decontaminated. SEEK MEDICAL ATTENTION IMMEDIATELY.

INHALATION

Remove to fresh air; if breathing is difficult, have trained person administer oxygen. If respiration stops, give mouth-to-mouth resuscitation. GET MEDICAL ATTENTION.

INGESTION

NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. If available, give several glasses of milk. If vomiting occurs spontaneously, keep airway clear. SEEK MEDICAL ATTENTION IMMEDIATELY.

ROUTES OF EXPOSURE

INHALATION

Airborne concentrations of dust, mist, or spray may cause damage to the upper-respiratory tract and even to the lung tissue proper which could produce chemical pneumonia, depending upon severity of exposure.

SKIN

Destructive to tissues contacted and produces severe burns. A latent period may exist between exposure and sense of irritation.

EYE CONTACT

Destructive to eye tissues on contact. Will cause severe burns that result in damage to the eyes and including blindness.

INGESTION

Swallowing can cause severe burns and complete tissue perforation of mucous membranes of the mouth, throat, esophagus, and stomach.

EFFECTS OF OVEREXPOSURE

ACUTE

Corrosive to all body tissues with which it comes in contact. The effect of local exposure may consist of multiple areas of superficial destruction of the skin or of primary irritant dermatitis. Similarly, inhalation of dust, spray, or mist may result in varying degrees of irritation or damage of the respiratory tract tissues and an increased susceptibility to respiratory illness. These effects occur only when the TLV is exceeded.

CHRONIC

PRODUCT: CAUSTIC POTASH-ANHYDROUS (ALL GRADES)

ORDER NO: 185995
PROD NO : 500916

No known chronic effects.

TOXICOLOGY DATA
Potassium Hydroxide
Acute Oral LD50 (rat) 365 mg/kg

Regardless of concentration, the severity of damage and extent of its irreversibility increases with length of contact time. Prolonged contact with even dilute potassium hydroxide solution (=>2.0%) can cause a high degree of tissue destruction. The latent period, following skin contact during which no sensation of irritation occurs also varies with concentration.

SYNERGISTIC MATERIALS
None known.

3. IMPORTANT COMPONENTS

CAS NUMBER / NAME
1310583 Potassium Hydroxide (KOH)

EXPOSURE LIMITS	PERCENTAGE	
PEL 2 mg/m3, Ceiling	VOL	NO
TLV 2 mg/m3, Ceiling	WT	87.50-90.50

COMMON NAMES
CAUSTIC POTASH
KOH

Listed On(List Legend Below)
10 18 21 -- -- -- -- -- -- -- --
- -

7732185 water

EXPOSURE LIMITS	PERCENTAGE	
PEL Not Established	VOL	NO
TLV Not Established	WT	9.50-10.50

COMMON NAMES

Listed On(List Legend Below)
10 23 -- -- -- -- -- -- -- -- --
- -

All components of this product that are required to be on the TSCA Inventory are listed on the inventory.

PRODUCT: CAUSTIC POTASH-ANHYDROUS (ALL GRADES)

ORDER NO: 185993
PROD NO : 500916

Not listed as carcinogen - IARC, NTP, OSHA

LIST LEGEND
13 PA ENVIRONMENTAL HAZ SUBSTANCE 16 NY HAZARDOUS SUBSTANCES
19 PA REQUIREMENT- 3% OR GREATER 21 NJ SPECIAL HEALTH HAZ SUB
23 NJ REQUIREMENT- 1% OR GREATER

4 FIRE AND EXPLOSION DATA

FLASH POINT None AUTOIGNITION TEMPERATURE Nonflammable

FLAMMABLE LIMITS IN AIR, % BY VOLUME- UPPER Not applicable
LOWER Not applicable

EXTINGUISHING MEDIA
This product is not combustible. Water spray, foam, carbon dioxide or dry chemical may be used in areas where this product is stored.

SPECIAL FIRE FIGHTING PROCEDURES
Avoid direct contact of this product with water since this can cause a violent exothermic reaction.

Protective clothing and pressure demand, self-contained breathing apparatus should be worn by fire-fighters in areas where product is stored.

UNUSUAL FIRE AND EXPLOSION HAZARD
None. See Reactivity Section.

SENSITIVITY TO MECHANICAL IMPACT
Not sensitive

SENSITIVITY TO STATIC DISCHARGE
Not sensitive

5. SPECIAL PROTECTION

VENTILATION REQUIREMENTS
Special ventilation is not required under normal use. Use local exhaust ventilation where mist, spray, or re-suspended dust may be generated.

NOTE Where carbon monoxide may be generated, special ventilation may be required.

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

PRODUCT: CAUSTIC POTASH-ANHYDROUS (ALL GRADES)

ORDER NO: 185995
PROD NO : 500916

RESPIRATORY
Respiratory protection is not required under normal use. Use NIOSH/MSHA approved respirators following manufacturer's recommendations where dust, mist, or spray may be generated.

EYE
Wear chemical safety goggles plus full face shield to protect against splashing (ANSI Z87.1).

GLOVES
Impervious gloves should be worn. Gloves may be decontaminated by washing with mild soap and water. Natural and butyl rubber or neoprene, nitrile and PVC have been suggested.

OTHER CLOTHING AND EQUIPMENT
Impervious protective clothing and chemical resistant safety shoes should be worn to minimize contact. Wash contaminated clothing with soap and water and dry before reuse. Emergency shower and eyewash facility should be in close proximity (ANSI Z358.1).

