM HYDROXIDE DIFFERS FROM OTHER ALKALIS IN ITS VOLATILITY; VAPOR (NH₃) EVEN IN LOW CONCEN IS EXTREMELY IRRITATING TO SKIN, EYES, & RESP PASSAGES. ... INGESTION OF AMMONIA SOLN PRODUCES EFFECTS SIMILAR TO OTHER CORROSIVE ALKALIS, NOTABLY CORROSIVE ESOPHAGITIS & GASTRITIS.

[Gosselin, R.E., R.P. Smith, H.C. Hodge. Clinical Toxicology of Commercial Products. 5th ed. Baltimore: Williams and Wilkins, 1984.,p. III-22]**PEER REVIEWED**

The healing response of human volunteers was measured by monitoring the reestablishment of skin surface markings in unroofed blisters induced by brief exposure to a 1:1 aq soln of **ammonium hydroxide**. At all stages of repair, older individuals (ages 65-75 yr) as a group lagged behind young adults (ages 18-25 yr).

[Grove GL; Arch Dermatol Res 272 (3-4): 381-5 (1982)]**PEER REVIEWED**

An acute case /is described in/ which a tank of **ammonium hydroxide** overflowed and exposed a worker to a very high concentration of ammonia. Based on the **ammonium hydroxide** concentration and weather conditions, the ammonium concentration was estimated as 10,000 ppm. The patient immediately experienced cough and vomiting and had difficulty in breathing. The length of exposure was not stated, but he performed "small jobs" for the remaining 3 hours of work before he was seen at a clinic. At that time, his face was red and swollen, he had conjunctivitis, and his mouth and throat were red and raw. His voice was disappearing and he had labored breathing. The heart appeared to be normal, but while X-rays were being taken, the heart stopped. He was revived by massage and artificial respiration and was transferred to a hospital. Six hours after the accident his heart stopped again and he died. Autopsy showed marked inflammation of the respiratory tract. No pulmonary edema was present, but the tracheal epithelium was almost completely denuded.

[NIOSH; Criteria Document: Ammonia p.29-30 (1979) DHEW Pub. NIOSH 74-136]**PEER REVIEWED**

TOXIC BY INGESTION; BOTH LIQ & VAPOR EXTREMELY IRRITATING, ESP TO EYES.
 [Sax, N.I. and R.J. Lewis, Sr. (eds.). Hawley's Condensed Chemical Dictionary. 11th ed. New York: Van Nostrand Reinhold Co., 1987. 64]**PEER REVIEWED**

ONE TEASPOONFULL (3 TO 5 ML) OF STRONG (28%) AMMONIA SOLN HAS BEEN RECORDED AS FATAL DOSE BUT RECOVERY HAS FOLLOWED AS MUCH AS 1 FLUID OZ ON SEVERAL OCCASIONS.

[Gosselin, R.E., R.P. Smith, H.C. Hodge. Clinical Toxicology of Commercial Products. 5th ed. Baltimore: Williams and Wilkins, 1984.,p. III-22]**PEER REVIEWED**

A 54 year old man with a history of mild hypertension, adult onset diabetes, and heavy smoking was examined for possible ocular, upper airway, and pulmonary manifestations from chronic exposure to **ammonium hydroxide**. The patient was a custodian who daily, for 19 yr, had diluted a 28% solution of **ammonium hydroxide** with water for cleaning. This was his only contact with the chemical. A chest X-ray examination showed a reticular interstitial pattern, and a physical examination showed cataracts and fine inspiratory crackles over both lung fields. An exercise study demonstrated ventilatory restriction after the maximum oxygen consumption had been attained, and a transbronchial lung biopsy showed interstitial fibrosis with chronic inflammation. Fibrous obliteration of the small airways, bronchiectasis, and cataracts were previously described in relation to acute exposure to **ammonium hydroxide**.

[Kollef MH; Ann Intern Med 107 (1): 118 (1987)]**PEER REVIEWED**

When ammonia is splashed or sprayed into the eyes, time is the most important consideration and the first 10 seconds are critical if blindness is to be prevented.

[NIOSH; Criteria Document: Ammonia p.73 (1974) DHEW Pub. NIOSH 74-136]**PEER REVIEWED**

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

[Braker W, Mossman A; Matheson Gas Data Book 6th ED p.24 (1980)]**PEER REVIEWED**

With **ammonium hydroxide** skin tests, older subjects had a shorter reaction time (MBT, minimal blistering time), whereas the time needed to develop a tense blister was longer ..., and longer time was needed for the resorption of a wheal elicited by saline injection.

[Marzulli, F.N., H.I. Maibach. Dermatotoxicology 4th ed. New York, NY: Hemisphere Publishing Corp., 1991. 233]**PEER REVIEWED**

Skin, Eye and Respiratory Irritations:

Ammonium hydroxide causes extremely painful irritation of all mucous membranes.

[Dreisbach, R.H. Handbook of Poisoning. 12th ed. Norwalk, CT: Appleton and Lange, 1987. 214]**PEER REVIEWED**

BOTH LIQ & VAPOR EXTREMELY IRRITATING, ESP TO EYES.

[Sax, N.I. and R.J. Lewis, Sr. (eds.). Hawley's Condensed Chemical Dictionary. 11th ed. New York: Van Nostrand Reinhold Co., 1987. 64]**PEER REVIEWED**

Medical Surveillance:

The following medical procedures should be made available to each employee who is exposed to ammonia at potentially hazardous levels: (1) A complete medical history and physical examination: the purpose is to detect existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the eyes and respiratory tract should be stressed. The skin should be examined for evidence of chronic disorders; (2) 14" x 17" chest roentgenogram: Ammonia causes human lung damage. Surveillance of the lung is indicated; (3) FVC and FEV (1 sec): Ammonia is a respiratory irritant. Persons with impaired pulmonary function

may be at increased risk from exposure. Periodic surveillance is indicated. Medical examinations should be repeated on an annual basis, except that an X-ray is necessary only when indicated by the results of pulmonary function testing, or by signs and symptoms of respiratory disease. /Ammonia/ [Mackison, F. W., R. S. Stricoff, and L. J. Partridge, Jr. (eds.). NIOSH/OSHA - Occupational Health Guidelines for Chemical Hazards. DHHS(NIOSH) PublicationNo. 81-123 (3 VOLS). Washington, DC: U.S. Government Printing Office, Jan. 1981. 1] **PEER REVIEWED**

Emergency Medical Treatment:

Emergency Medical Treatment:

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The following Overview, *** AMMONIA ***, is relevant for this HSDB record chemical.

Life Support:

- o This overview assumes that basic life support measures have been instituted.

Clinical Effects:

SUMMARY OF EXPOSURE

0.2.1.1 ACUTE EXPOSURE

- o Ammonia is a highly water-soluble alkaline gas that produces severe irritation of the respiratory mucosa with upper airway greater than lower airway involvement. Anhydrous ammonia reacts with moisture in mucosal surfaces (eyes, skin, and respiratory tract) to produce ammonium hydroxide which may cause caustic injury. The severity of injury depends upon the concentration and duration of exposure. The extent of injury ranges from mild erythema to severe full thickness burns, and from mild cough to laryngeal edema and life-threatening pulmonary edema.
- o HOUSEHOLD AMMONIA (5 to 10% ammonia) rarely causes burns, but is irritating to the eyes, nose, throat, and tracheobronchial tree. Rarely, deliberate suicidal ingestion has resulted in esophageal burns.
- o Agricultural ammonia is usually more concentrated and may result in irritation and severe burns of the eyes, lungs, upper airway, and skin.
- o When heated to decomposition, ammonia emits toxic fumes of ammonia and oxides of nitrogen.
- o The mixture of ammonia and hypochlorite bleaches results in formation of chloramine, which produces a toxic pneumonitis (pulmonary edema) following inhalation, and may produce residual pulmonary function abnormalities.

VITAL SIGNS

0.2.3.1 ACUTE EXPOSURE

- o Increases in blood pressure and pulse have been reported.

HEENT

0.2.4.1 ACUTE EXPOSURE

- o Exposure to concentrated ammonia vapors results in mucosal burns of the eyes, nose, pharynx, and larynx.

Eye exposure may result in conjunctivitis, lacrimation, corneal irritation, and temporary or permanent blindness. Total corneal epithelial loss may occur.

CARDIOVASCULAR

0.2.5.1 ACUTE EXPOSURE

- o Myocardial fibrosis has been reported in animals.

RESPIRATORY

0.2.6.1 ACUTE EXPOSURE

- o Bronchospasm, laryngitis, tracheitis, wheezing, dyspnea, chest pain, laryngeal stridor may be noted. Mucosal burns to the tracheobronchial tree, pulmonary edema, and associate hypoxemia frequently occur following exposure to concentrated, industrial strength ammonia.
- o Ventilatory and diffusion abnormalities, chest irritation, chemical pneumonitis, changes in minute ventilation, and laryngospasm may occur.

0.2.6.2 CHRONIC EXPOSURE

- o Chronic cough, asthma, and lung fibrosis have been reported.

NEUROLOGIC

0.2.7.1 ACUTE EXPOSURE

- o An altered mental status (coma) may be seen, but is not characteristic unless hypoxemia occurs. Headache and somnolence have been reported with chronic exposure.

0.2.7.2 CHRONIC EXPOSURE

- o Headache and somnolence have been reported.

GASTROINTESTINAL

0.2.8.1 ACUTE EXPOSURE

- o Nausea and vomiting occur frequently following ingestion. Swelling of the lips, mouth, and larynx, and oral or esophageal burns may occur if concentrated ammonia solutions are ingested.

HEPATIC

0.2.9.2 CHRONIC EXPOSURE

- o Liver congestion has been reported in animals.

