



Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

School Materials Safety Manual:

No. 47 Urea
Issued 2/87

Revision B, 9/90

♦ SECTION 1 INTRODUCTION

Material Urea, ca 100%*

Chemical Formula $\text{CO}(\text{NH}_2)_2$

CAS Number 0057-13-6

DOT Classification Not listed as a Hazardous Material for Transportation (49 CFR 172.101)

EPA Classification Not listed as a RCRA Hazardous Waste (40 CFR 261.33), a CERCLA Hazardous Substance (40 CFR 302.4), a SARA Extremely Hazardous Substance (40 CFR 355), or a SARA Toxic Chemical (40 CFR 372.65)

OSHA Classification Not listed as an Air Contaminant (29 CFR 1910.1000, Subpart Z)

Synonyms Aquacare, Aquadrate, Basodexan, carbamide, carbonyldiamide, Hyanit, Keratinamin, Onychomal, Pastaron, Ureaphil

NFPA Hazard Rating

Not found

Genium Hazard Rating

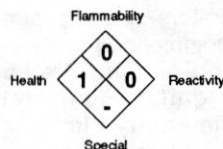
4 = Extreme

3 = High

2 = Moderate

1 = Slight

0 = Minimum



* Typical industrial grade: Total nitrogen is 45%.

Description Liquid ammonia and carbon dioxide at 320 to 392 °F (160 to 200 °C) at 1750 to 3000 psi form ammonium carbamate. Decomposition of ammonium carbamate at about 80 psi yields urea and water. White crystals with a cooling, saline taste. Urea develops an odor of ammonia.

Overview Urea was the first organic compound synthesized. It is of low toxicity and noncombustible. It presents few hazards if used with care and reasonable precautions. The most common area of use in the school environment is in the laboratory for experiments in thermal chemistry. Other uses include fertilizer, plastics, animal feed, adhesives, sulfamic acid production, separation of hydrocarbons (as urea adducts), preparation of biuret, dentifrices, pharmaceuticals, cosmetics, flameproofing agents; as a diuretic, a chemical intermediate, a stabilizer in explosives, and a viscosity modifier for starch or casein-based paper coatings. Urea is a normal component of human urine.

Manufacturer Always request an up-to-date MSDS from your chemical supplier. That sheet should identify the substance's manufacturer and include an emergency phone number. This *Manual's* Resources/Manufacturers Index lists some larger manufacturers and available emergency phone numbers.

♦ SECTION 2 USE AND STORAGE DATA

Preliminary Planning Considerations *Plan and provide for safe disposal of all school-generated chemical waste.* Check applicable regulations prior to use. For safety, *do not wear contact lenses in the lab:* soft lenses may absorb, and all lenses concentrate, irritants. Particles

adhering to contact lens surfaces can cause corneal damage. Wear rubber gloves to minimize skin contact. Employees and students should know the location of eyewash and shower facilities near where chemicals are used. Be sure that eyewash stations and safety showers are in good working order. Individuals with kidney impairment or asthmatic condition should have physician's approval before exposure to urea dust.

Usage Precautions and Procedure Before using, *read this material's container label* and follow all precautions. Avoid creating airborne dust conditions and breathing of dust. Wear safety glasses or goggles and appropriate protective clothing to work with this substance. Practice good housekeeping to avoid unintentionally mixing incompatibles. Avoid contact of urea with caustic and alkaline materials. Do not allow chemical residue or dust buildup in lab or work areas. Keep this material away from notebooks, textbooks, and personal belongings to avoid transporting chemical residues from the lab/work area. After working with chemical materials, and before eating, drinking, or smoking, always wash hands and face. Remove and launder contaminated clothing before reusing.

Additional Data Urea is stable at room temperature in closed containers under normal handling and storage conditions. It does not polymerize. Water solutions decompose upon heating, giving off some ammonia (NH_3). This material reacts with calcium hypochlorite or sodium hypochlorite to form explosive nitrogen trichloride. Its incompatibilities include sodium nitrite, gallium perchlorate, strong oxidizing agents (permanganate, dichromate, nitrate, chlorine), phosphorus pentachloride, nitrosyl perchlorate, titanium tetrachloride, and chromyl chloride. Urea, dichloromaleic anhydride, and sodium chloride form potentially explosive dichloromaleimide.

Preferred Storage Location and Methods Storage areas should be cool and well ventilated, and the containers tightly closed and stored away from incompatible materials. Store with compatible materials on sturdy shelving away from strong oxidizing agents and heat sources (direct sunlight). Protect all chemical containers from physical damage. To separate incompatible chemicals, store by chemical family, not by alphabetical name. Prohibit smoking in chemical storage areas. Purchase amounts equal to only a year's needs, if at all.