6. PHYSICAL DATA

BOILING POINT @ 760 mm Hg 1320 C

FREEZING POINT 400 C (742 F)

VAPOR PRESSURE 60mm Hg @ 1010 C

SPECIFIC GRAVITY (H2O=1) 2.044 @ 20 C

SOLUBILITY IN H2O % BY WT Completely Soluble

VAPOR DENSITY (Air=1) Not applicable

APPEARANCE AND ODOR White solid with no distinct odor

ODOR THRESHOLD (ppm) Not applicable

pH 0.01 Moles/liter has pH 12.0

COEFFICIENT WATER/OIL DISTRIBUTION Not available

% VOLATILES BY VOL. Nil

7. REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY
Under normal conditions, the material is stable.

INCOMPATIBILITY
See Handling and Storage Section. Avoid direct contact with water. This product may be added slowly to water or acids with dilution and agitation to avoid a violent exothermic reaction. When handling this product, avoid contact with aluminum, tin, zinc, and alloys containing these metals. Do not mix strong acids without dilution and agitation to prevent violent or explosive reaction. Avoid contact with leather, wool, acids, organic halogen compounds, or organic nitro compounds.

HAZARDOUS DECOMPOSITION PRODUCTS
None.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION
Material is not known to polymerize.

8. HANDLING AND STORAGE

HANDLING AND STORAGE PRECAUTIONS
Do not get into eyes, on skin, on clothing.
Avoid breathing dust, mist, or spray.
Do not take internally.
Use with adequate ventilation and use respiratory protection when exposure to dust, mist or spray is possible.
When handling, wear chemical splash goggles, face shield, rubber gloves and protective clothing.
Wash thoroughly after handling or contact - exposure can cause burns which are not immediately painful or visible.
Keep container closed.
Product can react violently with water, acids, and other substances - read Special Mixing and Handling Instructions below carefully before using.
Product is corrosive to tin, aluminum, zinc and alloys containing these metals, and will react violently with these metals in powder form.
Hazardous carbon monoxide gas can form upon contact with reducing sugars and food and beverage products in enclosed spaces and can cause death. Follow appropriate tank entry procedures (ANSI Z117.1).

SPECIAL MIXING AND HANDLING INSTRUCTIONS
Considerable heat is generated when product is mixed with water. Therefore, when making solutions always carefully follow these steps

---

ALWAYS wear ALL protective clothing described above. NEVER add water to product. ALWAYS add product - with constant stirring - slowly to surface of lukewarm (80-100 F) water, to assure product is being completely dissolved as it is added.

If product is added too rapidly, or without stirring, and becomes concentrated at bottom of mixing vessel, excessive heat may be generated, resulting in DANGEROUS boiling and spattering, and a possible IMMEDIATE AND VIOLENT ERUPTION of highly caustic solution.

NOTE 50 pounds of product dissolved in 30 gallons of 90 F water will raise temperature of resulting solution to approximately 180 F. Never add more product than can be absorbed by solution while maintaining temperature below 200 F (@ sea level) to prevent boiling and spattering.

Product can react EXPLOSIVELY with acids, aldehydes, and many other organic chemicals - when mixing product with solutions containing such chemicals, follow all of above mixing instructions, and add product very gradually, while stirring constantly.

ALWAYS empty and clean containers of all residues before adding product, to avoid possible EXPLOSIVE reaction between product and unknown residue.

Returnable containers should be shipped in accordance with supplier's recommendations. Return shipments should comply with all federal, state, and DOT regulations. All residual caustic potash should be removed from containers prior to disposal.

F. ENVIRONMENTAL PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
Leaks should be stopped. Spills should be contained and cleaned up immediately and removed to chemical waste area. Spills should be shoveled up or removed by using a vacuum truck (if liquid). Neutralize remaining traces of material with any dilute inorganic acid such as hydrochloric, sulfuric, nitric, phosphoric, and acetic acid. The spill area should then be flushed with water followed by liberal covering of sodium bicarbonate. All clean-up material should be removed and placed in approved containers, labeled and stored in a safe place to await proper treatment or disposal. Spills on areas other than pavement, e.g., dirt or sand, may be handled by removing the affected soils and placing in approved containers. Persons

performing clean-up work should wear adequate personal protective equipment and clothing. Spills or releases should be reported, if required, to the appropriate local, state, and federal regulatory agencies.

CAUTION Anhydrous Caustic Potash may react violently with acids and water.

WASTE DISPOSAL METHOD

The materials resulting from clean-up operations may be hazardous wastes and, therefore, subject to specific regulations. Package, store, transport, and dispose of all clean-up materials and any contaminated equipment in accordance with all applicable federal, state, and local health environmental regulations. Shipments of waste materials may be subject to manifesting requirements per applicable regulations. Appropriate disposal will depend on the nature of each waste material and should be performed by competent and properly permitted contractors. Ensure that all responsible federal, state, and local agencies receive proper notification of spill and disposal of waste.

10. ADDITIONAL INFORMATION

OSHA Standard 29CFR 1910.1200 requires that information be provided to employees regarding the hazards of chemicals by means of a hazard communication program including labeling, material safety data sheets, training and access to written records. We request that you, and it is your legal duty to, make all information in this Material Safety Data Sheet available to your employees.

To aid our customers in complying with regulatory requirements, SARA Title III hazard categories for this product are indicated in Section I. If the word "YES" appears next to any category, this product may be reportable by you under the requirements of 40 CFR Part 370. Please consult those regulations for details.