GENITOURINARY

0.2.10.1 ACUTE EXPOSURE

- o Urinary retention may occur.

0.2.10.2 CHRONIC EXPOSURE

- o Calcification and epithelial proliferation of the renal tubules, congestion of the kidneys, and degenerative changes in the suprarenal glands has been reported in animals

HEMATOLOGIC

0.2.13.1 ACUTE EXPOSURE

- o In an experimental study, approximately 30% of bovine lymphocytes were killed by ammonia during 72 hours of incubation.

DERMATOLOGIC

0.2.14.1 ACUTE EXPOSURE

- o Concentrated ammonia may produce liquifaction necrosis and deep penetrating burns.
- o Anhydrous ammonia is usually stored at -28 degrees F. Exposure may result in frostbite injury.

0.2.14.2 CHRONIC EXPOSURE

- o Dermatitis has been reported.

ENDOCRINE

0.2.16.1 ACUTE EXPOSURE

- o Hyperglycemia and adrenocortical changes have been noted in animal studies.

REPRODUCTIVE HAZARDS

- o At the time of this review, no data were available to assess the teratogenic potential of this agent.
- o Decreased egg production has occurred in experimental animals. Elevated ammonia tissue concentration in cows decreased conception rates and increased the calving-to-conception intervals. Ammonia crosses the

- o ovine placental barrier.
- o At the time of this review, no data were available to assess the potential effects of exposure to this agent during lactation.
- o No information about possible male reproductive effects was found in available references at the time of this review.

CARCINOGENICITY

0.2.21.2 HUMAN OVERVIEW

- o At the time of this review, no data were available to assess the carcinogenic potential of this agent.

GENOTOXICITY

- o Mutations have been detected in E. coli. Chromosome aberration were detected by cytogenetic analysis in rat studies.

OTHER

0.2.23.1 ACUTE EXPOSURE

- o Ammonia toxicity from absorption of glycine has been reported.

0.2.23.2 CHRONIC EXPOSURE

- o Congestion of the spleen was reported in experimental animals.

Laboratory:

- o Ammonia blood levels are not useful indications of exogenous ammonia exposure or toxicity.

Treatment Overview:**SUMMARY EXPOSURE**

- o Initial treatment is primarily supportive. Remove patient from inhalation exposure, administer humidified oxygen, administer bronchodilators and manage airway as need. Do not induce emesis, perform gastric lavage or attempt neutralization after ingestion. Dilution with milk or water may be of benefit. Endoscopic evaluation may be required. Treat skin or eye exposures with copious irrigation and thorough evaluation to determine the extent of injury.

ORAL EXPOSURE

- o DO NOT INDUCE EMESIS, administer activated charcoal, perform gastric lavage, or attempt to neutralize with weak acids.
- o MUCOSAL DECONTAMINATION: If no respiratory compromise is present, dilute immediately with milk or water; use no more than 8 ounces in adults and 4 ounces in children.
- o GASTRIC DECONTAMINATION: Ipecac is contraindicated. Consider insertion of a small, flexible nasogastric or orogastric tube to suction gastric contents after recent large ingestions; the risk of further mucosal injury must be weighed against potential benefits.
- D. ENDOSCOPY: Perform within 24 hours to evaluate for burns in adults with deliberate ingestion or any signs or symptoms attributable to ingestion, and in children with stridor, vomiting, or drooling. Consider endoscopy in children with dysphagia, refusal to swallow, significant oral burns, or abdominal pain. If burns are found, follow 10 to 20 days later with barium swallow or esophagram.
- XB E. PHARMACOLOGIC TREATMENT: Corticosteroids are controversial. Consider use in second degree burns within 48 hours of ingestion in patients without gastrointestinal bleeding or evidence of perforation. Antibiotics are indicated for suspected perforation or infection and in patients receiving corticosteroids.
- XB F. SURGICAL OPTIONS: Initially, if severe esophageal burns

are found a string may be placed in the stomach to facilitate later dilation. Insertion of a specialized nasogastric tube after confirmation of a circumferential burn may prevent strictures. Dilation is indicated after 2 to 4 weeks if strictures are confirmed; if unsuccessful, either colonic intraposition or gastric tube placement may be performed. Consider early laparotomy in patients with severe esophageal and/or gastric burns.

- o Administer oxygen as needed. INTUBATION OR TRACHEOSTOMY MAY BE LIFE-SAVING if evidence of upper airway obstruction is present. Monitor pulse oximetry and/or blood gases in patients with respiratory effects.
- XB H. PULMONARY EDEMA (NONCARDIOGENIC): Maintain ventilation and oxygenation and evaluate with frequent arterial blood gas or pulse oximetry monitoring. Early use of PEEP and mechanical ventilation may be needed.
- o MONITOR FLUID AND ELECTROLYTE balance and restore if abnormal. Fluids should be administered cautiously to patients with pulmonary edema.

INHALATION EXPOSURE

- o DECONTAMINATION: Move patient to fresh air. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Administer 100 percent humidified supplemental oxygen with assisted ventilation as required.

EYE EXPOSURE

- o Exposed eyes should be irrigated with copious amounts of tepid water for at least 15 minutes. If irritation, pain, swelling, lacrimation, or photophobia persist, the patient should be seen in a health care facility and referral to an ophthalmologist considered.

DERMAL EXPOSURE

- o DECONTAMINATION: Wash exposed area extremely thoroughly with soap and water. A physician may need to examine the area if irritation or pain persists.

Range of Toxicity:

- o Household (5 to 10%) ammonia rarely causes tissue burns. Industrial strength ammonia (27 to 30%) is highly corrosive and likely to cause burns.

[Rumack BH: POISINDEX(R) Information System. Micromedex, Inc., Englewood, CO, 2001; CCIS Volume 107, edition exp February, 2001. Hall AH & Rumack BH (Eds): TOMES(R) Information System. Micromedex, Inc., Englewood, CO, 2001; CCIS Volume 107, edition exp February, 2001.] **PEER REVIEWED**

Antidote and Emergency Treatment:

Agents causing ocular burns, steps in treatment, and special problems are described. Injuries are caused by neutral organic, acid, and alkali compounds. Contact time and pH are the most important variables in any chemical burn. The corneal epithelium and endothelium provide a barrier to water soluble substances while the stroma is a barrier to lipid soluble substances. Alkali compounds cause most severe injuries depending on the hydroxyl ion concentration and the cation. Calcium hydroxide, sodium hydroxide, and **ammonium hydroxide** are most often responsible for alkali burns.

Ammonium hydroxide penetrates most rapidly of all alkali compounds.

[Nelson JD, Kopietz LA; Postgraduate Medicine 81 (4): 62-75 (1987)] **PEER REVIEWED**

Basic treatment: Establish a patent airway. Suction if necessary. Watch for signs of respiratory insufficiency and assist ventilations if necessary. Administer oxygen by nonrebreather mask at 6 to

12 L/min. Monitor for pulmonary edema and treat if necessary Monitor for shock and treat if necessary For eye contamination, flush eyes immediately with water. Irrigate each eye continuously with normal saline during transport Do not use emetics. For ingestion, rinse mouth and administer 5 mL/kg up to 200 mL of water for dilution if the patient can swallow, has a strong gag reflex, and does not drool Do not attempt to neutralize. Cover skin burns with dry sterile dressings after decontamination /Inorganic bases/alkaline corrosives and related cmpds/ [Bronstein, A.C., P.L. Currence; Emergency Care for Hazardous Materials Exposure. 2nd ed. St. Louis, MO. Mosby Lifeline. 1994. 165]**PEER REVIEWED**

Advanced treatment: Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious or in respiratory arrest. Early intubation, at the first signs of upper airway obstruction, may be necessary. Positive-pressure ventilation techniques with a bag-valve-mask device may be beneficial. Monitor cardiac rhythm and treat arrhythmias as necessary Start an IV of D5W TKO /SRP: "To keep open", minimal flow rate/. Use lactated Ringer's if signs of hypovolemia are present. Watch for signs of pulmonary edema. For hypotension with signs of hypovolemia, administer fluid cautiously. Watch for signs of fluid overload Consider drug therapy for pulmonary edema Use proparacaine hydrochloride to assist eye irrigation /Inorganic bases/alkaline corrosives and related cmpds/ [Bronstein, A.C., P.L. Currence; Emergency Care for Hazardous Materials Exposure. 2nd ed. St. Louis, MO. Mosby Lifeline. 1994. 166]**PEER REVIEWED**

Animal Toxicity Studies:

Non-Human Toxicity Excerpts:

... APPLICATION OF 28.5% AMMONIUM HYDROXIDE TO /RABBIT/ EYES FOR 2-20 SEC (BEFORE IRRIGATION WITH WATER) CAUSES INJURY RANGING FROM FAINT PERMANENT CORNEAL NEBULA TO PROFOUND CORNEAL OPACIFICATION & VASCULARIZATION PROPORTIONAL TO LENGTH OF EXPOSURE

[Grant, W.M. Toxicology of the Eye. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986. 87]**PEER REVIEWED**

SOLN AT PH 9-11.5 APPLIED CONTINUOUSLY TO GINGIVAL CREVICE OF MONKEYS CAUSED ULCERATIVE LESIONS SIMILAR TO THOSE SEEN IN ACUTE NECROTIZING ULCERATIVE GINGIVITIS, BUT GINGIVAL DESTRUCTION MAY HAVE BEEN DUE TO UNIONIZED AMMONIA LIBERATED FROM AMMONIUM SOLN.