♦ SECTION 3 SPILL/DISPOSAL PROCEDURES

If Spilled Ventilate spill area. Clean up spilled material promptly and thoroughly. Cleanup personnel should protect against skin or eye contact and inhalation. For liquid (solution) spills, cover with an inert, solid absorbent (vermiculite, dry sand, etc.) and scoop into appropriate disposal containers (with a secure lid) for disposal in accordance with existing regulations. For larger spills, dike the spill area with an inert, absorbent material, as needed, to contain the spilled material. For dry spills, carefully collect and scoop the spilled dry material into secure disposal or reclamation containers. Avoid creating airborne dust condi-

No. 47 Urea

tions. Sweep, vacuum (with an appropriate filter), or wet mop to minimize dust dispersion. Do not contaminate solid waste with oxidizing agents such as nitrates.

Disposal of Small Quantities *Handle emptied containers carefully since residues may remain.* Check regulations before disposal is necessary. Investigate recycling, reclamation, or destruction to a less hazardous material rather than disposal of untreated waste in a landfill. If this method is not practical, feasible, or in accord with existing regulations, contact your supplier or a licensed disposal contractor for specific treatment/disposal procedures.

Disposal of Larger Amounts Contact your supplier or a licensed disposal company.

Follow all applicable local, state, and Federal regulations for all waste disposal.

◆ **SECTION 4 HEALTH HAZARDS**

Urea is a normal breakdown product of protein within the animal kingdom, including humans. It is filtered out of the blood by the kidneys and is present in urine. However, chemically active and quite irritating at high concentrations, urea is moderately toxic by ingestion, intravenous, and subcutaneous routes. Its most frequent adverse effects are headache, nausea, and vomiting. Disorientation, nervousness, hypotension, hyperthermia, tachycardia, and cardiotoxicity resulting in ECG changes may also occur. This material is also an irritant to the skin, eyes, and mucous membranes. Its strong osmotic effect is used beneficially in medicinal applications. When heated, urea breaks down to ammonia and carbon dioxide (SMSM, No. 25). Ingestion may cause methemoglobinemia

1989-90 ACGIH TLV None established

1988 NIOSH REL None established

1989 OSHA PEL None established

1985-6 Toxicity Data Human, skin: skin exposed intermittently to 22 mg/kg over 3 days develops mild irritation; Human lymphocyte, DNA inhibition: 600 mmol/liter; Woman, 16 weeks pregnant, TD_{Lo}: 1600 mg/kg affects fertility (abortion).

Carcinogenicity Not listed by the NTP, IARC, or OSHA, although human and animal experiments show urea is a carcinogen, neoplastigen, and mutagen. Reproductive and fertility effects are also reported.

Acute Effects Excessive inhalation of urea dust may cause irritation and coughing. Prolonged skin contact may cause a stinging sensation and mild irritation.

Chronic Effects A study of 67 workers in an environment with high airborne concentrations of urea found a high incidence of protein metabolism disturbances, moderate emphysema, and chronic weight loss.

◆ **SECTION 5 FIRST AID PROCEDURES**

Eye Contact Promptly flush eyes with plenty of running water for at least 15 min, including under the eyelids. Get prompt medical attention.

Skin Contact Remove heavily contaminated clothing. After flushing with large amounts of water, wash exposed areas with soap and water. Get medical attention if irritation occurs.

Inhalation Remove victim from exposure to fresh air and support breathing as necessary.

Ingestion Get *prompt* medical attention. Never give anything by mouth to an unconscious or convulsing person. If ingested, have that conscious person drink several glasses of milk or water to dilute and induce vomiting.

Get proper in-school, paramedic, or community medical attention and support.

◆ **SECTION 6 FIRE PROCEDURES AND DATA**

Fire Hazards Be aware of explosive mixtures with oxidizing agents such as nitrates and hypochlorites. For major fires, or for fires involving large quantities, firefighters should wear appropriate protective clothing and respirators. A self-contained breathing apparatus (SCBA) is recommended.

Flash Point and Method Noncombustible

Autoignition Temperature Noncombustible

Flammability Limits in Air (vol. %) Not applicable

Hazardous Decomposition Products Thermal oxidative decomposition of urea can produce toxic fumes of nitrogen oxide, ammonia, biuret, and cyanuric acid.

Extinguishing Media Since urea is noncombustible, use extinguishing media appropriate to the surrounding fire. A water spray may be used to wet down the materials and to reduce airborne particulate levels.

◆ **SECTION 7 PHYSICAL DATA**

Boiling Point (at 1 atm) Decomposes

Melting Point (at 1 atm) 270.9 °F (132.7 °C)

Solubility in Water (at 20 °C) 51.6% soluble

pH (10% water solution) 7.2

Molecular Weight 60.07

Specific Gravity (H₂O = 1 at 4 °C) 1.33 at 20 °C

References 1, 4-7, 9-11, 23, 54, 73, 84, 103, 109, 123, 126, 127; Genium's *Material Safety Data Sheets Collection*, No. 528 (4/90)

Prepared by MJ Allison, BS

School Staff Review by JH Bartsch, MS

Industrial Hygiene Review by DJ Wilson, CIH

Medical Review by AC Darlington, MD

Edited by JR Stuart, MS