WHMIS CLASSIFICATION D1B, E

11. PREPARATION INFORMATION

For additional Non-Emergency health, safety, or environmental information telephone (716) 286-5081, or write to
Occidental Chemical Corporation
Product Stewardship Department
360 Rainbow Boulevard South
Niagara Falls, NY 14302

PRODUCT: CAUSTIC POTASH-ANHYDROUS (ALL GRADES)

ORDER NO: 185995
PROD NO : 500916

For Emergencies 24 HOUR EMERGENCY PHONE 1-800-733-3665

To request an MSDS 716-256-3400

This Material Safety Data Sheet (MSDS) covers the following materials

- BRIQUETTES 90%
- FLAKE 90%
- BRIQUETTES
- STANDARD FLAKE
- CRYSTAL
- LOW CHLORIDE 90%
- FLAKE LOW CHLORIDE
- STANDARD CRYSTAL

WARNING LABEL INFORMATION

SIGNAL WORD DANGER

STATEMENT OF HAZARDS
CAUSES SEVERE BURNS TO SKIN AND EYES
CONTACT WITH EYES CAN CAUSE PERMANENT EYE DAMAGE
INHALATION OF DUST, MIST, OR SPRAY CAN CAUSE SEVERE LUNG DAMAGE
CAN REACT VIOLENTLY WITH WATER, ACIDS, AND OTHER SUBSTANCES.

PRECAUTIONARY STATEMENTS
Do not get into eyes, on skin, on clothing.
Avoid breathing dust, mist, or spray.
Do not take internally.
Use with adequate ventilation and wear respiratory protection when exposure to dust, mist, or spray is possible.
When handling, wear chemical splash goggles, face shield, rubber gloves, and protective clothing.
Wash thoroughly after handling or contact - exposure can cause burns which are not immediately painful or visible.
Keep container closed.
Product can react violently with water, acids, and other substances - read Handling and Storage instructions carefully before using.
Product is corrosive to tin, aluminum, zinc, and alloys containing these metals, and will react violently with these metals in powder form.
Hazardous carbon monoxide gas can form upon contact with reducing sugars, food and beverage products and can cause death in enclosed spaces. Follow appropriate tank entry procedures.

FIRST AID

FOR EYES
OBJECT IS TO FLUSH MATERIAL OUT IMMEDIATELY THEN SEEK MEDICAL ATTENTION. IMMEDIATELY flush eyes with large amounts of water for at least 15 minutes, holding lids apart to ensure flushing of

the entire surface. Washing eyes within several seconds is essential to achieve maximum effectiveness. SEEK MEDICAL ATTENTION IMMEDIATELY.

FOR SKIN

IMMEDIATELY wash contaminated areas with plenty of water for 15 minutes. Remove contaminated clothing and footwear. Wash clothing before reuse and discard footwear which cannot be decontaminated. SEEK MEDICAL ATTENTION IMMEDIATELY.

IF INHALED

Remove to fresh air; if breathing is difficult, have trained person administer oxygen. If respiration stops, give mouth-to-mouth resuscitation. GET MEDICAL ATTENTION.

IF SWALLOWED

NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. If available, give several glasses of milk. If vomiting occurs spontaneously, keep airway clear. SEEK MEDICAL ATTENTION IMMEDIATELY.

IN CASE OF
SPILL OR LEAK

Leaks should be stopped. Spills, after containment, should be shoveled up or removed by vacuum truck (if liquid) to chemical waste area. Neutralize residue with dilute acid, flush spill area with water followed by liberal covering of sodium bicarbonate. Dispose of wash water and spill by-products according to federal, state, and local regulations.

HANDLING AND STORAGE

Considerable heat is generated when product is mixed with water. Therefore, when making solutions always carefully follow these steps

ALWAYS wear ALL protective clothing described above. NEVER add water to product. ALWAYS add product - with constant stirring - slowly to surface of lukewarm (80-100 F) water, to assure product is being completely dissolved as it is added.

If product is added too rapidly, or without stirring, and becomes concentrated at bottom of mixing vessel, excessive heat may be generated, resulting in DANGEROUS boiling and spattering, and a possible IMMEDIATE AND VIOLENT ERUPTION of highly caustic solution.

NOTE 50 pounds of product dissolved in 30 gallons of 70 F

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water will raise temperature of resulting solution to approximately 180 F. Never add more product than can be absorbed by solution while maintaining temperature below 200 F (@ sea level) to prevent boiling and spattering.

Product can react EXPLOSIVELY with acids, aldehydes, and many other organic chemicals - when mixing product with solutions containing such chemicals, follow all of above mixing instructions, and add product very gradually, while stirring constantly.

ALWAYS empty and clean containers of all residues before adding product, to avoid possible EXPLOSIVE reaction between product and unknown residue.

Returnable containers should be shipped in accordance with supplier's recommendations. Return shipments should comply with all federal, state, and DOT regulations. All residual caustic potash should be removed from containers prior to disposal.

DISPOSAL

The materials resulting from clean-up operations may be hazardous wastes and, therefore, subject to specific regulations. Package, store, transport, and dispose of all clean-up materials and any contaminated equipment in accordance with all applicable federal, state, and local health environmental regulations. Shipments of waste materials may be subject to manifesting requirements per applicable regulations. Appropriate disposal will depend on the nature of each waste material and should be performed by competent and properly permitted contractors. Ensure that all responsible federal, state, and local agencies receive proper notification of disposal.