[JANN RC ET AL; J S CALIF DENT ASS 41 (6): 485-8 (1973)]**PEER REVIEWED**

Using a (51)Chromium release assay, the cytotoxic potencies of 56 test substances were evaluated in corneal endothelial cell cultures. All of these substances were nonirritants. **Ammonium hydroxide** was one of the tested substances.

[Douglas WHJ, Spilman SD; Altern Methods Toxicol 1 (Prod Saf Eval): 205-30 (1983)]**PEER REVIEWED**

Acids and alkalis /**ammonium hydroxide**/ were instilled into the eyes of 2 groups of rabbits; the eyes of 1 group were washed with tap water 30 seconds after exposure. All the alkalis of pH 11.5-13.5 produced opacities and other ocular damage of different degrees depending upon the alkali and its concn. Acidity and alkalinity of the test material are not the only factors to be considered in relation to a substances' capacity to produce severe ocular injury. The concn of the test chemical and its period of contact with the eye prior to washing are also important.

[Murphy JC et al; Toxicol 23 (4): 281-91 (1982)]**PEER REVIEWED**

... /IN STUDY/ OF PENETRATION OF AMMONIA INTO EYE ... /RABBIT EYES WERE/ EXPOSED ... TO 10% AMMONIUM HYDROXIDE SOLN, & ... /PENETRATION DETERMINED BY TESTING/ AQUEOUS HUMOR FOR AMMONIUM IONS WITH NESSLER'S REAGENT ... A VERY STRONG REACTION /WAS FOUND/ IN 10 MIN, & PERSISTENCE OF AMMONIUM IONS IN ANTERIOR CHAMBER FOR AT LEAST 2 HR

/WAS OBSERVED/, BUT NONE WAS DISCOVERED IN THE VITREOUS.

[Grant, W.M. Toxicology of the Eye. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986. 90]**PEER REVIEWED**

In carp the acute toxicity of total and unionized ammonia was determined in the 48 hr tests. Experiments were performed in aquariums (245 cu dm) under static conditions, ie without water flow; with the toxic solutions being replaced every 24 hr. Five ammonium compd were used as toxic agents. Eight experimental series were carried out; each series comprising of 5-7 ammonium concn and a control fish group. The 48 hr median lethal concn (LC50) and the 95% confidence interval were determined. The concn of unionized ammonia were calculated. The resulting values of 48 hr LC50 of total ammonia remained within the range of 6.6-109 mg/cu dm whereas the respective values of unionized ammonia amounted to 1.15-1.96 mg/cu dm.

[Dabrowska H, Sikora H; Pol Arch Hydrobiol 33 (1): 121-8 (1986)]**PEER REVIEWED**

The effect of 0.13 mg/l **ammonium hydroxide** on *Oncorhynchus kisutch* (coho salmon) in a pH of 8.0 and temperature of 14.2 deg C for 72 hours was a critical level for the fish. /From table/

[USEPA; Ambient Water Quality Criteria Doc: Ammonia p.145 (1984) EPA 440/5-85-001]**PEER REVIEWED**

The effect of 0.04-0.11 mg/l **ammonium hydroxide** on *Oncorhynchus tshawytscha* (chinook salmon) at a pH of 7.6 and temperature of 15.3 deg C for 72 hours was a critical level for the fish. /From table/

[USEPA; Ambient Water Quality Criteria Doc: Ammonia p.145 (1984) EPA 440/5-85-011]**PEER REVIEWED**

The effect of 29.6 mg/l **ammonium hydroxide** on *Salmo gairdneri* (rainbow trout) in a pH of 9.42 and a temperature of 13.5 deg C for 3.5 hours was that activity ceased. /From table/

[USEPA; Ambient Water Quality Criteria Doc: Ammonia p.145 (1984) EPA 440/5-85-001]**PEER REVIEWED**

0.15 mg/l of **ammonium hydroxide** on *Salmo trutta* (brown trout) in pH 7.8 and a temperature of 11 deg C for 18 hr results in 36% mortality. /From table/

[USEPA; Ambient Water Quality Criteria Doc: Ammonia p.148 (1984) EPA 440/5-85-001]**PEER REVIEWED**

0.26-1.2 mg/l of **ammonium hydroxide** on *Semotilus erythrophthalmus* (creek chub) in pH of 8.3 and a temperature of 15-21 deg C for 24 hr resulted in a critical level. /From table/

[USEPA; Ambient Water Quality Criteria Doc: Ammonia p.150 (1984) EPA 440/5-85-001]**PEER REVIEWED**

Chronic effects of ammonia to rainbow trout (*Salmo gairdneri*) exposed to concn ranging from 0.01 to 0.07 mg/l at mean pH of 7.7 & temp of 9.3 deg C were studied in the lab over a 5 yr period. Parental fish were exposed for 11 mo, the first filial generation (F1) for 4 yr, & second filial generation (F2) for 5 mo. Parental fish spawned at all concn. F1 was manually spawned at 4 yr of age. There was no correlation between ammonia concn & egg reproduction, growth of progeny, or mortality of parents or progeny in any generation. Histopathological lesions were common in parental & F1 generation at blood ammonia non-ionized concn of 0.04 mg/l, & at 0.02 mg/l in F2 generation. The F2 generation incurred a severe protozoan infection at this concn.

[Thurston RV et al; Trans Am Fish Soc 113 (1): 56-73 (1984)]**PEER REVIEWED**

Non-Human Toxicity Values:

LD50 Rat oral 350 mg/kg

[Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996. 210]**PEER REVIEWED**

Ecotoxicity Values:

LC50 *Lepomis macrochirus* (bluegill) 0.024-0.093 mg/l/48 hr. /Conditions of bioassay not specified/
[USEPA; Ambient Water Quality Criteria Doc: Ammonia p.151 (1984) EPA 440/5-85-001]**PEER REVIEWED**

LC50 *Ictalurus punctatus* (channel catfish) 0.974 mg/liter/one week pH= 7.7 Temp= 21.1 degrees C.
/Conditions of bioassay not specified/
[USEPA; Ambient Water Quality Criteria Doc: Ammonia p.150 (1984) EPA 440/5-85-001]**PEER REVIEWED**

LC50 *Ictalurus punctatus* (channel catfish) 1.27 mg/liter/one week pH= 7.8 Temp= 21.7 degrees C.
/Conditions of bioassay not specified/
[USEPA; Ambient Water Quality Criteria Doc: Ammonia p.150 (1984) EPA 440/5-85-001]**PEER REVIEWED**

LC50 *Ictalurus punctatus* (channel catfish) 1.41 mg/liter/one week pH= 7.8 Temp= 22.8 degrees C.
/Conditions of bioassay not specified/
[USEPA; Ambient Water Quality Criteria Doc: Ammonia p.150 (1984) EPA 440/5-85-001]**PEER REVIEWED**

LC50 *Ictalurus punctatus* (channel catfish) 1.97 mg/liter/one week pH= 8.0 Temp= 22.8 degrees C.
/Conditions of bioassay not specified/
[USEPA; Ambient Water Quality Criteria Doc: Ammonia p.150 (1984) EPA 440/5-85-001]**PEER REVIEWED**

TLm Fathead minnow 8.2 mg/l/96 hr (hard water) /Conditions of bioassay not specified/
[Verschueren, K. Handbook of Environmental Data of Organic Chemicals. 2nd ed. New York, NY: Van Nostrand Reinhold Co., 1983. 195]**PEER REVIEWED**

LC50 Atlantic Salmon smolt 5 to 8 mg/l/24 hr /Conditions of bioassay not specified/
[Environment Canada; Tech Info for Problem Spills: Ammonia (Draft) p.85 (1983)]
PEER REVIEWED

LC50 Perch 0.29 mg/l/7 days /Un-ionized ammonia/ /Conditions of bioassay not specified/
[Environment Canada; Tech Info for Problem Spills: Ammonia (Draft) p.85 (1983)]
PEER REVIEWED

TLm Bluegill 3.4 mg/l/96 hr /hard water, 20 deg C/ /Conditions of bioassay not specified/
[Environment Canada; Tech Info for Problem Spills: Ammonia (Draft) p.85 (1983)]
PEER REVIEWED

LC50 *Daphnia magna* 0.66 mg/l/48 hr 22 deg C /Conditions of bioassay not specified/
[Environment Canada; Tech Info for Problem Spills: Ammonia (Draft) p.86 (1983)]
PEER REVIEWED

TLm Diatom 420 mg/l/120 hr 50% growth reduction /hard water and soft water, 22 deg C/
/Conditions of bioassay not specified/
[Environment Canada; Tech Info for Problem Spills: Ammonia (Draft) p.86 (1983)]
PEER REVIEWED

TLm Snail 90 mg/l/96 hr (soft water, 20 deg C) /Conditions of bioassay not specified/
[Environment Canada; Tech Info for Problem Spills: Ammonia (Draft) p.86 (1983)]
PEER REVIEWED

TLm Striped bass 0.97 ug/l/96 hr (15 deg C); 0.73 ug/l/96 hr (23 deg C) /Unionized NH₃/
/Conditions of bioassay not specified/
[Environment Canada; Tech Info for Problem Spills: Ammonia (Draft) p.87 (1983)]
PEER REVIEWED

TLm Stickleback 96 hr 5.05 ug/l (15 deg C); 1.12 mg/l (23 deg C) (Unionized ammonia) /Conditions of bioassay not specified/
 [Environment Canada; Tech Info for Problem Spills: Ammonia (Draft) p.87 (1981)]
 PEER REVIEWED

LC50 Salmo gairdnerii 8 ug/ml NH₃/24 hr /Conditions of bioassay not specified/
 [Fromm PO; Toxic Action of Water Soluble Pollutants on Freshwater Fish; EPA Water Pollution Control Research Series No. 18050 DST (1970)]**PEER REVIEWED**