INFORMATION REQUIRED BY FEDERAL, STATE OR LOCAL REGULATIONS

This product contains

CAS#	NAME
1310583	Potassium hydroxide (K(OH))
7732185	Water

HMIS RATING SYSTEM HEALTH 3 FLAMMABILITY 0 REACTIVITY 2

FOR INDUSTRIAL USE ONLY LABEL 093M31867

PRODUCT: CAUSTIC POTASH-ANHYDROUS (ALL GRADES)

ORDER NO: 165995
PROD NO : 500916

---------- FOR ADDITIONAL INFORMATION ----------

CONTACT: MSDS COORDINATOR VAN WATERS & ROGERS INC.
DURING BUSINESS HOURS, PACIFIC TIME (206)889-3400

06/05/95 11:44 PRODUCT: 500916 CUST NO: 160235 ORDER NO: 165995

---------- NOTICE ----------

** VAN WATERS & ROGERS INC. ("VWR") EXPRESSLY DISCLAIMS ALL EXPRESS OR

IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE,

WITH RESPECT TO THE PRODUCT OR INFORMATION PROVIDED HEREIN, AND SHALL UNDER

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*** E N D O F M S D S ***

Allied Chemical

PRODUCT SAFETY DATA SHEET

AMMONIUM HYDROXIDE SOLUTION— AQUA AMMONIA

00003 JUL 1984 #96

A. GENERAL INFORMATION

TRADE NAME (COMMON NAME OR SYNONYM)	[X] C.A.S. NO.	[X] ALLIED PRODUCT CODE
AMMONIUM HYDROXIDE, 25-30% SOLUTION — AQUA AMMONIA (See H for type designations)	1336-21-6	See H.

CHEMICAL NAME
Ammonium Hydroxide (Synonyms; ammonia, aqueous; ammonia solution ammoniacal liquor)

R-CH-004
AQUA-AMMONIA

FORMULA	MOLECULAR WEIGHT
NH_4OH/H_2O	35.06 (formula weight)

DIVISION/PLANT ADDRESS (No., STREET, CITY, STATE AND ZIP CODE)
Allied Chemical
P.O. Box 1139R
Morristown, N.J. 07960

CONTACT	PHONE NUMBER	ISSUED DATE	REVISED DATE
Director, Product Safety	(201) 455-4157	Feb., 1979	Apr., 1981

B. FIRST AID MEASURES

EMERGENCY PHONE NUMBER (201) 455-2000

Eye: Flood with large amounts of water. Call a physician.
Skin: Remove contaminated clothing and wash with large amounts of water. Wash clothing before re-use.
Inhalation: Don respiratory protection as necessary and remove to fresh air at once. If breathing has stopped, give artificial respiration. If breathing with difficulty, give oxygen. Keep patient recumbent.
Ingestion: Do not induce vomiting. Encourage victim to drink large amounts of water, substituting, as available, diluted vinegar, lemon juice, orange juice, or other fruit juice. Follow with a demulcent such as egg white, olive oil, milk, if available.

C. HAZARDS INFORMATION

FIRE AND EXPLOSION

FLASH POINT	AUTOIGNITION TEMPERATURE	FLAMMABLE LIMITS IN AIR (% BY VOL)
N.A. °C (liquid, not flammable) [ ] OPEN CUP [ ] CLOSED CUP	651 °C (NH_3)	(NH_3) LOWER 16 UPPER 25

UNUSUAL FIRE AND EXPLOSION HAZARDS
NH_3 increases the fire hazard from other combustible materials, including oil. Flammable limits are broadened by increasing temperature.

HEALTH

INHALATION
Highly irritating to throat at approx. 400 ppm. Causes edema, dyspnea, bronchospasm, chest pain, pink frothy sputum. LC_{50} (mouse): 4837 ppm/1H. 2500-6500 ppm considered dangerous to life in 30 minutes. Ref. (h).

INGESTION
As with other corrosive alkalis: severe burning of gullet, stomach, mouth, and throat. Possible death from shock or asphyxia. LD_{50} (rat): 350 mg/kg. Human lethal dose not established: any amount can be dangerous - Ref. (g).

SKIN
Liquid: Corrosive burns or blister formation.
Gas: Irritates moist skin.

EYES
Liquid: Intensely irritating; in extreme, corneal ulceration or blindness.
Gas: Irritates.

PERMISSIBLE CONCENTRATION: AIR (SEE SECTION J)	BIOLOGICAL
50 ppm (TWA) (Ceiling, OSHA)	Unknown

UNUSUAL CHRONIC TOXICITY
None observed in Allied Chemical studies, see OSHA Proposed Standard, November 25, 1979, 49 FR 45684. Subject reviewed there.

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D. PRECAUTIONS PROCEDURES

VENTILATION

1. HEAVY HANDLING (e.g. cases of bottles/carboys/drums/pallets of cases/tank trucks):
Sufficient to reduce ammonia concentrations below permissible level. Packaging and unloading areas and open processing equipment may require mechanical exhaust systems.

SPECIALIZED HANDLING (e.g. bottles):
Handling should be done in a closed ventilated system (e.g. exhausted hood). This is customary in the semiconductor industry.

NORMAL HANDLING

Avoid all contact of liquid with the body. Minimize gas contact. Good maintenance to prevent leaks. Keep away from heat and open flame. Use good process control.

STORAGE

Perferably stored outside, otherwise in cool, dry, well-ventilated, non-combustible location, away from all possible sources of ignition and oxidizers. Ref., (d). Protect containers from heat, corrosion, and physical damage; further, Section K.

PRECAUTIONARY LABEL ☐ ATTACHED ☒ NOT ATTACHED

DOT Class: Corrosive Material (Liquid).
DANGER! CAUSES BURNS. MAY BE FATAL IF INHALED OR SWALLOWED. VAPOR EXTREMELY IRRITATING.

SPILL OR LEAK

Evacuate unprotected personnel. Protected personnel may shut off leak and remove ignition sources. Use water spray to protect personnel from fire risk and to knock down NH_3 gas. Flush small spills with copious quantities of water. Dike up large spills with sand or other inert solid. Pump into drums, close, and label "Corrosive".

FIRE EXTINGUISHING AGENTS RECOMMENDED

Water.

SPECIAL FIRE FIGHTING PRECAUTIONS

ter to keep fire-exposed containers cool. Wear full protective clothing. See reference (a).

FIRE EXTINGUISHING AGENTS TO AVOID

CO_2: may react violently.

SPECIAL PRECAUTIONS/PROCEDURES

Note action level = 1/2 (permissible concentration) = 25 ppm. Reference (e) would require monitoring action at this level. Reference (e) would require worker training, medical surveillance, labels and placards. Ref. (c) shows the need for personnel training, adequate inspection of equipment, particularly pumps, valves and hoses.

E. PERSONAL PROTECTIVE EQUIPMENT

See page 5.

RESPIRATORY PROTECTION

EYES AND FACE

HANDS, ARMS, AND BODY

CLOTHING AND EQUIPMENT

F. PHYSICAL DATA

MATERIAL IS (AT NORMAL CONDITIONS):	APPEARANCE AND ODOR	
☒ LIQUID ☐ SOLID ☐ GAS ☐ _____	Water white liquid; strong, pungent ammonia aroma.	
BOILING POINT N.A. °C Salting-out temperatures (see K) (−40°F) −40 °C	SPECIFIC GRAVITY (H_2O = 1) Liquid 0.897 28-30% 0.88 20.4%	VAPOR DENSITY (AIR = 1) (NH_3 gas) 0.596 (60°F., 15.6°C.)
SOLUBILITY IN WATER (% by Weight) Complete	pH Unknown. 11.6 for a normal solution.	VAPOR PRESSURE (mm Hg at 20°C.): (partial, NH_3) wt. % 28 501 29.4 546 30 561
EVAPORATION RATE (ether = 1) <1 (time to evaporate)	% VOLATILES BY VOLUME (At 20°C) 100	

G. REACTIVITY DATA

STABILITY	CONDITIONS TO AVOID
☐ UNSTABLE ☒ STABLE	Heat decomposes without violence in absence of incompatible materials.

INCOMPATIBILITY (MATERIALS TO AVOID)

Strong oxidizers, including halogens, also see last page.

HAZARDOUS DECOMPOSITION PRODUCTS

Gaseous NH_3 on heating. We have no data on its combustion products, but nitrogen oxides expected.

HAZARDOUS POLYMERIZATION	CONDITIONS TO AVOID
☐ MAY OCCUR ☒ WILL NOT OCCUR	

H. HAZARDOUS INGREDIENTS (Mixtures Only)

MATERIAL OR COMPONENT		Wt. %	HAZARD DATA (SEE SECT. J)
Ammonia (NH_3)	Low Mobile Ion 124-002645 Semiconductor 124-002640	28-30	See C.
(C.A.S. No., 7664-41-7)	PARTICU-LOT™ 124-003645 (low particle)	28-30 28-30	
Aqua Ammonia		25-30	
			105

I. ENVIRONMENTAL

DEGRADABILITY	OCTANOL/WATER PARTITION COEFFICIENT
Not applicable (inorganic) ie Aqua Ammonia (ammonium hydroxide) is a fertilizer, it may promote eutrophication in waterways.	Unknown

WASTE DISPOSAL METHODS*

Disposal of Ammonium Hydroxide or Aqua Ammonia may be subject to federal,state and local regulations. Users of this product should review their operations in terms of applicable federal, state and local laws and regulations, then consult with appropriate regulatory agencies before descharging or disposing of waste material.

*DISPOSER MUST COMPLY WITH FEDERAL, STATE AND LOCAL DISPOSAL OR DISCHARGE LAWS.

J. REFERENCES

PERMISSIBLE CONCENTRATION REFERENCES

OSHA Regs., 29 CFR 1910.1000

REGULATORY STANDARDS

DOT Hazardous Materials Table: 49 CFR 172.101.
nated a hazardous substance for spills by EPA (40 CFR, Parts 116-117).
...A Status: Hazardous Waste No. D002 (corrosive) if discarded undiluted - 40 CFR 261.22 (a) (1) and (b).

GENERAL

(a) NFPA Manual 49, "Hazardous Chemicals Data", 1975, National Fire Protection Assoc., 470 Atlantic Ave., Boston, MA 02210;
(b) NFPA Manual 491M "Manual of Hazardous Chemical Reactions", 1975. Same publisher as Ref. (a) above.;
(c) MCA, Case Histories of Accidents in the Chemical Industry, Vols. 1-3 covering 1951-1966, with supplements, Manufacturing Chemists Association, 1825 Connecticut Ave., Washington, DC 20009.

(Cont'd. See Page 5.)

K. ADDITIONAL INFORMATION

Section D: Storage: Ref. (e) would require, in locating storage areas consideration be given to health and fire hazards, population density, and proximity of water supplies. Also that closed containers be provided with safety relief valves, as necessary.

Label - Handling and Storage: 1. Before moving, be sure closures are securely fastened.; 2. Loosen closures carefully.; 3. Keep out of sun and away from heat.; 4. Never use pressure to empty.; 5. In case of spillage, flush with plenty of water.; 6. Keep upright.

Section C: Health: NIOSH has recommended a ceiling of 50 ppm for a 5-minute exposure based on effect on airways.

Section F: Salting-out temperature applies to Aqua ammonia, 26° Baume, which contains 29.4% ammonia (24.2% nitrogen).

THIS PRODUCT SAFETY DATA SHEET IS OFFERED SOLELY FOR YOUR INFORMATION, CONSIDERATION AND INVESTIGATION.

ALLIED CHEMICAL PROVIDES NO WARRANTIES, EITHER EXPRESS OR IMPLIED, AND ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE DATA CONTAINED HEREIN.