TLm Goldfish 2 to 2.5 mg/l/24-96 hr /Conditions of bioassay not specified/
 [Verschueren, K. Handbook of Environmental Data of Organic Chemicals. 2nd ed. New York, NY: Van Nostrand Reinhold Co., 1983. 195]**PEER REVIEWED**

LC50 Coho salmon 0.45 mg/l/96 hr, Flow-through bioassay
 [Verschueren, K. Handbook of Environmental Data of Organic Chemicals. 2nd ed. New York, NY: Van Nostrand Reinhold Co., 1983. 195]**PEER REVIEWED**

LC50 Guppy fry 74 mg/l/72 hr, Static bioassay
 [Verschueren, K. Handbook of Environmental Data of Organic Chemicals. 2nd ed. New York, NY: Van Nostrand Reinhold Co., 1983. 195]**PEER REVIEWED**

LC50 Salmo clarki (cutthroat trout fry) flow-through bioassay 0.5-0.8 mg/l/96 hr; 0.56 mg/l/36 day 0.56 mg/l
 [Verschueren, K. Handbook of Environmental Data of Organic Chemicals. 2nd ed. New York, NY: Van Nostrand Reinhold Co., 1983. 195]**PEER REVIEWED**

LC50 Rainbow trout: (fertilized egg) > 3.58 mg/l/24 hr; alevin (0-50 days old) > 3.58 mg/l/24 hr; fry (85 days old) 0.068 mg/l/24 hr; adult 0.097 mg/l/24 hr, Static bioassay
 [Verschueren, K. Handbook of Environmental Data of Organic Chemicals. 2nd ed. New York, NY: Van Nostrand Reinhold Co., 1983. 195]**PEER REVIEWED**

LC50 Walking catfish 0.28 mg/l/48 hr, Static bioassay
 [Verschueren, K. Handbook of Environmental Data of Organic Chemicals. 2nd ed. New York, NY: Van Nostrand Reinhold Co., 1983. 195]**PEER REVIEWED**

Metabolism/Pharmacokinetics:

Metabolism/Metabolites:

Male rats gavaged with 1000 umol (15)N-ammonium chloride each day for 5 days excreted low, but significant amounts of excess (15)N-NO₃⁻ in urine on the 5 days of treatment & on the 5 subsequent days. An in vitro chemical model system was used to demonstrate that oxidation of ammonia to NO₃⁻ by the hydroxyl radical at physiological pH is chemically feasible. These results are consistent with the hypothesis that ammonia is oxidized to NO₃⁻ in vivo by a nonenzymic process which involves active O species such as the hydroxyl radical.

[Saul RL, Archer MC; Carcinogenesis 5 (1): 77-81 (1984)]**PEER REVIEWED**

Absorption, Distribution & Excretion:

... EXCRETION IS PRIMARILY BY WAY OF KIDNEYS, BUT A NOT INSIGNIFICANT AMT IS PASSED THROUGH SWEAT GLANDS.

[Clayton, G.D., F.E. Clayton (eds.) Patty's Industrial Hygiene and Toxicology. Volumes 2A, 2B, 2C, 2D, 2E, 2F: Toxicology. 4th ed. New York, NY: John Wiley & Sons Inc., 1993-1994. 760]**PEER REVIEWED**

... Ammonium toxicity induced by ammonium acetate administration in frogs led to variable

excretion of ammonia and urea into the medium. When 11.45 mM/kg body wt of ammonium acetate was administered, ammonia excretion increased while urea excretion decreased. When 4.17 mM/kg body wt of ammonium acetate was administered, the urea excretion increased while NH₃ excretion decreased.

[Neeraja P, Swami KS; Indian J Physiol Pharmac 27 (2): 123-8 (1983)]**PEER REVIEWED**

Ammonium hydroxide penetrates fastest, followed by sodium hydroxide, potassium hydroxide, and finally calcium hydroxide.

[Sullivan, J.B. Jr., G.R. Krieger (eds.). Hazardous Materials Toxicology-Clinical Principles of Environmental Health. Baltimore, MD: Williams and Wilkins, 1992. 433]**PEER REVIEWED**

Pharmacology:

Therapeutic Uses:

10% ammonia water as a reflex respiratory stimulant; MEDICATION (VET): externally on bites & stings; As rubefacient on bruises, sprains; Inhalant; Internally as an antacid & carminative /Ammonia water-10%/

[The Merck Index. 10th ed. Rahway, New Jersey: Merck Co., Inc., 1983. 74]**PEER REVIEWED**

Environmental Fate & Exposure:

Environmental Standards & Regulations:

FIFRA Requirements:

Residues of **ammonium hydroxide** are exempted from the requirement of a tolerance when used as a solvent, cosolvent, neutralizer, or solubilizing agent in accordance with good agricultural practices as inert (or occasionally active) ingredients in pesticide formulations applied to growing crops or to raw agricultural commodities after harvest.

[40 CFR 180.1001(c) (7/1/97)]**PEER REVIEWED**

CERCLA Reportable Quantities:

Persons in charge of vessels or facilities are required to notify the National Response Center (NRC) immediately, when there is a release of this designated hazardous substance, in an amount equal to or greater than its reportable quantity of 1000 lb or 454 kg. The toll free number of the NRC is (800) 424-8802; In the Washington D.C. metropolitan area (202) 426-2675. The rule for determining when notification is required is stated in 40 CFR 302.4 (section IV. D.3.b).

[40 CFR 302.4 (7/1/97)]**PEER REVIEWED**

Clean Water Act Requirements:

Designated as a hazardous substance under section 311(b)(2)(A) of the Federal Water Pollution Control Act and further regulated by the Clean Water Act Amendments of 1977 and 1978. These regulations apply to discharges of this substance.

[40 CFR 116.4 (7/1/88)] **QC REVIEWED**

FDA Requirements:

Ammonium hydroxide used as a general purpose food additive in animal drugs, feeds, and related products is generally recognized as safe when used in accordance with good manufacturing or

feeding practice.

[21 CFR 582.1139 (4/1/97)]**PEER REVIEWED**

Substance added directly to human food affirmed as generally recognized as safe (GRAS).

[21 CFR 184.1139 (4/1/97)]**PEER REVIEWED**

Allowable Tolerances:

Residues of **ammonium hydroxide** are exempted from the requirement of a tolerance when used as a solvent, cosolvent, neutralizer, or solublizing agent in accordance with good agricultural practices as inert (or occasionally active) ingredients in pesticide formulations applied to growing crops or to raw agricultural commodities after harvest.

[40 CFR 180.1001(c) (7/1/97)]**PEER REVIEWED**

Chemical/Physical Properties:

Molecular Formula:

H5-N-O

PEER REVIEWED

Molecular Weight:

35.05

[Lide, D.R. (ed.). CRC Handbook of Chemistry and Physics. 76th ed. Boca Raton, FL: CRC Press Inc., 1995-1996.,p. 4-40]**PEER REVIEWED**

Color/Form:

Colorless liquid

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 87]**PEER REVIEWED**

Odor:

Intense, pungent, suffocating odor

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 87]**PEER REVIEWED**

Taste:

Acrid taste

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 87]**PEER REVIEWED**

Threshold value (unspecified-detection or recognition) of an unspecified purity in water is 3.40×10^{-1} ppm.

[Fazzalari, F.A. (ed.). Compilation of Odor and Taste Threshold Values Data. ASTM Data Series DS 48A (Committee E-18). Philadelphia, PA: American Society for Testing and Materials, 1978. 12]**PEER REVIEWED**

Threshold value (unspecified-detection or recognition) of an unspecified purity in coffee brew is 1.04×10^{-2} ppm.

[Fazzalari, F.A. (ed.). Compilation of Odor and Taste Threshold Values Data. ASTM

Data Series DS 48A (Committee E-18). Philadelphia, PA: American Society for Testing and Materials, 1978. 12]**PEER REVIEWED**

Corrosivity:

Dissolves copper, zinc

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 87]**PEER REVIEWED**

Density/Specific Gravity:

About 0.90 @ 25 deg C/25 deg C

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 87]**PEER REVIEWED**

Dissociation Constants:

pKb= 4.767, Kb= 1.710X10⁻⁵ at 20 deg C; pKb= 4.751, Kb= 1.774X10⁻⁵ at 25 deg C; pKb= 4.740, Kb= 1.820X10⁻⁵ at 30 deg C

[Weast, R.C. (ed.) Handbook of Chemistry and Physics, 68th ed. Boca Raton, Florida: CRC Press Inc., 1987-1988.,p. D-163]**PEER REVIEWED**

pH:

pH= 11.6 (1.0 N solution); 11.1 (0.1 N solution); 10.6 (0.01 N solution)

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 87]**PEER REVIEWED**

Solubilities:

Exists only in solution

[Lide, D.R. (ed.). CRC Handbook of Chemistry and Physics. 76th ed. Boca Raton, FL: CRC Press Inc., 1995-1996.,p. 4-40]**PEER REVIEWED**

Vapor Pressure:

2160 mm Hg @ 25 deg C

[Daubert, T.E., R.P. Danner. Physical and Thermodynamic Properties of Pure Chemicals Data Compilation. Washington, D.C.: Taylor and Francis, 1989.]**PEER REVIEWED**

Other Chemical/Physical Properties:

Reaction with sulfuric acid or other strong mineral acids is exothermic; mixture becomes boiling hot

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 87]**PEER REVIEWED**

Fumes are formed when ammonia water is brought near volatile acids

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 87]**PEER REVIEWED**

Specific gravity: 0.957 25 deg C/25 deg C /Ammonia water - 10%/

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and

Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 87]**PEER REVIEWED**

Specific gravity (20 deg C/4 deg C) (Solution concn): 0.9939 (1%); 0.9811 (4%); 0.9651 (8%); 0.9362 (16%); 0.9229 (20%); 0.9101 (24%); 0.8980 (28%)

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 87]**PEER REVIEWED**

Freezing point (solution concn): -2.9 deg C (4%); -8.1 deg C (8%); - 23.1 deg C (16%); - 34.9 deg C (20%); -44.5 deg C (24%); -69.2 deg C (28%)

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 87]**PEER REVIEWED**

Produces low temperatures by its own evaporation.