SECTION J (Continued) – GENERAL

(d) NIOSH Criteria Document for Anhydrous Ammonia, 1974, HHS Publication No. (NIOSH) 74-136, PB 246699, NTIS; (e) OSHA Proposed Standard (See C).; (f) Miller, W.B., et al., National Safety News, Dec., 1976 pp. 58-61 (interprets Ref. e); (g) Gosselin, R.E. et al., Clinical Toxicology of Commercial Products – Acute Poisoning, 4th Ed., Williams & Wilkins, Baltimore, 1976; (h) AMIA Technical Guide No. 7 "Handbook of Hazardous Materials", 1974, American Mutual Insurance Alliance, 20 No. Wacker Dr., Chicago, IL., 60606.

SECTION E (Continued) – PROTECTIVE EQUIPMENT

1. HEAVY HANDLING (e.g. cases of bottles/carboys/drums/pallets of cases/tank trucks):

Respiratory Protection

Where required, use a respirator approved by NIOSH for ammonia. Details*.

Hands, Arms, and Body

As a minimum, wear rubber apron, protective clothing, boots, and gloves for routine product use.

Eyes and Face

As a minimum, wear hard hat, chemical safety goggles, full-face plastic shield if eyes are not covered by respiratory device. Do not wear contact lenses.

Other Clothing and Equipment

Eyewash and quick- drench shower facilities.

2. SPECIALIZED HANDLING (e.g. bottles):
(only applicable for use with closed ventilated systems, D)

Hands, Arms, and Body

As a minimum, alkali-resistant gloves. For leak or spill or other emergency, use full protective clothing (see page 5 under 1. HEAVY HANDLING – Hands, Arms, and Body).

Respiratory Protection

Generally not required. For spill or leak or other emergency, use a respirator approved by NIOSH for ammonia, details*, or nitrogen oxide gases or mist, as applicable.

Eyes and Face

As a minimum, safety glasses with non-perforated sideshields. Add a face shield if pouring liquid. For leak or spill or other emergency, use chemical safety goggles and face shield if eyes are not covered by respiratory device. Do not wear contact lenses.

Other Clothing and Equipment

Eyewash and quick-drench shower facilities.

* ("Special" refers to a specific cartridge or canister for NH_3 Gas.) Up to 100 ppm chemical cartridge respirator, special, supplied-air respirator, or self-contained breathing apparatus. 100 to 300 ppm, chemical cartridge respirator, special, with full facepiece. 300 to 500 ppm, gas mask, special, supplied-air respirator, or self-contained breathing apparatus. Latter two types should have full facepiece.

SECTION G – REACTIVITY DATA (Cont'd.)

Incompatability

"Separate from other chemicals, particularly oxidizing gases, chlorine, bromine, iodine, and acids." – Ref. (a), pg. 40.

Note hazardous reactions have been documented for contact of ammonia gas with:

Acetaldehyde, acrolein, boron, bromine, chlorine, chlorites, chromium trioxide, ethylene oxide, fluorine, gold, hypochlorous acid, iodine, mercury, nitric acid, nitrogen tetroxide, phosphorous trioxide, picric acid, potassium chlorate, potassium ferricyanide, silver, silver chloride. – Ref. (b) pg. 35-37.

Note hazardous reactions have been documented for contact of ammonium hydoxide with:

Acrolein, acrylic acid, dimethyl sulfate, fluorine, hydrochloric acid, hydrofluoric acid, iodine, nitric acid, oleum, propylene oxide, silver nitrate, and sulfuric acid. – Ref. (b) pg. 38.

Allied Chemical

PRODUCT SAFETY DATA SHEET

AMMONIUM HYDROXIDE SOLUTION— AQUA AMMONIA

00003

JUL 1984

A. GENERAL INFORMATION

TRADE NAME (COMMON NAME OR SYNONYM)	[X] C.A.S. NO.	[X] ALLIED PRODUCT CODE
AMMONIUM HYDROXIDE, 25-30% SOLUTION – AQUA AMMONIA (See H for type designations)	1336-21-6	See H.

CHEMICAL NAME
Ammonium Hydroxide (Synonyms: ammonia, aqueous; ammonia solution ammoniacal liquor)

R-CH-004
AQUA-AMMONIA

FORMULA	MOLECULAR WEIGHT
NH_4OH/H_2O	35.06 (formula weight)

DIVISION/PLANT ADDRESS (No., STREET, CITY, STATE AND ZIP CODE)
Allied Chemical
P.O. Box 1139R
Morristown, N.J. 07960

CONTACT	PHONE NUMBER	ISSUED DATE	REVISED DATE
Director, Product Safety	(201) 455-4157	Feb., 1979	Apr., 1981

B. FIRST AID MEASURES

EMERGENCY PHONE NUMBER
(201) 455-2000

Eye: Flood with large amounts of water. Call a physician.
Skin: Remove contaminated clothing and wash with large amounts of water. Wash clothing before re-use.
Inhalation: Don respiratory protection as necessary and remove to fresh air at once. If breathing has stopped, give artificial respiration. If breathing with difficulty, give oxygen. Keep patient recumbent.
Ingestion: Do not induce vomiting. Encourage victim to drink large amounts of water, substituting, as available, diluted vinegar, lemon juice, orange juice, or other fruit juice. Follow with a demulcent such as egg white, olive oil, milk, if available.