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 87]**PEER REVIEWED**

Chemical Safety & Handling:

Hazards Summary:

The major hazards encountered in the use and handling of **ammonium hydroxide** stem from its toxicologic properties. Toxic by all routes (ie, inhalation, ingestion, and dermal contact), exposure to this colorless, intensely pungent-smelling liquid may occur from its use in fertilizers, dyes, explosives, plastics, cleansing agents, fibers, and resins. Effects from exposure may include extreme irritation of the eyes and mucous membranes, contact burns to the skin and eyes, and life-threatening pulmonary edema. In activities and situations where over-exposure is possible, wear a self-contained breathing apparatus, and protective clothing (including full face protection). If contact should occur, immediately flush affected skin or eyes with running water for at least 15 minutes, and remove contaminated clothing and shoes at the site. While **ammonium hydroxide** does not ignite easily, it can burn with the production of irritating or poisonous gases. Fires involving **ammonium hydroxide** may be extinguished with dry chemical, CO₂, Halon, water spray, fog, or standard foam.

Ammonium hydroxide may be shipped via air, rail, road, and water, in containers bearing warning labels that differ depending upon the density, specific gravity, and percent composition of the solution being shipped. Consult the regulatory requirements of the US Department of Transportation before shipping. **Ammonium hydroxide** should be stored in cool, well-ventilated areas, in strong glass, plastic, or rubber stoppered bottles, away from heavy metals, acids, and combustibles (eg, wood, paper, oil). For small spills of **ammonium hydroxide**, first isolate the spill area, then take up with sand or other noncombustible absorbent and place into a container for later disposal. Large spills should be diked far ahead of the spill, taking care to stay out of low areas. Before implementing land disposal of waste **ammonium hydroxide**, consult with environmental regulatory agencies for guidance.

PEER REVIEWED

DOT Emergency Guidelines:

Health: TOXIC; may be fatal if inhaled. Vapors are extremely irritating and corrosive. Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite. Fire will produce irritating, corrosive and/or toxic gases. Runoff from fire control may cause pollution. /Ammonia, solution, with more than 35% but not more than 50% ammonia; Ammonia solution, with more than 50% ammonia/ [U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of a Hazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of Hazardous Materials Initiatives and Training (DHM-50), Washington, D.C. (1996)., p.

G-125]**PEER REVIEWED**

Fire or explosion: Some may burn, but none ignite readily. Vapors from liquefied gas are initially heavier than air and spread along ground. Some of these materials may react violently with water. Containers may explode when heated. Ruptured cylinders may rocket. /Ammonia, solution, with more than 35% but not more than 50% ammonia; Ammonia solution, with more than 50% ammonia/
 [U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-125]**PEER REVIEWED**

Public safety: ... Isolate spill or leak area immediately for at least 100 to 200 meters (330 to 660 feet) in all directions. Keep unauthorized personnel away. Stay upwind. Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks). Keep out of low areas. Ventilate closed spaces before entering. /Ammonia, solution, with more than 35% but not more than 50% ammonia; Ammonia solution, with more than 50% ammonia/
 [U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-125]**PEER REVIEWED**

Protective clothing: Wear positive pressure self-contained breathing apparatus (SCBA). Wear chemical protective clothing which is specifically recommended by the manufacturer. It may provide little or no thermal protection. Structural firefighters' protective clothing is recommended for fire situations ONLY; it is not effective in spill situations. /Ammonia, solution, with more than 35% but not more than 50% ammonia; Ammonia solution, with more than 50% ammonia/
 [U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-125]**PEER REVIEWED**

Evacuation: Spill: Fire: If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions. /Ammonia, solution, with more than 35% but not more than 50% ammonia; Ammonia solution, with more than 50% ammonia/
 [U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-125]**PEER REVIEWED**

Fire: Small fires: Dry chemical or CO2. Large fires: Water spray, fog or regular foam. Move containers from fire area if you can do it without risk. Do not get water inside containers. Damaged cylinders should be handled only by specialists. Fire involving tanks: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Do not direct water at source of leak or safety devices; icing may occur. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. Always stay away from the ends of tanks. /Ammonia, solution, with more than 35% but not more than 50% ammonia; Ammonia solution, with more than 50% ammonia/
 [U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p.

G-125] **PEER REVIEWED**

Spill or leak: Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire. Do not touch or walk through spilled material. Stop leak if you can do it without risk. If possible, turn leaking containers so that gas escapes rather than liquid. Prevent entry into waterways, sewers, basements or confined areas. Do not direct water at spill or source of leak. Use water spray to reduce vapors or divert vapor cloud drift. Isolate area until gas has dispersed. /Ammonia, solution, with more than 35% but not more than 50% ammonia; Ammonia solution, with more than 50% ammonia/

[U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-125] **PEER REVIEWED**

First aid: Move victim to fresh air. Call emergency medical care. Apply artificial respiration if victim is not breathing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Administer oxygen if breathing is difficult. Remove and isolate contaminated clothing and shoes. In case of contact with liquefied gas, thaw frosted parts with lukewarm water. In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes. Keep victim warm and quiet. Keep victim under observation. Effects of contact or inhalation may be delayed. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. /Ammonia, solution, with more than 35% but not more than 50% ammonia; Ammonia solution, with more than 50% ammonia/

[U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-125] **PEER REVIEWED**

Health: TOXIC, inhalation, ingestion, or skin contact with material may cause severe injury or death. Contact with molten substance may cause severe burns to skin and eyes. Avoid any skin contact. Effects of contact or inhalation may be delayed. Fire may produce irritating, corrosive and/or toxic gases. Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution. /Ammonia, solution, with more than 10% but not more than 35% ammonia/

[U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-154] **PEER REVIEWED**

Fire or explosion: Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes. Some are oxidizers and may ignite combustibles (wood, paper, oil, clothing, etc.). Contact with metals may evolve flammable hydrogen gas. Containers may explode when heated. /Ammonia, solution, with more than 10% but not more than 35% ammonia/

[U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-154] **PEER REVIEWED**

Public safety: ... Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions. Keep unauthorized personnel away. Stay upwind. Keep out of low areas. Ventilate enclosed areas. /Ammonia, solution, with more than 10% but not more than 35% ammonia/

[U.S. Department of Transportation. 1996 North American Emergency Response

Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-154]**PEER REVIEWED**

Protective clothing: Wear positive pressure self-contained breathing apparatus (SCBA). Wear chemical protective clothing which is specifically recommended by the manufacturer. Structural firefighters' protective clothing is recommended for fire situations ONLY, it is not effective in spill situations. /Ammonia, solution, with more than 10% but not more than 35% ammonia/
[U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-154]**PEER REVIEWED**

Evacuation: Spill: Fire: If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. /Ammonia, solution, with more than 10% but not more than 35% ammonia/
[U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-154]**PEER REVIEWED**

Fire: Small fires: Dry chemical, CO2 or water spray. Large fires: Dry chemical, CO2, alcohol-resistant foam or water spray. Move containers from fire area if you can do it without risk. Dike fire control water for later disposal; do not scatter the material. Fire involving tanks or car/trailer loads: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from the ends of tanks. /Ammonia, solution, with more than 10% but not more than 35% ammonia/
[U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-154]**PEER REVIEWED**

Spill or leak: ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. DO NOT GET WATER INSIDE CONTAINERS. /Ammonia, solution, with more than 10% but not more than 35% ammonia/
[U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-154]**PEER REVIEWED**

First aid: Move victim to fresh air. Call emergency medical care. Apply artificial respiration if victim is not breathing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Administer oxygen if breathing is difficult. Remove and isolate contaminated clothing and shoes. In case of contact with substance, immediately flush skin or eyes

with running water for at least 20 minutes. For minor skin contact, avoid spreading material on unaffected skin. Keep victim warm and quiet. Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. /Ammonia, solution, with more than 10% but not more than 35% ammonia/

[U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-154]**PEER REVIEWED**

Initial Isolation and Protective Action Distances: Small Spills (from a small package or small leak from a large package): First, ISOLATE in all Directions 30 meters (100 feet); then, PROTECT persons Downwind during DAY 0.2 kilometers (0.1 miles) and NIGHT 0.2 kilometers (0.1 miles). LARGE SPILLS (from a large package or from many small packages): First, ISOLATE in all Directions 60 meters (200 feet); then, PROTECT persons Downwind during DAY 0.2 kilometers (0.1 miles) and NIGHT 0.3 kilometers (0.2 miles). /Ammonia solution, with more than 50% ammonia/

[U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. TABLE]**PEER REVIEWED**

Skin, Eye and Respiratory Irritations:

Ammonium hydroxide causes extremely painful irritation of all mucous membranes.

[Dreisbach, R.H. Handbook of Poisoning. 12th ed. Norwalk, CT: Appleton and Lange, 1987. 214]**PEER REVIEWED**

BOTH LIQ & VAPOR EXTREMELY IRRITATING, ESP TO EYES.

[Sax, N.I. and R.J. Lewis, Sr. (eds.). Hawley's Condensed Chemical Dictionary. 11th ed. New York: Van Nostrand Reinhold Co., 1987. 64]**PEER REVIEWED**

Hazardous Reactivities & Incompatibilities:

CAUSTIC LIQ FORMS EXPLOSIVE CMPD WITH MANY HEAVY METALS SUCH AS SILVER, LEAD, ZINC, & THEIR SALTS, ESPECIALLY HALIDE SALTS.

[Association of Official Analytical Chemists. Official Methods of Analysis. 10th ed. and supplements. Washington, DC: Association of Official Analytical Chemists, 1965. New editions through 13th ed. plus supplements, 1982.,p. 13/881 51.033]**PEER REVIEWED**

With sodium hydroxide and silver nitrate: During preparation of an oxidizing agent on a larger scale than described, addition of warm sodium hydroxide solution to warm ammoniacal silver nitrate with stirring caused immediate precipitation of black silver nitride, which exploded. Similar incidents had been reported previously, including one where explosion appeared to be initiated by addition of Devarda's alloy (Al-Cu-Zn).

[Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990 22]**PEER REVIEWED**

Incompatible with acrolein, nitromethane, acrylic acid, chlorosulfonic acid, dimethyl sulfate, halogens, (Au + aqua regia), HCl, HF, HNO₃, oleum, beta-propiolactone, propylene oxide, ... Ag₂O, (Ag₂O + C₂H₅OH), AgMnO₄, H₂SO₄.

[Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996. 211]**PEER REVIEWED**

Reaction with sulfuric acid or other strong mineral acids is exothermic; mixture becomes boiling hot

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 87]**PEER REVIEWED**

Fumes are formed when ammonia water is brought near volatile acids

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 87]**PEER REVIEWED**

Hazardous Decomposition:

When heated to decomposition it emits ammonia and nitroxides.

[Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996. 211]**PEER REVIEWED**

Immediately Dangerous to Life or Health:

300 ppm /Ammonia/

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 14]**PEER REVIEWED**

Protective Equipment & Clothing:

Employees working in areas where /**ammonium hydroxide**/ is used must be trained in escape methods and in the use of safety equipment, including goggles, gas masks, showers, eye fountains, water hoses, exits, lifelines and first-aid equipment ... Equipment must be constantly inspected to prevent accidents. All valves should be labeled to prevent accidental opening. If a contaminated area must be entered, a full-face airline mask or self-contained oxygen mask must be worn.

[Dreisbach, R.H. Handbook of Poisoning. 12th ed. Norwalk, CT: Appleton and Lange, 1987. 214]**PEER REVIEWED**

[ACGIH; Guidelines Select of Chem Protect Clothing Volume #1 Field Guide p.67 (1983)] Some data suggest breakthrough times for **ammonium hydroxide** of approximately an hour or more for natural rubber. For **ammonium hydroxide** (30-70%), breakthrough times greater than one hour have been reported (normally) by two or more testers for viton.

[Weast, R.C. (ed.) Handbook of Chemistry and Physics, 68th ed. Boca Raton, Florida: CRC Press Inc., 1987-1988.,p. B-70]**PEER REVIEWED**

For **ammonium hydroxide**, two or more testers have reported (normally) breakthrough times for neoprene to be greater than one hour.

[ACGIH; Guidelines Select of Chem Protect Clothing Volume #1 Field Guide p.67 (1983)]**PEER REVIEWED**

For **ammonium hydroxide**, two or more testers have reported (normally) breakthrough times for nitrile rubber to be greater than one hour.

[ACGIH; Guidelines Select of Chem Protect Clothing Volume #1 Field Guide p.67 (1983)]**PEER REVIEWED**

For **ammonium hydroxide**, two or more testers have reported (normally) breakthrough times for polyvinyl chloride to be greater than one hour.

[ACGIH; Guidelines Select of Chem Protect Clothing Volume #1 Field Guide p.67 (1983)]**PEER REVIEWED**

Some data suggesting breakthrough times, for **ammonium hydroxide** (< 30%), of approximately an hour or more for natural rubber.

[ACGIH; Guidelines Select of Chem Protect Clothing Volume #1 Field Guide p.67 (1983)]**PEER REVIEWED**

There are some data for **ammonium hydroxide (< 30%)** suggesting breakthrough times of approximately one hour or more for neoprene.
 [ACGIH; Guidelines Select of Chem Protect Clothing Volume #1 Field Guide p.67 (1983)]**PEER REVIEWED**

There are some data for **ammonium hydroxide (< 30%)** suggesting breakthrough times of approximately one hour or more for nitrile rubber.
 [ACGIH; Guidelines Select of Chem Protect Clothing Volume #1 Field Guide p.67 (1983)]**PEER REVIEWED**

There are some data (usually from immersion tests) for **ammonium hydroxide (< 30%)** suggesting breakthrough times greater than one hour are not likely for polyvinyl chloride.
 [ACGIH; Guidelines Select of Chem Protect Clothing Volume #1 Field Guide p.67 (1983)]**PEER REVIEWED**

There are some data for **ammonium hydroxide (30-70%)** suggesting breakthrough times of approximately one hour or more for natural rubber.
 [ACGIH; Guidelines Select of Chem Protect Clothing Volume #1 Field Guide p.67 (1983)]**PEER REVIEWED**

There are some data for **ammonium hydroxide (30-70%)** suggesting breakthrough time of approximately an hour or more for neoprene.
 [ACGIH; Guidelines Select of Chem Protect Clothing Volume #1 Field Guide p.67 (1983)]**PEER REVIEWED**

There are some data for **ammonium hydroxide (30-70%)** suggesting breakthrough time of approximately an hour or more for nitrile rubber.
 [ACGIH; Guidelines Select of Chem Protect Clothing Volume #1 Field Guide p.67 (1983)]**PEER REVIEWED**

Preventive Measures:

SRP: The scientific literature for the use of contact lenses in industry is conflicting. The benefit or detrimental effects of wearing contact lenses depend not only upon the substance, but also on factors including the form of the substance, characteristics and duration of the exposure, the uses of other eye protection equipment, and the hygiene of the lenses. However, there may be individual substances whose irritating or corrosive properties are such that the wearing of contact lenses would be harmful to the eye. In those specific cases, contact lenses should not be worn. In any event, the usual eye protection equipment should be worn even when contact lenses are in place.
 PEER REVIEWED

Use care in handling strong ammonia solution because of caustic nature of solution & irritating properties of its vapor. Cool container well before opening, & cover closure with a cloth or similar material while opening.
 [Osol, A. (ed.). Remington's Pharmaceutical Sciences. 16th ed. Easton, Pennsylvania: Mack Publishing Co., 1980. 1257]**PEER REVIEWED**

... GREATEST HAZARD OF WORKING WITH ALKALINE MATERIALS IS FROM SPLASH OR SPLATTER OF PARTICLES OR SOLN OF STRONGER ALKALIES ENTERING EYES OF WORKMEN. THIS CAN BE PREVENTED BY USE OF EYE PROTECTION THAT IS EFFECTIVE AT ALL ANGLES. PROPER PROVISIONS SHOULD ... BE AVAIL FOR IMMEDIATE & PROLONGED WASHING WITH WATER SHOULD ... EYE CONTAMINATION OCCUR.

[Clayton, G.D., F.E. Clayton (eds.) Patty's Industrial Hygiene and Toxicology. Volumes 2A, 2B, 2C, 2D, 2E, 2F: Toxicology. 4th ed. New York, NY: John Wiley & Sons Inc., 1993-1994. 755]**PEER REVIEWED**

SRP: Contaminated protective clothing should be segregated in such a manner so that there is no direct personal contact by personnel who handle, dispose, or clean the clothing. Quality assurance to ascertain the completeness of the cleaning procedures should be implemented before the decontaminated protective clothing is returned for reuse by the workers.

PEER REVIEWED

Shipment Methods and Regulations:

No person may /transport,/ offer or accept a hazardous material for transportation in commerce unless that person is registered in conformance ... and the hazardous material is properly classed, described, packaged, marked, labeled, and in condition for shipment as required or authorized by ... /the hazardous materials regulations (49 CFR 171-177)./

[49 CFR 171.2 (7/1/96)]**PEER REVIEWED**

The International Air Transport Association (IATA) Dangerous Goods Regulations are published by the IATA Dangerous Goods Board pursuant to IATA Resolutions 618 and 619 and constitute a manual of industry carrier regulations to be followed by all IATA Member airlines when transporting hazardous materials.

[IATA. Dangerous Goods Regulations. 38th ed. Montreal, Canada and Geneva, Switzerland: International Air Transport Association, Dangerous Goods Board, January, 1997. 96]**PEER REVIEWED**

The International Maritime Dangerous Goods Code lays down basic principles for transporting hazardous chemicals. Detailed recommendations for individual substances and a number of recommendations for good practice are included in the classes dealing with such substances. A general index of technical names has also been compiled. This index should always be consulted when attempting to locate the appropriate procedures to be used when shipping any substance or article.

[IMDG; International Maritime Dangerous Goods Code; International Maritime Organization p.2016,2017,8110 (1988)]**PEER REVIEWED**

Storage Conditions:

Keep cool in strong glass, plastic, or rubber stoppered bottles not completely filled. /Ammonia water: 28-29%/

[The Merck Index. 10th ed. Rahway, New Jersey: Merck Co., Inc., 1983. 74]**PEER REVIEWED**

Disposal Methods:

SRP: At the time of review, criteria for land treatment or burial (sanitary landfill) disposal practices are subject to significant revision. Prior to implementing land disposal of waste residue (including waste sludge), consult with environmental regulatory agencies for guidance on acceptable disposal practices.