C. HAZARDS INFORMATION

FIRE AND EXPLOSION

FLASH POINT	AUTOIGNITION TEMPERATURE	FLAMMABLE LIMITS IN AIR (% BY VOL)
N.A. °C (liquid, not flammable) [ ] OPEN CUP [ ] CLOSED CUP	651 °C (NH_3)	(NH_3) LOWER 16 UPPER 25

UNUSUAL FIRE AND EXPLOSION HAZARDS
NH_3 increases the fire hazard from other combustible materials, including oil. Flammable limits are broadened by increasing temperature.

HEALTH

INHALATION
Highly irritating to throat at approx. 400 ppm. Causes edema, dypsnea, bronchospasm, chest pain, pink frothy sputum. LC_{50} (mouse): 4837 ppm/1H. 2500-6500 ppm considered dangerous to life in 30 minutes. Ref. (h).

INGESTION
As with other corrosive alkalis: severe burning of gullet, stomach, mouth, and throat. Possible death from shock or asphyxia. LD_{50} (rat): 350 mg/kg. Human lethal dose not established: any amount can be dangerous - Ref. (g).

SKIN
Liquid: Corrosive burns or blister formation.
Gas: Irritates moist skin.

EYES
Liquid: Intensely irritating; in extreme, corneal ulceration or blindness.
Gas: Irritates.

PERMISSIBLE CONCENTRATION: AIR (SEE SECTION J)	BIOLOGICAL
50 ppm (TWA) (Ceiling, OSHA)	Unknown

UNUSUAL CHRONIC TOXICITY
None observed in Allied Chemical studies, see OSHA Proposed Standard, November 25, 1979, 49 FR 45684. Subject reviewed there.

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D. PRECAUTIONS, PROCEDURES

VENTILATION

1. HEAVY HANDLING (e.g. cases of bottles/carboys/drums/pallets of cases/tank trucks):
Sufficient to reduce ammonia concentrations below permissible level. Packaging and unloading areas and open processing equipment may require mechanical exhaust systems.

SPECIALIZED HANDLING (e.g. bottles):
Handling should be done in a closed ventilated system (e.g. exhausted hood). This is customary in the semiconductor industry.

NORMAL HANDLING

Avoid all contact of liquid with the body. Minimize gas contact. Good maintenance to prevent leaks. Keep away from heat and open flame. Use good process control.

STORAGE

Perferably stored outside, otherwise in cool, dry, well-ventilated, non-combustible location, away from all possible sources of ignition and oxidizers. Ref., (d). Protect containers from heat, corrosion, and physical damage; further, Section K.

PRECAUTIONARY LABEL ☐ ATTACHED ☒ NOT ATTACHED

DOT Class: Corrosive Material (Liquid).
DANGER! CAUSES BURNS. MAY BE FATAL IF INHALED OR SWALLOWED. VAPOR EXTREMELY IRRITATING.

SPILL OR LEAK

Evacuate unprotected personnel. Protected personnel may shut off leak and remove ignition sources. Use water spray to protect personnel from fire risk and to knock down NH_3 gas. Flush small spills with copious quantities of water. Dike up large spills with sand or other inert solid. Pump into drums, close, and label "Corrosive".

FIRE EXTINGUISHING AGENTS RECOMMENDED

Water.

SPECIAL FIRE FIGHTING PRECAUTIONS

ter to keep fire-exposed containers cool. Wear full protective clothing. See reference (a).

FIRE EXTINGUISHING AGENTS TO AVOID

CO_2: may react violently.

SPECIAL PRECAUTIONS/PROCEDURES

Note action level = 1/2 (permissible concentration) = 25 ppm. Reference (e) would require monitoring action at this level. Reference (e) would require worker training, medical surveillance, labels and placards. Ref. (c) shows the need for personnel training, adequate inspection of equipment, particularly pumps, valves and hoses.

E. PERSONAL PROTECTIVE EQUIPMENT

See page 5.

RESPIRATORY PROTECTION

EYES AND FACE

HANDS, ARMS, AND BODY

CLOTHING AND EQUIPMENT

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F. PHYSICAL DATA

MATERIAL IS (AT NORMAL CONDITIONS):	APPEARANCE AND ODOR	
☒ LIQUID ☐ SOLID ☐ GAS ☐ _____	Water white liquid; strong, pungent ammonia aroma.	
BOILING POINT N.A. °C Salting-out temperatures (see K) −40 (−40°F) °C	SPECIFIC GRAVITY (H_2O = 1) Liquid 0.897 28-30% 0.88 20.4%	VAPOR DENSITY (AIR = 1) (NH_3 gas) 0.596 (60°F., 15.6°C.)
SOLUBILITY IN WATER (% by Weight) Complete	pH Unknown. 11.6 for a normal solution.	VAPOR PRESSURE (mm Hg at 20°C.): (partial, NH_3) wt. % 28 501 29.4 546 30 561
EVAPORATION RATE (ether = 1) <1 (time to evaporate)	% VOLATILES BY VOLUME (At 20°C) 100	

G. REACTIVITY DATA

STABILITY	CONDITIONS TO AVOID
☐ UNSTABLE ☒ STABLE	Heat decomposes without violence in absence of incompatible materials.

INCOMPATIBILITY (MATERIALS TO AVOID)

Strong oxidizers, including halogens, also see last page.

HAZARDOUS DECOMPOSITION PRODUCTS

Gaseous NH_3 on heating. We have no data on its combustion products, but nitrogen oxides expected.