PEER REVIEWED

Neutralization: Put into large vessel containing water. Neutralize with hydrochloric acid. ... Recommendable methods: Landfill, ... chemical treatment. Not recommendable method: Thermal destruction. Peer-review: Small amounts only: Landfill, great dilution before discharge to sewer. Large amounts of ammonia in landfill leachate may make disposal of leachate difficult. (Peer-review conclusions of an IRPTC expert consultation (May 1985))

[United Nations. Treatment and Disposal Methods for Waste Chemicals (IRPTC File). Data Profile Series No. 5. Geneva, Switzerland: United Nations Environmental Programme, Dec. 1985. 84]**PEER REVIEWED**

SRP: Contaminated protective clothing should be segregated in such a manner so that there is no direct personal contact by personnel who handle, dispose, or clean the clothing. Quality assurance to ascertain the completeness of the cleaning procedures should be implemented before the decontaminated protective clothing is returned for reuse by the workers.

PEER REVIEWED

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[49 CFR 171.2 (7/1/96)]**PEER REVIEWED**

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[IMDG; International Maritime Dangerous Goods Code; International Maritime Organization p.2016,2017,8110 (1988)]**PEER REVIEWED**

Storage Conditions:

Keep cool in strong glass, plastic, or rubber stoppered bottles not completely filled. /Ammonia water: 28-29%/

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PEER REVIEWED

Neutralization: Put into large vessel containing water. Neutralize with hydrochloric acid. ... Recommendable methods: Landfill, ... chemical treatment. Not recommendable method: Thermal destruction. Peer-review: Small amounts only: Landfill, great dilution before discharge to sewer. Large amounts of ammonia in landfill leachate may make disposal of leachate difficult. (Peer-review conclusions of an IRPTC expert consultation (May 1985))

[United Nations. Treatment and Disposal Methods for Waste Chemicals (IRPTC File). Data Profile Series No. 5. Geneva, Switzerland: United Nations Environmental Programme, Dec. 1985. 84]**PEER REVIEWED**

Occupational Exposure Standards:**Immediately Dangerous to Life or Health:**

300 ppm /Ammonia/

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 14]**PEER REVIEWED**

Manufacturing/Use Information:**Major Uses:**

Textiles; mfr of rayon, rubber; condensation polymerization; pharmaceuticals; ceramics; photography (development of latent images); ammonia soaps; lubricants; fireproofing wood; ink mfr; ammonium compd; saponifying fats & oils; org synth; detergent; household cleanser; food additive
[Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 12th ed. New York, NY: Van Nostrand Reinhold Co., 1993 66]**PEER REVIEWED**

Detergent, removing stains, bleaching, calico printing, extracting plant colors (cochineal, archil, etc.) and alkaloids; manuf ammonium salts, aniline dyes, and a wide variety of other uses.
[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 87]**PEER REVIEWED**

FERTILIZER FOR DIRECT SOIL APPLICATION (INCL ANHYD); CHEM INT FOR EXPLOSIVES & FERTILIZERS (SUCH AS AMMONIUM NITRATE); PLASTICS; ELASTOMERS; FIBERS & LIVESTOCK FEED CHEM (INCL ANHYD); SOLVENT FOR CASEIN IN PULP & PAPER INDUSTRY; REFRIGERANT; WOOD PULPING CHEM (INCL ANHYDROUS)
[SRI]**PEER REVIEWED**

AQUEOUS SOLUTION IS USED IN VARIOUS PHARMACEUTICAL PROCESSES AS A MILD ALKALIZER
[Osol, A. (ed.). Remington's Pharmaceutical Sciences. 16th ed. Easton, Pennsylvania: Mack Publishing Co., 1980. 350]**PEER REVIEWED**

ADDED TO PUBLIC WATER SUPPLY TO AID CHLORINATION PROCESSES
[National Research Council. Drinking Water and Health. Volume 2. Washington, DC: National Academy Press, 1980. 19]**PEER REVIEWED**

Ammonia is used in extracting such metals as copper, nickel, and molybdenum from their ores.
[Braker W, Mossman A; Matheson Gas Data Book 6th ED p.24 (1980)]**PEER REVIEWED**

Diluted solution of ammonia in water is used as a common household cleansing agent.
[Braker W, Mossman A; Matheson Gas Data Book 6th ED p.24 (1980)]**PEER REVIEWED**

... The substitution of ammonia for calcium /is used/ in the bisulfite pulping of wood. This improves the yield and quality of the pulp. Ammonia is used as a solvent for casein in the coating of paper.
[Braker W, Mossman A; Matheson Gas Data Book 6th ED p.24 (1980)]**PEER REVIEWED**

Medication

PEER REVIEWED

... Used to increase palatability, preserve gloss, and inhibit discoloration of foods, including glazes, polishes, waxes, and protective coatings. /Surface-finishing agents, from table/

[Klaassen, C.D., M.O. Amdur, Doull J. (eds.). Casarett and Doull's Toxicology. The Basic Science of Poisons. 5th ed. New York, NY: McGraw-Hill, 1995. 925]**PEER REVIEWED**

Manufacturers:

General Alum & Chemical Corporation, 1630 Timberwolf Drive, Holland OH 43528 (419) 865-8000. Production site: Searsport MA 04974

[SRI. 1997 Directory of Chemical Producers - United States of America. Menlo Park, CA: SRI International 1997. 453]**PEER REVIEWED**

General Chemical Corporation, Hq, 90 E. Halsey Rd., Parsippany, NJ 07054, (201) 515-0900. Production site: Pittsburg, CA 94565

[SRI. 1997 Directory of Chemical Producers - United States of America. Menlo Park, CA: SRI International 1997. 453]**PEER REVIEWED**

LaRoche Industries Inc., 1100 Johnson Ferry Road N.E., Atlanta, GA 30342 (404) 851-0476. Production site: Cherokee, AL 35616

[SRI. 1997 Directory of Chemical Producers - United States of America. Menlo Park, CA: SRI International 1997. 453]**PEER REVIEWED**

Mallinckrodt Baker, Inc., 222 Red School Lane, Phillipsburg, NJ 08865 (908). Production sites: Phillipsburg, NJ 08865, St. Louis, MO 63147

[SRI. 1997 Directory of Chemical Producers - United States of America. Menlo Park, CA: SRI International 1997. 453]**PEER REVIEWED**

Old Bridge Chemicals, Inc., Old Waterworks Road, P.O. Box 194, Old Bridge, NJ 08857, (908) 727-2229

[SRI. 1997 Directory of Chemical Producers - United States of America. Menlo Park, CA: SRI International 1997. 453]**PEER REVIEWED**

Methods of Manufacturing:

DIRECT REACTION OF HYDROGEN AND NITROGEN OVER A CATALYTIC SURFACE BASED ON METALLIC IRON FOLLOWED BY ADDITION OF THE RESULTING AMMONIA TO WATER

[SRI]**PEER REVIEWED**

General Manufacturing Information:

A solution of 28-29% NH₃ in water.

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 87]**PEER REVIEWED**

Formulations/Preparations:

... AMMONIA IS COMMONLY ENCOUNTERED AS AQUEOUS SOLUTIONS OF 28 PERCENT (AQUAMMONIA), CALLED AMMONIUM HYDROXIDE AND 10 PERCENT, CALLED HOUSEHOLD AMMONIA.

[Clayton, G.D., F.E. Clayton (eds.) Patty's Industrial Hygiene and Toxicology. Volumes 2A, 2B, 2C, 2D, 2E, 2F: Toxicology. 4th ed. New York, NY: John Wiley & Sons Inc., 1993-1994. 756]**PEER REVIEWED**

... STRONG AMMONIA SOLN (USP) IS 27 TO 30% (WT/VOL) NH₃.

[Gosselin, R.E., R.P. Smith, H.C. Hodge. Clinical Toxicology of Commercial Products. 5th ed. Baltimore: Williams and Wilkins, 1984.,p. II-105]**PEER REVIEWED**

Grades: technical; chemically pure; 16%; 20%; 26%; NF (strong); Food Chemical Codex [Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 12th ed. New York, NY: Van Nostrand Reinhold Co., 1993 66]**PEER REVIEWED**

Aqueous soln of ammonia ... is often referred to & labeled as a soln of **ammonium hydroxide** /although there is little **ammonium hydroxide** present/. In commerce, ammonia is avail ... in form of aqueous soln of varying concn, or as anhydrous ammonia furnished in liquefied form ... Ammonia in household use contains 10% ammonia & is ... known as 16 deg ammonia (referring to density in degrees Baume, a concn term). /Ammonia/ [Osol, A. (ed.). Remington's Pharmaceutical Sciences. 16th ed. Easton, Pennsylvania: Mack Publishing Co., 1980. 350]**PEER REVIEWED**

Consumption Patterns:

CONSUMPTION PATTERN FOR /AMMONIUM HYDROXIDE & ANHYD AMMONIA/: FERTILIZER USE AND CHEM INT FOR FERTILIZER, 74%; CHEM INT IN MANUFACTURE OF FIBERS, PLASTICS, RESINS, AND ELASTOMERS, 6%; CHEM INT IN MANUFACTURE OF EXPLOSIVES, 4%; CHEM INT FOR LIVESTOCK FEED, 2%; MISCELLANEOUS USES (EG, AS A REFRIGERANT, AS A SOLVENT FOR CASEIN AND AS A WOOD PULPING CHEM), 14% (1975)

[SRI]**PEER REVIEWED**

U. S. Production:

(1977) 4.68X10+10 GRAMS

[SRI]**PEER REVIEWED**

(1979) 3.49X10+10 GRAMS

[SRI]**PEER REVIEWED**

U. S. Imports:

(1977) 2.86X10+9 GRAMS

[SRI]**PEER REVIEWED**

(1979) 3.11X10+8 GRAMS

[SRI]**PEER REVIEWED**

(1984) 1.43X10+9 g /AMMONIA, AQ/

[BUREAU OF THE CENSUS. U.S. IMPORTS FOR CONSUMPTION AND GENERAL IMPORTS 1984 p.1-346]**PEER REVIEWED**

6.47X10+6 lb (AMMONIA, AQ)

[BUREAU OF THE CENSUS. US IMPORTS FOR CONSUMPTION AND GENERAL IMPORTS 1986 p.1-152]**PEER REVIEWED**

U. S. Exports:

(1979) 1.84X10+9 GRAMS

[SRI]**PEER REVIEWED**

(1984) 3.38X10+8 g /AMMONIA, AQ/

[BUREAU OF THE CENSUS. U.S. EXPORTS, SCHEDULE E, 1984 p.2-89]**PEER REVIEWED**

(1987) 1.80X10+3 content ton (AMMONIA, AQ)

[BUREAU OF THE CENSUS. U. S. EXPORTS, SCHEDULE E, OCTOBER 1987, P.2-91]**PEER REVIEWED**

Laboratory Methods:

Special References:

Synonyms and Identifiers:

Related HSDB Records:

162 [AMMONIA]

Synonyms:

Ammonia aqueous
PEER REVIEWED

AMMONIA, MONOHYDRATE
PEER REVIEWED

AMMONIA SOLUTION
PEER REVIEWED

AMMONIUM HYDRATE
PEER REVIEWED

AQUA AMMONIA
PEER REVIEWED

AQUAMMONIA
PEER REVIEWED

Formulations/Preparations:

... AMMONIA IS COMMONLY ENCOUNTERED AS AQUEOUS SOLUTIONS OF 28 PERCENT (AQUAMMONIA), CALLED AMMONIUM HYDROXIDE AND 10 PERCENT, CALLED HOUSEHOLD AMMONIA.

[Clayton, G.D., F.E. Clayton (eds.) Patty's Industrial Hygiene and Toxicology. Volumes 2A, 2B, 2C, 2D, 2E, 2F: Toxicology. 4th ed. New York, NY: John Wiley & Sons Inc., 1993-1994. 756]**PEER REVIEWED**

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[Gosselin, R.E., R.P. Smith, H.C. Hodge. Clinical Toxicology of Commercial Products. 5th ed. Baltimore: Williams and Wilkins, 1984.,p. II-105]**PEER REVIEWED**

Grades: technical; chemically pure; 16%; 20%; 26%; NF (strong); Food Chemical Codex
[Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 12th ed. New York, NY: Van Nostrand Reinhold Co., 1993 66]**PEER REVIEWED**

Aqueous soln of ammonia ... is often referred to & labeled as a soln of **ammonium hydroxide** /although there is little **ammonium hydroxide** present/. In commerce, ammonia is avail ... in form of aqueous soln of varying concn, or as anhydrous ammonia furnished in liquefied form ... Ammonia in household use contains 10% ammonia & is ... known as 16 deg ammonia (referring to density in degrees Baume, a concn term). /Ammonia/

[Osol, A. (ed.). Remington's Pharmaceutical Sciences. 16th ed. Easton, Pennsylvania: Mack Publishing Co., 1980. 350]**PEER REVIEWED**

Shipping Name/ Number DOT/UN/NA/IMO:

UN 2672; Ammonia solutions density (specific gravity) between 0.880 and 0.957 at 15 deg C in water with more than 10% but not more than 35% ammonia.

UN 2073; Ammonia solutions density (specific gravity) less than 0.880 at 15 deg C in water, with more than 35% but not more than 50% ammonia.

UN 1005; Ammonia solutions density (specific gravity) less than 0.880 at 15 deg C in water, with more than 50% ammonia.

IMO 2.2; Ammonia solutions density (specific gravity) less than 0.880 at 15 deg C in water, with more than 50% ammonia; Ammonia solutions density (specific gravity) less than 0.880 at 15 deg C in water, with more than 35% but not more than 50% ammonia.

IMO 8.3; Ammonia solutions density (specific gravity) between 0.880 and 0.957 at 15 deg C in water, with more than 10% but not more than 35% ammonia.

Standard Transportation Number:

49 352 80; **Ammonium hydroxide** (containing not less than 12% but not more than 44% ammonia)

49 403 47; **Ammonium hydroxide** (containing less than 12% ammonia).

49 403 16; **Ammonium hydroxide** (containing less than 12% ammonia, Ammoniacal liquor, not elsewhere classified)

49 352 34; **Ammonium hydroxide** (containing not less than 12% but not more than 44 ammonia, Ammoniacal liquor, not elsewhere classified)

49 042 20; Ammonia solutions containing more than 44% ammonia

49 048 79; Anhydrous ammonia (tundra cooling units, condensers, equalizers, or exchangers, oil field, gas or liquid, iron or steel, pipe type, containing not more than 0.0125 pounds anhydrous ammonia per foot of pipe length)

RTECS Number:

NIOSH/BQ9625000

Administrative Information:

Hazardous Substances Databank Number: 5125

Last Revision Date: 20000612

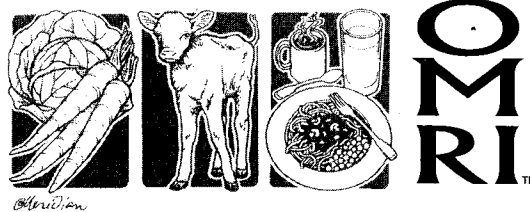
Last Review Date: Reviewed by SRP on 1/31/1999

Update History:

Complete Update on 06/12/2000, 1 field added/edited/deleted.
Complete Update on 02/08/2000, 1 field added/edited/deleted.
Complete Update on 09/21/1999, 1 field added/edited/deleted.
Complete Update on 04/28/1999, 40 fields added/edited/deleted.
Complete Update on 06/02/1998, 1 field added/edited/deleted.
Complete Update on 11/01/1997, 1 field added/edited/deleted.
Complete Update on 09/08/1997, 1 field added/edited/deleted.
Complete Update on 04/24/1997, 2 fields added/edited/deleted.
Complete Update on 03/18/1997, 2 fields added/edited/deleted.
Complete Update on 02/28/1997, 1 field added/edited/deleted.
Complete Update on 05/13/1996, 1 field added/edited/deleted.
Complete Update on 01/28/1996, 1 field added/edited/deleted.
Complete Update on 01/05/1995, 1 field added/edited/deleted.
Complete Update on 05/05/1994, 1 field added/edited/deleted.
Complete Update on 04/04/1994, 1 field added/edited/deleted.
Field update on 01/03/1993, 1 field added/edited/deleted.
Complete Update on 11/20/1992, 1 field added/edited/deleted.
Complete Update on 11/05/1992, 1 field added/edited/deleted.
Complete Update on 06/11/1991, 1 field added/edited/deleted.
Complete Update on 05/21/1990, 2 fields added/edited/deleted.
Complete Update on 07/12/1989, 57 fields added/edited/deleted.
Field Update on 05/05/1989, 1 field added/edited/deleted.
Complete Update on 10/14/1986

Record Length: 88199

March 26, 2001
 Food and Drug Administration
 Freedom of Information Staff (HFI-35)
 5600 Fishers Lane
 Rockville, MD 20857



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 Albuquerque, NM

Affiliations listed for identification

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 for use as a boiler water additives:

<u>Substance</u>	<u>CAS #</u>	<u>21 CFR</u>
Ammonium Hydroxide	1336-21-6	184.1139

We are unable to find the appropriate reference to the use of this substance as a boiler water additive under 21 CFR 173.310, or any *Federal Register* notice for such use. Please provide any data or information that clarifies the safe use of this substance as a boiler compound when used in the preparation of steam that contacts food. This would include quantitative limits on its use, and any restrictions from use in the production of certain foods, such as dairy products. OMRI specifically requests any data on file with FDA regarding the amount of this chemical found in steam and food.

Also, please provide any information on verification and enforcement of compliance. 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 these compounds.

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 of the FOIA will be presented to the NOSB as part of a petition to add the substance to the National List of substances allowed for use in processing

organic food. Evidence of OMRI's previous work is available on our website and can be provided to the FDA upon request.

(2) It is not primarily in the commercial interest of the requester.

OMRI is a non-commercial, 501(c)(3) tax-exempt research and education scientific non-profit institution. OMRI has no commercial interest in the product petitioned and the information provided in response to the FOIA will not commercially benefit OMRI in any way.

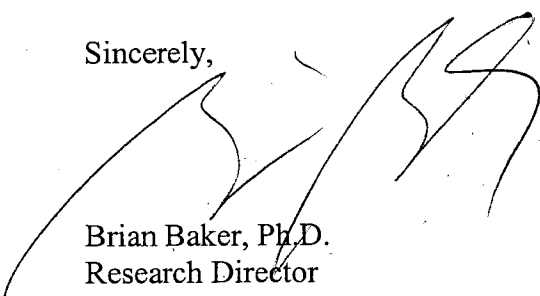
OMRI also asks that this FOIA request be handled as a response to government consultants and advisory boards under 21 CFR 20.84. In the event FDA relies on one or more FOIA exemptions to redact or deny access to records, please state the reasons for denying the fulfillment of the request.

If you have any questions or require further clarification, please contact the following person:

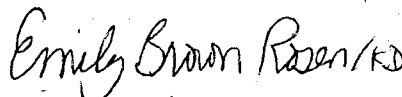
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We look forward to your response.

Sincerely,



Brian Baker, Ph.D.
Research Director



Emily Brown Rosen
Policy Director

xc: Keith Jones, USDA National Organic Program
Carolyn Brickey, Chair, NOSB
Kim Burton, Chair, NOSB Materials Committee
Steven Harper, Chair, NOSB Processing Committee
Kathleen Downey, Executive Director, OMRI