HAZARDOUS POLYMERIZATION	CONDITIONS TO AVOID
☐ MAY OCCUR ☒ WILL NOT OCCUR	

H. HAZARDOUS INGREDIENTS (Mixtures Only)

MATERIAL OR COMPONENT		Wt. %	HAZARD DATA (SEE SECT. J)
Ammonia (NH_3)	Low Mobile Ion 124-002645 Semiconductor 124-002640	28-30	See C.
(C.A.S. No., 7664-41-7)	PARTICU-LOT™ 124-003645 (low particle)	28-30 28-30	
Aqua Ammonia		25-30	
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I. ENVIRONMENTAL

DEGRADABILITY	OCTANOL/WATER PARTITION COEFFICIENT
Not applicable (inorganic) :e Aqua Ammonia (ammonium hydroxide) is a fertilizer, it may promote eutrophication in waterways.	Unknown

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WASTE DISPOSAL METHODS*

Disposal of Ammonium Hydroxide or Aqua Ammonia may be subject to federal,state and local regulations. Users of this product should review their operations in terms of applicable federal, state and local laws and regulations, then consult with appropriate regulatory agencies before descharging or disposing of waste material.

*DISPOSER MUST COMPLY WITH FEDERAL, STATE AND LOCAL DISPOSAL OR DISCHARGE LAWS.

J. REFERENCES

PERMISSIBLE CONCENTRATION REFERENCES

OSHA Regs., 29 CFR 1910.1000

REGULATORY STANDARDS

DOT Hazardous Materials Table: 49 CFR 172.101.
ıated a hazardous substance for spills by EPA (40 CFR, Parts 116-117).
...A Status: Hazardous Waste No. D002 (corrosive) if discarded undiluted - 40 CFR 261.22 (a) (1) and (b).

GENERAL

(a) NFPA Manual 49, "Hazardous Chemicals Data", 1975, National Fire Protection Assoc., 470 Atlantic Ave., Boston, MA 02210;
(b) NFPA Manual 491M "Manual of Hazardous Chemical Reactions", 1975. Same publisher as Ref. (a) above.;
(c) MCA, Case Histories of Accidents in the Chemical Industry, Vols. 1-3 covering 1951-1966, with supplements, Manufacturing Chemists Association, 1825 Connecticut Ave., Washington, DC 20009.

(Cont'd. See Page 5.)

K. ADDITIONAL INFORMATION

Section D: Storage: Ref. (e) would require, in locating storage areas consideration be given to health and fire hazards, population density, and proximity of water supplies. Also that closed containers be provided with safety relief valves, as necessary.

Label - Handling and Storage: 1. Before moving, be sure closures are securely fastened.; 2. Loosen closures carefully.; 3. Keep out of sun and away from heat.; 4. Never use pressure to empty.; 5. In case of spillage, flush with plenty of water.; 6. Keep upright.

Section C: Health: NIOSH has recommended a ceiling of 50 ppm for a 5-minute exposure based on effect on airways.

Section F: Salting-out temperature applies to Aqua ammonia, 26° Baume, which contains 29.4% ammonia (24.2% nitrogen).

IS PRODUCT SAFETY DATA SHEET IS OFFERED SOLELY FOR YOUR INFORMATION, CONSIDERATION AND INVESTIGATION.

ALLIED CHEMICAL PROVIDES NO WARRANTIES, EITHER EXPRESS OR IMPLIED, AND ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE DATA CONTAINED HEREIN.

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SECTION J (Continued) – GENERAL

(d) NIOSH Criteria Document for Anhydrous Ammonia, 1974, HHS Publication No. (NIOSH) 74-136, PB 246699, NTIS; (e) OSHA Proposed Standard (See C).; (f) Miller, W.B., et al., National Safety News, Dec., 1976 pp. 58-61 (interprets Ref. e); (g) Gosselin, R.E. et al., Clinical Toxicology of Commercial Products – Acute Poisoning, 4th Ed., Williams & Wilkins, Baltimore, 1976; (h) AMIA Technical Guide No. 7 "Handbook of Hazardous Materials", 1974, American Mutual Insurance Alliance, 20 No. Wacker Dr., Chicago, IL., 60606.

SECTION E (Continued) – PROTECTIVE EQUIPMENT

1. HEAVY HANDLING (e.g. cases of bottles/carboys/drums/pallets of cases/tank trucks):

Respiratory Protection

Where required, use a respirator approved by NIOSH for ammonia. Details*.

Hands, Arms, and Body

As a minimum, wear rubber apron, protective clothing, boots, and gloves for routine product use.

Eyes and Face

As a minimum, wear hard hat, chemical safety goggles, full-face plastic shield if eyes are not covered by respiratory device. Do not wear contact lenses.

Other Clothing and Equipment

Eyewash and quick- drench shower facilities.

2. SPECIALIZED HANDLING (e.g. bottles):
(only applicable for use with closed ventilated systems, D)

Hands, Arms, and Body

As a minimum, alkali-resistant gloves. For leak or spill or other emergency, use full protective clothing (see page 5 under 1. HEAVY HANDLING – Hands, Arms, and Body).

Respiratory Protection

Generally not required. For spill or leak or other emergency, use a respirator approved by NIOSH for ammonia, details*, or nitrogen oxide gases or mist, as applicable.

Eyes and Face

As a minimum, safety glasses with non-perforated sideshields. Add a face shield if pouring liquid. For leak or spill or other emergency, use chemical safety goggles and face shield if eyes are not covered by respiratory device. Do not wear contact lenses.

Other Clothing and Equipment

Eyewash and quick-drench shower facilities.

* ("Special" refers to a specific cartridge or canister for NH_3 Gas.) Up to 100 ppm chemical cartridge respirator, special, supplied-air respirator, or self-contained breathing apparatus. 100 to 300 ppm, chemical cartridge respirator, special, with full facepiece. 300 to 500 ppm, gas mask, special, supplied-air respirator, or self-contained breathing apparatus. Latter two types should have full facepiece.

SECTION G – REACTIVITY DATA (Cont'd.)

Incompatability

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